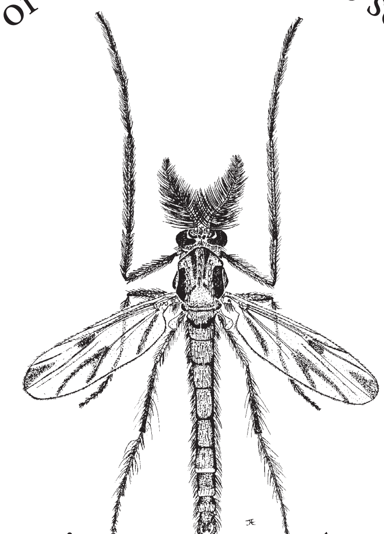
IDENTIFICATION MANUAL
FOR THE
LARVAL CHIRONOMIDAE (DIPTERA)
OF
NORTH AND SOUTH CAROLINA

A guide to the taxonomy of the midges of the southeastern United States



including Florida

John H. Epler, Ph.D.

version 1.0

IDENTIFICATION MANUAL
FOR THE
LARVAL CHIRONOMIDAE (DIPTERA)
OF
NORTH AND SOUTH CAROLINA

A guide to the taxonomy of the midges of the southeastern United States, incuding Florida

John H. Epler, Ph.D.
Aquatic Entomologist
461 Tiger Hammock Road
Crawfordville, FL 32327
jhepler@concentric.net

This document was made possible by EPA Grant #X984170-97
WQ Program Sec, 104(b)93)
EPA Region 4 and Human Health and Ecological Criteria Division

Project Officer: David Lenat
North Carolina Department of Environment and Natural Resources
Division of Water Quality

27 September 2001

version 1.0

TABLE OF CONTENTS

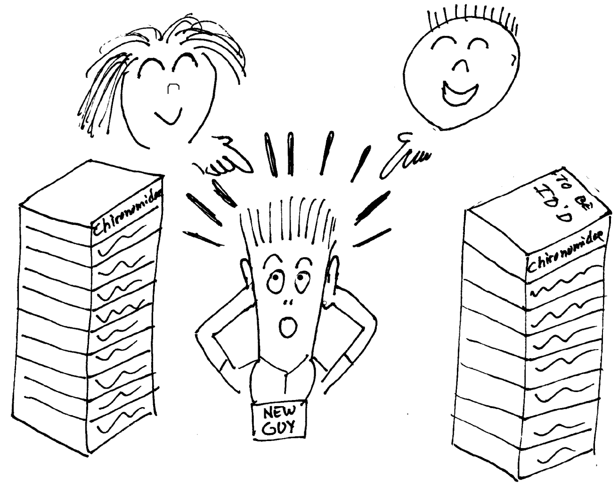
INTRODUCTION
and key to subfamilies

1

CHIRONOMIDAE - a word that brings either a smile, a groan or a look of terror, or perhaps all! Chironomidae - a fantastically diverse large group of small flies whose larvae inhabit just about every niche possible in most freshwater aquatic ecosystems - not to mention marine and terrestrial forms.

As a benthologist, at one time or another you will have some sort of interaction with Chironomidae. Whether it is a pleasant or unpleasant encounter may depend on how well you feel about and what you know about the organisms with which you are working. Yes, identifying chironomids can be a daunting task, but it is possible - sometimes even easy! - and the amount of information one can gather can be prodigious. Too many studies list Chironomidae only at the family level; identification at the generic level introduces many more data, while species-level identifications provide the most data, especially when biodiversity is an issue.

The Chironomidae typically have been shunned by many benthologists because of perceived difficulties in specimen preparation, identification, taxonomy, morphology and literature.



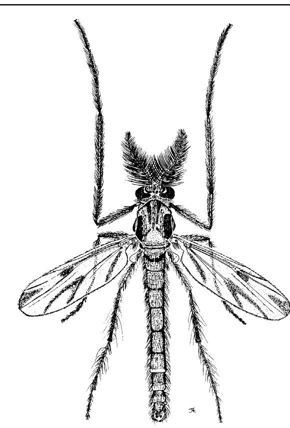
Hey - we've got a new guy in the lab! Let's make him do the chironomid identifications!!!

Depending on the taxa, identification can be easy or perhaps difficult; I've examined collections of Chironomidae that were basically 100% correctly identified, but I've also seen some collections with as many as 65% of the specimens misidentified!

Hopefully, this manual will make your life with Chironomidae easier. It is possible that, ***with experience***, you will eventually be able to identify most chironomids to genus, or even species. Note that some identifications can be done while the larvae are still in fluid preservative (BUT only with much experience!!!!)

The Family Chironomidae

The Chironomidae are a relatively primitive (phylogenetically speaking) group of flies (Diptera) in the suborder Nematocera. Commonly called non-biting midges, or "blind mosquitoes", as adults and "bloodworms" as larvae, chironomids are closely related to mosquitoes (Culicidae) and biting midges (Ceratopogonidae). Unlike their nasty relatives, female chironomids do not bite!

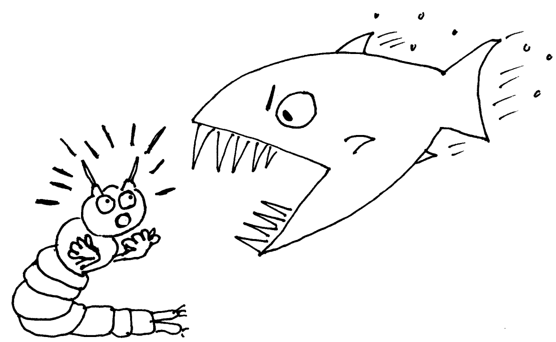


An adult midge, Dicrotendipes thanatogratus

The Chironomidae are usually the most abundant macroinvertebrate group, in numbers of species and individuals, encountered in the majority of freshwater aquatic habitats. In addition, chironomids have invaded the sea, being found along coastlines world wide and occurring at least 30 m down in the ocean, and the land, where they may be encountered in a corn field or in dry hardwood forest litter. They occur on all continents - chironomids are the only free-living holometabolous (meaning with complete metamorphosis; a four stage life cycle) insects to do so - and are found living from heights of 5600 m on glaciers in Nepal down to depths of over 1000 m in Lake Baikal. Chironomid larvae, pupae and adults form an integral part of the food web, serving as food for larger invertebrates, fish, amphibians and birds. Many larvae possess giant chromosomes and have been used extensively in genetic research. Chironomid adults are considered nuisances when large emergences occur in close proximity to human habitations. They have also been implicated in allergenic reactions in humans (see Ali (1991) and Armitage et al. (1995) for an overview of pestiferous Chironomidae). Chironomids are recorded as pests in rice fields, where the larvae mine the leaves and eat the seeds and seedlings. In somewhat of a turnabout, relatives of these pest species (mostly members of the genus *Cricotopus*) may find a use in biological control of nuisance aquatic plants in the southern US.

However, to benthologists, the Chironomidae have long been known as potential indicators of water quality. Some groups of genera and/or species are known to inhabit water of high quality; others are well known dwellers in water of poor quality. Unfortunately, many of the larvae have been (and some still are) very difficult to identify, and much of the literature is burdened with studies done with Chironomidae that were misidentified.

Some of the confusion is due to the complexity of the taxonomy of the family. The Chironomidae have suffered a "double whammy" of sorts: a) their names were confusing due to changes necessitated by the Code of Zoological Nomenclature at the time, and b) there were two systems of classification, one based on adults, the other on immature stages. Ashe (1983) gives an excellent review of the taxonomic problems the Chironomidae have gone through. Today these differences have been largely reconciled because knowledgeable workers utilize characters from all life stages to separate species and delimit genera. A comprehensive update of our knowledge of the biology and ecology of the Chironomidae has recently been published (Armitage et al. 1995). Identifications of chironomid larvae became much more realistic in 1983 when the first volume of the Entomologica Scandinavica "Holarctic Keys", dealing with larvae, was published (Wiederholm 1983). A pupal volume was produced three years later (Wiederholm 1986), followed by the adult volume (Wiederholm 1989). The volumes combine keys, excellent illustrations and, most importantly, diagnoses for each genus. (A diagnosis is a short description of the characters of a taxon that will separate it from other similar taxa.) However, many new genera and previously unknown larvae have been described and some previously described genera have been reorganized since the publication of the larval volume. These books remain a necessity for chironomid workers but must be supplemented with more recent literature.



Chironomid larvae, pupae and adults form an integral part of the food web, serving as food for larger invertebrates, fish, amphibians and birds.

The family is divided into 11 subfamilies, seven of which occur in North America. Two of the subfamilies, Telmatogetoninae and Podonominae, are relatively restricted in habitat; two other subfamilies, the Diamesinae and Prodiamesinae, are, depending on your locality, relatively uncommon. The majority of Chironomidae you will encounter will probably be members of the subfamilies Tanypodinae, Orthocladiinae and Chironominae.

How to use this manual

Area covered: This manual was written for use in the states of North and South Carolina, and will identify all genera known to me from these states. In actuality, this manual should identify larvae of most genera and species encountered on what is commonly called the Southeastern Coastal Plain. States covered include Alabama, Florida, Georgia, eastern Kentucky, Mississippi, North and South Carolina, eastern Tennessee and most of Delaware, Pennsylvania and Virginia. The manual should be useful for most of the eastern United States, with the caveat that the further that one is from the Southeast, the less effective the manual will be.

Illustrations and abbreviations: The majority of the illustrations in this manual were produced by the author from southeastern US specimens, most of which were reared or otherwise associated. Some are somewhat schematic in that all parts of a structure are not drawn. For example, in the Chironominae, often only one ventromental plate is drawn, and only a portion of the ventromental striae are shown; premandibular brushes are often not drawn unless they are an important character, and the pecten mandibularis is not fully drawn on most mandibles. When specimens were unavailable or not suitable for illustration, figures were borrowed from other sources. Thus, some illustrations differ in the amount of shading, structures included, etc. If the illustrations were from publications other than my own, the source of each figure is cited at least once within the manual.

Abbreviations used are explained in the Glossary that begins on page 1.10.

Taxonomy: In general, I have not used the author's name(s) for genera and species within the text and keys; complete names are listed in chapter 10. For arrangement of tribes and subgenera, see Caldwell et al. (1997) or Oliver et al. (1990).

Many larvae are undescribed or unassociated with the adult stages. Species definitions in the Chironomidae are, for the most part, based on the adult male. Several undescribed larval "types" are known on the genus and species level. These have been given letter or number designators, such as "*Tanytarsus* sp. A" or "Chironomini genus III". These may represent taxa with described adults, or species new to science. When reared or otherwise associated with an identifiable life stage, the names can be updated. Many new, undescribed species are included in this manual. However, a manual such as this is not the proper place to publish new names and descriptions. Thus, as is noted in the text, these new species will be described in papers currently in progress. However, the following changes are proposed in this manual:

Corynoneura taris Roback is considered a junior synonym of *C. lobata* Edwards

Einfeldia austini (Beck & Beck) is moved to *Chironomus* and is now *Ch. (Lobochironomus) austini* (Beck & Beck).

The Layout: This manual is divided into ten chapters. This introduction is the first chapter, followed by seven subfamily chapters, which are then followed by a Bibliography and a checklist of the Chironomidae of North and South Carolina. The subfamily chapters are arranged phylogenetically; chapters are paginated separately. Each subfamily chapter has a key to genera which is followed by "generic units" in alphabetical order. Undescribed genera are at the end of each chapter. Each genus unit consists of several parts:

A **Diagnosis**, or short descriptive summary of the genus' morphological characters which will separate it from similar taxa. Although this manual is intended for stand-alone use, it will be most effective when used in conjunction with the more detailed diagnoses in Wiederholm (1983). ***Note that the diagnoses in this manual pertain to character states of southeastern taxa!*** Some genera include species that are different from those in the Southeast. For instance, *Dicrotendipes lobiger*, a species not known to occur in the Southeast, has a frontoclypeal apotome - all southeastern *Dicrotendipes* have a frontal apotome.

A **Notes** section which contains additional information concerning the taxonomy and biology of the genus.

An **Additional References** section lists additional literature that may give more information. ***Wiederholm (1983, 1986, 1989) is always considered to be an additional reference.***

Illustrations of important body structures are included for each genus; a **Key** to species and a **Notes on species** section are included when possible.

The Keys: ***The keys are written for fourth instar larvae!*** Measurements are only valid for fourth instar larvae, but ratios may still be useful for other instars. Illustrations are usually arranged from left to right and/or top to bottom with regards to the order of statements in the couplet(s). If you are new to chironomids, you'll have to start with the key for subfamilies that starts on page 1.41 at the end of this chapter. Key your larva to subfamily, then go to the subfamily chapter. There you may key your larva to genus. If it fits, then key your specimen to species, if a species key is available for that genus. When (if!) you get to the species, check to see if there are additional notes ("Notes on species") concerning that species.

How to use a dichotomous key: The identification keys used in this manual are dichotomous keys. Never used a dichotomous key before? Read on!

A dichotomous key is basically a series of either/or statements ("dichotomous" means "dividing into two parts"). One runs through the statements making choices and eventually should end up with an answer or "identification". For example, let's say you have 4 objects – a red triangle named Phil, a white square called Bobby, a white circle named Mickey and a red circle named Jerry. Here's how a key would work to identify them. The first couplet (group of choices) would read:

1	Object red in color …………………………	2
1'	Object white in color ……………………….	3

Here you have a choice – your object is either red or white. If it's red, go to couplet "2"; if it's white go to couplet "3". When we go to "2" we see:

2(1)	Object triangular …………………………	Phil
2'	Object circular …………………………..	Jerry

What's that "1" doing in parentheses after the "2", you may ask? That's the number of the couplet that led you to where you are now! In a long key, you can use these numbers to trace your steps back. Sometimes you may have to venture forward in a key when you're not sure which couplet fits your taxon, i.e., try going both ways from a couplet. With the parenthetical numbers, it's easier to retrace your steps. You can even start at an endpoint in the key (your "identification") and run through the key backwards!

The key ends with:

3(1')	Object square …………………………..	Bobby
3'	Object circular …………………………..	Mickey

Now you may think you've identified your objects, but now comes a very important part – you must check your "identification" against a diagnosis (a brief synopsis of the characters that distinguish your taxon from others that may resemble it) or a description (a full blown listing of the characters of the taxon). Pictures may also help, but pictures can also be a trap into which you can easily fall. Why? Because the picture may be of a structure that is similar in several organisms and may not illustrate a definitive character for your organism. When Wiederholm (1983) first appeared, featuring figures of many Palaearctic species, there was an increase in "records" of those species from the US. Hmmm ...

Remember that if you start to key something, that something will end up somewhere in the key – but that doesn't mean you've identified it correctly. If you go to key a larva to species in the wrong genus key, sure, you'll end up with an identification – but it'll be wrong (trust me – I've seen this a lot!!). Another thing to remember about using a key – don't insert information that is not specifically put forth in the key at the point in the key at which you are working; i.e., answer only the question(s) in that specific couplet.

And, most importantly, you must have your identifications verified by a qualified expert! Be sure to read the sections on "Identifying Chironomidae" (page 1.14) and "Quality Assurance" (page 1.28)

Acknowledgements

Although I am the sole author of this manual (and thus must accept all responsibility for any errors or omissions), a work such as this is the result of the combined efforts and assistance of many helpful people.

For procuring and managing the funding for this project I am grateful to Dave Lenat (NCDENR), Jim Harrison (USEPA) and Susan Jackson (USEPA).

Our understanding of the chironomid fauna is greatly enhanced by reared material, but it requires special effort to obtain such material. I am deeply indebted to the following workers who went the extra mile/kilometer and provided reared material: Robert Bode (NY State Department of Environmental Conservation), Mike Bolton (Ohio EPA), Broughton Caldwell (Lawrenceville, GA), Carlos de la Rosa (Brooker Creek Preserve, FL), Barb Hayford (Wayne State College, NE), Mike Heyn (FDEP, Tallahassee) Rick Jacobsen (Everglades National Park), Bob Rutter (FDEP, Punta Gorda), Ford Walton (FDEP, Punta Gorda), Charles Watson (SBI Environmental), and Tom Wilda (Duke Power, NC).

Many other workers graciously supplied specimens. I thank Peter Adler (Clemson University), Don Azuma (ANSP), Mike Bolton, Steven Brooks (The Natural History Museum, London, England), Broughton Caldwell, Jim Cuda (University of Florida), Jeff Cumming (Canadian National Collection), John Davis and his staff at Environmental Services & Permitting (Alachua, FL); Carlos de la Rosa, Dana Denson (FDEP, Orlando), Larry Eaton (NCDENR), Steve Fend (USGS, Menlo Park, CA), Harry Gaymon (SC Department of Health and Environmental Control), Jon Gelhaus (ANSP), Stephen Grabe (Environmental Protection Commission of Hillsborough County, Tampa, FL); Phyllis Guthrie (Gainesville, FL), Tor Christian Hestenes (University of Bergen, Bergen, Norway), Rick Hoebeke (Cornell University), Rick Jacobsen, Ryan King (Duke University), Don Klemm (USEPA), Steve Krotzer (Alabama Power), Dave Lenat (NCDENR), Phil Lewis (USEPA), Jim Liebherr (Cornell University), Rob Mattson (Suwannee River Water Management District, FL), Steve Moore (Clemson University), Peggy Morgan (FDEP, Tampa), John Morse (Clemson University), Steve Moulton (USGS, Denver, CO), Chuck Parker (Great Smoky Mountains National Park), Bill and Jan Peters (Florida A&M University), Bob Rutter (FDEP, Punta Gorda), Wolfgang Schacht (Zoologische Staatssammlung, Munich, Germany), Michelle Scharer (University of Puerto Rico), Marty Sneen (EA Engineering, Science, & Technology, Inc., Deerfield, IL), Martin Spies (Zoologische Staatssammlung, Munich, Germany), Doug Strom (FDEP, Port St. Lucie), David Wahl (American Entomological Institute, Gainesville, FL), Harold Walther (Canadian National Collection), Ford Walton, Charles Watson, Cliff Webber (Auburn University), Tom Wilda and Doug Wymer (Tennessee Tech University) for the loan, gift or opportunity to examine some of the specimens utilized in this study.

Thanks to the following workers who reviewed sections of the manual or tested keys: Bohdan Bilyj (Biotax, Otobicoke, Ontario, Canada), Mike Bolton, Mac Butler (North Dakota State University), Broughton Caldwell, Pete Cranston (University of California, Davis), Anker Halvorsen (Bergen, Norway), Rick Jacobsen, Dave Lenat, Steve Moulton and his crew at USGS (Brian Creutzburg, Gregg Easley, Thomas Greene, Scott Grotheer, Rob Hood, James Kippen, Brian Krestian, Dan Pickard, Brady Richards, Marcia Siebenmann, Joe Slusark), Bob Rutter, Ole Sæther (University of Bergen, Bergen, Norway), Martin Spies, Jim Sublette (Tucson, AZ), Charles Watson and Tom Wilda.

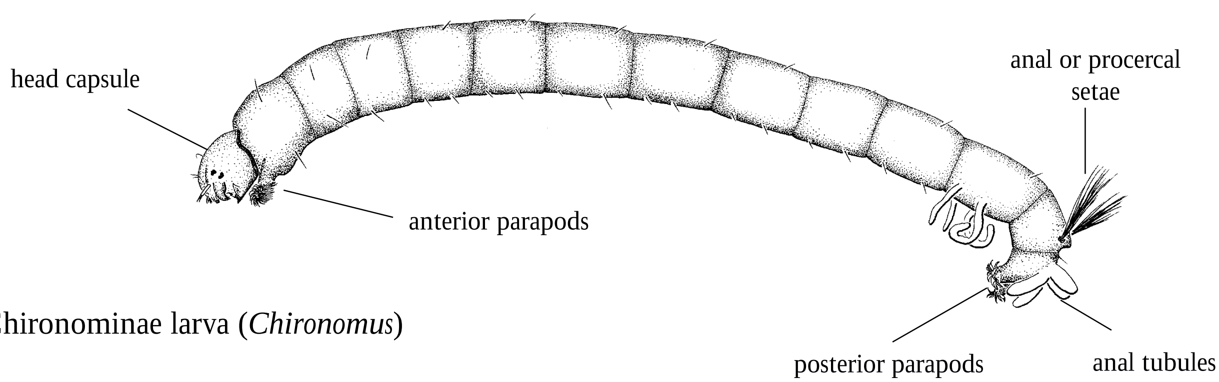
Judy and Barry Merrill (Merrill Consultants, Dallas, TX) supplied much of the funding for my laboratory and computer equipment- thanks again, guys! Their generosity has made it far easier to accomplish the gargantuan task of producing this manual.

My wife Linda helped secure funding for this project, has handled the administrative tasks, proofed text, prepared the table of contents and has put up with the isolation that results from my being almost totally involved with the production of this manual for the last four years. I am forever grateful for her help, love and understanding.

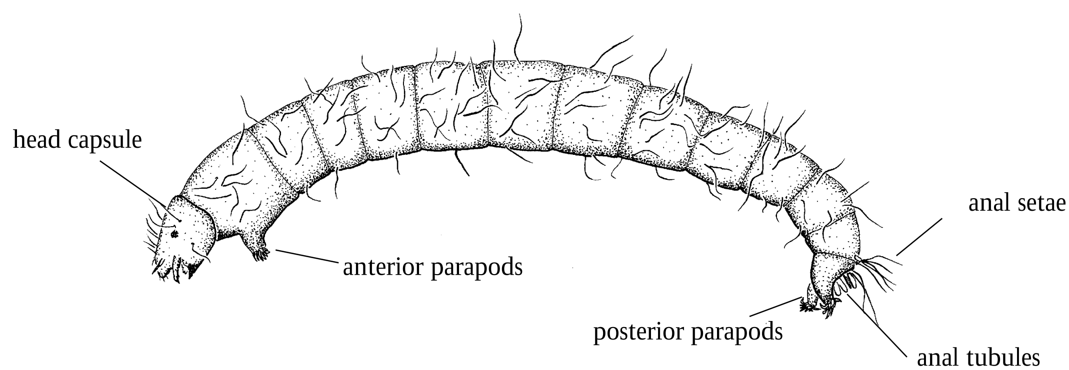
Morphology

Another component of the complexity of the Chironomidae is their morphology. Just as many species have gone under several different synonyms, many anatomical structures have often gone under several names. For example, the mentum has been called the hypochilum, hypostoma, hypostomium, hypostomial plate, labium, or labial plate. Many of these changes in structure names were evolutionary, due to our increased knowledge of chironomid morphology. Sæther (1980a) produced a glossary of chironomid morphology terminology that is largely followed today.

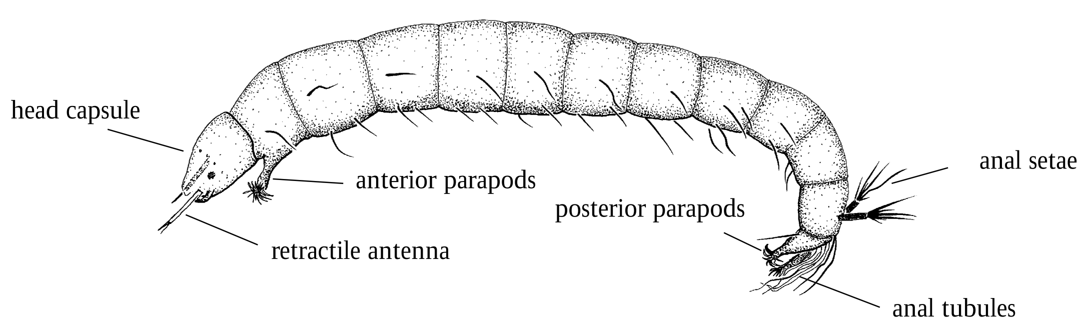
Chironomid larvae bear a sclerotized, non-retractile head capsule, with opposing mandibles, on a narrow, cylindrical body. There usually is one pair of unjointed anterior parapods ("prolegs") on the first body segment, one pair of unjointed posterior parapods on the last body segment, which also bears a pair of setae-bearing procerci, and one to three (usually two) pairs of anal tubules. Some terrestrial chironomids and others living in specialized environments have lost one or both pairs of parapods. There are usually no spiracles, except in some members of the subfamily Podonominae. There are four larval instars (the larvae sheds its skin four times before pupating).



Chironominae larva (*Chironomus*)



Orthocladiinae larva (*Tvetenia*)

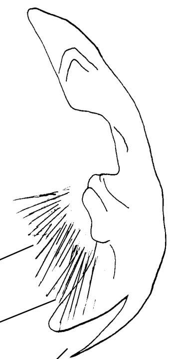


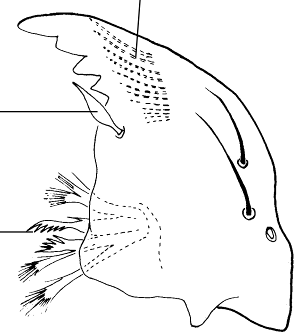
Tanypodinae larva (*Pentaneura*)

The Head Capsule

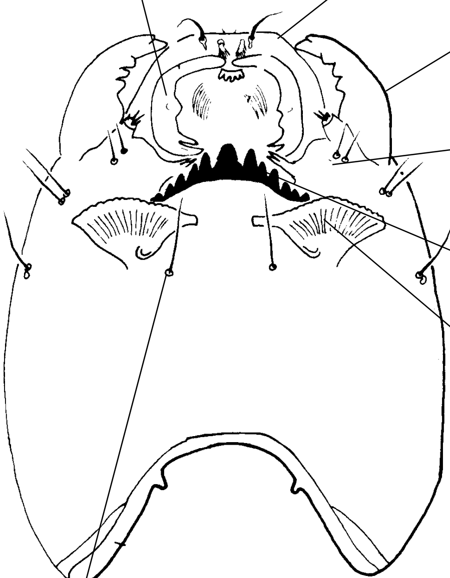
The majority of the characters used for larval identification are found on the sclerotized head capsule, with most of the more easily found characters located on the ventral side of the head. Below is a ventral view of the head capsule of *Dicrotendipes*, a typical member of the subfamily Chironominae; most other Nearctic subfamilies are generally similar, except for the Tanypodinae (see page 6).

The **premandibles** are located below the surface of the **labrum**; they are absent in some subfamilies. The number of apical teeth and the presence or absence of a group of setae, the **premandibular brush**, can be of importance.

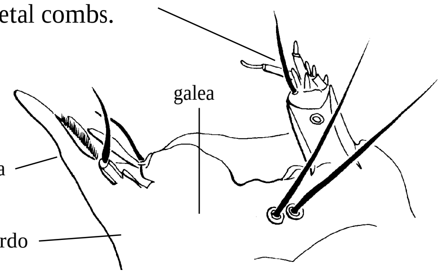




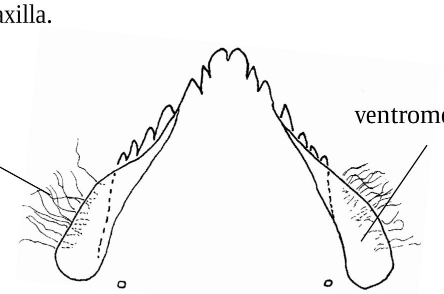
Many characters useful in identification are located on the **mandible**. These include the number and shape of the inner, apical and dorsal teeth, the presence or absence of a **seta interna**, the morphology of the **seta subdentalis** and the **pecten mandibularis**.



The **maxilla** bears structures useful in identification, such as the **maxillary palp** and various setae and setal combs.



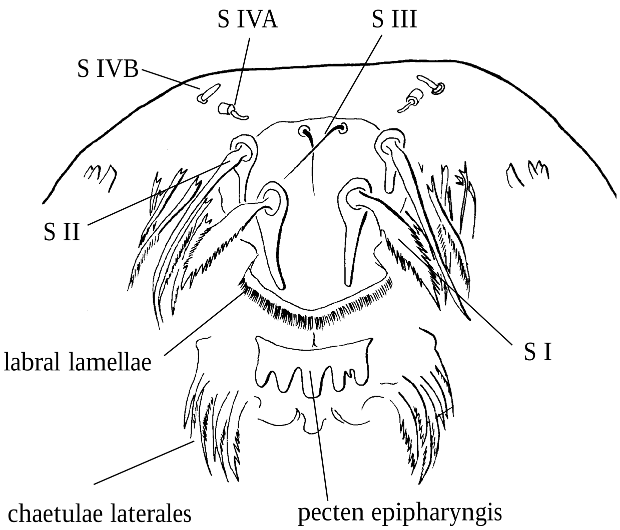
The **mentum** is often one of the most noticeable structures of the head capsule. The shape and number of teeth can be of great importance in identification. In several subfamilies, ventromental plates are present. A group of setae, the **beard**, may be present under or near the ventromental plates and/or the margin of the mentum or the maxilla.



Mentum of an Orthocladiinae larva, *Rheocricotopus robacki*, showing beard setae beneath ventromental plates.

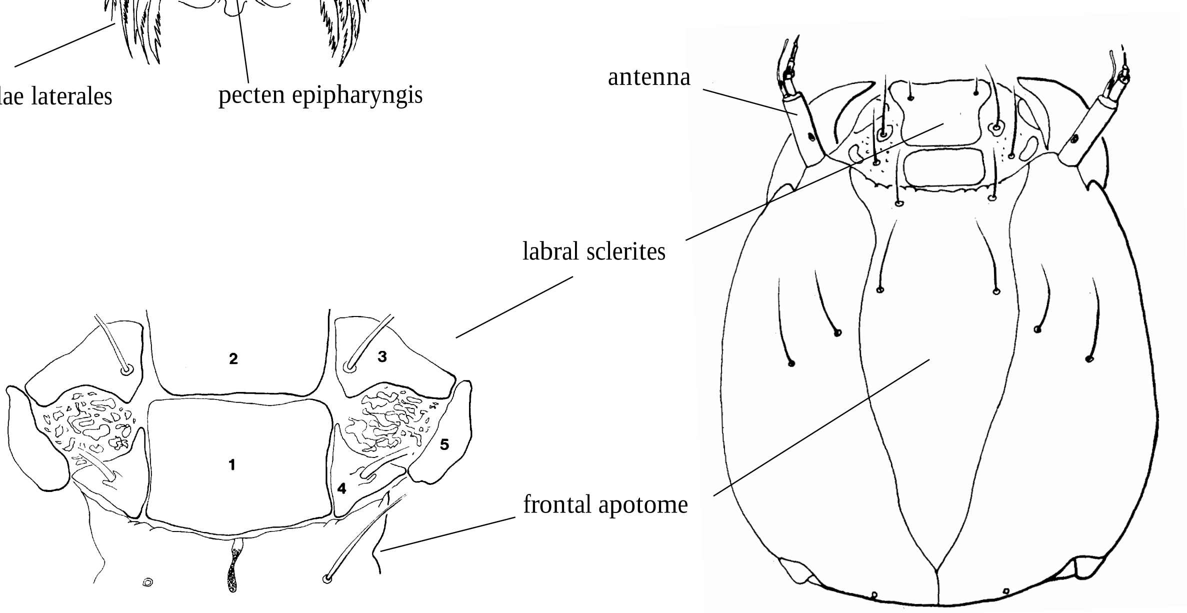
The placement and/or shape of a pair of setae posterior to the mentum, the **setae submenti**, are of importance in some taxa.

Dorsal view of the labrum



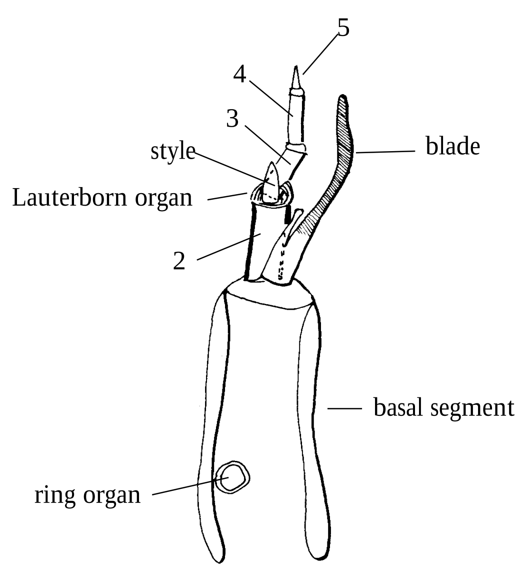
Although located on the dorsum of the head capsule, the labrum is usually folded under in slide mounts and is most often viewed "dorsally" in a ventral aspect. Several very important setae and other structures are located on or near the labrum - the **S setae**, the **labral lamellae** and the **pecten epipharyngis.**

Dorsal view of the head capsule



Posterior to the labrum are the **labral sclerites**. All of the labral sclerites figured above are not always present, dependent upon various degrees of fusion of the sclerites. Labral sclerite 1 is often fused with the apotome, forming a frontoclypeal apotome.

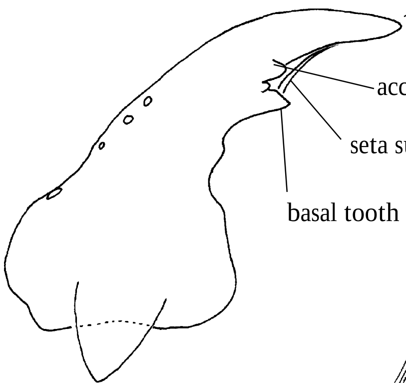
In all subfamilies, the **antennae** provide important characters. A commonly used character is the antennal ratio, **AR**. This is the length of the basal antennal segment divided by the combined lengths of the remaining segments (the remaining segments are collectively termed the **flagellum**). The apical segments are sometimes difficult to discern, especially in those genera with 6-, 7- or 8-segmented antennae. The placement and shape of the **Lauterborn organs**, sensory structures usually located on the second antennal segment or at its apex, are important, as is the location of the **ring organ**. Phase-contrast optics aid greatly in observing these hyaline (translucent) structures of the antennae and the dorsum of the labrum.



The tanypodine head capsule

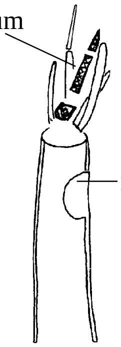
Members of the subfamily Tanypodinae differ from all other subfamilies in having retractile antennae and numerous other uniquely modified structures. Many of the specialized structures, such as the **ligula**, **paraligula** and the **M appendage,** are modifications of the premento-hypopharyngeal complex and associated structures, located dorsally of the mentum.

All Tanypodinae are predacious; the long apical tooth of the **mandible** is well suited for capturing and holding prey.

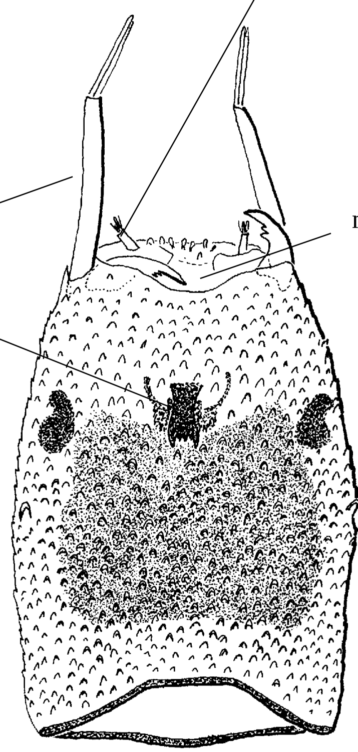


Paramerina mandible

In tanypods, the **maxillary palp** may be simple or divided into as many as 6 sections. At the apex of the palp are several sensillae; the number of "segments" of the **b sensillum** is useful in separating some genera.

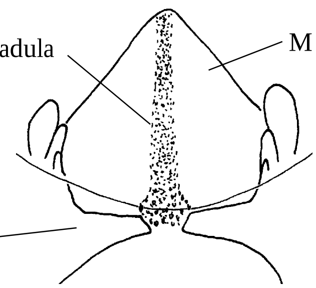


Conchapelopia maxillary palp, with three segmented b sensillum

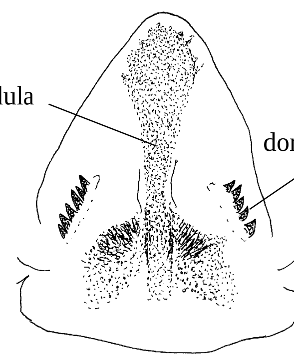


Labrundinia sp. A head capsule

Labrundinia sp. A ligula and paraligula

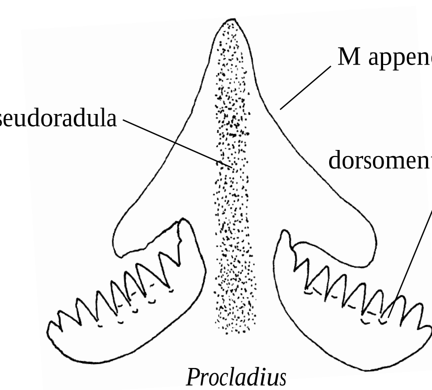


Labrundinia



Coelotanypus

The **ligula** is often the most noticeable feature of tanypod head capsules. While the **mentum** is quite distinct in many chironomids, it is weakly developed in many tanypods, with large teeth present only in phylogenetically "primitive" taxa. The **M appendage** of the mentum usually bears a strip of chitinized points, the **pseudoradula.**



Procladius

Glossary and Abbreviations

Outdated terms are in italics; plurals are in parentheses.
Most structures are illustrated in figures on the previous pages.

accessory blade - smaller elongate structure adjacent to antennal blade, usually partially fused with antennal blade at base **.**

accessory tooth - in Tanypodinae, small tooth between basal tooth and apical tooth of mandible; see also **dorsal accessory tooth**.

anal seta (setae) - seta(e) located on apex of procercus; also termed procercal setae.

antennal blade - elongate structure adjacent to antennal flagellum, arising from apex of first segment.

apotomal fenestra - circular to oval to quadrate area, usually anteromedial, on apotome that is lighter in color, a different thickness or of a different "texture" than the remainder of apotome.

apotome - see frontal apotome.

ANSP - Academy of Natural Sciences of Philadelphia.

AR - antennal ratio. In larvae, the ratio of the length of the basal antennal segment divided by the length of the combined apical segments (the **flagellum**). When I measure the flagellum, I measure from the bottom of segment 2 to the apex of the last segment; intersegmental membranes are incuded.

b sensillum - small, cylindrical, one to three sectioned ("segmented") sensillum on apex of maxillary palp; useful in delimiting genera in the *Thienemannimyia* group of tanypod larvae.

basal tooth - large tooth near base of seta subdentalis of tanypod mandible.

beard - in chironomid larvae, a group of setae present beneath or adjacent to the lateral margin of the mentum and ventromental plates. A cardinal beard, the type most often found in orthoclads, is one which originates from the cardo of the maxilla; it often appears as setae beneath the ventromental plates. A ventromental beard originates from the dorsal, inner surface of the ventromentum; it is found in prodiamesines and the orthoclad *Diplocladius*.

bifid - divided into two parts.

cardo (cardines) - the inner basal portion of the maxilla.

chaetulae laterales - simple or pectinate blades on each side of the pecten epipharyngis.

clypeus - dorsal sclerite of the head immediately anterior to the frontal apotome that bears the S 3 setae.

conjunctiva (conjunctivae) - intersegmental membrane(s).

corona - in Tanypodinae pupae, the clear area near apex of thoracic horn.

crenulate - incised in a regular manner, so that a margin appears to have a series of small rounded or truncated teeth, as in the margin of a scallop shell; adjective: **crenulated.**

digitiform - finger-like.

distal - towards the apex.

dorsal - referring to the upper surface or "top" side.

dorsal accessory tooth - dorsal tooth or teeth of mandible in addition to the "normal", more apical and larger dorsal tooth; present in several species of *Tanytarsus*.

dorsum - the upper surface; the "top" side.

exuviae - shed skin. "Exuviae" is the singular and plural form of this word; the use of the word "exuvium" is incorrect.

FAMU - Florida A & M University, Tallahassee, FL.

FDEP - Florida Department of Environmental Protection.

flagellum - collective term for the apical segments of the antenna.

frontal apotome - elongate plate at center of dorsum of head formed by sutures that, in most taxa, will split and allow the pupa to emerge. If the clypeus is fused to the apotome, it is termed the **frontoclypeal apotome**.

frontal pit - small to medium, internal pit found near middle of anterior margin of the frontal apotome of some larvae (*Dicrotendipes*) or directly anterior to apotome (*Glyptotendipes*). This is not the same structure as the apotomal fenestra (q.v.).

frontoclypeal setae - the S 3 setae, borne on the fused clypeus and frontal apotome.

in part - in the keys, this means that the taxon appears in the key more than once.

labial plate - mentum.

labral lamella (lamellae) - scale-like to plumose structures near median anterior margin of labrum.

labral sclerite(s) - central sclerite(s) directly anterior to clypeus and frontal apotome on dorsum of head.

labrum - the anterior dorsal portion of the head capsule, essentially the upper lip.

lateral - towards the side (also **laterad**)

Lauterborn organs - sensory organs on antennae, usually located on apex of second segment, but may arise elsewhere. Usually digitiform but may be on pedicels and collectively may appear leaf-like (in Tanytarsini).

ligula - in Tanypodinae, a sclerotized, toothed, tongue-like internal plate near center of head.

M appendage - membranous, triangular to arrowhead shaped appendage (in Tanypodinae) near anterior center of prementum; usually bears the pseudoradula (q.v.).

maxilla (maxillae) - mouthpart located near base of mandible; bears the maxillary palp. Composed of cardo, galea, lacinia, stipes (these structures essentially fused in chironomid larvae) and maxillary palp.

maxillary plate - basal ventral side of maxilla that lies above striae of ventromental plate; the striae of the maxillary plate join with the striae of the ventromental plate to form tubes through which silk may be expressed.

medial - referring to the middle or towards the middle.

mentum (**menta**) - (usually) toothed plate on anterior ventral margin of head capsule, composed of a fused ventromentum and dorsomentum.

mola - inner portion of mandible below teeth.

nomen dubium (nomina dubia) - a scientific name that is considered doubtful or unknown in its application; it usually refers to a name that can not be reliably connected to a taxon because there is no extant material of the taxon and/or the taxon can not be identified from its description.

NCDENR - North Carolina Department of Environment and Natural Resources.

palmate - like a hand, with finger-like processes.

paralabial plate - ventromental plate.

paraligula - small sclerotized structure adjacent to ligula.

parapod(s) - “legs” of larva; most larvae have a pair of anterior and a pair of posterior parapods (posterior pair often absent in terrestrial larvae).

pecten epipharyngis - structure located beneath the anterior central margin of the labrum, often composed of three scales, lamellae or spines (most Orthocladiinae), or may be a pectinate comb (many Chironominae).

pecten galearis - small, usually comb-like structure on the dorsal surface of the galea of the maxilla.

pecten hypopharyngis - in Tanypodinae, the comb-like structures on either side of the base of the ligula.

pecten mandibularis - group of setae near ventral apex of mandible.

pedestal - in tanytarsine larvae, the tubercle on the dorsum of the head capsule from which the antenna arises.

pectinate - comb-like.

pedicel - stalk or stem.

pharate - stage within the cuticle of the preceding stage, such as the pharate pupa developed within the larval skin, or a pharate adult developed within the pupal skin.

plastron - in Tanypodinae, the apical porous plate on the pupal thoracic horn.

plumose - featherlike, extremely finely divided.

postmentum - ventral area of head capsule posterior to the mentum.

premandible - one of a pair of elongate movable structures beneath the labrum, lacking or vestigial in some subfamilies (Podonominae, Tanypodinae).

premandibular brush - group of setae near premandible.

prementum - internal, soft, ventral lobe of the premento-hypopharyngeal complex, located dorsal of the mentum, that carries the ligula, paraligula, labial palp and M appendage.

procercus (procerci) - tubercle (may be elongate, especially in Tanypodinae) located above the anus; bears the anal setae apically. Absent or vestigial in some taxa.

proximal - towards the base.

pseudoradula - longitudinal band of fine to coarse points present on middle of M appendage.

ring organ - a circular structure (campaniform sensillum) found on the basal segment of the maxillary palp and the antenna.

rugose - wrinkled or corrugated.

S I, S II, S III, SIVA, S IVB - major setae of the anterodorsal surface of the labrum.

S 1 – S 12 - setae of the head capsule (not including the setae of the labrum listed above). They are numbered from the anterior end to the posterior end of the head and may have specific names for the structure they arise from or to which they are closest. Those used in this manual are the S 1 and S 2 setae, also termed the labral setae; the S 3 setae, termed the clypeal or frontoclypeal setae; and the S 9 and S 10 setae of the tanypod genus *Larsia*.

seta interna - seta located near base of dorsal side of mandible; it is usually apically branched.

seta subdentalis - seta on mandible proximal to inner teeth.

setae submenti (singular: **seta submenti**) - pair of setae immediately posterior to mentum; in some taxa displaced farther posteriorly.

sternite - ventral portion of a segment (in pupae refers to an abdominal segment).

stria (striae) - fine, impressed line; usually refers to lines on the ventromental plates of Chironominae ("**strial ridges**"). Striate or striated refers to a structure having striae.

style - small (usually) cylindrical sensory organ usually located at tip of second antennal segment; occasionally located near middle of segment.

supraanal setae - setae ventral to procerci and dorsal to anal tubules.

taenia (taeniae) – flattened, ribbon-like setae; adjective form: **taeniate**.

taxon (taxa) – a taxonomic unit, such as a species, genus, family, etc.

tergite - dorsal portion of a segment (in pupae refers to an abdominal segment).

teneral - recently molted. Teneral individuals usually do not have the "normal" coloration and portions of the body are not yet completely sclerotized ("hardened").

thoracic horn - structure near the "shoulder" of pupa; may be a simple bag-like structure, tubular, ellipsoid, branched, plumose or absent.

triangulum occipitale - the roughly triangular area between the posterior margin of the head capsule and the first suture anterior to it (the secondary postocciptal margin).

tribe - a taxonomic unit between the subfamily and genus; e.g., similar genera within a subfamily are grouped into tribes. The only tribes used in this manual are those of the subfamily Chironominae: Chironomini, Pseudochironomini and Tanytarsini.

tubules - tubular gill-like structures originating from body segments X-XI (ventral and/or caudolateral tubules) or from near anus (anal tubules).

USGS – United States Geological Survey.

VP - ventral pore, a sensory structure on the venter of the head capsule.

venter - the lower or "bottom" side.

ventral - referring to the lower or "bottom" side.

ventromental plate(s) - plate-like or shelf-like ventral outgrowth of the head capsule adjacent to each side of the mentum.

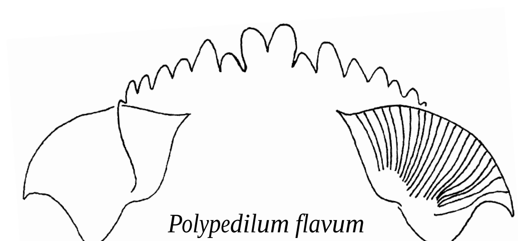
vortex (vortices) - circular group of spines located on posterolateral portion of some pupal abdominal sternites, formerly termed "pedes spurii A".

About the Names ...

As noted previously, one of the confusing aspects of working with chironomids has been the apparently rampant changing of names. There are good reasons for some of this "name changing". First is the Principle of Priority, one of the main principles of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999). Simply put, the first name given an organism is the one that has priority over other names applied to the same organism at a later date. As with everything, there are exceptions! The "rules" have been suspended in some cases. An example would be when a name that has been in usage for a long time is discovered to be a junior synonym of a name that has not been used since it was published; the older name may be suppressed by a special ruling of the International Commission on Zoological Nomenclature. This has happened with several names in the Chironomidae, including the family name itself! See Ashe (1983) for a more detailed explanation of some of the family's name changes.

Other name changes may occur when a species is transferred from one genus to another. In Latin, there are three genders: masculine, feminine and neuter. The gender of the species name must agree in gender with the genus name. Thus, when a species is moved from one genus to another with a different gender, the spelling of the species name may change. For example, Johannsen described the species *Chironomus flavus*. *Chironomus*, ending in *-us*, is masculine, so *flavus* is masculine to agree with it. When the species was moved to *Polypedilum* (which ending in *-um*, is neuter), *flavus* was changed to *flavum* to agree in gender with the neuter *Polypedilum*. It seems pretty simple, doesn't it? HA! There are also many other things to consider when coining names, such as the derivation of the name, its case, its tense, etc. And, just to confuse things, in plants, many genera ending in *-us* are feminine! For an insight on the formation and meaning of scientific names, see Brown (1956) and Ride et al. (1985).

We also have problems with mistaken identities. The example I just used, *Polypedilum flavum*, is the correct name for the species that has been called *Polypedilum convictum* in this country for years! This happened because Townes (1945) synonymized the Nearctic *Chironomus flavus* with the Palaearctic *Chironomus convictus*, because the adults were apparently inseparable (the species were originally described in *Chironomus*; later taxonomic work showed that they belonged in the genus *Polypedilum*). However the immature stages are quite different. The necessity for a "name change" was postulated in Epler (1992, 1995 - and note that I failed to correct the specific name for gender!) and finally made "official" in Oyewo & Sæther (1998).



Polypedilum flavum
mentum

Collecting and Preserving Chironomidae

Larval Chironomidae can be collected with any of the standard benthic collection devices. Larvae are best preserved in 70-80% ethanol. Formalin preserved larvae (and other life stages) can be difficult to clear if left in formalin for more than a few days or weeks.

Many workers add Rose Bengal stain to samples to facilitate "picking"- if you don't absolutely need it, please don't use it. I strongly recommend that this stain **NOT** be used! Rose Bengal often excessively stains many head capsules, making them too dark for proper light transmission. This obscures many of the tiny structures present on chironomids, rendering specimens very difficult to identify. Mountants, such as CMCP-9AF, that stain specimens should also not be used.

Identifying Chironomidae

Believe it or not, identifying chironomid larvae is easier than identifying the larvae of some other aquatic groups! Chironomidae have fascinated many aquatic scientists (it seems there is always a plentiful supply of "nuts"), and a large number of taxa have been reared and associated with their adult forms. The adults are important because historically, most Chironomidae species have been described based on characters of the adult male. Compared to some other families of aquatic flies, larval Chironomidae offer numerous morphological characters for identification. Problems arise when all these easily seen characters are similar in closely related (or sometimes not so closely related) taxa. Some characters are minute and hyaline, and are visible best under a high power oil immersion lens, using phase contrast or Nomarski optics/lighting.

Because of the similarity of some of these easily observed characters, it often is not possible to identify a chironomid by simply matching structures of your larva with a picture of a structure. This apparently has been the case in many misidentified North American specimens I've seen; many of these specimens were apparently matched with pictures of structures illustrated in Wiederholm (1983), for they bear names of species known only from the Palaearctic. Match-the-picture technology may work with identifying birds, but not, in general, with chironomids! Of course, there are many exceptions; they wouldn't be chironomids if there were no exceptions!! There are many species with Holarctic distribution patterns - and we will continue to find more such taxa as our knowledge of the Nearctic fauna grows - but one must exercise caution when applying names to taxa which are apparently extralimital.

Identifying an organism does not mean just running it through a key and coming up with an "identification" - after all, if you start to key something out, it will key somewhere! That does not mean you have arrived at the correct destination. Once a specimen has been keyed, you must double check your findings by consulting a diagnosis or description of the taxon you believe you have, or check it against specimens in a reference collection, if such a collection is available ***and*** if the collection has been verified by an expert. You should also look for information on distribution and hopefully some illustrations of morphological structures unique to that taxon; a major failing of many identification guides is their lack of diagnoses or descriptions, and insufficient illustrations. While well written keys will work for some groups for some geographical areas, this is not always the case with our wonderful chironomids! A lot of misinformation has been "provided" by poorly written or researched keys. You should also keep in mind that the specimen you're keying out may be new to science and/or was not seen by the person who wrote the key(s) you are using.

There is no single document that will allow one to identify all North American chironomid larvae to the species level; Wiederholm (1983, 1986, 1989) and Coffman & Ferrington (1996) go only to genus. There are two ways you can try to identify larvae to species:

1) Go to the literature and search for revisions of the taxa that you have already identified to genus. If the genus has been revised, you may be able to find keys or descriptions that will enable you to identify your specimen.

2) Look for regional guides to larval identification. Unfortunately, for North America there are very few such guides, and of those, two (Beck 1976, 1979; Webb & Brigham 1982) should not be used because of the inaccurate information they contain. Regional guides such as those by Epler (1995) and Simpson & Bode (1980) are reasonably accurate, although they are both out of date taxonomically (what's new?). The 1995 Epler guide was updated via the World Wide Web, but this current manual supercedes it and will be the one updated via my web site from now on (see Sources).

The credibility of good identifications with a regional guide may be high if the guide is extensively researched. Take for example the guide to Florida larval Chironomidae (Epler 1995). This guide was possible because of the large amount of reared material that was available to the author. Previous workers in Florida, such as Bill and Beth Beck, Annelle Soponis and myself, had reared a considerable number of the species in Florida, and additional *reared* material and information had been provided by other workers such Broughton Caldwell, Bohdan Bilyj, Martin Spies, Mike Bolton, Jim Sublette, Bob Rutter, Mike Heyn, Charles Watson and many others. A larval guide to species level identification was possible because many of the larvae had been associated with the adult stage (although, of course, not enough!) in a relatively small area (Florida). This current guide to the Carolinas was possible for the same reasons - and most of the same people (see Acknowledgements). I also studied a large number of type specimens and in essence did mini-revisions of many of the genera in this manual.

In order to really get a handle on the larval Chironomidae of North America, more revisionary work utilizing all life stages is necessary. And more regional guides to larvae and pupae are needed!

Regional guides can sometimes be used outside of the region they cover, but one must exercise caution! Regional guides often omit taxa that may be present in your area, and include taxa that probably will not be present in your area. In general, the chironomid fauna of any area is elucidated by the collection of adults (remember, most of the names of species are based on characters of adult males) and the rearing of larvae to adulthood, thus (hopefully) making it possible to identify the larvae. The Southeast US is one of the better known areas of the Nearctic, but we still have dozens of undescribed species. We must use letter or number designators (sp. A, sp. 1, etc.) to "identify" such species until the immature stages are associated with described adults, or the complete metamorphosis of the new species is described.

Do not identify specimens to a level beyond your capability or the capability of current taxonomy. Given the incomplete status of our knowledge of some chironomid taxa, many times an identification to a species group or complex will be all that is currently possible. Also, remember that most keys are based on fourth instar larvae. The fourth instar is the last larval instar; reared associations usually consist of the fourth instar larval exuviae, the pupal exuviae and the adult. Thus the fourth instar may be the only larval instar known with any morphological "precision". Some larval characters may change from one instar to the next; this is especially true for relative/comparative lengths of some body parts; earlier instars may not, or in some cases, *will not*, key correctly. There is no shame in listing a specimen as a "*Dicrotendipes* sp." when you can not be positive of your determination at the species level (without fourth instar specimens or associated material this may be necessary for many larvae). I have seen numerous studies and species lists based solely on larval identifications that would be impossible to achieve without associated specimens - just how were those specimens identified? By comparing pictures? Wishful thinking? Intuition? Did somebody pin a list on a wall and throw darts at it? (I've seen some collections that apparently were identified in a manner similar to this!) If you can't realistically and accurately put a species name on a specimen, drop back and punt at the generic level!

If you are uncertain of a generic or species identification but are relatively sure that you're close to being correct with a name, you can use the modifier "cf.". This is an abbreviation for a Latin term that means "compare to". If you're uncertain about the genus, use: "cf. *Meropelopia*" (or whatever genus); if uncertain of the species use: "*Goeldichironomus* cf. *natans*" (or whatever). Question marks can also be used, but many workers place them incorrectly, which leads to confusion! This confusion is best avoided by not using question marks in names. Also, do not use the modifier "nr." (an abbreviation for "near"; an example would be "*Polypedilum* nr. *illinoense*"). This implies a close phylogenetic relationship between your specimen and another species. Many keys are artificial constructs used to identify organisms; they do not necessarily imply phylogenetic relationships. Thus if your specimen keys to a couplet but doesn't quite fit, it does not automatically follow that your specimen is "near" the other taxon in that couplet.

Materials and Equipment Required for Larval Chironomid Identification

Microscopes: You will need a dissecting (stereo) microscope for sorting larvae and mounting them on microscope slides. A compound microscope is necessary for identification; one with phase-contrast optics or better is recommended. The compound microscope should have several objective lenses: a low power scanning lens (4X, which gives "40 power" with a 10X eyepiece), which makes it easier to locate your specimens on your slide, a 40X ("400 power") lens for most work and a 100X ("1000 power") oil-immersion lens; 10X and 20X objectives may be desirable, but are not necessary. Phase-contrast optics and a high power oil-immersion lens may be expensive, but are necessary for observing minute hyaline structures such as the S I, labral lamellae and the apical sensilla of the maxillary palpus. Another necessity is a measuring reticle (a glass disc etched with a grid or ruler line, which fits into one of the microscope's eyepieces); this accessory is needed to provide accurate length measurements (often the only way to separate some species) and to calculate ratios. Be sure to calibrate your reticle with a stage micrometer (usually, a precisely etched glass slide is used) at all magnifications you will be using.

Microscope slides, cover slips (glasses) and boxes: Whatever size you find convenient. Use glass cover slips. DO NOT USE PLASTIC COVER SLIPS!!! It is often necessary to press down on cover slips to reposition or flatten larvae; plastic cover slips will scratch and become impossible to see through. Round or square cover slips from 12 to 22 mm work well for most larvae. I favor the round ones because they allow more rotation and better positioning of your specimens. Although I have no empirical data, it also seems that round coverslips are less prone to air fingers than square or rectangular ones. Note that small round coverslips, from 6 to 10 mm, are useful for mounting associated larval and pupal exuviae with the emergent adult. Good slide boxes for maintaining reference collections are a necessity; don't scrimp on quality!

Mounting medium. There are two major kinds of mounting media:

1} media in which chironomid larvae can be mounted directly from water or alcohol. CMC-10 is the most widely used of these; Hoyer's (or Berlese's) is also sometimes used. These media almost always must be ringed to achieve any degree of longevity; slides made with them may be considered at best to be "semi-permanent".

2} media which require "clearing" and/or dehydration of the material to be mounted. This includes mountants such as Canada balsam and Euparal. In general, these media can produce museum quality slides that can be considered "permanent".

Both types have their advantages and disadvantages - of course! Nothing is ever simple!! We'll discuss CMC first, since it apparently is the medium of choice for most benthologists involved in large studies where hundreds or thousands of slides must be made.

CMC The negligible or reduced specimen preparation time no doubt makes CMC a favorite time saver. CMC medium comes in several varieties - CMC-10 (and to a much lesser extent, CMC-9) appears to be the most widely used for invertebrate slide making. CMC is a water-based medium; material can be mounted in it from alcohol or water, and the medium does impart a clearing action (clearing refers to the maceration or "digestion" of inner muscle tissue, thus allowing light rays to pass through the body. Remember that a compound microscope essentially shines a light through the viewed subject; if there is too much muscle tissue obstructing the light beams, one can not readily observe the structures necessary for identification.) Note that CMC may not sufficiently clear larvae with thick, dark head capsules (some diamesines, orthoclads and chironomines) or specimens that have been heavily stained with Rose Bengal; in such cases, the larvae may have to be cleared in KOH before mounting (see under Canada balsam technique).

advantages: quick mounting; clearing action; possible to mount large numbers of larvae in short time; can be thinned with water or alcohol; water-base makes it easy to soak off old cover slips and remount material.

disadvantages: medium may develop "air fingers" unless (or even if!) coverslip is ringed; medium can crystallize; some larvae will not clear sufficiently for identification without prior maceration in KOH; some larvae may effervesce and produce gas bubbles after the coverslip is put on; medium is temporary or semi-permanent at best; bad odor and may be hazardous.

Hoyer's medium apparently can no longer be purchased in the US because it contains chloral hydrate, a federally controlled substance. However, if you wish to go through the agony of obtaining a federal permit (or if you have a friend in the chemistry department), Hoyer's may be prepared from the following ingredients:

30 g gum arabic (ground crystals or powder, *not* flakes)
200 g chloral hydrate
20 cc glycerin
50 cc water

After mixing (it will take some time for all materials to go into solution - do not heat the mixture to speed the process!), filter the mixture through glass wool before usage and/or storage.

advantages: same as those for CMC.

disadvantages: same as those for CMC; not available commercially.

Canada balsam and Euparal. These media require xylene, cellosolve (ethylene glycol monoethyl ether), or for Euparal, "Euparal essence", for thinning, and specimens must be cleared and dehydrated before mounting.

advantages: produces superior slides for permanent storage.

disadvantages: specimens must be cleared and dehydrated before mounting; long drying time.

Storage and dispensing of mounting media. In general, one should store media in the containers in which they were shipped; media may be affected by exposure to air or light. These containers are usually too large to work as a dispensing unit. There are containers made specifically to hold mountant, such as Wheaton balsam bottles (figured below). These bottles usually come with a rod or wand for dispensing the mountant. To help prevent evaporation or desiccation of the mountant, I put a small amount of petroleum jelly on the bottom lip of the bottle top. CMC, Canada balsam and Euparal can be stored in and dispensed from Wheaton bottles, but I also use a small plastic squeeze bottle (I use the little bottles from pH testing kits made for pools) for dispensing CMC.

Wheaton balsam bottle

Also see page 1.25 for a checklist of other materials that you may need.

Sorting Chironomid Larvae

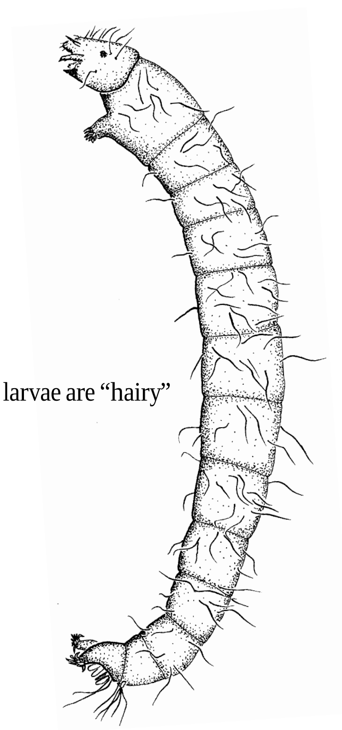
Mounting every chironomid from a sample is often unrealistic when huge numbers are collected. I always sort chironomids before slide mounting them. If you are mounting several specimens on one slide, you (hopefully) should at least have similar taxa under the cover slip and will be in the same part of the book when trying to identify them!

Many Chironomidae can be sorted to genus, even species, while still in fluid preservative, and representatives from each sorted group can be mounted. NOTE, however, that you should have considerable of experience before identifying unmounted larvae from fluid, and you should frequently mount specimens from groups you already "know" in order to be sure you're still looking at the same taxa. It is always best to remain skeptical of one's abilities!

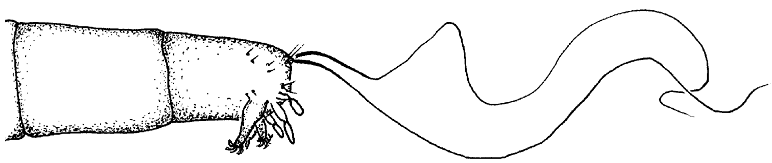
Chironomid larvae possess an abundance of characters that can be observed while in alcohol. Some of these are:

1. The general appearance of the body

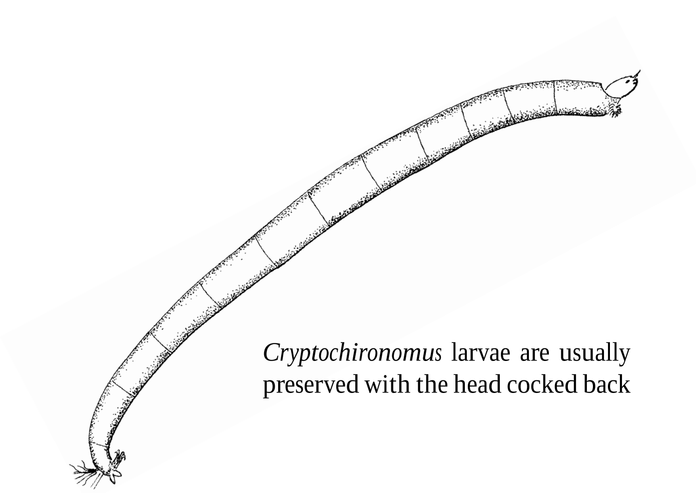
Is the body setose ("hairy")? Are the setae scattered, arranged in lines along the side of the body or are they grouped as tufts near the posterior corners of a segment? Are there setae at the end of the abdomen? If so, are they long or short? Is the body curved or the head distinctly bent? Are posterior parapods present? Are there any darkened claws on the posterior parapods? What is the condition of the anal tubules?



Tvetenia larvae are "hairy"



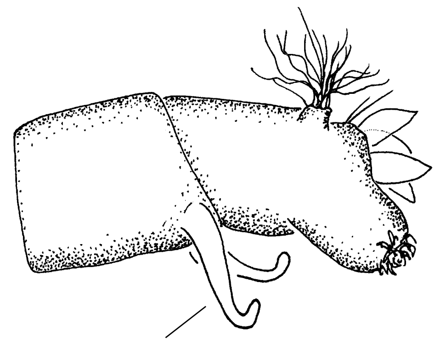
Parachaetocladius has extremely long anal seta
(Note: some other taxa also have long anal setae.)



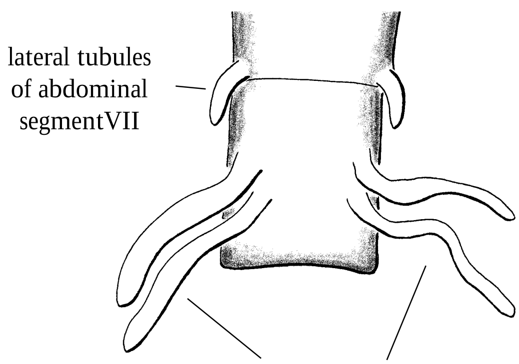
Cryptochironomus larvae are usually preserved with the head cocked back

The anal tubules of *Nilotanypus* and *Pentaneura* are longer than their posterior parapods

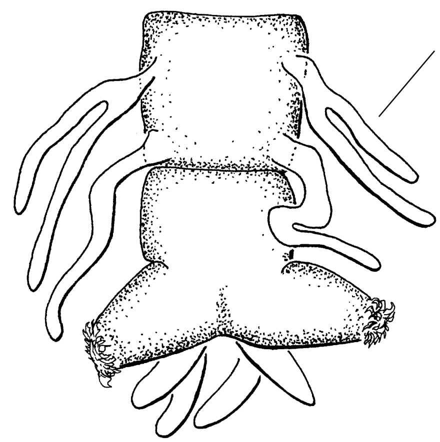
Are ventral or lateral tubules present near the end of the abdomen? If ventral tubules are present, how many pairs are there and how are they shaped? Note the shape and length of the anal tubules.



ventral tubules on abdominal segment VIII of *Glyptotendipes barbipes*

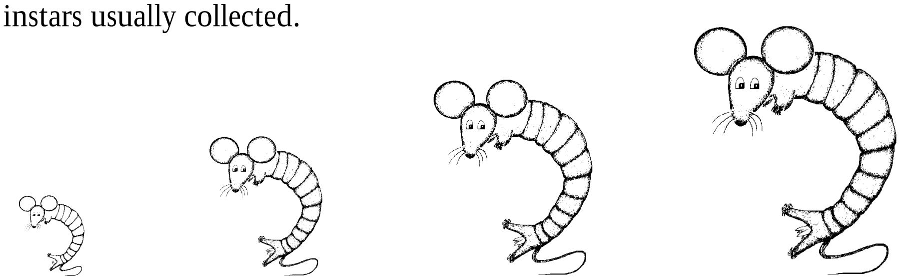


ventral tubules on abdominal segment VIII of a *Chironomus* species



ventral tubules on abdominal segment VIII of *Goeldichironomus holoprasinus* - note the bifid first pair

Size can also be considered; some larvae are huge (*Chironomus*, *Glyptotendipes*); others are tiny (*Corynoneura*, *Thienemanniella*). But, remember that although different taxa may be different sizes, different instars of one species will be of different dimensions. First instar larvae are tiny and may be generally planktonic; depending on the mesh size of your net or sieves, you may collect second instar larvae as well as the third and fourth instars usually collected.



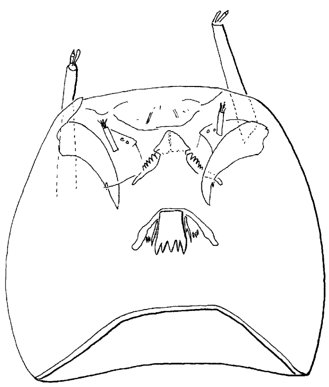
different instars of the same species will be of different sizes

2. Color of the body

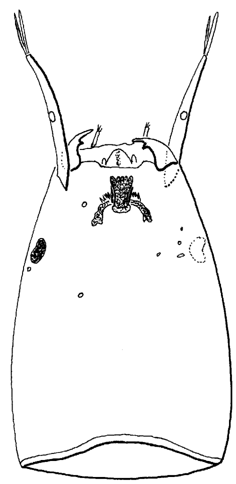
Best seen with live or fresh specimens (most alcohol preserved specimens will bleach). Some larvae may be white, cream, red, green or even purple! Some larvae may have color bands on the body. The larva of *Cricotopus lebetis* has its second and third thoracic segments colored a bright blue!

3. Shape and structures of the head capsule

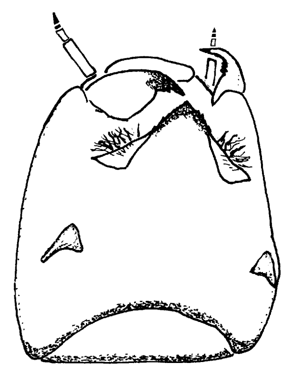
Some larvae have rounded head capsules, others are apically pointed; some are flattened. There are larvae with bumps, knobs or projections on the head capsule. Note the length of the antennae (see 5). The mentum and associated structures are easily visible on larger larvae and can get you right to genus with some taxa. In a lateral or ventral view, the triangulum occipitale provides a good character to separate larvae of *Kiefferulus* and *Goeldichironomus* (where it is large) from those of *Dicrotendipes*, *Einfeldia* and *Chironomus* (where it is small) while still in fluid preservative.



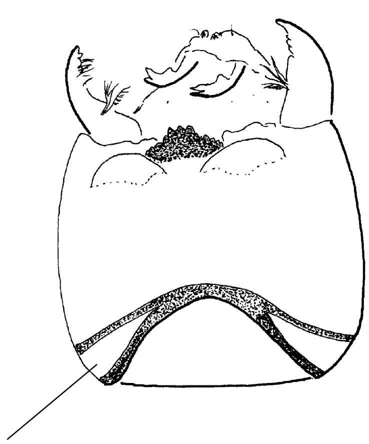
the head capsule of *Brundinella* is rounded



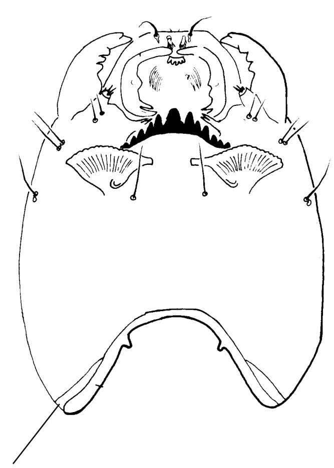
Denopelopia has a narrow head capsule



Rheocricotopus tuberculatus has a pair of small tubercles ventrally



the triangulum occipitale of *Goeldichironomus* is large



the triangulum occipitale of *Dicrotendipes* is small

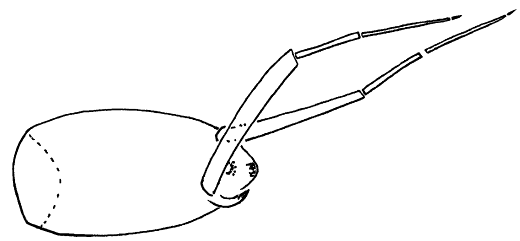
4. Color or markings of the head capsule.

As with body colors, head capsules come in a variety of colors, from colorless to black. The dorsum and/ or venter of the head may bear stripes, spots or bars. The postmentum (the area of the head capsule posterior to the mentum, also called the gular region) or the posterior margin of the head capsule may be darkened. Note how many eyespots are present and how they are arranged.

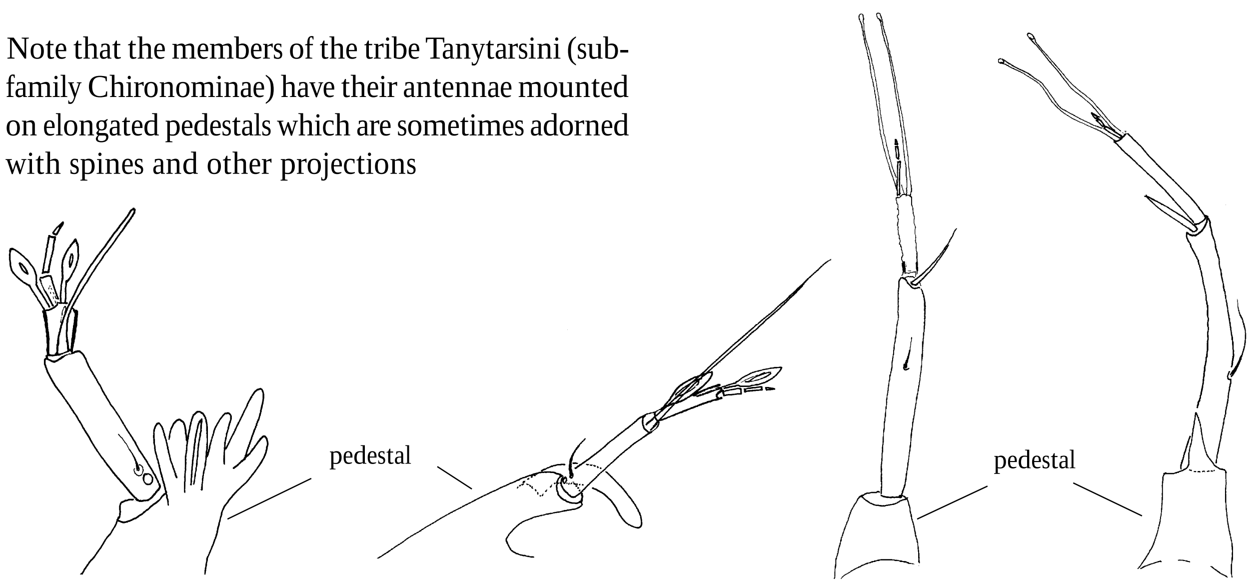
5. Antennae.

The shape and length of the antennae are diagnostic for many taxa. Larvae of the subfamily Tanypodinae have retractile antennae (they can be pulled into the head capsule) and are thus easily identified to subfamily while alive or in alcohol.

Note the long antennae of *Corynoneura*



Note that the members of the tribe Tanytarsini (subfamily Chironominae) have their antennae mounted on elongated pedestals which are sometimes adorned with spines and other projections



Stempellina - note the ornate pedestal

Stempellinella - this particular species has a long curved projection from the pedestal

the unadorned pedestal of a *Tanytarsus* species

this *Micropsectra* has a spine on its pedestal

6. Cases

Many benthic larvae build tubes of detritus, feces, and other available materials that are cemented with silk (*Chironomus, Glyptotendipes, Tanytarsus*); some larvae build transportable cases and they may often be collected while still in their cases. Note the distinctive cases of *Zavreliella* (like a hydroptilid caddisfly case) or the cases of *Rheotanytarsus*. Although it is not possible to identify most *Rheotanytarsus* larvae to species, they can be separated into two major groups by the type of larval/pupal case - the *Rh. pellucidus* group has a case with a long attachment stem; the *Rh. exiguus* group's case is attached along its side.

Slide Preparation

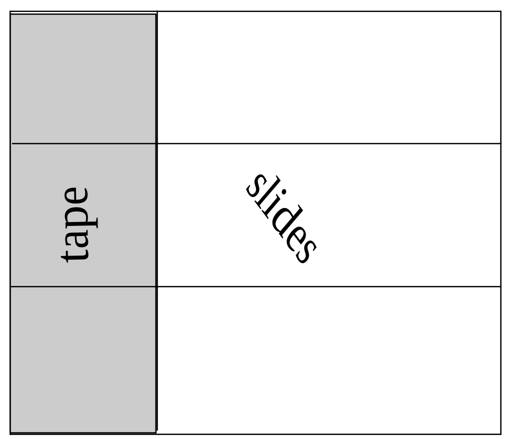
What follows below are the "long-winded", detailed directions for slide-making, replete with all kinds of good tips. A simple, basic version is provided on page 26, which may be easier to refer to while making slides. **HOWEVER**, be sure to read *ALL* of the material below before you make slides for the first time!! - or if you think there is a chance you may learn something new here ...

1 Always start with clean slides and cover slips. Note that although the box of cover slips may read "pre-cleaned", apparently a different definition of the term is being used than that accepted by most biologists; slides and especially cover slips can always benefit from a quick wipe before use (as long as a clean tissue is used).

2 Label the slide! Basically, slides without good labels are useless!! Few things are as irritating to a taxonomist than finding an interesting specimen with no collection data! Using codes or sample collection numbers is fine while the slide is in the lab, etc., but be sure to label the slide with complete information before sending it off to an expert for identification or verification, and before putting it into your reference collection. Years from now there is a good chance that nobody in the lab will remember to what the codes referred.

Always include complete collection data on any slides in your reference or voucher specimen collections!!!

There are several ways to put a label on a slide. Peel off and stick on labels are satisfactory, as are frosted slides, providing the "frosting' is fine. Avoid coarsely frosted slides - they do not allow fine writing. Satisfactory labels can also be made with transparent (regular "Scotch") tape. The tape method can be quite useful when making large numbers of slides; one can line up several slides and run a length of tape across all of them, and then use a knife or razor edge to separate the now labeled slides. Tape can be written on with pen or pencil; if using a pen, use at least waterproof ink. Alcohol-proof India ink is recommended - sooner or later, someone will spill something like alcohol over the slide and ...



tape can be applied to several slides at once and then cut with a knife, etc.

Remember that a compound microscope inverts the image. If you want to be able to look at your specimen and read the label on the slide, turn the slide around. This way you can read the slide label while the slide is on the microscope stage, and the head capsule will be oriented correctly.

Now you're ready to mount your specimens. What you do next depends on the type of mounting medium you are using. We'll discuss the most popular method using CMC first.

CMC method

Most specimens need no preparation before mounting in CMC; larvae may be mounted from alcohol or water. Place 2-5 drops of CMC on the slide (the amount will vary with how many specimens you are mounting, their size, etc.). It is generally to your advantage to use a small excess of mountant; this will reduce the possibility of “air fingers” from forming near the edge of the coverslip. However, if you are mounting many (more than seven or so) larvae under one coverslip, too much mountant may ooze out from under the slip and may carry a few larvae with it. If this happens, you can pick up the coverslip and try again, or you can sometimes push the larva(e) back under the slip.

Place the specimen(s) in the mountant, laying the larva(e) ventral side up (and head pointed up). You will note that allowing the larvae to sit in the mountant for a short period will soften them a bit and make them easier to manipulate. Tease out some of the larger bubbles that may form (don’t worry about getting them all; most will disperse on their own). When mounting from alcohol or water, if too much liquid is carried with the larvae, the mountant may spread out too much - it sometimes is necessary to wick the liquid off the larvae by gently touching them to a paper towel or similar absorbent surface.

The number of specimens and coverslips per slide is your choice. Certainly, ”special” larvae deserve their own separate slides, but for efficiency it is possible to mount numerous larvae on a slide. Note that while it is possible to mount 10 or more larvae under a single large coverslip (22 mm), and to put two such cover slips on a slide, such a technique frequently results in numerous larvae being oriented in a less than satisfactory position.

Some workers remove the head and mount it under a separate coverslip. This is not necessary for most larvae, but certain recalcitrant larvae do require decapitation in order to position the head capsule correctly. Be certain to mount the body on the same slide! Both head capsule and detached body can often be mounted under the same coverslip.

Using forceps (I use an old pair with relatively blunt points), take a clean coverslip and gently lower it over the mountant at an angle. Try not to drop the slip onto the mountant - this may trap air bubbles. If your mountant is a bit thick or has set up prematurely, dip the coverslip in alcohol, wipe it off, and then dip it back in the alcohol again to pick up a tiny drop of alcohol, then place it over the mountant; the drop of alcohol helps the coverslip settle over the medium more smoothly. Once the mountant has filled in under the coverslip, you can finish arranging your larva(e) under the slip. By pushing the coverslip from one side, etc., you can roll the larva(e) to the position desired. Then, gently press down on the coverslip over the head capsule with blunt forceps, pencil eraser, etc. to spread the mouthparts, and over the anal end to spread the claws of the hind parapods (especially important with tanypod larvae). It is important to spread the mandibles so that their inner teeth can be viewed.

Lay the slide on a flat surface and allow it to cure at room temperature for 2-3 hours. As it dries, the medium may shrink and produce air fingers at the edge of the cover slip; if any air fingers are present, fill them in with more CMC (place a small amount next to the affected area; capillary action will usually draw it in under the slip) and allow to cure for another 1-2 hours. For best results and more permanent slides, use clear fingernail polish or more CMC to ring the cover slips; this creates a seal that prevents more air fingers from forming. Note: if you are making large numbers of slides, it may be

> TIP: When mounting several larvae under one coverslip, it may be easier to lay them all on one side (all facing the same direction) and roll them over on their backs with the coverslip (after it is put on). Also, allowing the mountant to set up a bit after placing the larvae in it but before placing the coverslip on may help them stay in place when you finally do put the coverslip on.

time saving to examine the specimens before ringing them, and only ringing the slides with unusual, important or new specimens. After this the slides can be placed in a drying oven (do not exceed 55° C) for a day or two (usually longer at room temperature) and are then ready for detailed examination. Slides may be examined earlier, but do not use the oil immersion lens on slides until the medium has dried; otherwise, the coverslip may lift off or shift sideways and specimens may be damaged, or you may coat your objective lens with mountant!

“Bad” slides can be remounted easily by soaking the coverslip off in water; old slides may require soaking for several days. If the coverslip has already been ringed with fingernail polish, the sealant can be removed with ethyl acetate.

If CMC slides are examined within 3-4 weeks (and perhaps after even longer periods of time), it is usually possible to reorient larvae under a coverslip by applying pressure with blunt forceps over the area that needs to be moved. I do this at 40X power - the low power scanning objective of my compound microscope. You may be amazed how much you can move or squash specimens. Use caution about too much pressure or the coverslip will break!

Canada Balsam/Euparal Method

Important or potentially important material should be mounted in a good permanent medium. The two media most often used are Canada balsam and Euparal. Although both of these media can impart a slight clearing action, it generally is not sufficient for observation of many characters (although small larvae will often be sufficiently cleared). Thus we have several more steps in this slide making procedure involved in preparing the specimens before mounting. These steps include clearing the larvae followed by baths in various liquids. You will need several small containers, one for each bath - two of which will need lids to prevent evaporation of the liquids. I use very small, nesting watch glasses. Bear in mind that there are several techniques for treating specimens before mounting. What follows are the best methods I have used. Note that if you are mounting larval or pupal exuviae (shed skins), you need only soak the exuviae in 95% propanol before mounting in either balsam or Euparal.

1 - Begin with placing the larvae in a 10% solution of potassium hydroxide (KOH). KOH will digest the inner muscle tissue and leave the sclerotized portions of the larval exoskeleton, including the body. Larvae can be left in the solution over night at room temperature and by the next morning they should be sufficiently clear to begin the next step, dehydration. Or, to speed things up, the KOH solution with the larvae can be gently heated to just below its boiling point. You may wish to put the larvae and KOH in test tubes and then immerse the tubes in a beaker with boiling water, essentially a water bath. Or the KOH solution can be warmed directly on a hot plate using small ceramic pots containing the solution. Of course one must be very cautious not to over clear the specimens.

2 - Whether using heated or room temperature KOH, the next step for the specimens after clearing is a bath in distilled water. Note that some clearing action may continue in the water - larvae that have been over cleared may seem to “disappear” at this stage! Don’t worry too much - the specimens are still there. If the specimens are not easily visible, try lighting from below, or tilt the container; often bodies will line up along the meniscus. Transfer the specimens using a small dropper, or drape them over a needle, or lift them between the tips of forceps - be gentle! Specimens should sit in the water bath approximately 3 to 10 minutes, depending on the number of specimens and their size.

3 - Following the water bath, specimens are placed in glacial acetic acid (this container should remain covered) for 3 -10 minutes.

4 - Traditionally, the last bath may differ whether Euparal or Canada balsam is used. If using balsam, specimens go into a bath of 95% propanol layered

over cedar wood oil. Note that it is probably not necessary to use cedar wood oil, but be sure to test this before you mount important material without the cedar wood oil bath. I have had success using a final bath of just 95% propanol. If you are using Euparal, place in a bath of just 95% propanol. As with previous baths, allow 3 -10 minutes. With either fluid, the container should be covered to slow evaporation or absorption of atmospheric water.

From this point, directions are similar to the CMC method. Apply several drops of mountant on the slide. Using fine forceps or a needle, transfer the larva(e) to the mountant. The liquid transferred with the larva(e) will thin the mountant a bit. Arrange your larva(e) and put on a cover slip. Note that because the head capsule has been cleared, it will not take as much pressure to spread the mandibles, etc. Often, the weight of the coverslip will suffice. It is not necessary to ring slides made with Canada balsam or Euparal.

Once the slide is made, it should be placed in a drying oven. Slides made with balsam or Euparal take a much longer time to dry than those made with CMC. It may take two to three weeks before a Euparal slide can be looked at under an oil immersion lens.

If the mountant hardens too quickly, it may be thinned. With Canada balsam, use a bit of xylene; 95% propanol will also work, but xylene usually does a much better job. Euparal can be thinned on the slide with 95% propanol; Euparal essence should be used to thin Euparal that has become too thick or has dried out in its dispensing or storage containers. If slides need to be remade or cover slips need to be replaced, use xylene for balsam slides and Euparal essence or 95% propanol for Euparal mounts.

Cellosolve (ethylene glycol monoethyl ether) may be used as a thinner for Canada balsam (if all the xylene, normally used as a thinner for balsam, has been evaporated from the balsam). Material that doesn't require extensive clearing (lightly sclerotized body parts, etc.) can be placed in a bath of cellosolve and then directly in balsam. However, cellosolve is very prone to contamination with atmospheric water. This contamination can produce a cloudy mountant - and many times you won't know this until several weeks after the slides have been made. I no longer recommend using cellosolve.

When large numbers of larvae from several sites must be processed, an efficient assembly line procedure can be set up with both the CMC and Canada balsam methods.

Checklist of necessary lab equipment and materials:

slides
coverslips
slide labels
mounting medium
slide storage boxes
compound microscope with (at least) phase contrast optics
stereo (dissecting) microscope
forceps ("tweezers")
labware (dishes, vials, watch glasses, etc.)
70-80% ethanol
ethyl acetate
clear fingernail polish
* 95% propanol (used because it evaporates much more slowly than ethanol)
* glacial acetic acid
* cedar wood oil
* xylene
* hot plate
* Euparal essence (only if using Euparal)

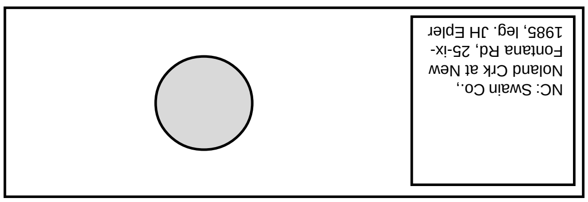
* = if using Canada balsam or Euparal

A note on forceps. I use forceps with the finest points available, Dumont #5's. It is important to keep your forceps as sharp as possible. I've been in labs where technicians were using old, blunt forceps that felt like two huge trees under the scope. Obtain a hard honing stone for maintaining sharp points; you'll be amazed at the comfort difference using sharp forceps makes!

Slide making with CMC

(see text for more details)

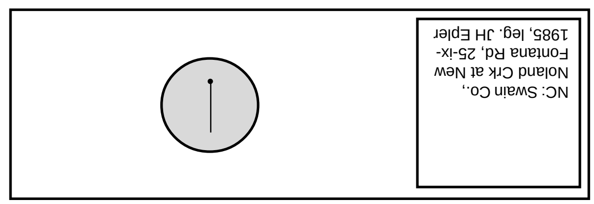
Start with a clean slide. The first thing you need to do is to label the slide! A short code, etc., is OK, but be sure to add complete label data if the slide will be a voucher or reference specimen, or if you send it to an expert for identification or verification.

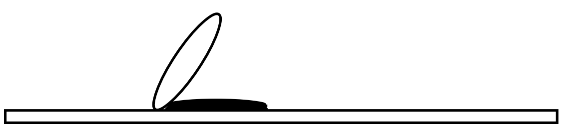


Then turn the slide around. Remember that a compound microscope inverts the image. This way you can read the slide label while the slide is on the microscope stage, and the head capsule will be oriented correctly.

Place 2-5 drops of CMC on the slide (the amount will vary with how many specimens you are mounting, their size, etc.)

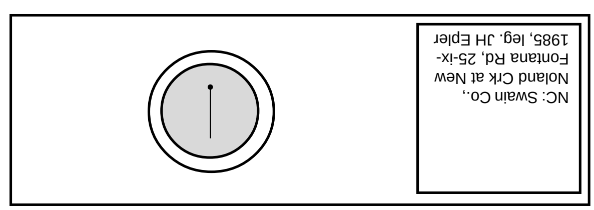
Place the specimen(s) in the mountant, laying the larva(e) ventral side up (and head pointed up). Tease out some of the larger bubbles that may form (don't worry about getting them all; most will disperse on their own).





Take a *clean* cover slip and gently lower it over the mountant at an angle. Try not to drop the slip onto the mountant - this will trap air bubbles.

Once the mountant has filled in under the cover slip, you can finish arranging your larva(e) under the slip. By pushing the cover from one side, etc., you can roll the larva(e) to the position desired. Then, *gently* press down on the cover slip over the head capsule with your forceps, pencil eraser, etc. to spread the mouthparts, and over the anal end to spread the claws of the hind parapods.



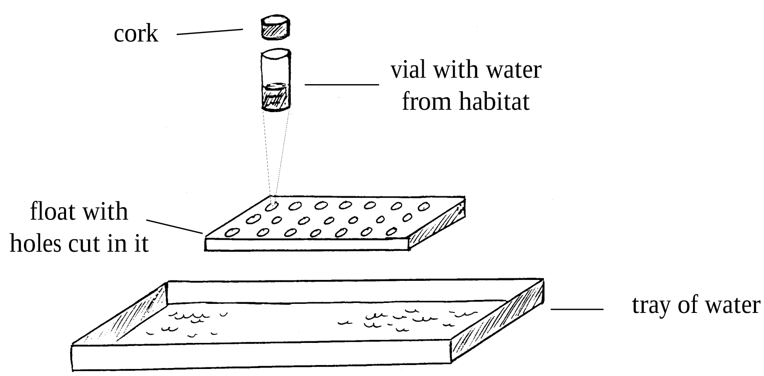
Lay the slide on a flat surface and allow it to cure at room temperature for 2-3 hours. Check for air fingers; if any are present fill them in with more CMC and allow to cure for 1-2 hours. Then use clear fingernail polish or more CMC to ring the coverslips. Slides can be placed in a drying oven (do not exceed 55° C) for a day or two (perhaps longer at room temperature) and are then ready for examination.

Rearing Larvae

Identification of some larvae is greatly aided by, or sometimes requires, associated pupal or adult material. Sometimes we get lucky and collect late fourth instar larvae in which developing pupal structures, such as the thoracic horn or various setal structures, can be observed; these can be particularly useful for separating genera of the *Thienemannimyia* complex or *Cricotopus* larvae from those of *Orthocladius*. Or one may collect pupae with larval exuviae still attached; sometimes pupae are found with developed adult genitalia within while the larval exuviae is still attached. Most often, though, one must collect living larvae and rear them to adulthood to make an association that may enable you to put a species name on a larva or with larval complexes that have not yet been deciphered.

Rearing refers to the process of allowing isolated larvae to go through the remaining stages of metamorphosis in order to associate the adult stage with the larval stage (and, of course, the pupal stage as well). Rearing most chironomid larvae is simple: collect live larvae in the field. Whether using a net or any other sampling device, place the material collected in a white (or any light color) pan, then sort through the detritus for larvae. Use an eye dropper for collecting and transferring larvae - do not pick up living larvae with forceps - they damage very easily! Place each larva in a separate 2 or 4 dram vial with a small amount of water from the habitat, and place a cork or other permeable stopper in it (don't use cotton unless you have nothing else; adults may lose legs and antennae in it). The vials can then be placed in racks or floats; I use closed cell foam with holes bored through it that are just a bit smaller than the diameter of the vials. Maintain an even temperature. This may require using a cooler; larvae are difficult to overcool for short periods, but succumb easily to high heat.

If field time is limited, take a container (cooler) with samplers with live insects back to lab, and sort larvae there. In the lab, place the vials in rafts floating in water, or if air conditioned, they can probably be left at room temperature. I've had good results at temperatures ranging from 15°-20+° C. This will vary depending on what and where you have collected, time of year, etc. Lentic taxa tend to be easier to rear than lotic taxa; in the Southeast US, psammophilic taxa (sand dwellers) seem to be the most difficult to rear. Check vials daily. If you have collected fourth instar larvae, they may pupate, and eventually an adult may emerge. Allow the adult to harden for several hours or a day, and then knock it into the water with a squirt of alcohol. There you have it: an adult with its shed pupal and larval skins! Be sure to add preservative in an adequate strength (70-80% ethanol). Incomplete rearings (larva died in transition to pupa, or pupa died before adult emerged) can also be extremely valuable. Reared larvae may be sent to experts for identification. You could be the person who makes an important association which allows better identifications for everyone. And, rearing and observing live larvae, pupae and adults can be quite interesting, educational and even fun!



a simple rearing setup

Quality Assurance

An often neglected factor in macroinvertebrate studies is the quality assurance of identifications. Although stringent guidelines may be in place for sample collection methods, chemical analyses or statistical tests, etc., too often too little attention is paid to monitoring or improving the abilities of lab personnel performing identifications.

We're all human - we all make mistakes - and we're working with biological units that are subject to variation. It's easy to mislabel a slide or write the wrong thing down if one is momentarily distracted - perhaps the person next to you in the lab had a big meal of beans the night before, etc. I view these errors as "mechanical" mistakes that are basically inevitable; regular QA/QC procedures should handle or catch many of these types of errors.

Identifying something incorrectly is another story. Novices and masters - all of us - need the feedback concerning the accuracy of our identifications. Then why don't more workers have their work checked?

I can postulate a number of reasons. The number one reason related to me by most biologists is that, although they'd like to have their work verified, they don't have the funds to have their material checked by outside experts. This is *not* a good reason. After all, the beginning data points for any study involving organisms are the organisms, and everything should be done to insure the accuracy of those data. And, sorry to say, passing the specimens around the lab for various opinions as to their identity is in many instances not a satisfactory solution. Funds for verification by experts should be incorporated into every study. In the past, it was often possible to get "free" identification help from taxonomists at museums, universities, etc. In some cases, this is still possible, but for many groups it no longer is. Museums have cut back on personnel, retiring systematists at universities are replaced by ecologists or molecular biologists with insufficient training in taxonomy, and many of the "old guard" have passed on. There are not that many students studying systematics today - why should they when the prospects for a job in systematics are bleak? Talk about "biodiversity" is cheap and hypocritical when systematics is not supported. Administrators must be made aware of the importance of correct identifications and the necessity (sometimes) to use an outside expert.

Reason number two is that many naive biologists actually believe they know what they're doing when it comes to identifying organisms. However, identifying an organism does not mean just running it through a key and coming up with an "identification" (see the section on Identifying Chironomidae above). If you don't have your work checked by someone who knows what he/she is doing, there is a good chance you have misidentified some taxa.

Reason number three is related to number two - some biologists believe that their work is so "good" that there is no reason to have it checked - it is a matter of personal ego. But this is supposed to be science we're doing, and a mainstay of science is the process of peer review.

And just in case there are non-believers out there who think that their work doesn't need to be checked, peruse the table below. It is a small sampling of the larval chironomid collections that I've examined recently. They come from a variety of sources: county, state and federal labs, universities and private consulting firms.

Collection	Number of specimens	Number misidentified	% misidentified
G	70	4	6
J	57	4	7
H	185	22	12
A	14	2	14
C	73	13	18
D	32	9	28
I	85	26	31
E	61	26	43
B	50	24	48
F	86	52	60

Can you imagine a collection with 60% of the specimens misidentified? Can you imagine writing a report utilizing such data? Imagine no longer, because it's been done!

Voucher specimens. All studies should have a collection of voucher specimens, i.e., specimens that are representatives of the organisms identified from that study. Ideally, such a collection would be verified by an expert.

Experts. Just who qualifies as an expert? How do you know whether you have a diamond or a cubic zirconium? A few things to consider:

The first thing one needs to realize is that mere possession of a Ph.D. does not mean that the bearer is an expert in taxonomy. The worst collections I've examined were "identified" by people with Ph.Ds. However, if that person earned his/her Ph.D. by doing a generic revision or similar systematic work, he/she could be considered expert at least with the taxon or taxa studied. Workers who have earned a Ph.D. may have been exposed to more serious taxonomic experience than those persons who have not spent as much time in a laboratory, but note that several North American experts do not hold a Ph.D.! Experience gained through years of working may be more instructive than taking courses, provided that the experience has been tempered with ample verification of identifications. Nothing beats the opportunity to examine material that has been correctly identified; some taxa bear nuances (or a "gestalt") that illustrations or descriptions don't quite bring out. In some cases it may even be necessary to study type material (but please note that such a circumstance would be relatively rare!).

Has your "expert" published on the taxonomy of the group in question? What we're talking about here is not papers dealing with new records for distribution or life history studies, but genuine taxonomic work, such as describing new taxa, redescribing taxa, generic revisions, reviews of museum specimens, etc. In lieu of published taxonomic experience, a conscientious worker with many years of experience, an up to date library and an extensive collection of ***verified*** reference specimens might be considered as an expert. Quite often, benthologists have seen more material of some taxa than the museum taxonomist!

Is your "expert" able to confirm or deduce larval identities based on associated pupal or adult stages? Without such an ability, it would seem hard to deem such a worker as an expert, although, as outlined above, there are many workers who have a great deal of expertise with only one life stage.

In general, we chironomid taxonomists have our areas of taxonomic and geographic specialization; if we have a specimen whose identity is unclear, we tend to send it to the worker who is the specialist with that group (usually the last person that did any taxonomic work on it - barring those who have already passed on) or region. A major problem is that there are not enough people doing genuine systematic research (and publishing it!) with Chironomidae in North America - the active publishing experts can be counted on two hands, and several fingers will be left over. Don't forget that these experts are often fooled (just read the literature!) and biological entities seem sometimes to get a bit cranky if you try to put a name on them. For instance, although I've worked with the genus *Dicrotendipes* for over 25 years, I still can not consistently separate some specimens of the common species *D. modestus*, *D. tritomus* and *D. neomodestus*, in either the larval, pupal or adult stages. Whether this is due to "natural" variation, hybridization or the presence of unrecognized, cryptic species is not known. It still is not possible to separate at the genus level many species of *Orthocladius* larvae from those of *Cricotopus* and/or *Paratrichocladius*, although with dedication, larval/pupal/adult associations and lots of experience, the larvae of many species of these three genera can be identified at the species level.

If you learn one thing from this manual, it should be:

You must have your identifications verified by a qualified expert!!

Literature

One of the most important things a good taxonomist has, in addition to lots of experience and a collection of correctly identified reference specimens, is an extensive, up to date library. Keeping up with the literature can be a daunting task, but today that task is aided by such helpful things as the annual NABS bibliographies and other literature available from Internet sites such as the Chironomid Home Page (see Sources).

Literature that should be in every lab is listed below. Literature that is not to be trusted is Beck (1976, 1979) and Webb & Brigham (1982); these publications are fraught with mistakes and misinformation.

If you're going to seriously work with Chironomidae, you should at a minimum obtain the following literature:

Armitage, et al. 1995
Coffman & Ferrington 1996
Epler 1995
Oliver et al. 1990
Oliver & Dillon 1994b
Sæther 1980a
Wiederholm 1983, 1986, 1989

Regional Guides

Epler 1995
Oliver et al. 1978
Simpson & Bode 1980

Other handy literature, including bibliographies, checklists, works on eggs, pupae and adults; some of these publications deal with the fauna of other areas, but they may include some taxa that occur in the Nearctic or may eventually be found here.

Ashe 1983
Caldwell et al. 1997
Fittkau 1962
Fittkau et al. 1976
Hoffrichter & Reiss 1981
Hudson et al. 1990
Langton 1991
Nolte 1993
Oliver & Roussel 1983b
Pinder 1978
Roback 1957, 1971
Schmid 1993
Simpson 1982
Simpson & Bode 1980
Spies & Reiss 1996
Townes 1945

Sources

Listed below are sources for laboratory materials, literature and additional information. Note that these are my recommendations and that the mention of a company, product or service does not indicate endorsement by any government agency!

Lab Materials:
CMC mounting medium:
Masters Company, Inc.
890 Lively Blvd.
Wood Dale, IL 60191
(630) 238-9292
Fax: (630) 238-9297

General lab products:
VWR Scientific Products
http://www.vwrsp.com

Entomology equipment:
BioQuip Products
17803 LaSalle Avenue
Gardena, CA 90248-3602
(310)-324-0620
e-mail: bioquip@aol.com

BioQuip is the best source for almost all entomological equipment and many books.

Livesay's, Inc.
456 West Columbus Drive
Tampa, FL 33602
(813)229-2715

Source for extra fine point Dumont number 5 forceps (Swiss made; expensive, but the best).

Literature:
Unfortunately, the larval volume (Wiederholm 1983) of the Holarctic Keys is out of print. The other Entomologica Scandinavica Holarctic Keys and other Ent. scand. chironomid related papers can be purchased from the following:

Scandinavian Entomology Ltd.
P.O. Box 24
S-240 17 S. Sandby,
Sweden
e-mail: Lennart.Cederholm@zool.lu.se

Entomologica Scandinavica on the web:
http://darwin.biol.lu.se/systzool/zoomus/ZooDoc/Publ
will take you to an index; click on the ESS numbers for a listing of Entomologica Scandinavica Supplements and their prices.

The Holarctic Keys are also available from:

Apollo Books
Kirkeby Sand 19
DK-5771 Stenstrup
Denmark
email: apollobooks@vip.cybercity.dk
web: **http://www.apollobooks.com**

Information sources on the World Wide Web:
Chironomidae and Water Beetles of Florida:
http://www.concentric.net/~jhepler/index.html
Features checklists of the Chironomidae of Florida, North Carolina, South Carolina and updates, additions and corrections to Epler's manuals, including this current manual.

The Chironomid Home Page
http://www.ouc.bc.ca/fwsc/iwalker/intpanis/
Central source of general information on Chironomidae and chironomid workers; includes a world-wide directory of chironomid workers and access to an extensive bibliography dealing with Chironomidae.

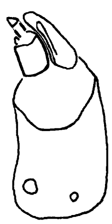
Chironomidae-L listserv
A listserv is like a distribution house for communications on certain subjects. Subscribers send in e-mail messages to a central address, and the computer there sends that message out to all subscribers. To subscribe, simply send an e-mail message to <majordomo@cf.ac.uk> with the text: "subscribe Chironomidae-L".

A Tour of the Subfamilies

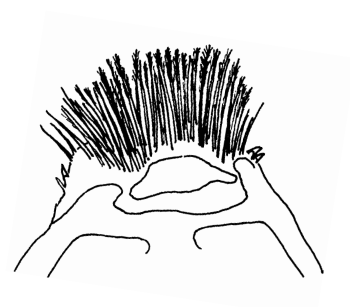
As noted before, seven of the described subfamilies of Chironomidae occur in North America. We'll take a short morphologically-based tour of these subfamilies in presumed phylogenetic order, beginning with the most "primitive". Note that characters referred to below pertain to North American members of the subfamilies; in other parts of the world some subfamilies have members which may differ. This tour is followed by a key to the subfamilies of the southeastern United States.

Subfamily Telmatogetoninae

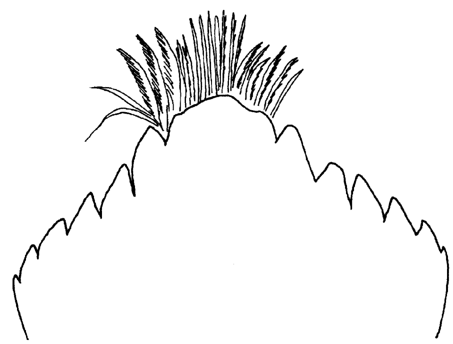
Recognized by the short 4 segmented antennae (less than 1/5 the length of the mandible), well developed mentum, the dense median brush of the prementum, and the lack of procerci and anal tubules. Two genera occur in North America; *Telmatogeton* is found on both coasts north to and including Canada; *Thalassomya* is apparently restricted to south Florida. All Nearctic members of this subfamily are marine coastal organisms, where they usually occur on algae on rocks, but note that some Hawaiian *Telmatogeton* species have invaded freshwater.



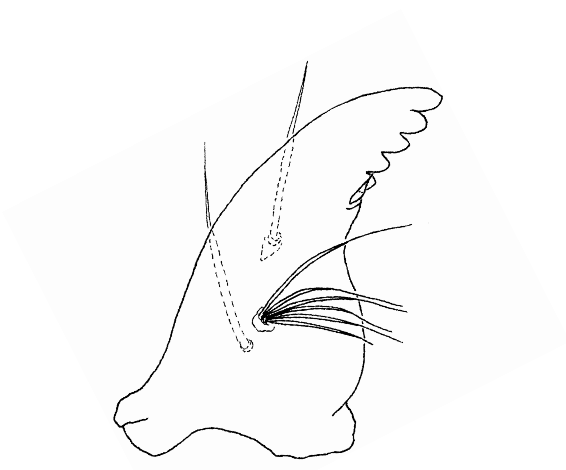
4 segmented antenna of *Telmatogeton*



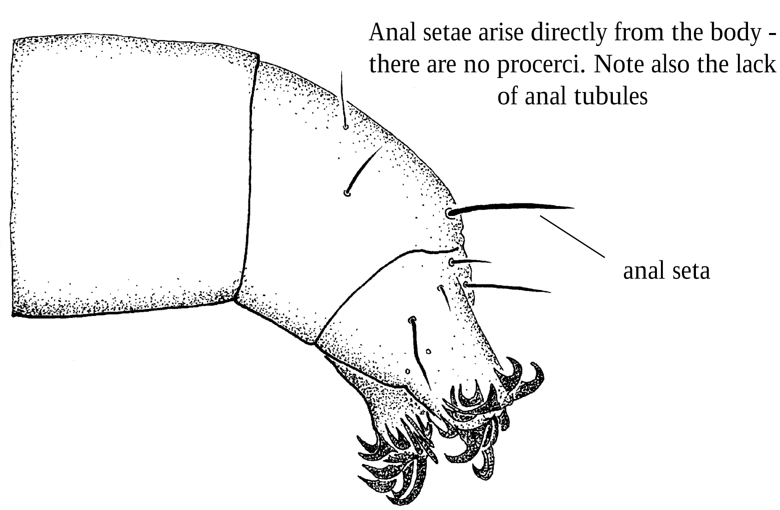
Telmatogeton prementum with dense median brush



Thalassomya mentum with brush of prementum visible dorsal to it



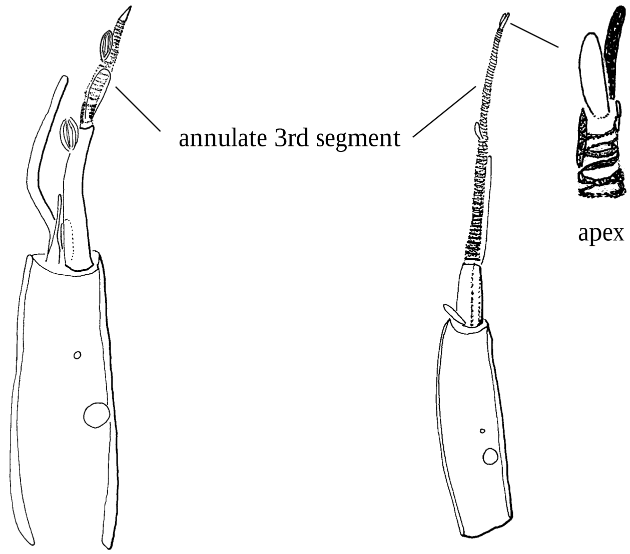
Telmatogeton mandible



posterior segments of *Telmatogeton*

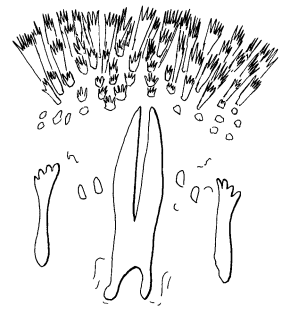
Subfamily Podonominae

Recognized by annulate 3rd antennal segment, lack of premandibles, a well developed mentum and long, well developed procerci. Five genera are found in North America. Podonomines are usually uncommon and restricted to cold springs, brooks and streams where the larvae are often associated with mosses.

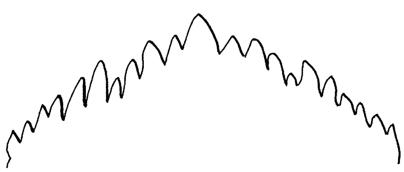


Paraboreochlus antenna

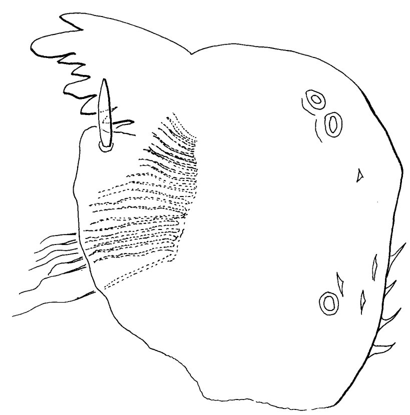
Boreochlus antenna



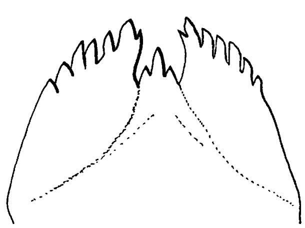
Boreochlus premento-hypopharyngeal area



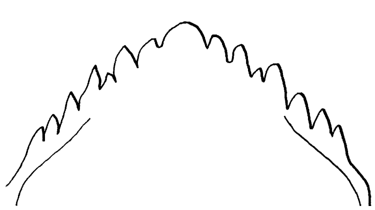
Lasiodiamesa mentum



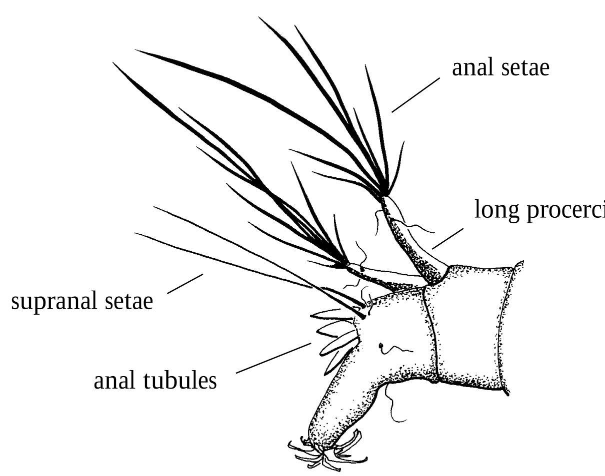
Paraboreochlus mandible



Trichotanypus mentum



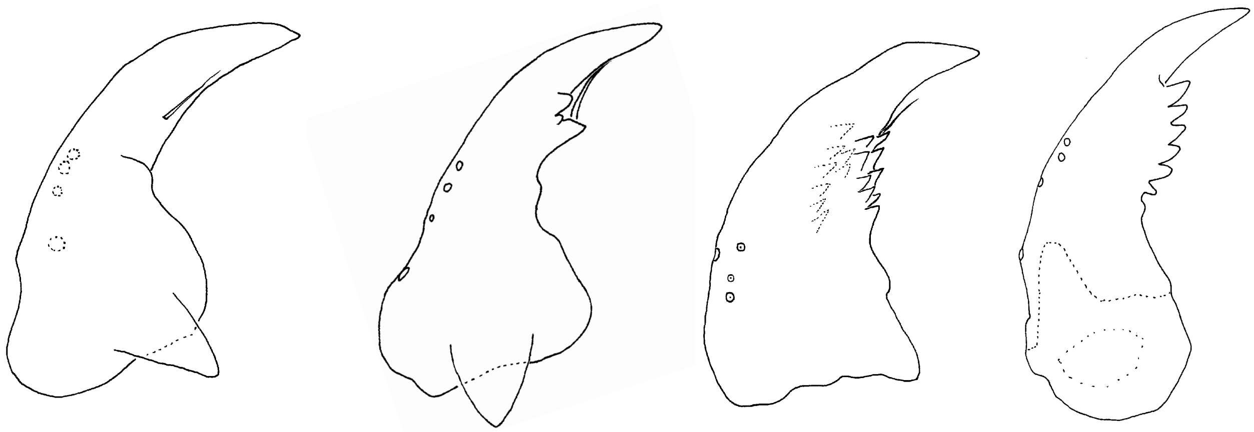
Paraboreochlus mentum



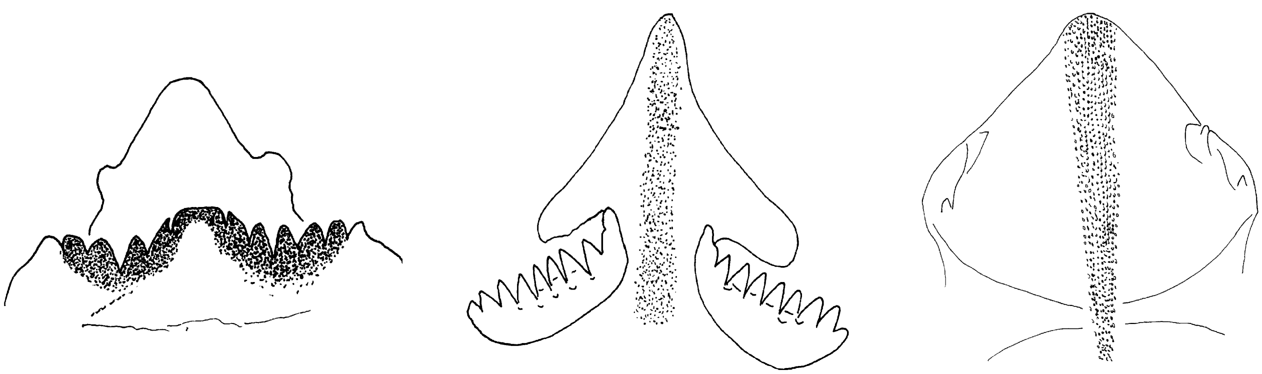
posterior segments of *Paraboreochlus*

Subfamily Tanypodinae

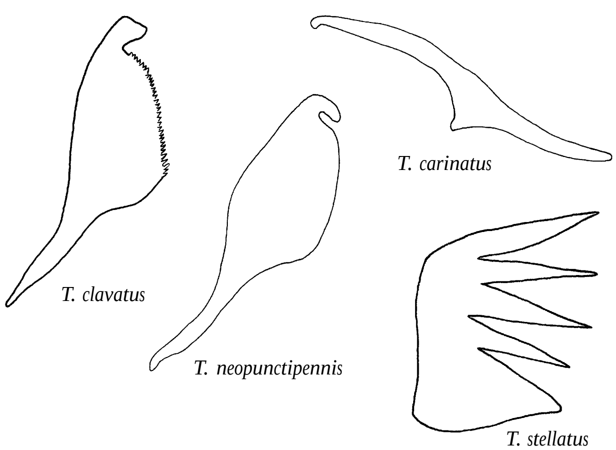
Members of this subfamily are easily recognized by the retractile antennae, lack of premandibles, a well developed ligula and well developed procerci. The setae and sensory pits of the head capsule are also very useful in identifying genera and some species. These setae were reviewed in detail by Kowalyk (1985). At least 39 genera occur in the Nearctic. All tanypods are predacious; larvae are found in all types of water bodies, including brackish water. Some genera possess hemoglobin and can live in low oxygen environments.



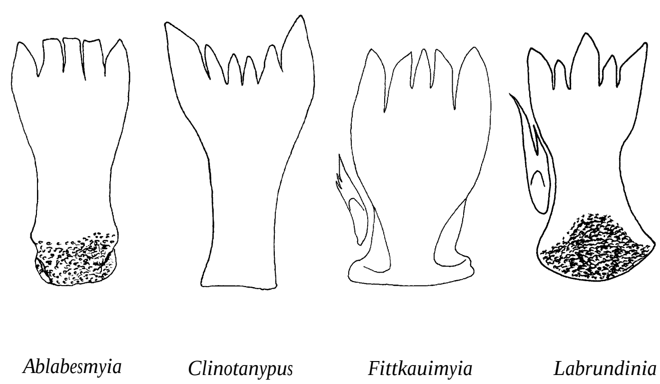
Tanypod mandibles can run from the extremely simple one of *Rheopelopia* to one with a few teeth (*Paramerina*) to one with many teeth *(Fittkauimyia, Psectrotanypus)*



The mentum may be complete *(Tanypus)* consist of two divided plates *(Procladius)* or have only a few widely separated blunt "teeth" *(Ablabesmyia)*



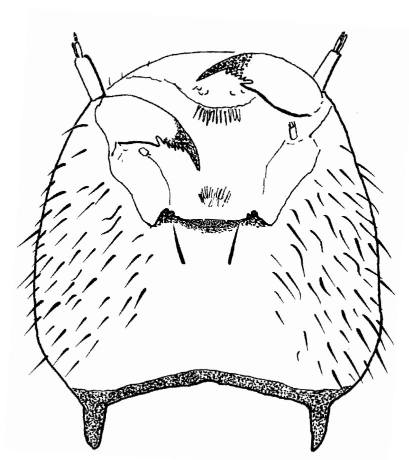
Claws on the posterior parapods can be of importance; above are 4 examples from the genus *Tanypus*



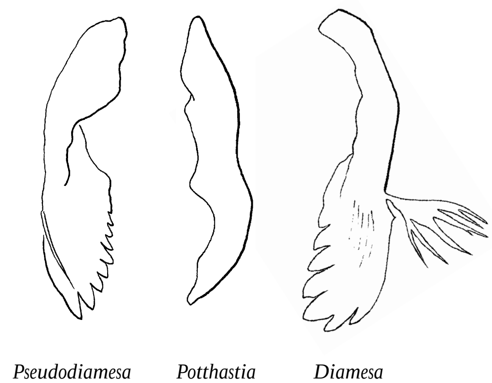
The ligula is also very important in tanypod taxonomy

Subfamily Diamesinae

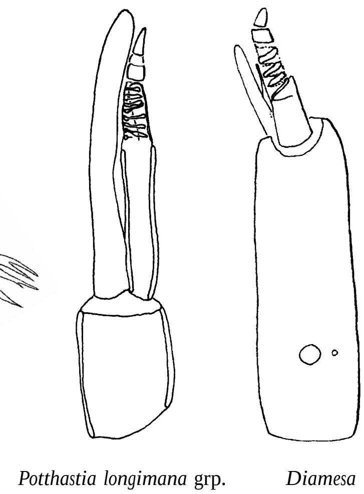
Most Nearctic genera have an annulate 3rd antennal segment, a well developed mentum and premandibles and 3 well developed brushes of setae on the prementum. *Protanypus*, the sole Nearctic diamesine without an annulate 3rd antennal segment, can be recognized by the numerous setae on the head capsule, which also bears two long ventrolateral posteriorly directed processes. Larvae of the *Potthastia longimana* group lack teeth on the mentum. Ventromental plates may be vestigial to well developed; in some genera they obscure the teeth of the mentum. There are no beard setae associated with the ventromentum. Procerci may be present or absent. Eleven genera occur in the Nearctic, with at least one additional “genus” from the SE US known only as a larva. Diamesines are most often found in cold or cool flowing water, but also are found in springs and lakes.



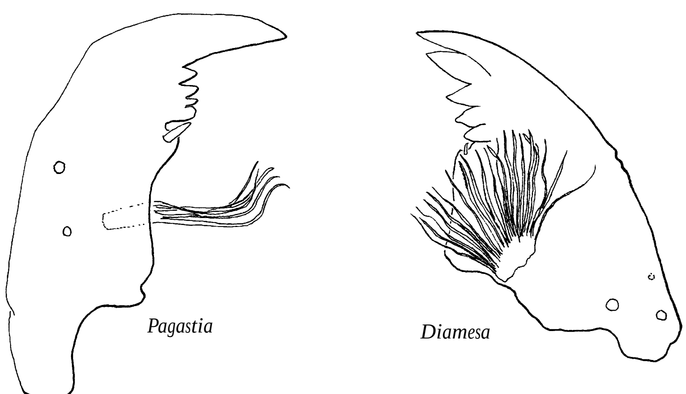
Protanypus head capsule



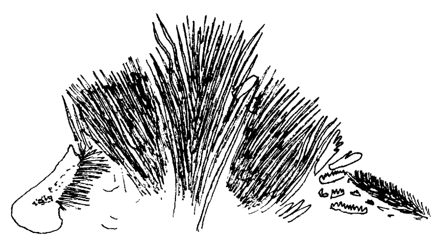
premandibles



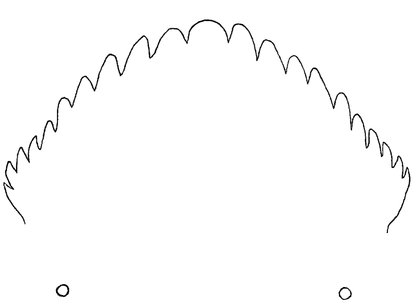
antennae



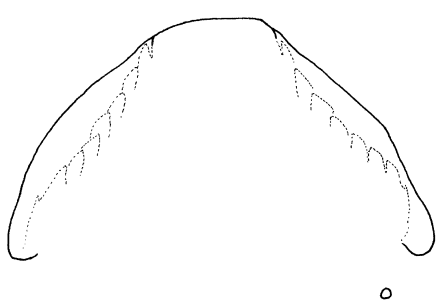
mandibles



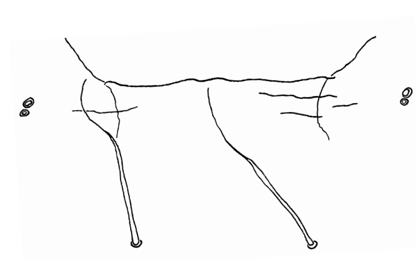
Diamesa prementum
with 3 large brushes



Diamesa mentum



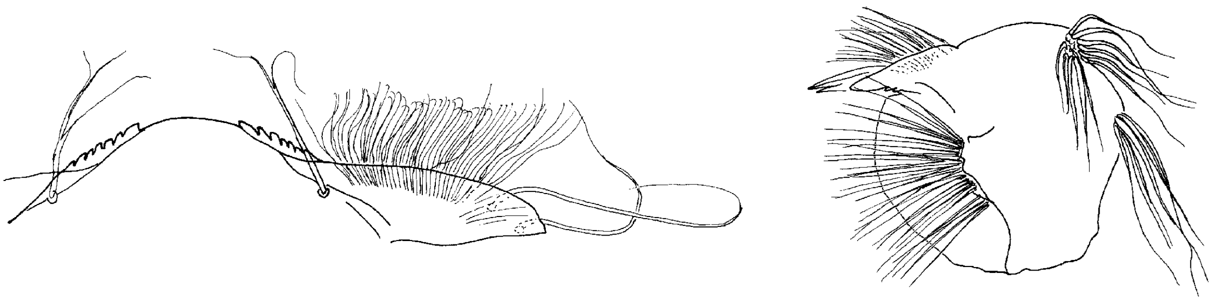
Potthastia gaedii grp. mentum



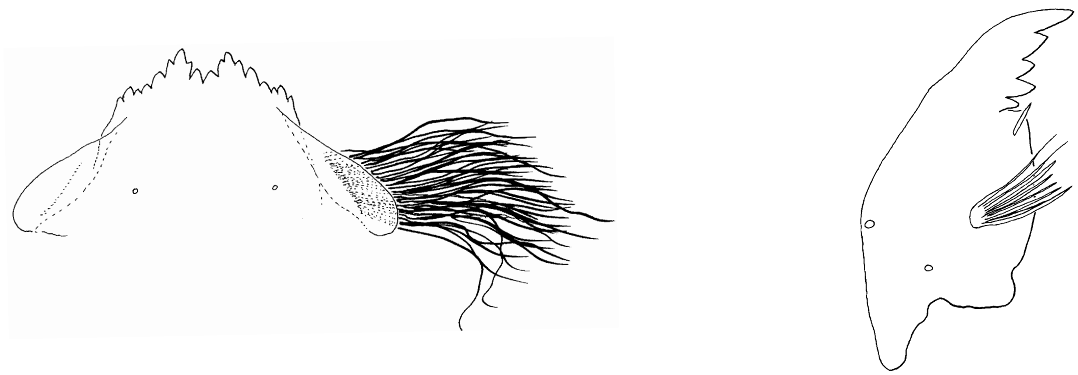
Potthastia longimana grp. mentum

Subfamily Prodiamesinae

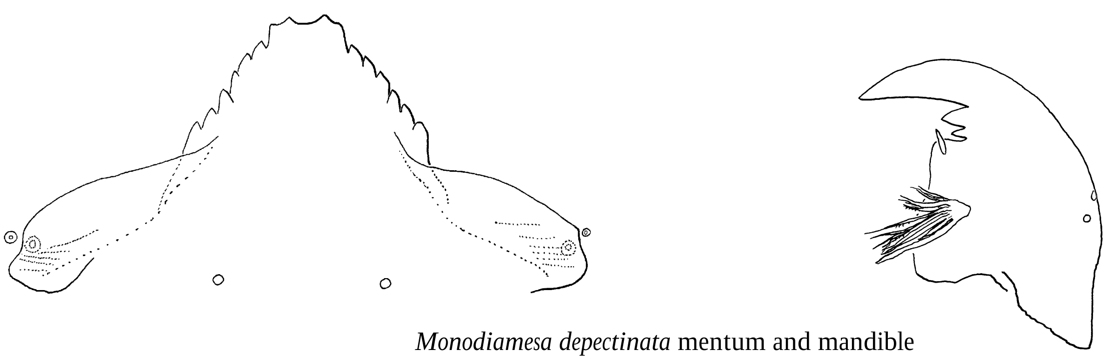
Recognized by the 4 segmented antennae, with segments 3 and 4 very small; well developed premandibles, prementum without a brush or brushes of setae and the well developed mentum with large unstriated ventromental plates, these plates with setae (often very long) beneath or adjacent to them. Four genera are known from the Nearctic, where larvae are found in springs, streams/rivers, ponds and the littoral zone of lakes.



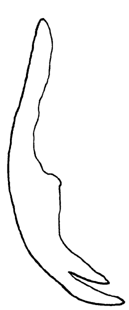
Odontomesa fulva mentum and mandible



Prodiamesa olivacea mentum and mandible



Monodiamesa depectinata mentum and mandible



Prodiamesa olivacea

Odontomesa fulva

Monodiamesa

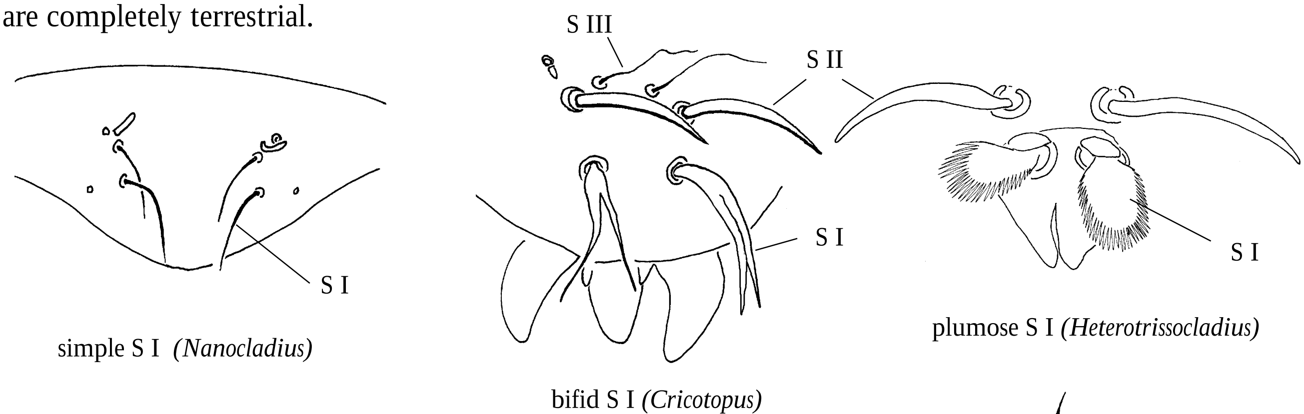
Odontomesa fulva

premandibles

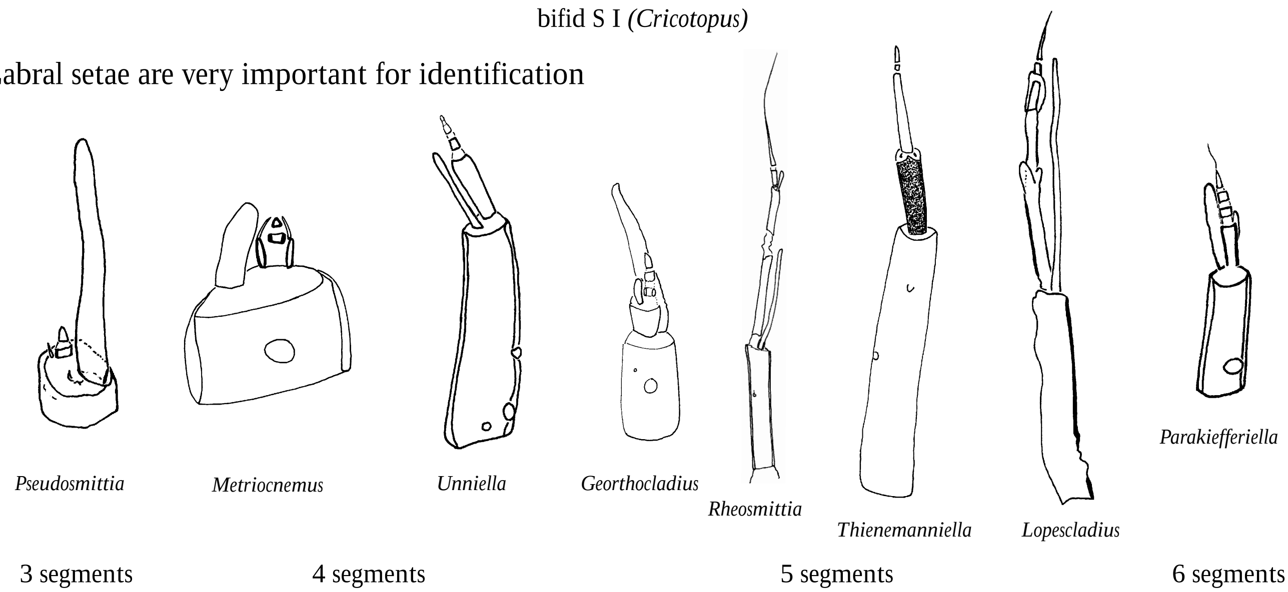
antennae

Subfamily Orthocladiinae

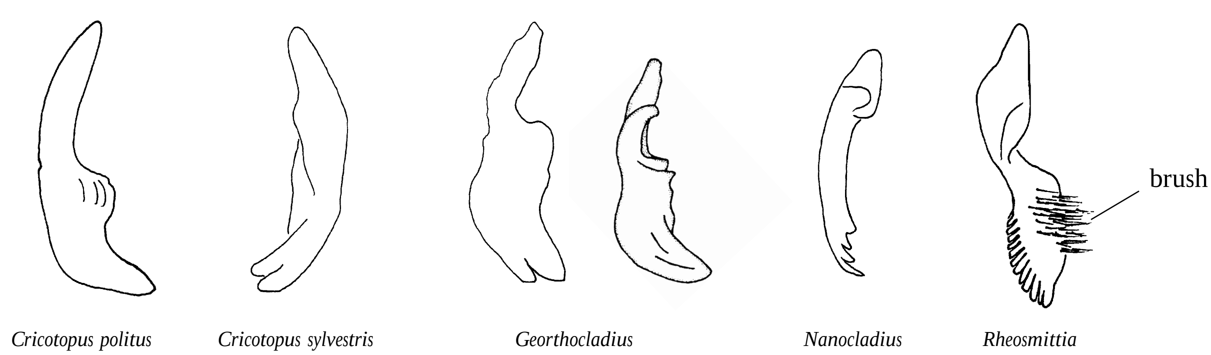
A morphologically and ecologically diverse subfamily, usually with well developed antennae (although sometimes strongly reduced) with 3-7 segments, a prementum without a dense brush or brushes of setae; well developed premandibles, and a well developed mentum, with or without unstriated ventromental plates (although weak ridges may be present in some taxa), with or without setae adjacent to or beneath them; some terrestrial/semi-aquatic larvae lack procerci, anal tubules and/or anterior and posterior parapods. At least 81 described genera occur in North America, with several additional taxa that probably represent new genera. Larvae are found in all aquatic habitats, including coastal marine areas; some taxa are completely terrestrial.



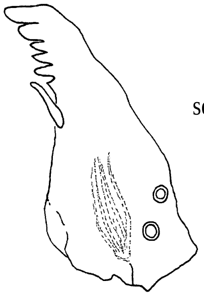
Labral setae are very important for identification



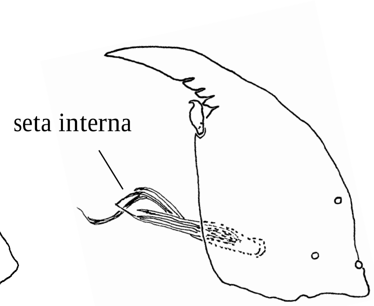
Orthoclad antennae exhibit a wide range of segmentation and design



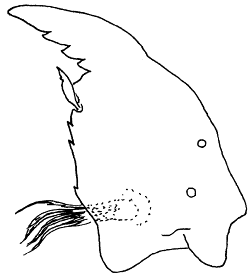
Premandibles may be simple or multi-toothed, with or without a brush of setae



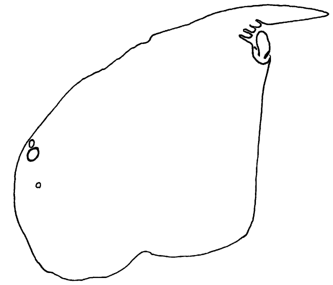
Lopescladius



Psectrocladius

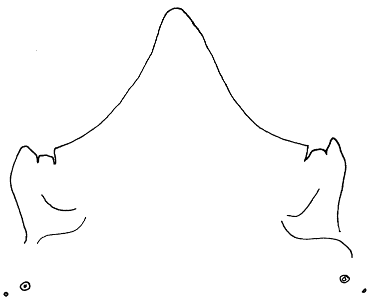


Cricotopus bicinctus

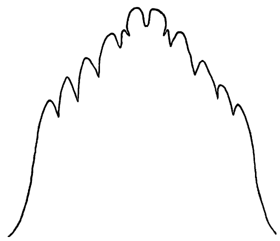


Orthocladiinae sp. C

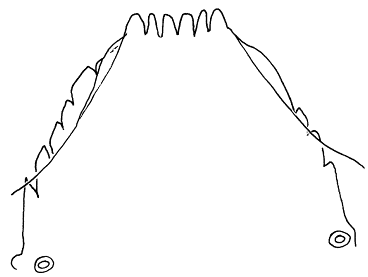
Orthoclad mandibles offer many characters for identification - their shape, number of teeth, presence or absence of a seta interna, and numerous other features



Orthocladius lignicola

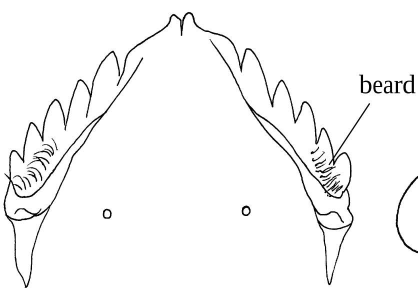


Corynoneura

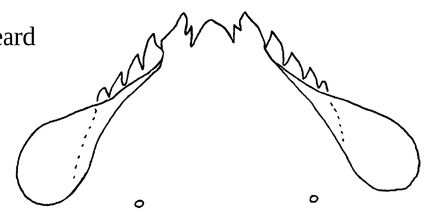


Epoicocladius

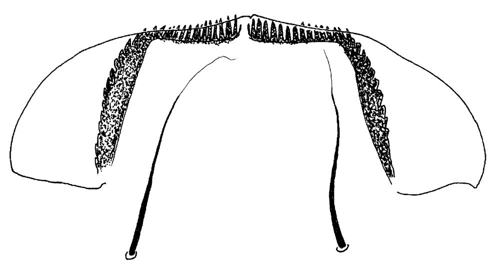
The mentum may lack ventromental plates, or ...



Psectrocladius

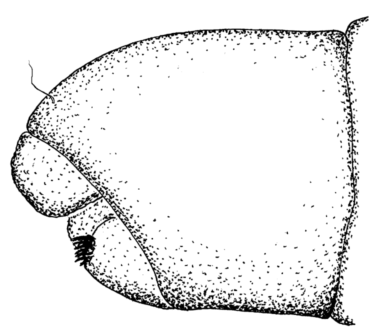


Unniella

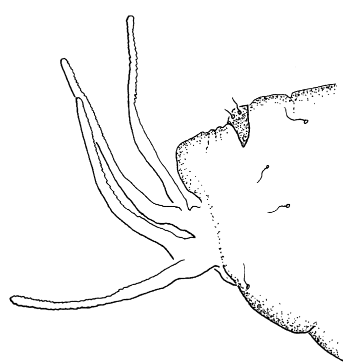


Orthocladiinae sp. C

ventromental plates may be small to large and may have a beard beneath or adjacent to them



Pseudosmittia posterior without procerci and reduced parapods

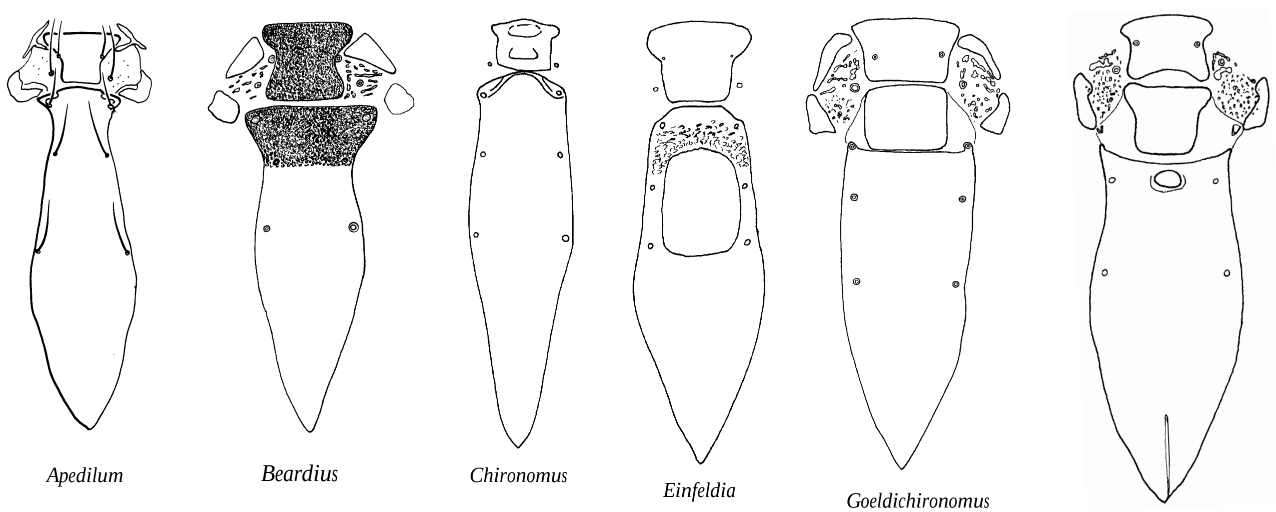


Georthocladius posterior without procerci or parapods

Some species modified for terrestrial or semi-terrestrial life have reduced or vestigial parapods, procerci and/or anal tubules

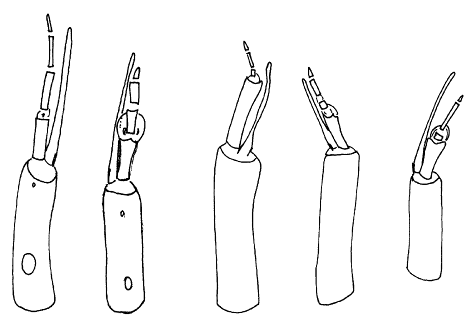
Subfamily Chironominae

Nearctic genera possess antennae with 5-8 segments; premandibles are present; the prementum does not bear large brushes. Most Nearctic chironomines possess a well developed mentum with striated ventromental plates (these plates are reduced and unstriated in the leaf-mining/wood-boring genera *Stenochironomus* and *Xestochironomus)*; a beard is not present in members of this subfamily. Two pairs of anal tubules are usually present; some genera may bear additional lateral and/or ventrolateral tubules; procerci and parapods are usually well developed. At least 71 described genera are found in North America, with several additional undescribed taxa that probably represent new genera. Larvae are found in all aquatic habitats, including coastal marine areas; some taxa can withstand extended periods of desiccation.



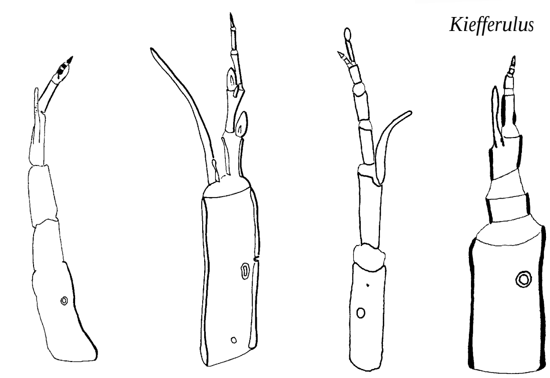
Apedilum *Beardius* *Chironomus* *Einfeldia* *Goeldichironomus* *Kiefferulus*

The apotome and labral sclerites can provide important characters



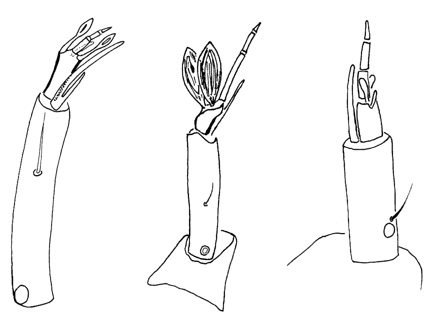
P. tritum *P. trigonus* *P. aviceps* *P. flavum* *P. halterale*

Antennae may provide important characters for species identification - above, 5 species of *Polypedilum*

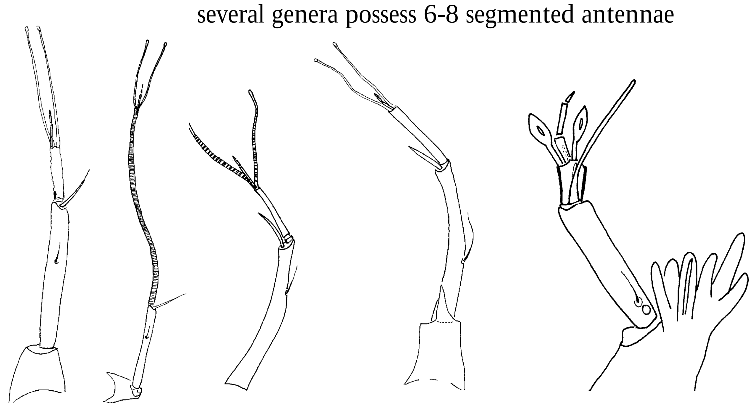


Chernovskiia *Apedilum* *Robackia* *Demicryptochironomus*

Although most Chironominae have 5 segmented antennae, several genera possess 6-8 segmented antennae

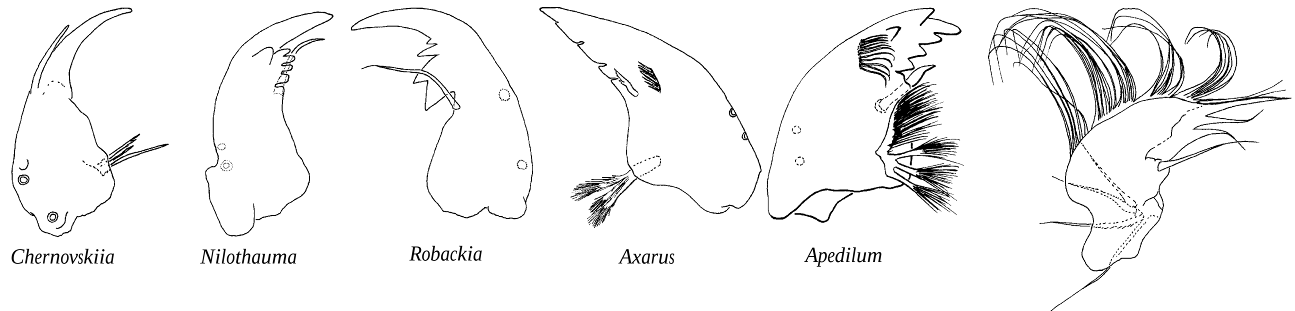


Rheotanytarsus *Cladotanytarsus* *Pontomyia*



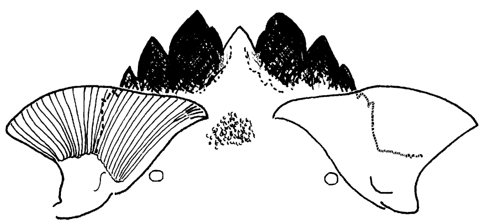
3 species of *Tanytarsus* *Micropsectra* *Stempellina*

Members of the tribe Tanytarsini display a wide variety of antennal types, but they always arise from a pedestal (not shown in all figures)

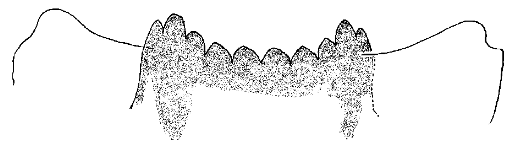


Chernovskiia *Nilothauma* *Robackia* *Axarus* *Apedilum* *Harnischia* complex genus B

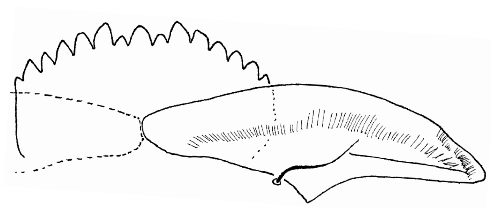
Chironomine mandibles range from the simple to the bizarre



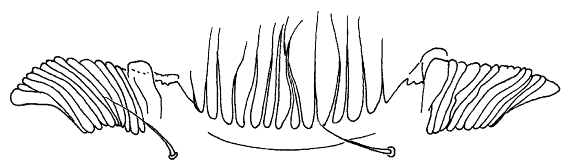
Beardius



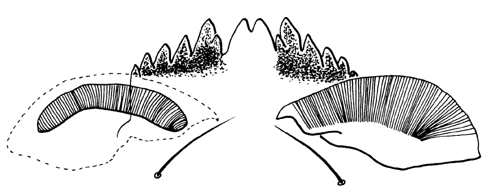
Stenochironomus



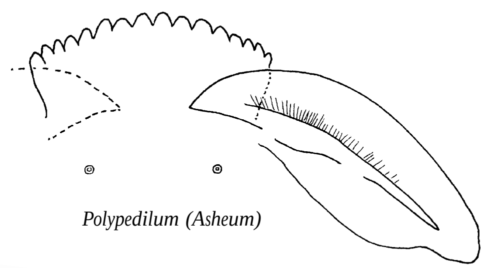
Axarus



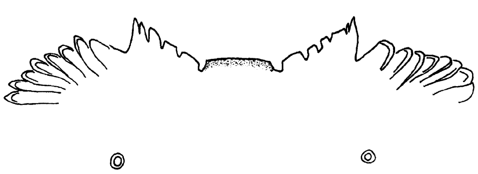
Harnischia complex genus B



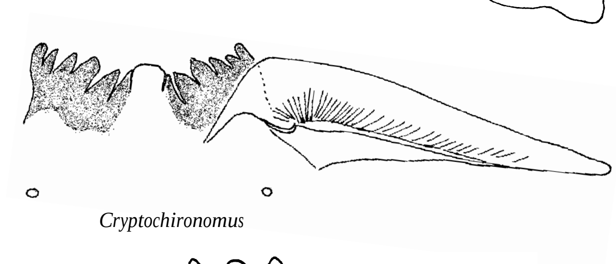
Apedilum



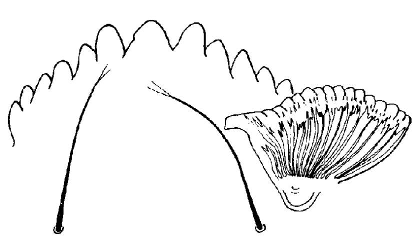
Polypedilum (Asheum)



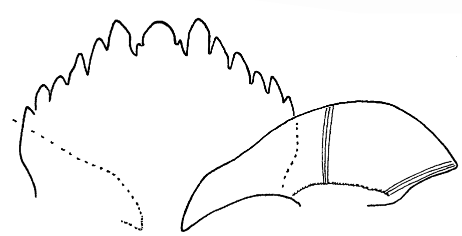
Chernovskiia



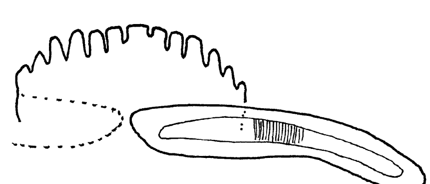
Cryptochironomus



Dicrotendipes



Goeldichironomus



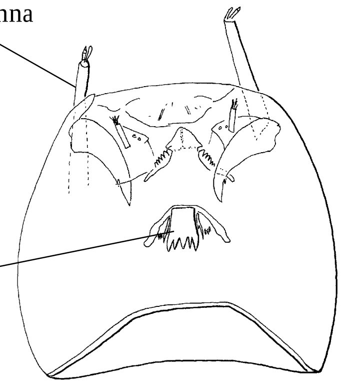
Cladotanytarsus

For identification purposes, the mentum and ventromental plates provide some of the most important characters, such as the number and arrangment of teeth on the mentum, its shape and the shape of the ventromental plates and the number of striae on them

Key to the subfamilies of Chironomidae of the southeastern United States

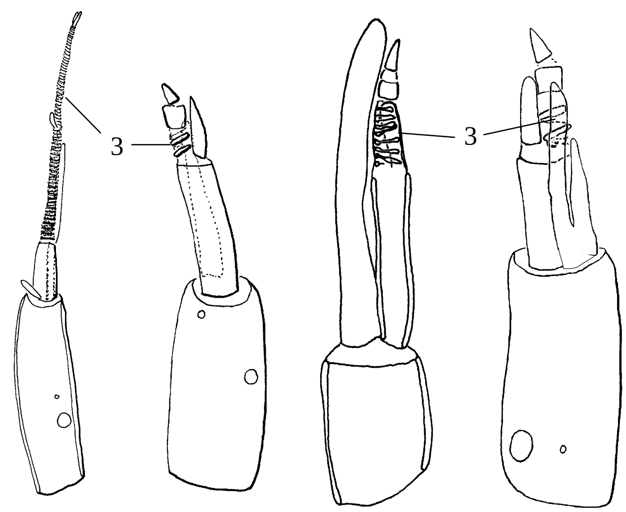
Use this key in conjunction with the figures found in the "Tour of the Subfamilies" beginning on page 1.32

1 Antennae retractile within head capsule; a large well sclerotized ligula present ... **Tanypodinae** (Chapter 4)



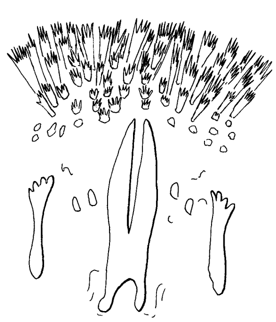
1' Antennae not retractile within head capsule; a well sclerotized ligula not present 2

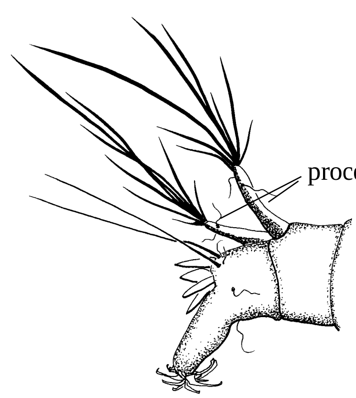
2(1') Third antennal segment annulated .. 3



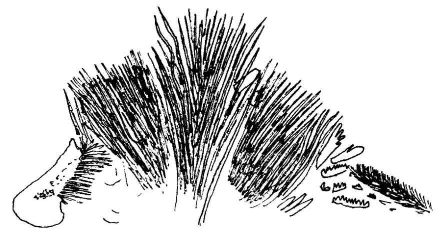
2' Third antennal segment never annulated (second antennal segment or Lauterborn organ pedicels may be annulated) 4

3(2) Premandibles absent; prementum without 3 large brushes of setae; procerci well developed, very long .... **Podonominae** (Chapter 3)



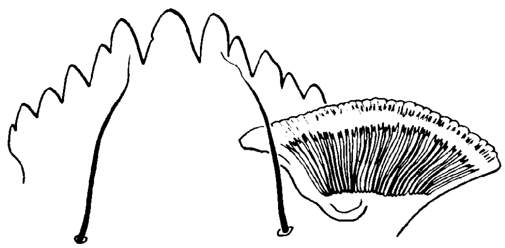


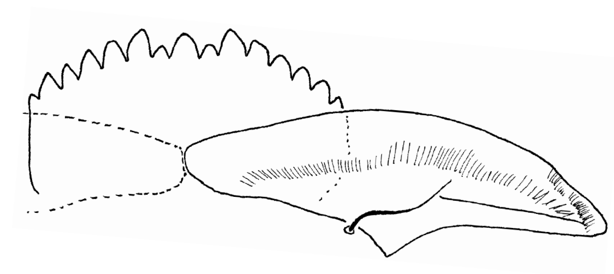
3’ Premandibles present; prementum with 3 dense brushes of setae; procerci vestigial or small, never long .... **Diamesinae** (Chapter 5)



prementum

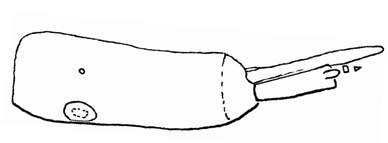
4(2’) Striated ventromental plates present; no beard (setae) present beneath ventromental plates .. .. **Chironominae** (in part) (Chapter 8)

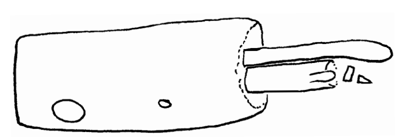


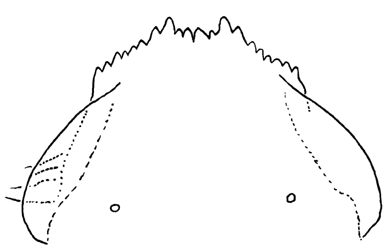


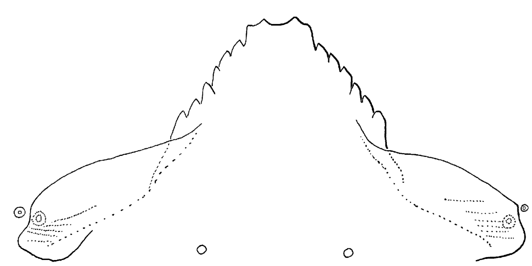
4’ Ventromental plates, if present, without striae (some *Nanocladius*, p. 7.89, may have a few markings on ventromental plates) 5

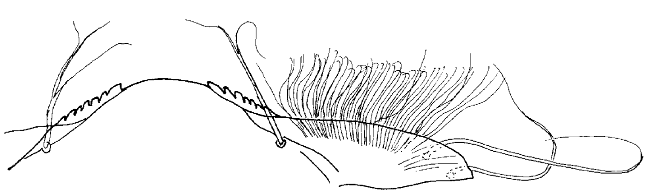
5(4’) Ventromental plates strongly expanded, with beard (setae) beneath (beard very well developed in 2 genera); antennae 4 segmented, with segments 3 and 4 very small ..... **Prodiamesinae** (Chapter 6)

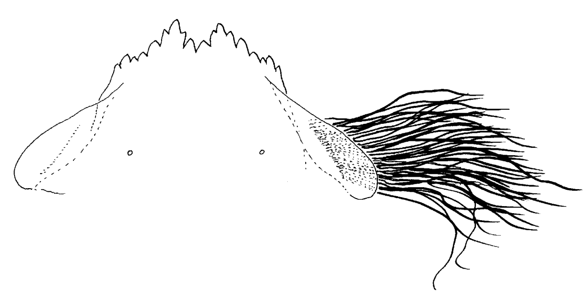






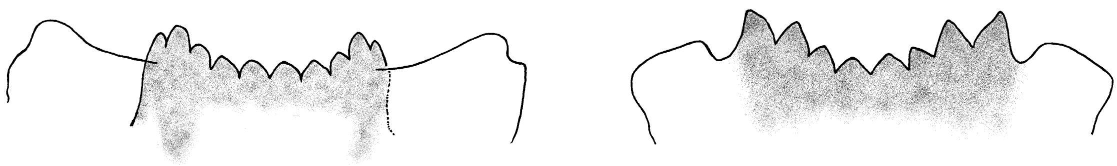






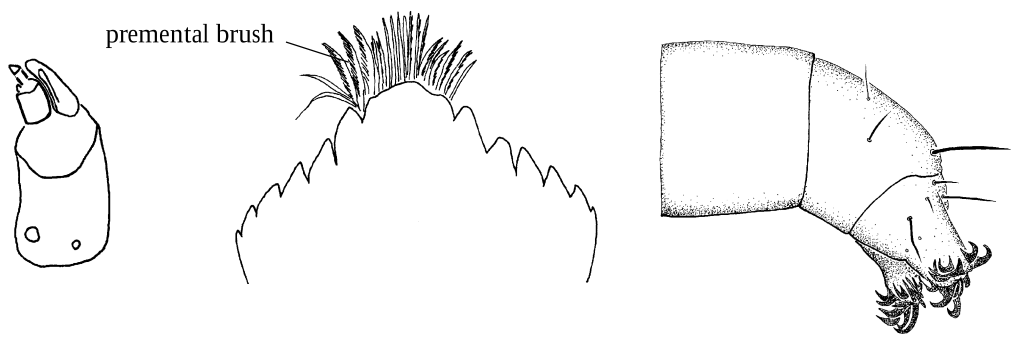
5’ If ventromental plates strongly expanded, then beard either absent or antennae not 4 segmented 6

6(5’) Ventromental plates fused to maxillae so not apparent; mentum concave; head flattened dorsoventrally, chisel-shaped; larvae mining in dead submerged wood and/or submerged leaves; may be common in Hester-Dendy samplers contructed of plant materials .... **Chironominae** (in part) (Chapter 8)

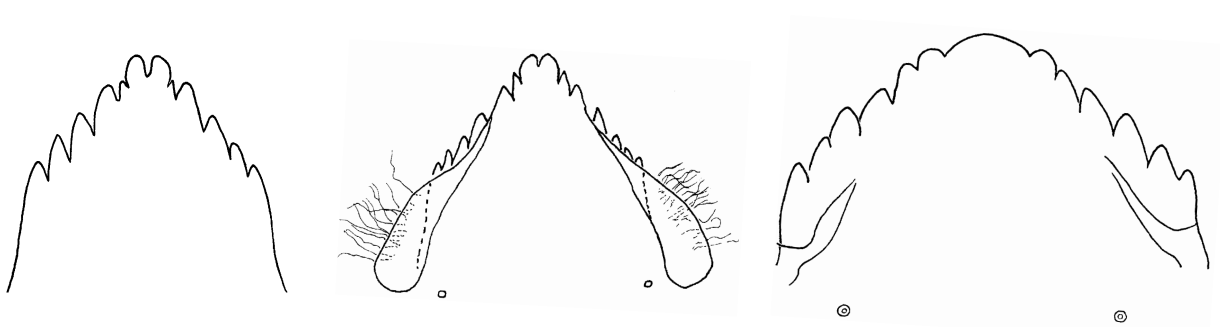


6’ Mentum, ventromental plates and head not as above; in a variety of habitats that may include submerged dead wood or leaves 7

7(6’) Antennae short, 4 segmented; prementum with well developed median brush; beard, procerci and anal tubules absent; exclusively marine in Southeast .... **Telmatogetoninae** (Chapter 2)



7’ Antennae 3-7 segmented; prementum without well developed median brush; beard present or absent; procerci and anal tubules present or absent (usually present, but often absent in terrestrial genera); larvae in a variety of habitats, but if marine, then antennae with 5 segments .... **Orthocladiinae** (Chapter 7)



NOTES

SUBFAMILY

TELMATOGETONINAE 2

DIAGNOSIS: Antennae 4 segmented, short (less than 1/5 length of mandible). **Labrum** with simple S setae. Labral lamellae absent. Premandibles present. **Mentum** with 11-15 teeth, ventromental plates and beard absent. **Prementum** with dense, well developed median brush. **Body** with well developed anterior and posterior parapods. Procercus absent. Anal tubules absent in eastern U.S. species.

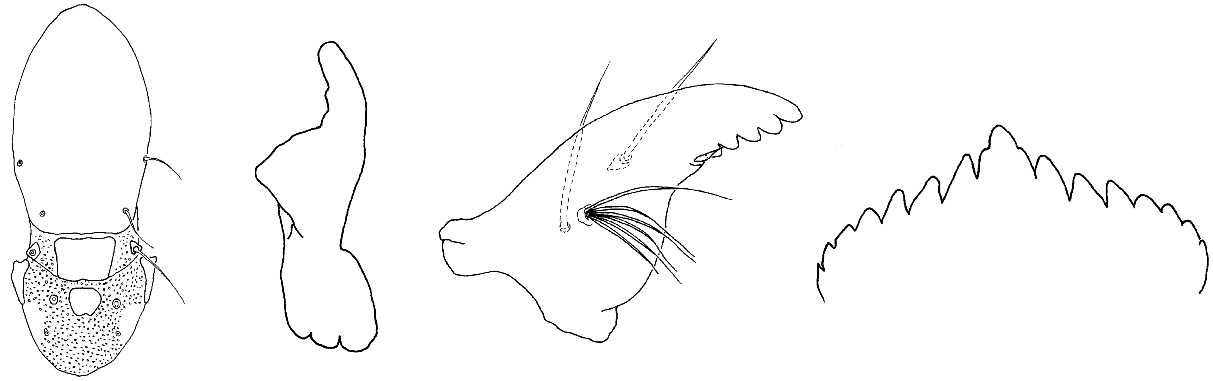
NOTES: In the continental United States, this subfamily is restricted to coastal marine environments such as rocky shores, coastal jetties, sea walls, salt water canals, etc. Larvae are almost invariably associated with algae growing attached to rocks. Two genera, each represented by a single species, occur in the eastern United States: *Telmatogeton* is found from Florida to Newfoundland; *Thalassomya* is apparently restricted to Florida in the U.S. Larvae of this subfamily may be mistaken for some orthoclad larvae, but can be easily distinguished by the dense median brush on the prementum, short antennae and the absence of procerci.

Key to the genera of larval Telmatogetoninae of the eastern United States

1 Anterodorsal portion of head without medial sclerites anterior to apotome; premandible simple; mandible apparently with 3 inner teeth; mentum with 13 teeth .... ***Thalassomya***

apotome premandible mandible mentum

1’ Anterodorsal portion of head with 2 well developed medial sclerites anterior to apotome; premandible with 3 blunt apical teeth; mandible with 4 inner teeth; mentum with 15 teeth (outer tooth very small; median tooth may appear notched) .... ***Telmatogeton***



apotome premandible mandible mentum

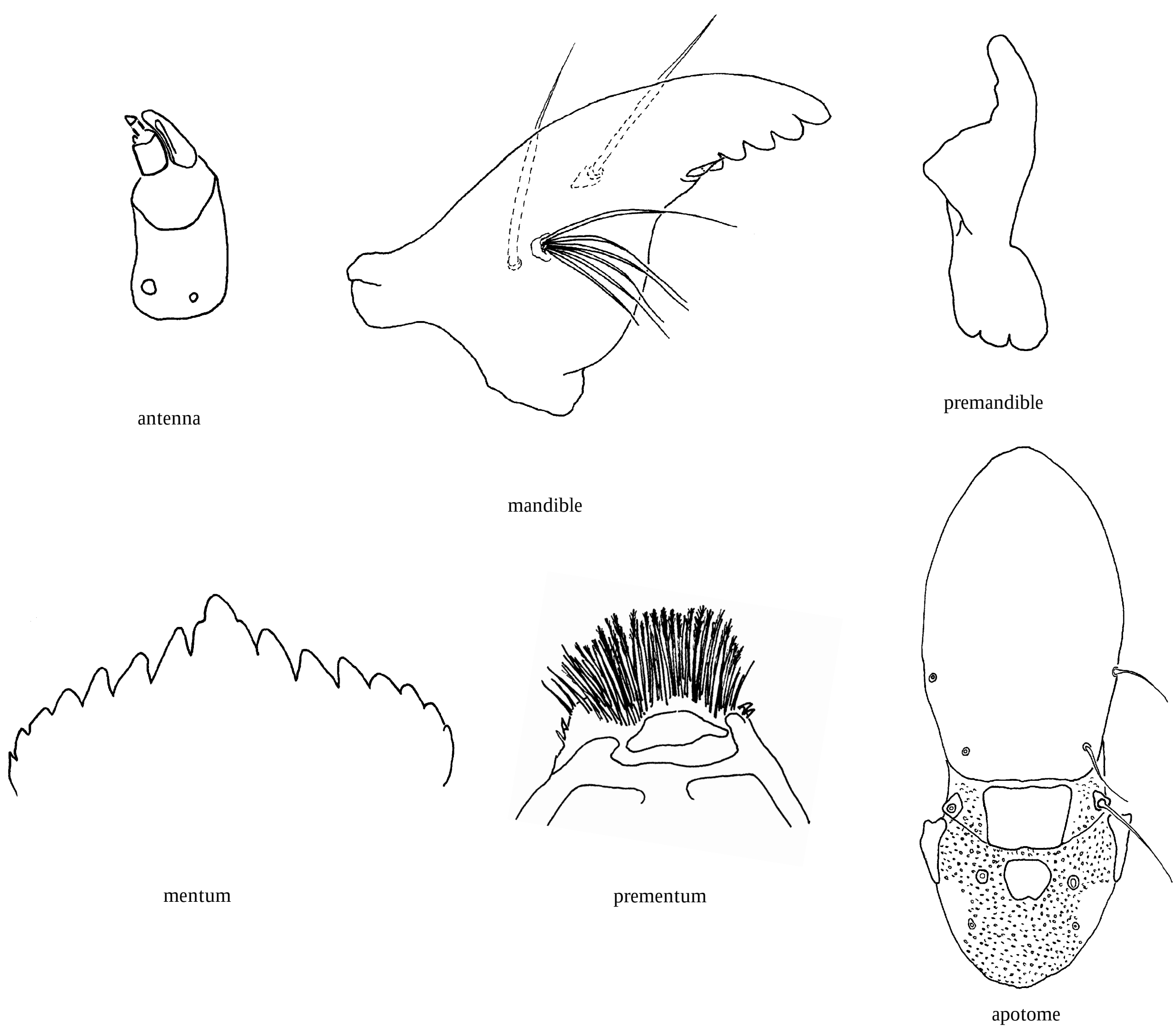
Genus *Telmatogeton*

DIAGNOSIS: Separated from *Thalassomya* by the presence of labral sclerites anterior to the apotome; premandible with blunt apical teeth; and 15-toothed mentum.

NOTES: Only one species, *T. japonicus*, is known from eastern North America; it is known to occur from Florida north to Newfoundland (Epler 1992; 1995, Colbo 1996). I have not seen any specimens from the Carolinas but it undoubtedly occurs here and is recorded by Caldwell et al. (1997). I have found this species to be abundant in March on rock jetties in several locations in Florida. Adults "swarm" on or immediately above the rocks of the jetties. Larvae and pupae can be collected from algae scraped from the rocks; larval and pupal exuviae are easily collected by skimming beachside foam produced by wave action.

Although all Tematogetoninae in the eastern U.S. are marine, several species of *Telmatogeton* have invaded freshwater in Hawaii.

ADDITIONAL REFERENCES: Tokunaga 1935; Wirth 1952.



T. japonicus, larval structures

Genus *Thalassomya*

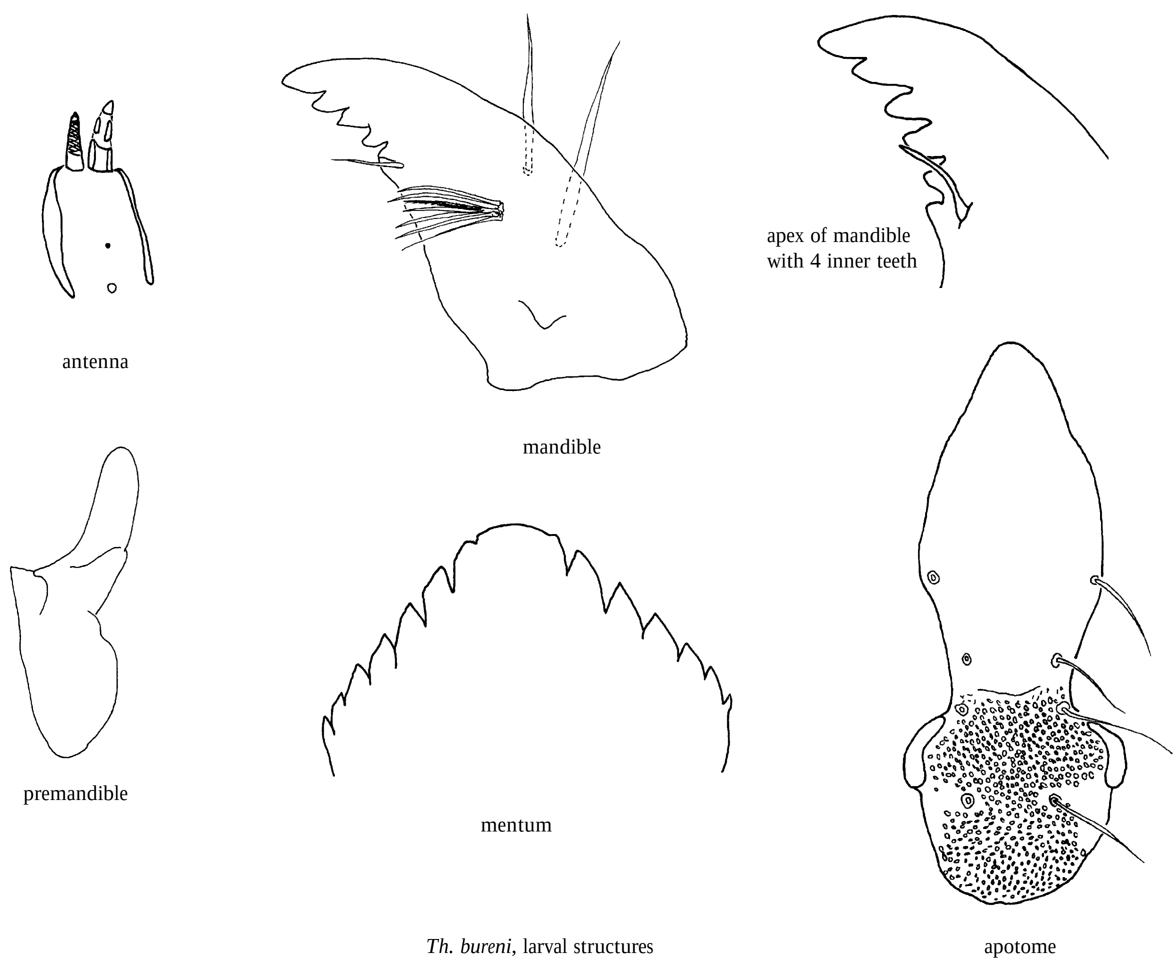
DIAGNOSIS: *Thalassomya* can be separated from *Telmatogeton* by the lack of distinct labral sclerites anterior to the apotome; the simple premandible; and the lower number of teeth on the mentum.

NOTES: One species, *Th. bureni*, is known from Florida in the Southeast U.S. Although Oliver et al. (1990) record this coastal marine species from Florida to North Carolina (and include a record from landlocked Kentucky!), I have not seen any specimens of *Thalassomya* collected north of coastal central Florida (Dunedin).

Wirth (1952) described the larva from specimens collected from algae on rocks at Lake Worth in Florida. I have collected larvae of *Thalassomya* from algae scraped from completely submerged rocks in the Intra-coastal Waterway in Pompano Beach, FL, where they coexisted with larvae of the orthoclad genus *Clunio.* I have also collected adults of *Th. bureni* on rock jetties in Dunedin and Key West, Florida.

Wirth (1952) described the larva of *Th. bureni* with 11 mental teeth and 3 inner teeth on the mandible. However, specimens of *Thalassomya* I've collected possess 13 mental teeth (the outermost teeth are small and can be closely appressed to their neighbors) and 4 inner teeth on the mandible. Some specimens appear to have only 3 teeth, but apparently this is a result of the innermost tooth being closely appressed to the molar region of the mandible. My specimens were not reared; if one assumes only one species occurs in the Southeast U.S., they represent *Th. bureni*.

ADDITIONAL REFERENCES: Wirth 1949; 1952.



Th. bureni, larval structures

NOTES

SUBFAMILY

PODONOMINAE 3

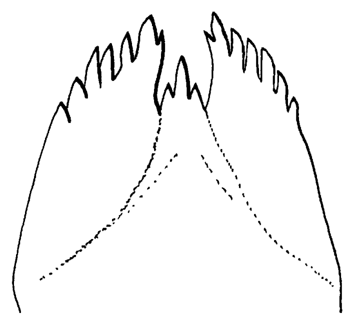
DIAGNOSIS: **Antennae** 4 or 5 segmented, with annulated 3rd segment (in eastern North American species); last segments very small. **Labrum** with well developed, simple, sickle-shaped S I and S II setae, S III similar in size and shape or more slender. Labral lamellae absent. Premandibles absent. **Mentum** with simple or trifid median tooth and 7-15 pairs of lateral teeth; ventromental plates weakly developed; beard absent. **Prementum** with numerous rows of small pectinate scales apically. **Body** with well developed anterior and posterior parapods. Procerci well developed. Anal tubules present.

NOTES: Podonomine larvae are often associated with mosses in springs, brooks and small streams; recent evidence also indicates that at least one genus, *Paraboreochlus*, may be hyporheic. Two genera of Podonominae occur in the Carolinas: *Boreochlus* and *Paraboreochlus*. Three other genera occur in North America and are included in the key below; although not recorded from the Carolinas, some of these other genera may eventually be found in the Smoky Mountains. In eastern North America, *Trichotanypus* is recorded from Greenland; *Lasiodiamesa* from New Hampshire, New York, Ontario and Quebec; and *Parochlus* from Maine, New York, New Brunswick, Ontario, Quebec and Greenland.

Key to the genera of larval Podonominae of eastern North America

1 Median tooth/teeth deeply recessed from anterior margin of mentum .... ***Trichotanypus***
(not recorded from the Carolinas and not included in this manual)

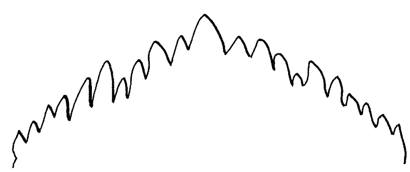
1' Median tooth/teeth not deeply recessed 2



Trichotanypus

2(1') Mentum with 15 pairs of lateral teeth; each procercus with more than 10 setae ..... ***Lasiodiamesa***
(not recorded from the Carolinas and not included in this manual)

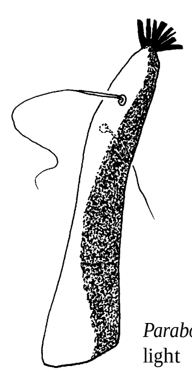
2' Mentum with 6-8 pairs of lateral teeth; each procercus with less than 10 setae 3



Lasiodiamesa

3(2') Procercus uniformly colored, either completely light or completely dark .... ***Parochlus***
(not recorded from the Carolinas and not included in this manual)

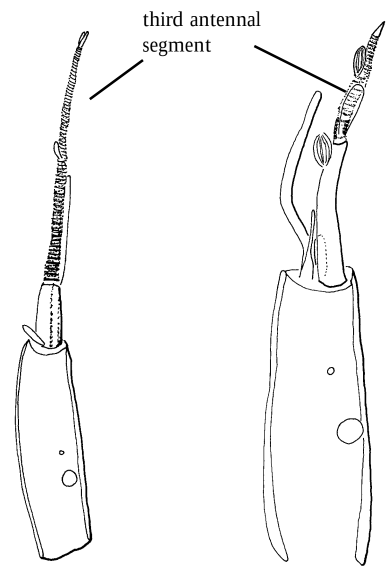
3' Procercus light anteriorly, darkened posteriorly 4



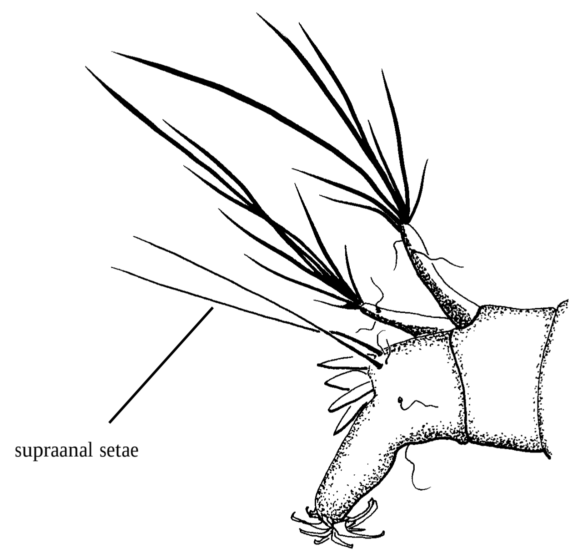
Paraboreochlus procercus
light anteriorly, dark posteriorly

4(3’) Annulate 3rd segment of antenna long; supra-anal setae absent or reduced; each procercus with 5 setae .... ***Boreochlus***

4’ Annulate 3rd segment shorter; supraanal setae long and dark; each procercus with 7-8 setae .... ***Paraboreochlus***



Boreochlus *Paraboreochlus*



Paraboreochlus

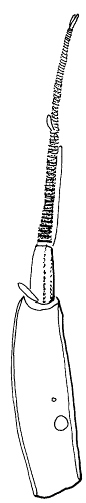
Genus *Boreochlus*

DIAGNOSIS: This genus is separated from other podonomines by long annulate third antennal segment (much longer than segment 2); mentum with 6-8 lateral teeth; mandible without small spines on outer margin; supraanal setae not developed as long dark setae; and procerci lighter anteriorly, darker posteriorly, each procercus with 5 setae.

NOTES: There apparently is only one species, *B. persimilis*, in eastern North America. I've seen numerous adults from several locations in Great Smoky Mountains National Park and northern Georgia. *Boreochlus* larvae are usually found living among mosses, etc., in springs and small streams.

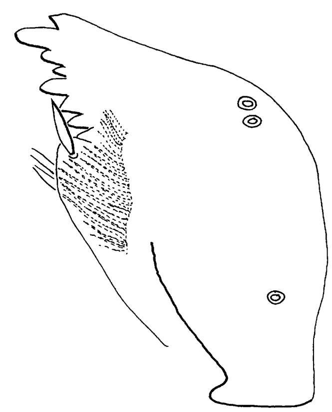
The larvae illustrated below were collected at springs in Ohio and Pennsylvania and are not associated with an adult. An interesting character not mentioned in any previous description of a podonomine larva is the large style (or Lauterborn organ?) at the apex of the annulated 3rd segment that is subequal to the accompanying 4th segment, giving the appearance of a bifid apex

ADDITIONAL REFERENCES: Brundin 1966.

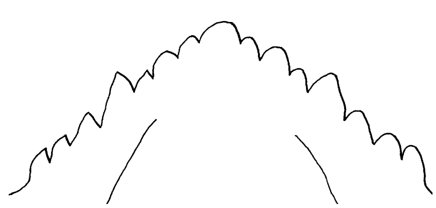


antenna

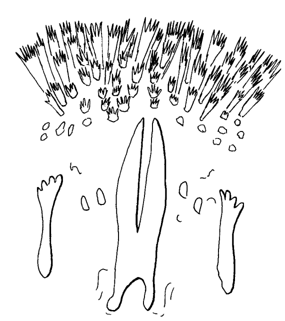
apex of antenna



mandible



mentum



premento-hypopharyngeal area

B. persimilis, larval structures

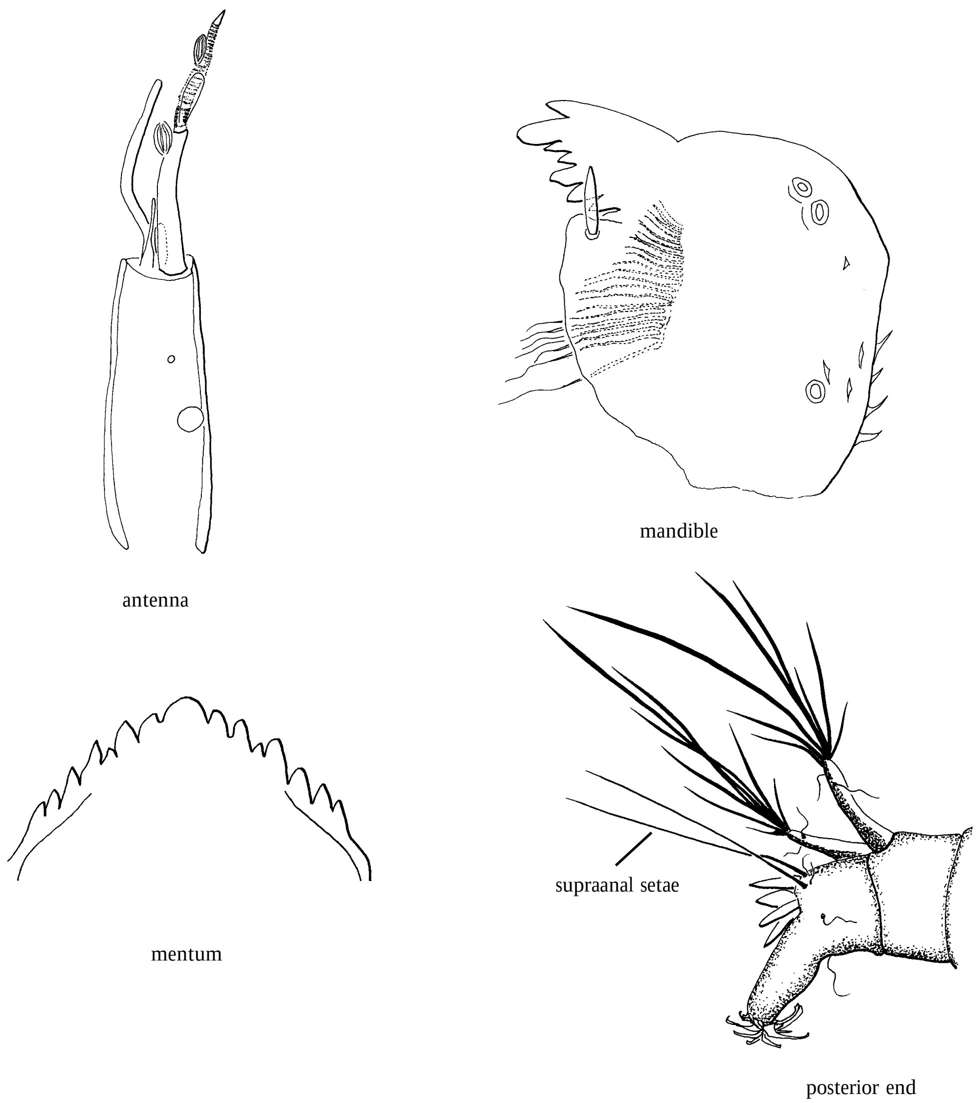
Genus *Paraboreochlus*

DIAGNOSIS: This genus is separated from other podonomines by the shorter annulate third antennal segment (slightly longer than segment 2); mandible with small spines on or near proximal outer margin; mentum with 6-8 lateral teeth; supraanal setae well developed as long dark setae; and procerci lighter anteriorly, darker posteriorly, each procercus with 7-8 setae.

NOTES: One species, *P. stahli*, is known from eastern North America. This genus is recorded from the Smoky Mountains in North Carolina by Beck (1980), based on a single larva from an unnamed stream in Swain Co. I have not seen any material of this genus from the Carolinas; the larva illustrated below was collected in Maine and agrees well with the description of *P. stahli*.

Larvae are reported to occur in mosses in cold springs, seeps and small streams. I collected the larva figured below from a gravel-bottomed stream near a peat bog in Maine. There is some evidence that larvae are hyporheic (Donley, et al. 1999).

ADDITIONAL REFERENCES: Brundin 1966; Coffman et al. 1988; Donley et al. 1999.



P. cf. *stahli*, larval structures

SUBFAMILY
TANYPODINAE 4

DIAGNOSIS: **Antennae** retractile into head capsule, 4 segmented in southeastern United States taxa. **Labrum** with sensillae usually simple, occasionally multibranched, on pedicels or with expanded bladder-like bases. Labral lamellae absent. **Mentum** with large membranous triangular M appendage; dorsomental teeth present as separate or fused transverse plates, in longitudinal rows, or as a few usually blunt teeth located laterad, or apparently absent; ventromental plates and beard absent. **Prementum** bears a large, well sclerotized 4-7 toothed ligula. **Body** with well developed anterior and posterior parapods; with or without lateral fringe of setae, sometimes with long setae; procerci present and well developed. Anal tubules usually well developed in freshwater forms; reduced in brackish water taxa.

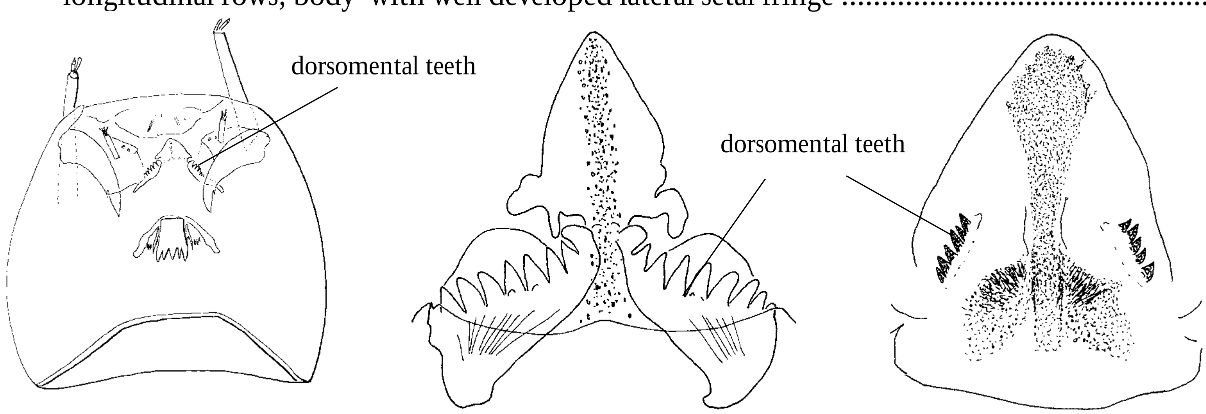
NOTES: Most members of this subfamily are free swimming or crawling predators; some burrow in bottom mud. Larvae are found in a variety of habitats, including water held by bromeliads or pitcher plants, as well as the more normal aquatic habitats such as springs, seeps, ditches, marshes, streams, rivers, ponds and lakes; one species is symbiotic in unionid mussels.

At the generic level the larvae of all southeastern tanypod genera are known. However, all are not easily identified. A particular problem exists with one group of the tribe Pentaneurini, the *Thienemannimyia* group. In the Carolinas the group includes *Conchapelopia, Hayesomyia, Helopelopia, Meropelopia, Rheopelopia* and perhaps *Telopelopia* and *Thienemannimyia* (not yet recorded from the Carolinas). While mature larvae of some of these genera can be easily identified, you may have to be happy with an identification of "*Thienemannimyia* group sp." for many early instar larvae of this complex of closely related genera. Mature fourth instar larvae with developing pupal characters may be positively identified by the internally developing thoracic horn; this structure is illustrated for each of these genera in the diagnoses and in the key below.

A very useful paper for confirming some genus level identifications by using the setae and sensillar structures of the tanypod head capsule is Kowalyk (1985)

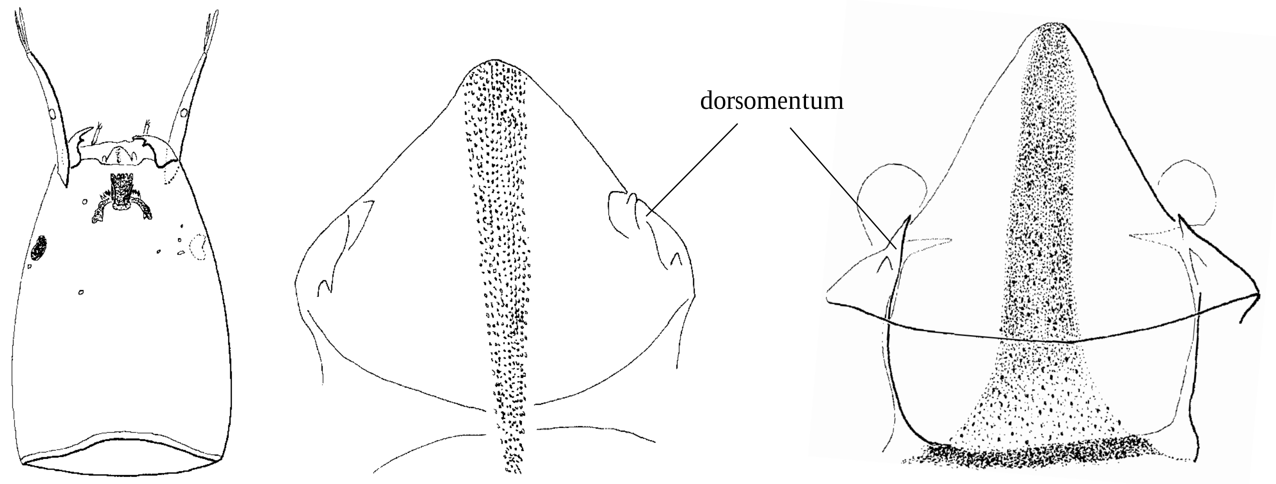
Key to the genera of larval Tanypodinae of the southeastern United States

1 Head capsule rounded to oval; dorsomental teeth present in well developed transverse plates or in longitudinal rows; body with well developed lateral setal fringe 2

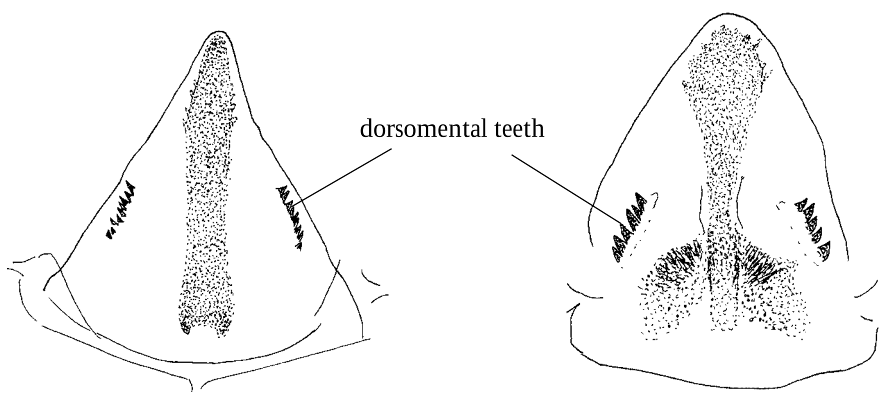


round head capsule

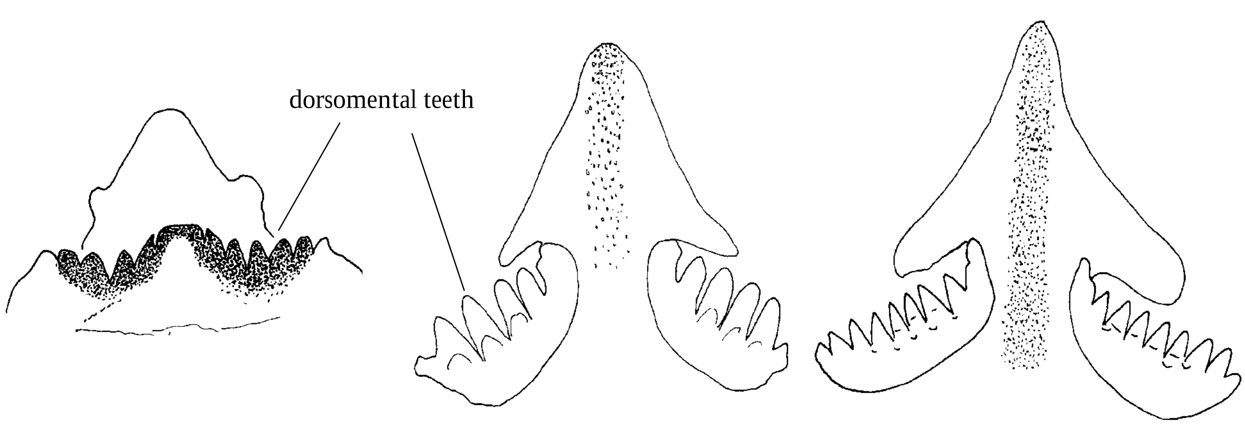
1’ Head capsule more elongate; dorsomentum without well developed teeth in transverse plates or longitudinal rows; body without well developed lateral fringe of setae (a small partial fringe of 4 setae is present in *Natarsia*) 14



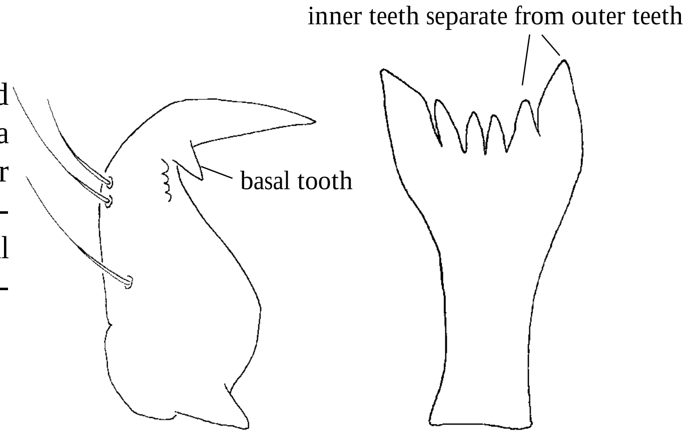
2(1) Dorsomental teeth arranged in longitudinal rows 3



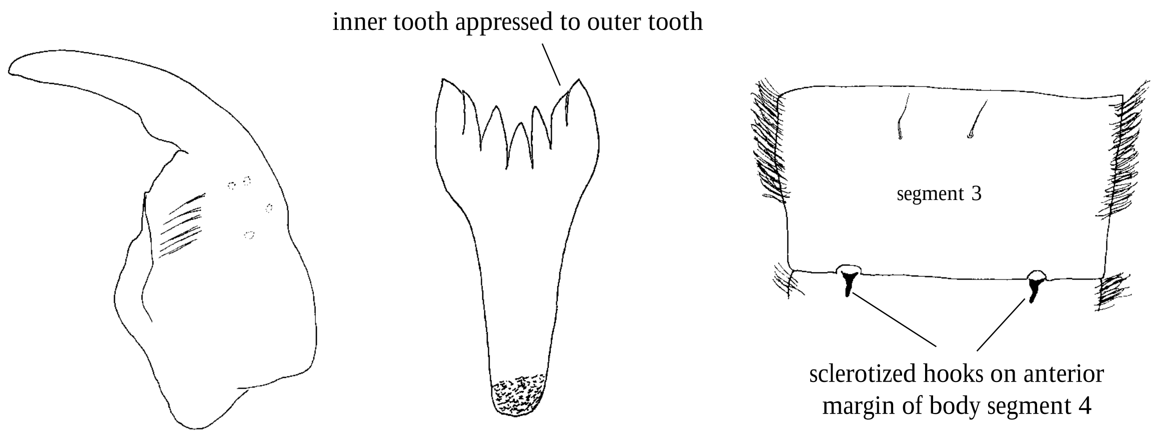
2’ Dorsomental teeth arranged in transverse or somewhat diagonal plates 4



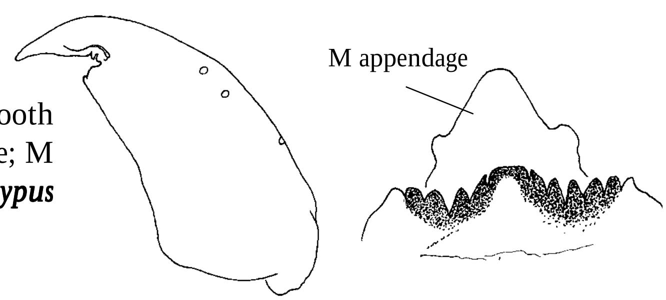
3(2) Mandible with apical tooth strongly hooked and with large pointed basal tooth; ligula usually with even number of teeth, inner teeth separate from outer teeth; dorsal anterior margin of body segment 4 (abdominal segment 1) without a pair of small sclerotized hooks .... ***Clinotanypus***



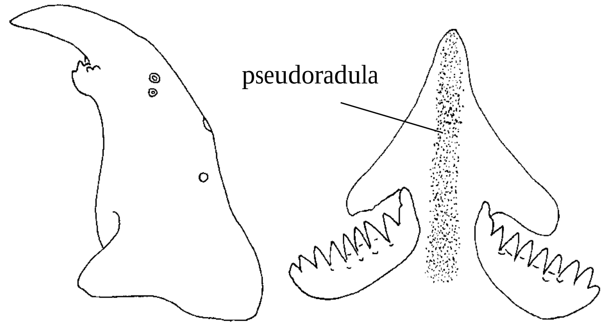
3’ Mandible with apical tooth gently curved, with basal tooth low and rounded; ligula usually with odd number of teeth, with outermost inner teeth appressed to outer teeth; dorsal anterior margin of body segment 4 (abdominal segment 1) with a pair of small sclerotized hooks .... ***Coelotanypus***



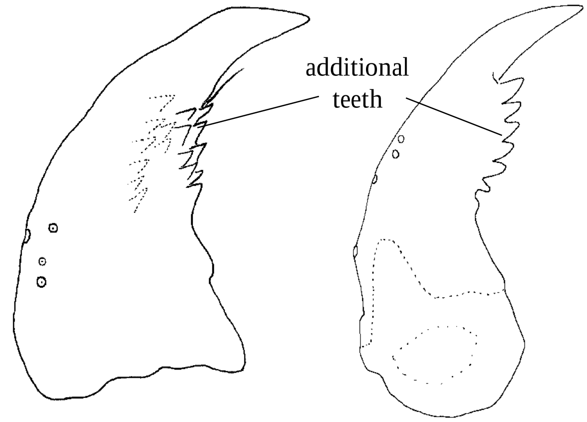
4(2’) Mandible with stout base, so that apical tooth appears small in relation to rest of mandible; M appendage without a pseudoradula .... ***Tanypus***



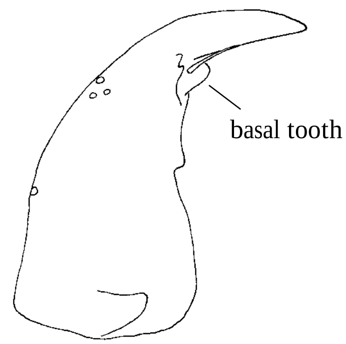
4’ Mandible not as stout, apical tooth appears large in relation to rest of mandible; M appendage with a pseudoradula 5



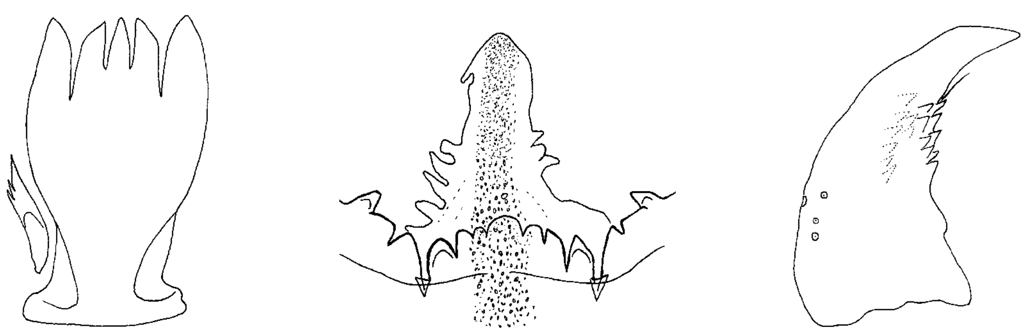
5(4') Mandible with numerous additional teeth, either in several dorsal and ventral rows or arranged on inner side of mandible 6



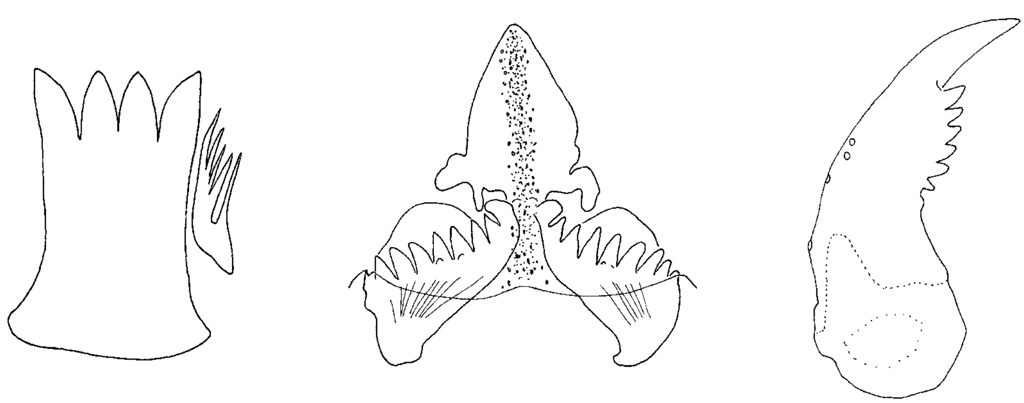
5' Mandible with basal tooth and 1 or 2 accessory teeth .. 7



6(5) Ligula with 5 teeth, inner teeth slanted towards median tooth; dorsomental teeth arranged in concave arch; mandible with several rows of additional small dorsal and ventral teeth .. ***Fittkauimyia***

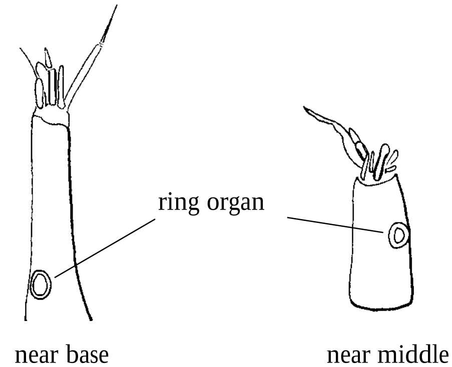


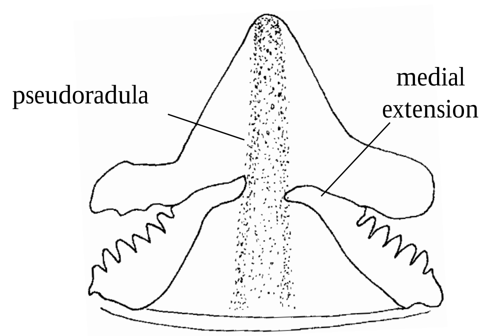
6' Ligula with 4 straight teeth; dorsomental teeth in straight transverse row; mandible with row of additional teeth on inner side .... ***Psectrotanypus***



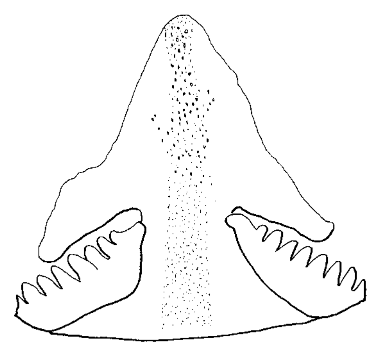
7(5') Ring organ of maxillary palp located near base 8

7' Ring organ of maxillary palp located near middle or apex 9

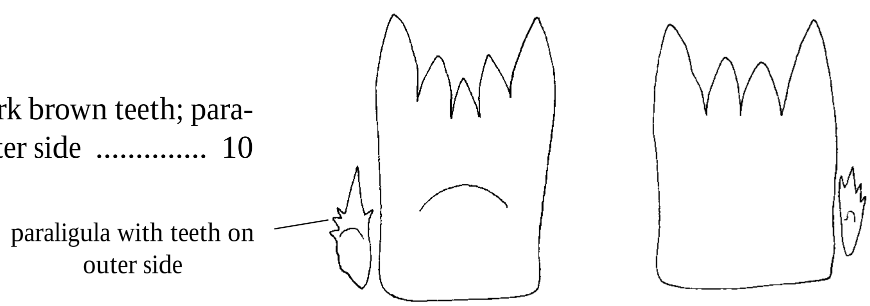




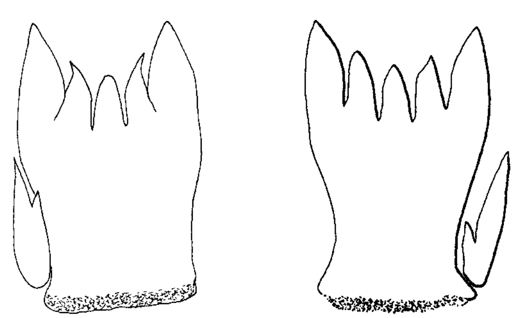
8(7) Dorsomental plates each with 5 large teeth (excluding the innermost and outermost teeth) and extended medially to reach or almost reach the pseudoradula .... ***Bethbilbeckia***



8' Dorsomental plates each with 6 large teeth (excluding the innermost and outermost teeth), with medial extension not reaching pseudoradula .... ***Macropelopia***

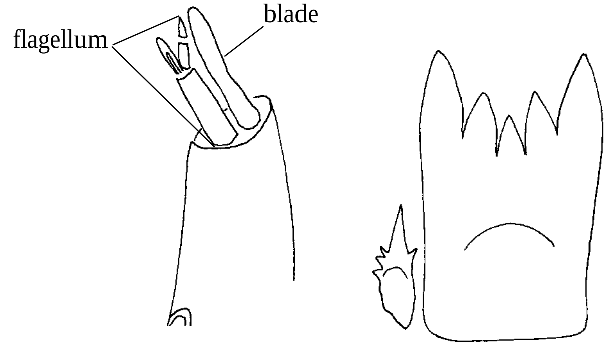


9(7') Ligula with black or dark brown teeth; paraligula with teeth on outer side 10

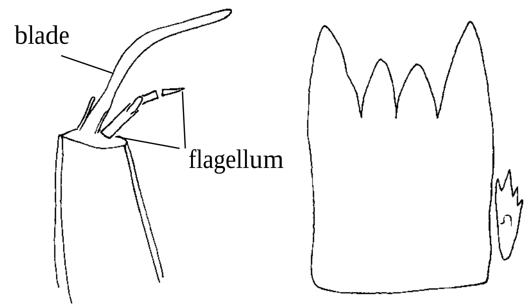


9' Ligula yellow-brown to reddish-brown; paraligula with one tooth on inner side 11

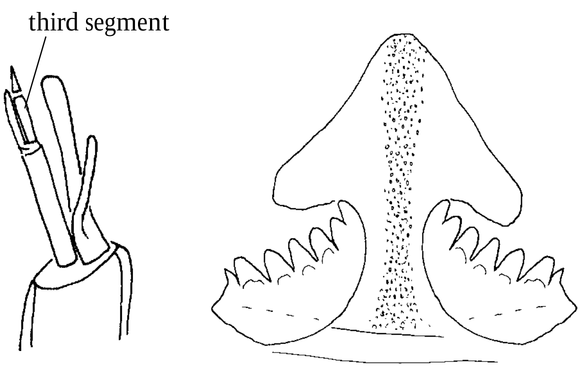
10(9) Antennal blade subequal to length of flagellum; ligula with 5 teeth (4 teeth in aberrant specimens) .... ***Procladius***



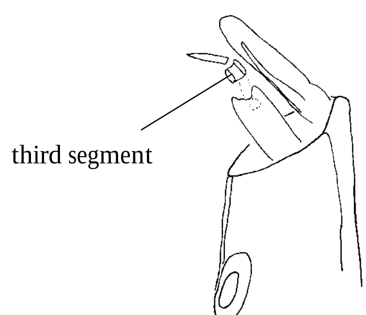
10' Antennal blade about twice as long as flagellum; ligula usually with 4 teeth, but may have 5 teeth .... ***Djalmabatista***

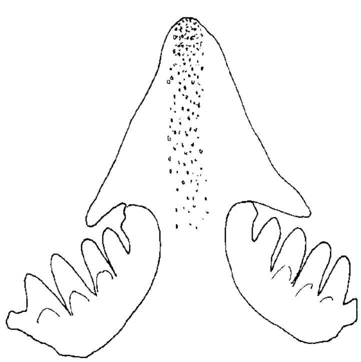


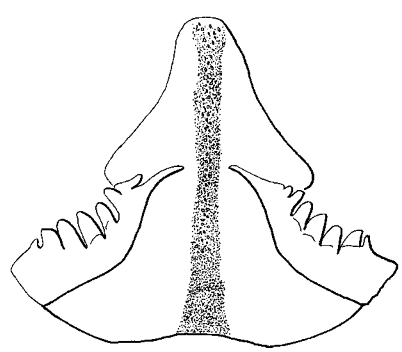
11(9') Third antennal segment about twice as long as wide; dorsomental plates each with 5-7 large teeth .... ***Alotanypus***



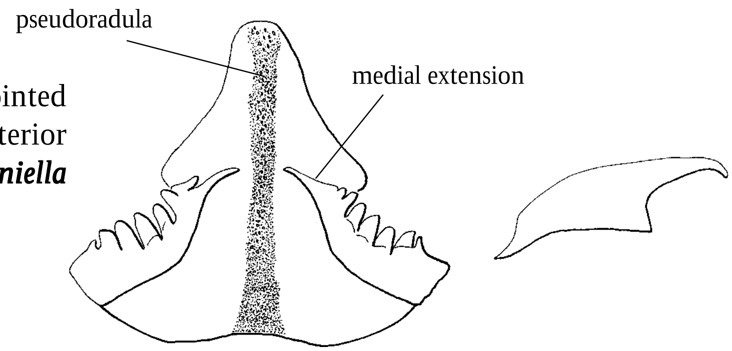
11' Third antennal segment shorter, about as long as wide; dorsomental plates with 4 to 6 large teeth 12



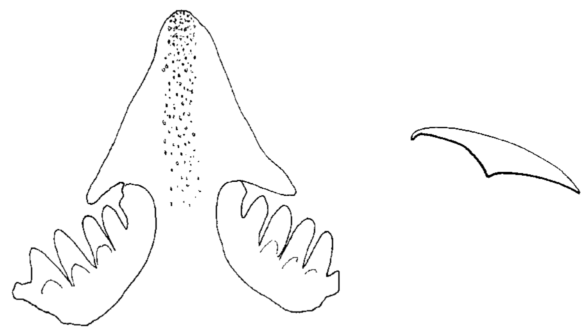




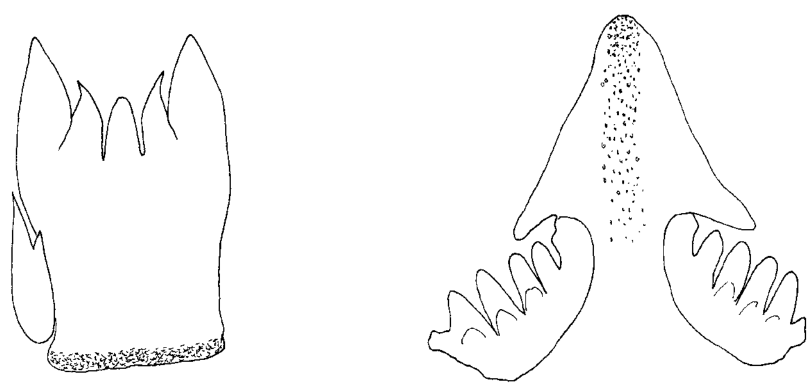
12(11’) Apex of dorsomental plates with pointed medial extension; small claw of posterior parapod with expanded base ... ***Brundiniella***



12’ Apex of dorsomental plates not medially pointed; small claw of posterior parapod without expanded base 13

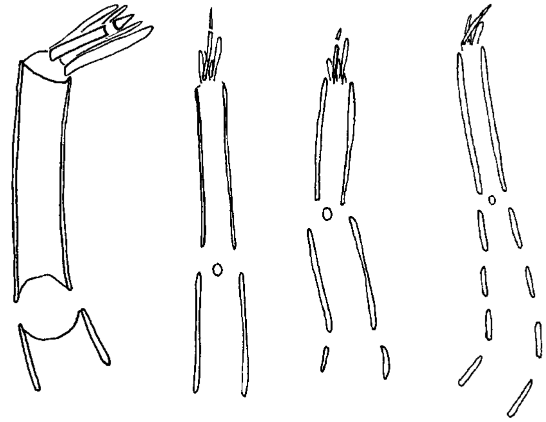


13(12’) Inner teeth of ligula curve outward; dorsomental plates with 4 large teeth .... ***Apsectrotanypus***

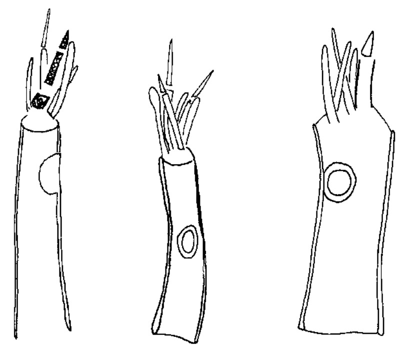


13’ Inner teeth of ligula directed forward; dorsomental plates with 5 large teeth .... ***Radotanypus*** (not recorded from the Carolinas)

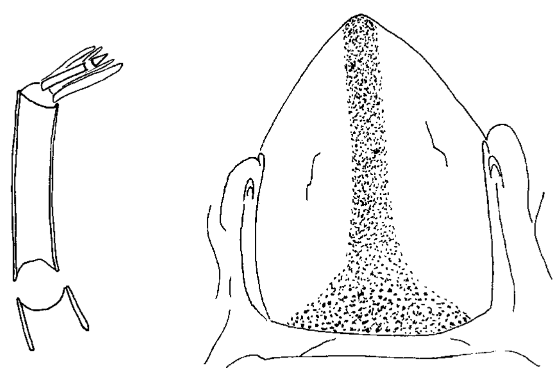
14(1') Maxillary palp with 2 or more sclerotized sections 15



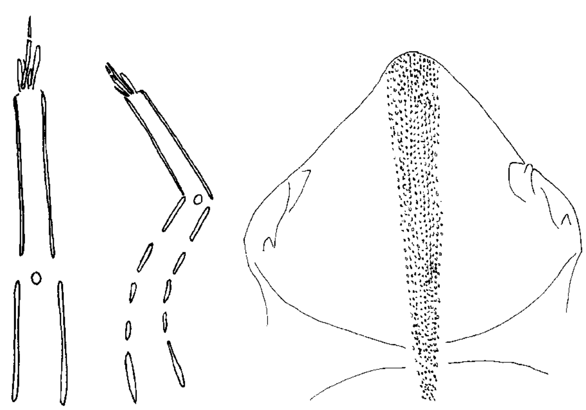
14' Maxillary palp with single sclerotized basal segment .. 16

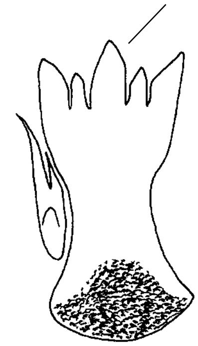


15(14) Maxillary palp with 2 unequal segments, basal segment less than 1/2 length of second segment; pseudoradula broadened posteriorly, appearing attached to transverse bar, with granules of pseudoradula not arranged in longitudinal rows .... ***Paramerina***

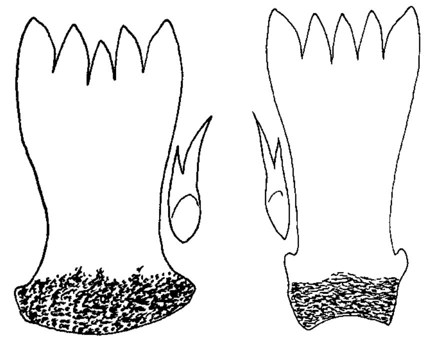


15' Maxillary palp with 2-6 segments; if only 2 segments then segments subequal in length or basal segment greater than 1/2 length of apical segment (note that in some species with more than 2 segments, basal segment may be very small); pseudoradula not broadened posteriorly, not appearing attached to transverse bar; with granules of pseudoradula often arranged in longitudinal rows .... ***Ablabesmyia***



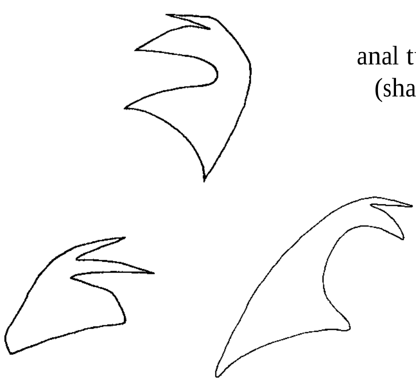


16(14’) Median tooth of ligula longer than inner teeth, reaching or surpassing level of outer teeth 17

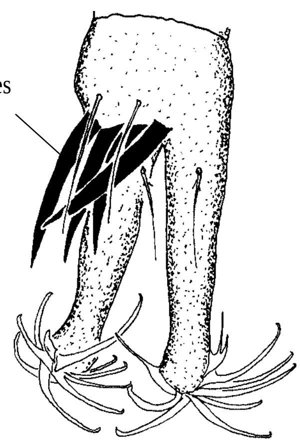


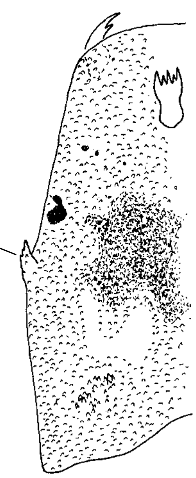
16’ Median tooth of ligula less than or equal to inner teeth .. 18

17(16) One small claw on posterior parapod bifid; anal tubules shorter than posterior parapods; head usually with lateral spines or covered with numerous small points or granules, or both, or rarely head capsule smooth .... ***Labrundinia*** (in part)

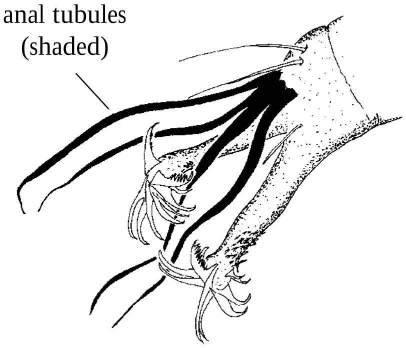


bifid claws of several species

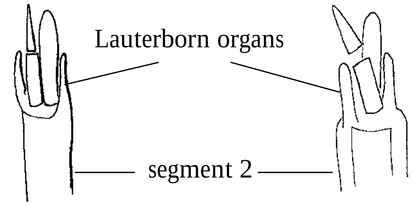




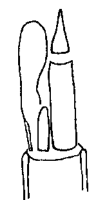
17’ One small or medium claw on posterior parapod pectinate or with inner serrations; anal tubules as long as or longer than posterior parapods; head never with lateral spines or covered with small points or granules .... ***Nilotanypus***



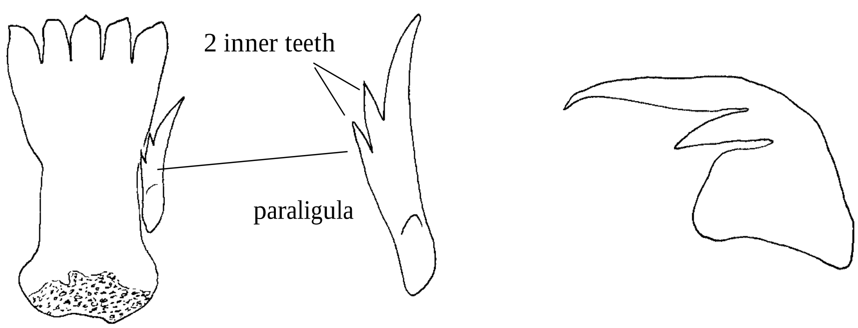
18(16') Apex of antennal segment 2 with large Lauterborn organs, appearing like a tuning fork 19



18' Lauterborn organs smaller, apex of second antennal segment not appearing like a tuning fork 23

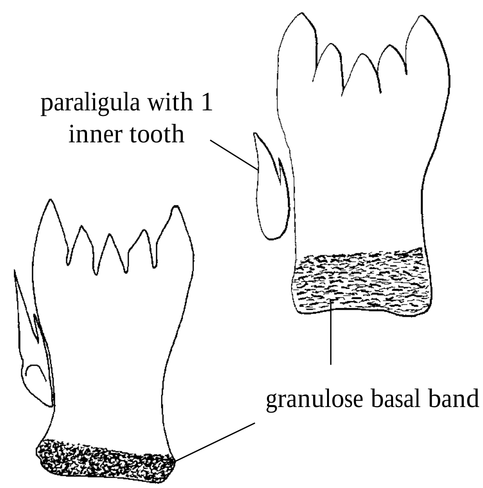


19(18) Paraligula with 2 inner teeth; small claws of posterior parapod with large inner tooth; all claws of posterior parapod pale .... ***Denopelopia***
(not recorded from the Carolinas)

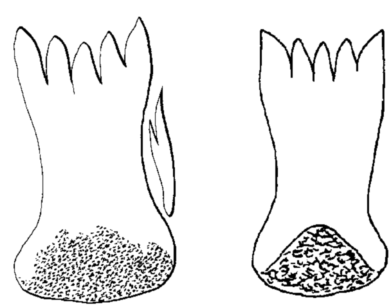


19' Paraligula with one inner tooth; posterior parapod with either pale simple claws or one dark claw and/or one or more small, transparent pectinate claws 20

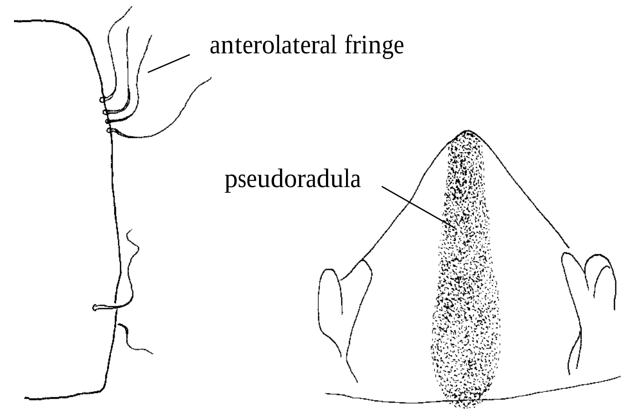
20(19') Granulose area at base of ligula forming a band .. 21



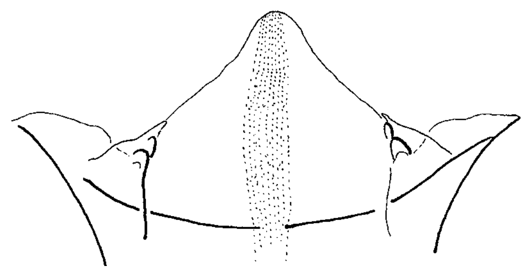
20' Granulose area at base of ligula roughly triangular or ovoid .. 22



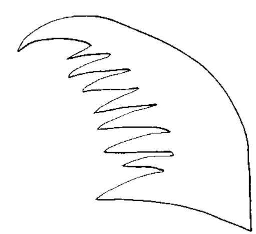
21(20) Body segments 4-10 with a small anterolateral fringe of 4 larger setae; pseudoradula with fine, uniform granulation .... ***Natarsia*** (in part)



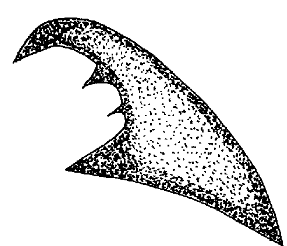
21' Body without small anterolateral fringe of 4 setae; granulation of pseudoradula coarse and arranged in longitudinal rows .... ***Krenopelopia***



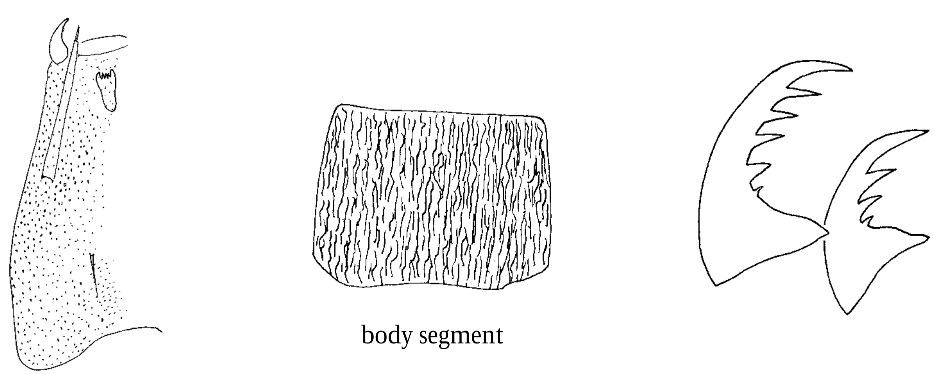
22(20') Posterior parapods with all claws transparent to pale yellowish-brown, with 3 smaller pectinate claws .... ***Cantopelopia***



22' Posterior parapods each with one small dark claw OR, if all claws transparent to pale yellowish-brown, then with either no pectinate claws or at most 2 pectinate claws .... ***Monopelopia***

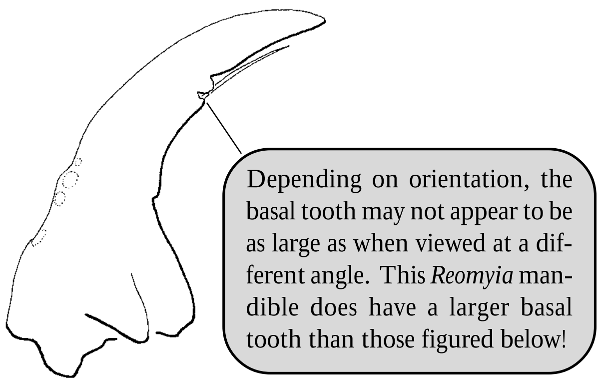


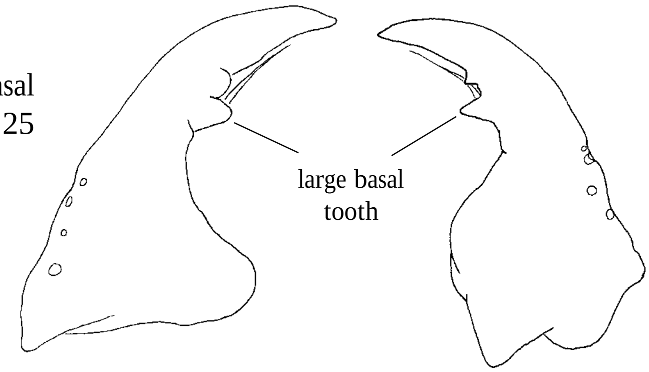
23(18') Surface of head granulose; body surface with undulating longitudinal wrinkles; 2-3 small claws of posterior parapod with 3 or more inner teeth .... ***Guttipelopia***

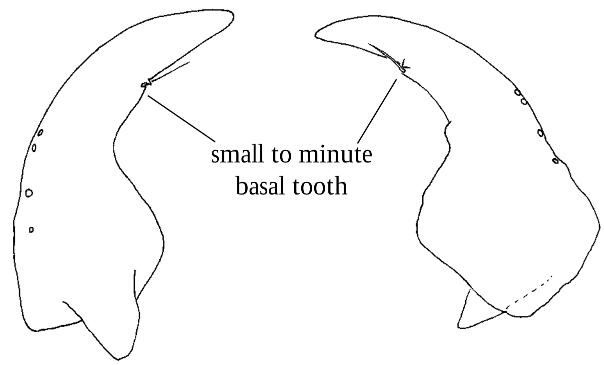


23' Surface of head usually smooth (covered with spinules in one species of *Labrundinia*, couplet 27); body surface smooth; at most 1 small claw of posterior parapod with a single inner tooth 24

24(23’) Mandible with a moderately large to large basal tooth 25

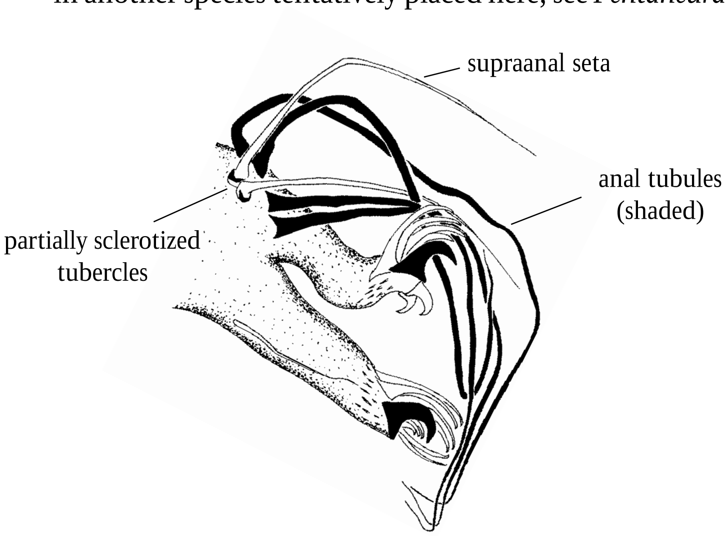


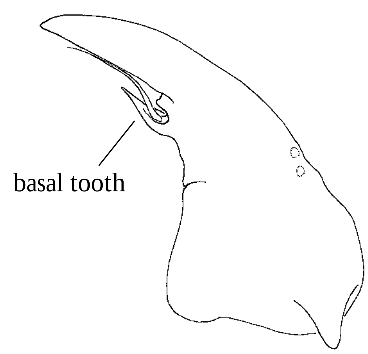




24’ Basal tooth of mandible small to minute ... 32

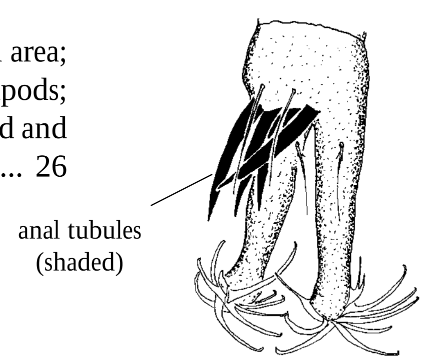
25(24) Supraanal setae arising from large tubercles with dark sclerotized area; (in the most common species, *P. inconspicua*, anal tubules are long and thin, greatly exceeding length of posterior parapods and mandible with large, sharply pointed, apically directed basal tooth; these characters are absent in another species tentatively placed here; see *Pentaneura*) .... ***Pentaneura***





P. inconspicua mandible

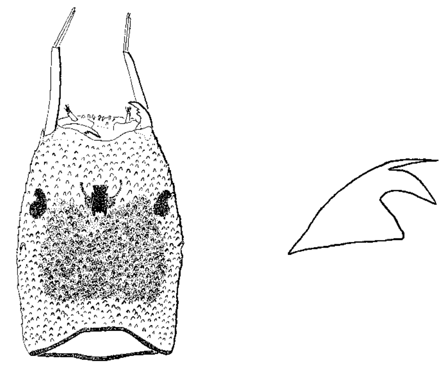
25’ Supraanal setae not arising from large tubercles with sclerotized area; anal tubules elongate-conical, at most subequal to posterior parapods; basal tooth of mandible variable, but never large, sharply pointed and directed apically (see figures above) 26



26(25) One small claw of posterior parapod with inner tooth or apically bifid 27

26' Small claws of posterior parapod simple 29

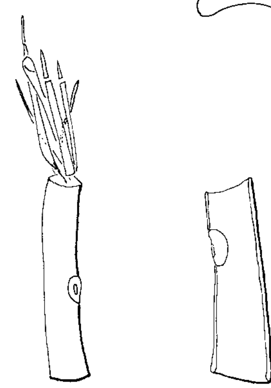
27(26) Head covered with spinules and with weak, blunt, lateral and ventral spines; inner tooth of small bifid claw on posterior parapod subequal to or longer than upper tooth .... ***Labrundinia*** (in part)
(*L*. sp. A, not known from the Carolinas)



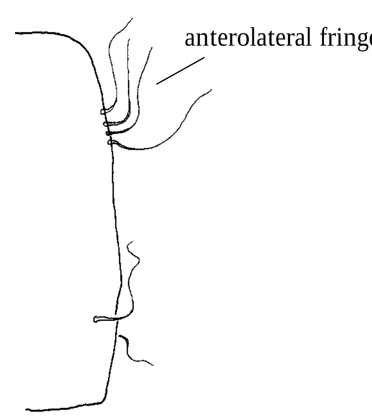
27' Head smooth, without lateral or ventral spines; inner tooth of small claw on posterior parapod much shorter than upper tooth 28

28(27', 30) Ring organ of maxillary palp 0.3-0.4 from base; basal segment about 6 times as long as wide .... ***Reomyia***

28' Ring organ of maxillary palp 0.5-0.7 from base; basal segment about 4 times as long as wide .... ***Zavrelimyia***



Reomyia *Zavrelimyia*
(apical sensilla omitted)

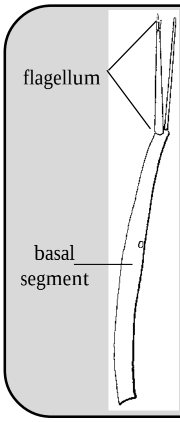


29(26') Body segments 4-10 with a small anterolateral fringe of 4 larger setae .... ***Natarsia*** (in part)

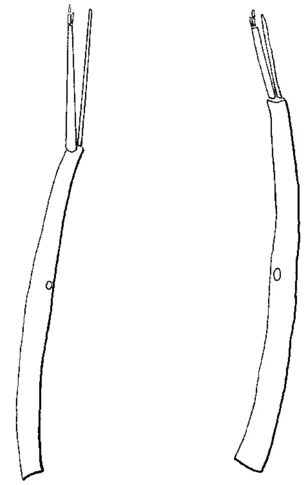
29' Body segments without such a fringe 30

30(29’) Second antennal segment long, with AR 2.4-3.4 .. back to 28

30’ Second antennal segment shorter, with AR 3.5-5.0 31

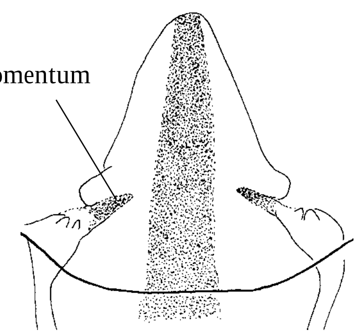


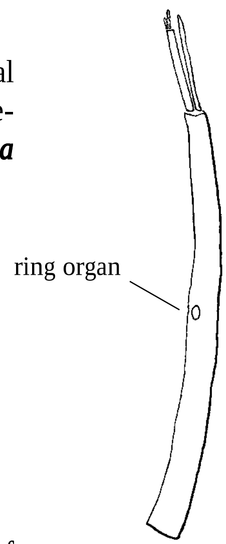
AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



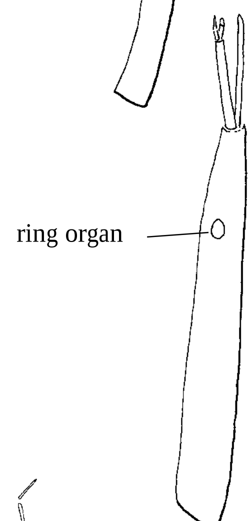
long segment 2 short segment 2

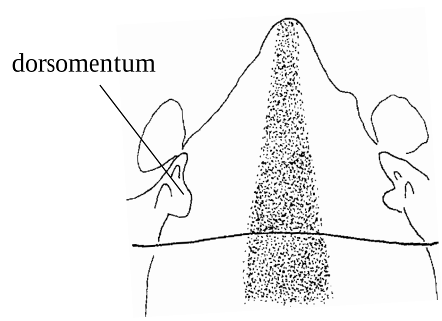
31(30’) Antennae long, about 3.5X length of mandible, with ring organ of basal segment near middle; inner apical margin of dorsomentum directed medially; common .... ***Larsia***





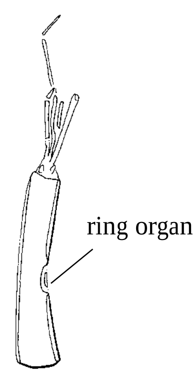
31’ Antennae shorter, about twice as long as mandible, with ring organ of basal segment near bottom of distal third; inner apical margin of dorsomentum directed apically; rare .... ***Telopelopia***
(not recorded from the Carolinas)

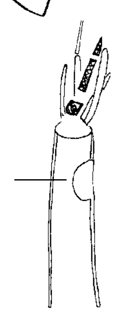




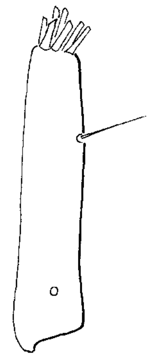
32(24’) Ring organ of maxillary palp near middle of basal segment .. 33

32’ Ring organ of maxillary palp near apex of basal segment 34

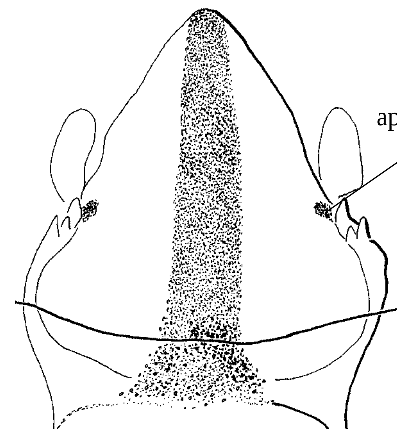




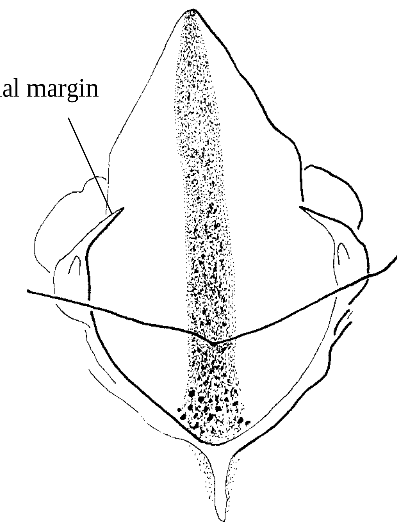
33(32) Procercus 4 or more times as long as wide; claws of posterior parapod without extensive thin lamellate outer margin; apicomedial margin of dorsomentum rounded .... ***Hudsonimyia***



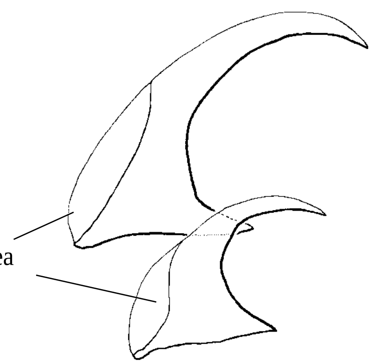
procercus
(anal setae abbreviated)



33’ Procercus 2.5-3.5 times as long as wide; most claws of posterior parapod with very thin, extensive lamellate outer margin; apicomedial margin of dorsomentum produced to a fine point .... ***Trissopelopia***



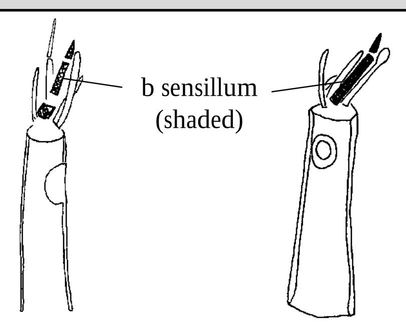
procercus
(anal setae abbreviated)



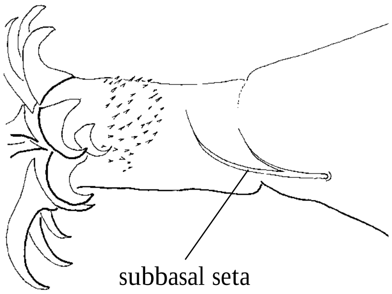
Beginning with couplet 34 below, the remainder of this key deals with the *Thienemannimyia* group. In the Carolinas the group includes *Conchapelopia, Hayesomyia, Helopelopia, Meropelopia, Rheopelopia* and perhaps *Telopelopia* (see couplet 31) and *Thienemannimyia.* While mature larvae of some of these genera can be easily identified, you may have to settle for an identification of “*Thienemannimyia* group sp.” for many larvae of this complex of closely related genera. Mature fourth instar larvae with developing pupal characters (prepupae) may often be positively identified by the developing thoracic horn; a typical example of this structure is illustrated for each of these genera in the key below.

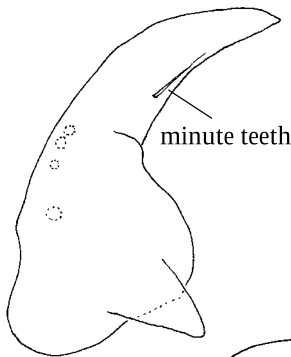
34(32’) Maxillary palp with b sensillum 3 segmented ... 35

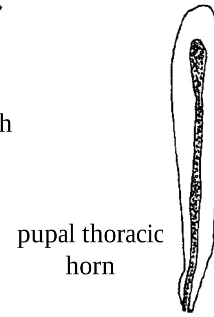
34’ Maxillary palp with b sensillum 2 segmented ... 37

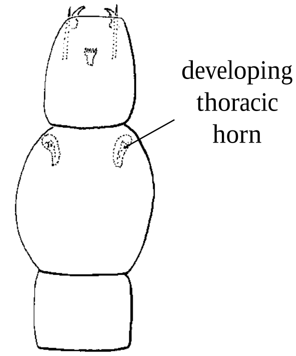


35(34) Basal and accessory teeth of mandible extremely reduced, accessory tooth visible only at 1000X; subbasal seta of posterior parapod unevenly bifid; pupal thoracic horn simple, saccoid .... ***Rheopelopia*** (in part)

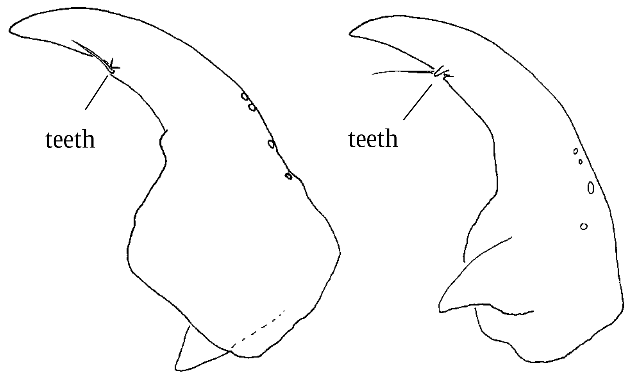






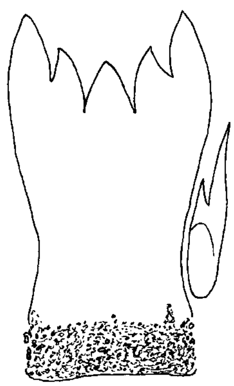


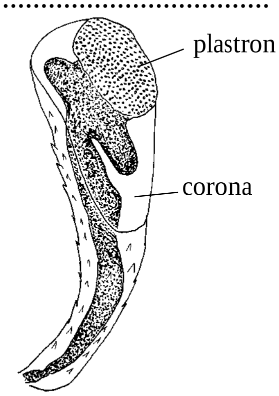
35’ Basal and accessory teeth larger, visible at 400X; subbasal seta of posterior parapod simple; pupal thoracic horn with plastron (see below) 36



36(35’) **Fourth instar only**: first antennal segment length > 375 µm; length of basal segment of maxillary palp > 70 µm; central tooth of ligula about as long as wide; pupal thoracic horn with small plastron plate and large corona (clear area) .... ***Helopelopia***

NOTE:
4th instar larvae are necessary for accurate measurements!!

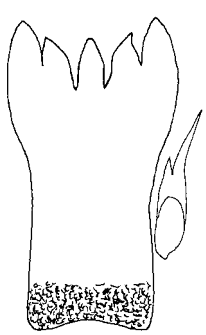


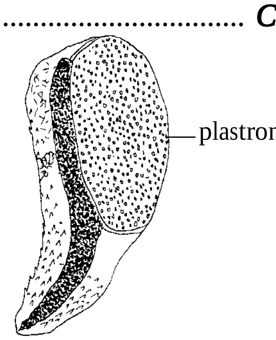


pupal thoracic horn

36’ **Fourth instar only**: first antennal segment length < 375 µm; length of basal segment of maxillary palp < 70 µm; central tooth of ligula about twice as long as wide; pupal thoracic horn with large plastron plate, corona variable .... ***Conchapelopia***

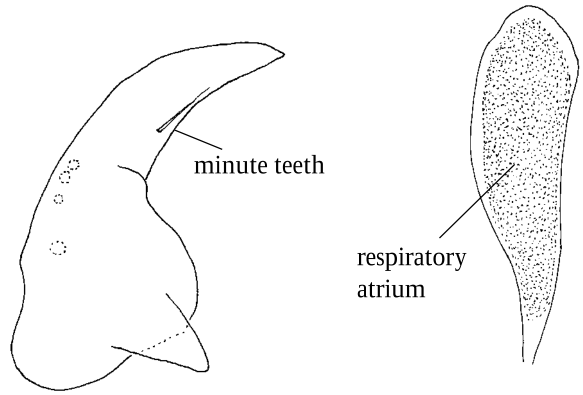
NOTE:
4th instar larvae are necessary for accurate measurements!!





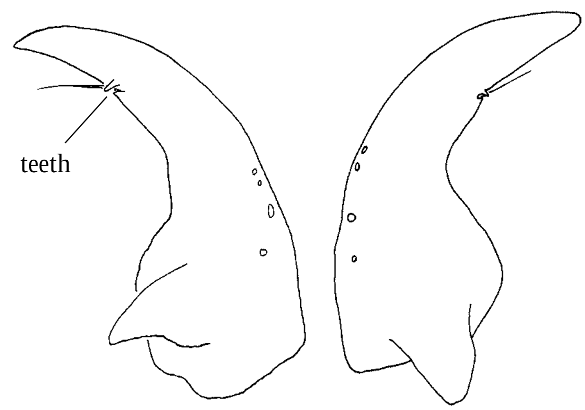
pupal thoracic horn

37(34’) Basal segment of maxillary palp shorter than antennal segment 2; basal and accessory teeth of mandible extremely reduced, accessory tooth visible only at 1000X; pupal thoracic horn simple, saccoid, with indistinct respiratory atrium .... ***Rheopelopia*** (in part)

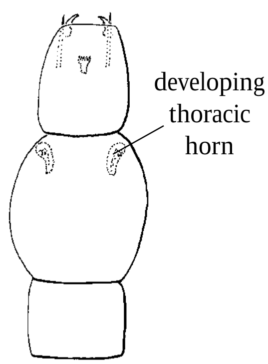


pupal thoracic horn

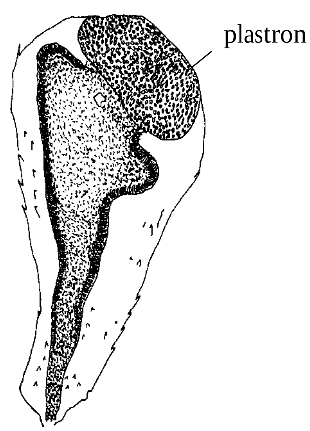
37’ Basal segment of maxillary palp longer than second antennal segment; basal and accessory teeth larger, visible at 400X; pupal thoracic horn with plastron or respiratory atrium convoluted (see below) 38



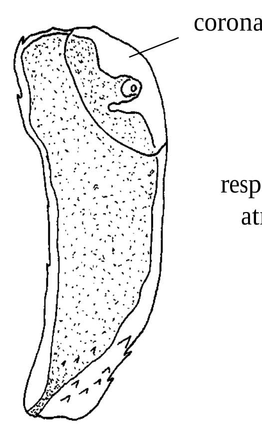
38(37’) Posterior margin of head capsule pale; length of antennal segment 1 divided by mandible length greater than 1.75; pupal thoracic horn with plastron and without a corona (clear area near apex) .... ***Meropelopia***



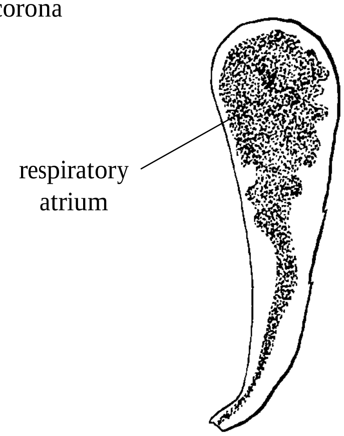
prepupal larva with developing thoracic horns



Meropelopia pupal thoracic horn



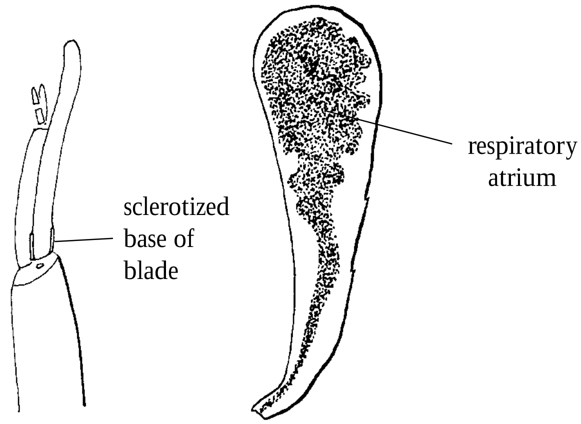
Hayesomyia pupal thoracic horn



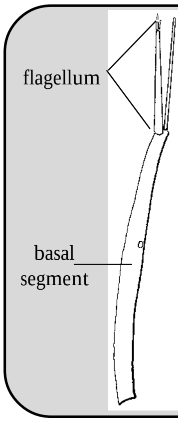
Thienemannimyia pupal thoracic horn

38’ Posterior margin of head capsule brown **OR** pale; length of antennal segment 1 divided by mandible length less than 1.90 (usually less than 1.50); pupal thoracic horn without plastron, corona present or absent 39

39(38’) **Fourth instar only:** AR > 5.0; second antennal segment length about 40 µm; sclerotized base of antennal blade about as long as wide; pupal thoracic horn without corona, respiratory atrium with numerous convolutions .... ***Thienemannimyia***
(not recorded from the Carolinas)

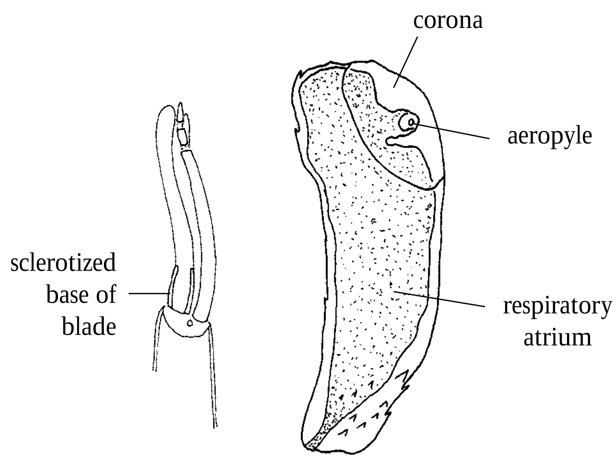


NOTE:
4th instar
larvae are necessary
for accurate
measurements!!



AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

39’ **Fourth instar only:** AR < 5.0; second antennal segment length about 50 µm; sclerotized base of antennal blade about twice as long as wide; pupal thoracic horn with a distinct aeropyle surrounded by a corona, respiratory atrium with only one or two convolutions ...... ***Hayesomyia***



Genus *Ablabesmyia*

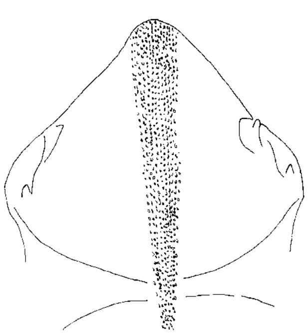
DIAGNOSIS: The anteriorly narrowed, elongate-oval head capsule; large basal tooth of the mandible; maxillary palpus with 2 or more segments, with the ring organ small (about 1/3 to 1/2 width of basal palpal segment) and located between the apical two segments; pseudoradula not broadened posteriorly, not connected to a transverse bar, and with its granules arranged in longitudinal rows, will distinguish this genus.

NOTES: *Ablabesmyia* is a common and widely distributed genus in the Southeast US; almost every described species known from the eastern U.S. has been recorded from the Carolinas. It is doubtful that all the *Ablabesmyia* species recorded from the two states actually occur there; some records are apparently based on larvae that were misidentified (many misidentifications are due to the use of older, incorrect literature, such as Beck 1976, 1979). I have not been able to see Carolinas material of all the purported species. The genus is represented in the Nearctic by three subgenera - *A. (Ablabesmyia)*, *A. (Asayia)* and *A. (Karelia)*. Larvae of the latter two subgenera have maxillary palpi with only two segments; with the exception of *A. annulata*, these larvae may be very difficult to separate. Species-level identifications of larvae of the subgenus *Karelia* must be viewed with skepticism unless accompanied by associated pupae or adult males. Most members of the *A. (A.) rhamphe* group can not be reliably identified as larvae without associated adult males.

Roback (1985) noted that *Ablabesmyia* larvae were found over a pH range of <4.1 - >8.1, but were predominantly found in a circumneutral range of 6.1-7.0. He observed that they preferred softer, less alkaline water (but see *A. cinctipes* under Notes on species). Roback also stated that larvae of the subgenus *Karelia* were most often encountered in lakes, ponds and swamps, but were also found in large shallow streams. Most other species in the genus were found in flowing water; at least one "form" of one species (*A. janta*) is known to live within freshwater mussels. It appears that *A. mallochi* is the most common and widespread species in streams and rivers throughout the Carolinas and the Southeast US.

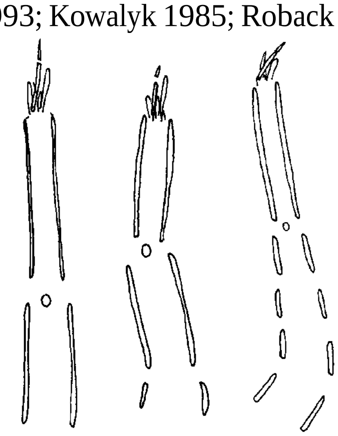
Many name changes have taken place in this genus; see the checklist and Notes on species following the key for synonyms. Roback (1985) described several "varieties" for several *Ablabesmyia* species, but considered that he did not have enough data to justify establishing them as different species. Identification of many larvae to the species level is difficult, especially in the subgenus *Karelia;* in many instances, your best identification with this group may be to subgenus. **Note** that early instar larvae may not possess the full complement of maxillary palpus segments! Larvae must be reared to positively identify several species!

ADDITIONAL REFERENCES: Caldwell 1993; Kowalyk 1985; Roback 1971, 1982a, 1985; Roback et al. 1980.



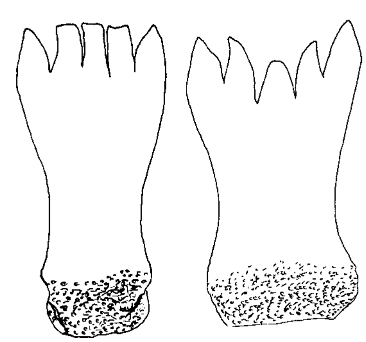
dorsomentum and M appendage

mandible



A. peleensis *A. rhamphe* *A. mallochi*

maxillary palps with 2, 3 and 5 segments

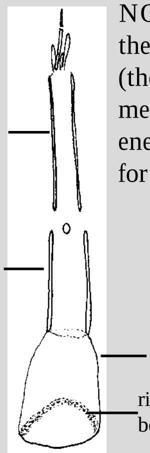


A. annulata *A. cinctipes*

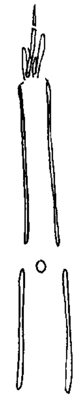
ligulae

Key to *Ablabesmyia* larvae of the southeastern United States

1 Maxillary palpus with 2 sclerotized segments 2

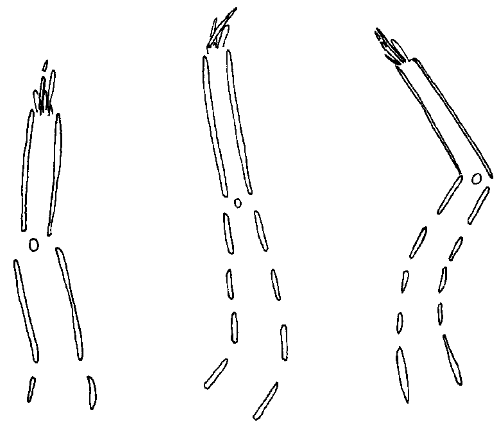


NOTE! Do not mistake portions of the membranous base of the palpus (the palpiger) for a sclerotized segment. The palpiger base has thickened tissues that might be mistaken for a palpal segment.



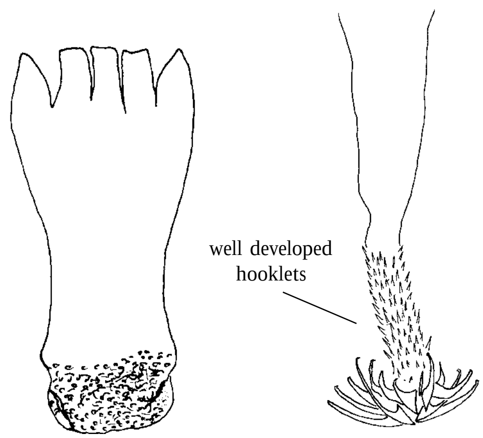
2 segments

1' Maxillary palpus with 3 or more sclerotized segments (the basal segment may be small) .. ***Ablabesmyia (Ablabesmyia)*** sp. 8



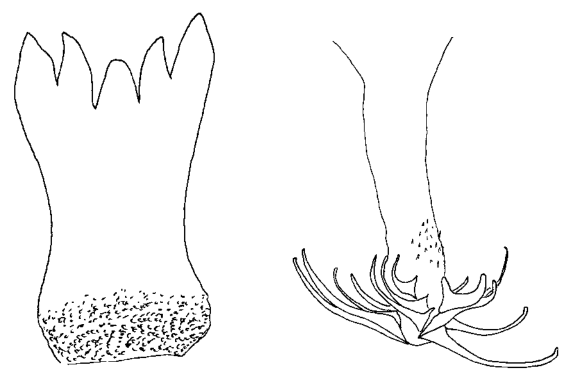
3 segments 5 segments 6 segments

2 (1) Apices of ligula teeth even, with 3 middle teeth apically truncate; procercus length 7-8X width; numerous well developed lateral hooklets on distal 4/10 of posterior parapod .... ***A. (Asayia) annulata***



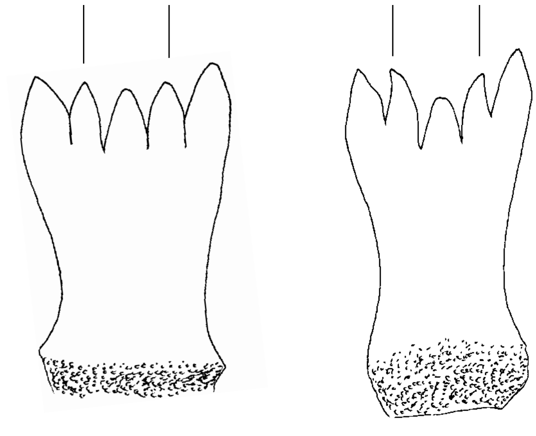
2' Apices of ligula teeth form a concave arc, middle teeth pointed; procercus length 2-4X width; lateral hooklets on posterior parapod smaller and less numerous .... ***A. (Karelia)* sp.** 3

(most of these species are difficult to separate; reared associations are necessary for accurate species determination; in most instances your most accurate identification may be "*A. (Karelia)* sp.")



3(2') Apex of inner tooth of ligula directed relatively straight forward; 1-3 dark claws on posterior parapod .... ***A. peleensis***

3' Apex of inner tooth of ligula directed slightly outward; 0-3 dark claws on posterior parapod 4

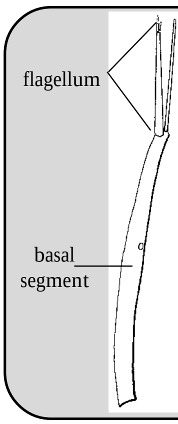


A. peleensis *A. cinctipes*

4(3') Posterior parapod with all claws pale; length of apical palpal segment 1.7-3X length of basal segment .... ***A. philosphagnos***

NOTE: 4th instar larvae are necessary for accurate measurements!!

4' Posterior parapod with 1-3 claws darker than others (difference in color may be slight); length of apical palpal segment 0.9-1.7X length of basal segment 5
(separation of the taxa beyond this couplet is very difficult; reared material is necessary; your best identification will probably be *A. (Karelia)* sp.)



AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

5 (4') Posterior parapod with 3 darker claws; ratio of length of apical palpal segment/basal palpal segment 0.9-1.3 (mean 1.2); AR = 4.6-5.2 (mean 4.8) .... ***A. cinctipes***

5' Posterior parapod with 1-2 darker claws; apical palpal segment/basal palpal segment 1.2-2.3 ; AR 4.0 -6.1 6

6(5') One dark claw on posterior parapod much longer than the other dark claw; length of first antennal segment > 600 µm; length of second antennal segment > 96 µm (4th instar only!!) .... ***A. illinoensis***
(see Notes on species!)

NOTE: 4th instar larvae are necessary for accurate measurements!!

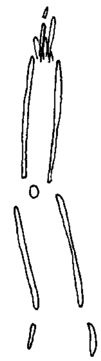
6' Dark claws of posterior parapod about the same size (although one may be larger than the other, but not to the extent as in *A. illinoensis*); length of first antennal segment < 600 µm; length of second antennal segment < 90 µm (4th instar only!!) 7

NOTE:
4th instar
larvae are necessary
for accurate
measurements!!

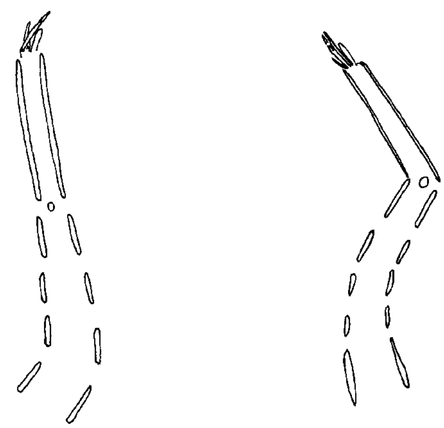
7(6’) AR 5.2- 6.1; basal antennal segment > 500 µm .... ***A. idei***

7’ AR 4.0-4.9; basal antennal segment < 425 µm .... ***A.* sp. A**
(known only from Florida)

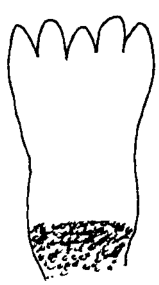
8(1’) Maxillary palpus with 3 sclerotized segments 9



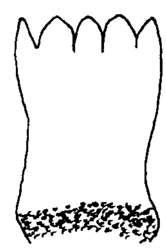
8’ Maxillary palpus with 5-6 segments 12



9(8) Apices of ligula teeth even or almost so .... ***A. janta*** (in part)



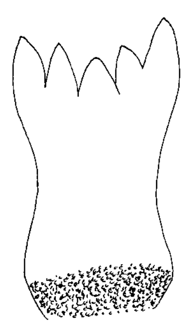
Two “varieties” of *A. janta* will key here; see Notes

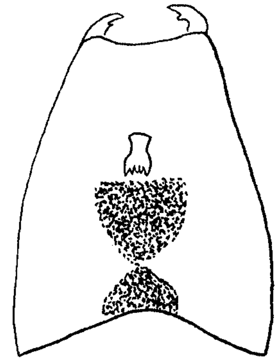


A. janta variety I has 1-2 slightly infuscated posterior parapod claws and is found only associated with unionid mussels

A. janta variety II has 2 dark posterior parapod claws and is free-living

9’ Apices of ligula teeth form a concave arc 10





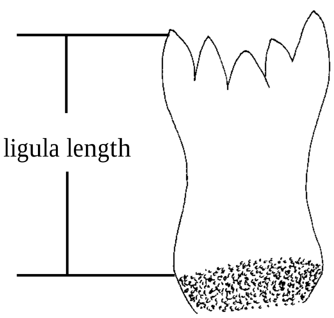
10(9') Head capsule with two large ventral spots; at most one dark claw on posterior parapod; no truncate-based claw present on posterior parapod .... ***A. simpsoni***

10' Head capsule with at most a diffuse ventromesal spot; posterior parapod with 2 dark claws; a truncate-based claw present on posterior parapod 11

truncate-based claw

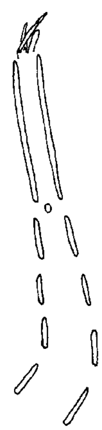
11(10') Ligula > 80 µm; mandible > 155 µm .... ***A. monilis***
(see Notes)

NOTE:
4th instar
larvae are necessary
for accurate
measurements!!

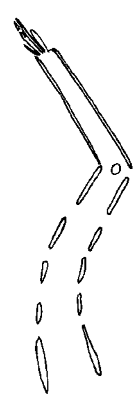


11' Ligula usually < 80 µm; mandible < 155 µm .... ***A. rhamphe* group**
(larvae of *A. janta* var. III, *A. parajanta* and *A. rhamphe* are inseparable without associated adult males; see Notes)

12(8') Maxillary palpus with 5 segments; small claw of posterior parapod without an expanded base .... ***A. mallochi***



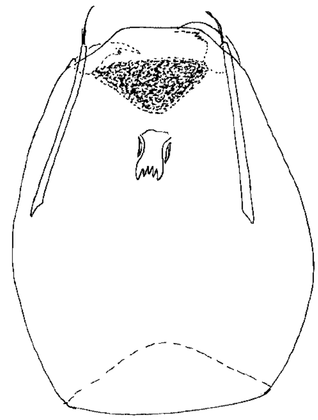
12' Maxillary palpus with 6 segments; small claw of posterior parapod with or without an expanded base 13



claw with expanded base

claw without expanded base

13(12') Head with a dorsal anteromesal brown spot; small claw of posterior parapod without expanded base .... ***A. hauberi***



13' Head without a dorsal anteromesal brown spot; small claw of posterior parapod with expanded base .... ***A. aspera***

Notes on species

A. annulata - This large species is unmistakable with its two-segmented maxillary palp, the ligula with the median teeth even and usually apically truncated, and the numerous large spines on the shaft of the posterior parapods. This species in apparently uncommon but widespread throughout the Southeast. This species is not keyed correctly in Beck (1976, 1979) and Webb & Brigham (1982).

A. aspera - An uncommon species in the Southeast; this species is very closely related to *A. hauberi*. Adults and pupae of *A. aspera* and *A. hauberi* are very difficult to separate, but the larvae are usually distinct. However, I have seen Florida *A. aspera* larvae with a small amount of brown anteromesally, but not as large or as dark as that of *A. hauberi*. Be sure to examine the small claw of the posterior parapod. Roback (1985) did not record *A. aspera* from the Carolinas, but I've seen material from the Piedmont (Barnwell Co.) in South Carolina; its presence in Florida and Georgia, and in Pennsylvania and West Virginia indicates that it should be found throughout the Carolinas. I have seen some larvae from Florida with a six-segmented palp, no head spot and a small claw on the posterior parapod without an expanded base. Whether this represents a hybrid or a distinct, separate taxon is unknown; none of the larvae were associated with other life stages.

A. cinctipes - The immature stages of this species have been described recently by Caldwell (1993). He found larvae living in a shallow, well-water fed pond with a high pH (7.6-8.8) and conductivity (410-494 µmhos/cm @ 25°C), the highest values published for an *Ablabesmyia* sp. However, larvae have been collected in Florida from an excavated pond with a conductivity value of 3465 µmhos (R. Rutter, pers. com.). Differences in coloration of the claws of the posterior parapod are subtle and make this species, as with the majority of species in the subgenus *Karelia*, difficult to identify. It will not key correctly in Beck (1976; 1979). It is likely that this species name has been misidentified often, and most records of *A. cinctipes* based on larvae are probably erroneous.

A. hauberi - This species is usually easily recognized as a larva; it is closely related to *A. aspera* (see above) and may be a southern form of that species. It is recorded from most of the states in the Southeast; it may reach its northern limit in North Carolina.

A. idei - Roback (1971) considered this species a synonym of *A. illinoensis*, but in 1985 returned it to species status. This member of the subgenus *Karelia* is not easily identifiable as a larva; larvae should be associated with a pupa (which is distinctive; see Roback (1985)) or an adult male. Unless accompanied by such an association, larvae should be identified as "*A. (Karelia)* sp." Roback recorded this species from South Carolina; I have also seen adults referable to this species from South Carolina (Barnwell Co.). It is also recorded from Pennsylvania and New York and thus probably occurs throughout the Carolinas.

A. illinoensis - This is a northern species recorded for the Carolinas by Hudson et al. (1990) and Caldwell et al. (1997); Roback (1985) did not record this species from further south than New York. I have not examined any material referable to this taxon from the Carolinas (or from anywhere in the Southeast) and doubt that it occurs there. The size differential of the dark claws of the posterior parapod should identify the larvae of this species, but any identifications of this taxon should be backed by associated or reared material.

A. janta - An enigmatic species - Roback (1985) recorded three varieties based on larvae and pupae; adult genitalia were similar for all three varieties. *Ablabesmyia janta* var. I is found associated with unionid clams (see Roback et al. 1980 and Roback 1982a) and is recorded from Florida, Oklahoma, Tennessee and Texas. Varieties II and III are free living; var. II has been recorded from South Carolina (Keowee Res., Oconee Co.) by Roback (1985). Variety III is based on a single rearing from Florida that may be missassociated. Unless larvae distinctly belong to varieties I or II, this taxon must be identified as "*A. rhamphe* group sp.", since larvae are indistinguishable from the other members of that group (see *A. rhamphe*).

A. mallochi - A very common and widespread species in lotic habitats throughout the eastern US. The names *auriensis*, *ornata* and *tarella* are considered synonyms, although *ornata* may represent a distinct species. Roback (1985) considered two varieties of *A. mallochi* larvae: var. I was distinguished by the longest dark claw of the posterior parapod being 105-121 µm in length; in var. II the longest dark claw was 30-95 µm long. Roback (1985) considered that he did not have enough evidence to justify establishing two species from his material; if the varieties were elevated to species rank, var. II would correspond with *A. ornata*. Roback (1985) recorded both varieties from Florida, Georgia, Kentucky and North and South Carolina in the Southeast. More data, based on reared material, are needed.

A. monilis - Another difficult to identify (as a larva) species that apparently reaches its southern limit in South Carolina. Roback (1985) used ligula and mandible length to separate *A. monilis* larvae from the *A. rhamphe* group. However, I have reared a specimen of *A. parajanta* from north Florida in which the larval ligula is 80 µm long, the lower limit for Roback's *A. monilis*. Larval *A. monilis* should only be identified to the species level with associated material.

A. parajanta - A member of the *A. rhamphe* group found throughout the Southeast; this species is not identifiable to the species level as a larva. Records of this species based solely on larvae should be corrected to "*A. rhamphe* group sp."

A. peleensis - Another member of the subgenus *Karelia*; larvae are usually identifiable because of the forward pointing inner teeth of the ligula. This character can be quite variable and is dependent on the angle at which the ligula is viewed. Roback (1985) noted two larval types based on differences of the dark claws on the posterior parapods. Larval type 1, recorded by Roback (1985) from Florida, Georgia, Kentucky, South Carolina and Tennessee, has the base of one of the dark claws expanded; larval type 2, recorded from Florida and Georgia, does not.

A. philosphagnos - This species, like *A. cinctipes*, will not key correctly in Beck (1976, 1979) and Webb & Brigham (1982), perhaps due to confusion concerning the coloration of the posterior parapod claws. Older records of *A. cinctipes* that may be based on identifications using those keys should be viewed with skepticism.

A. rhamphe - As a larva, not separable from *A. janta* type III and *A. parajanta*. Larvae should be identified as "*A. rhamphe* group." Associated adult males are necessary for correct species level identification.

A. simpsoni - Roback (1985) described this new species based on a reared specimen from New York; he also recorded a single larva from the Savannah River in South Carolina. I have seen a specimen from the Coastal Plain of North Carolina (Tar River in Edgecombe Co.) that also fits this distinctively marked species.

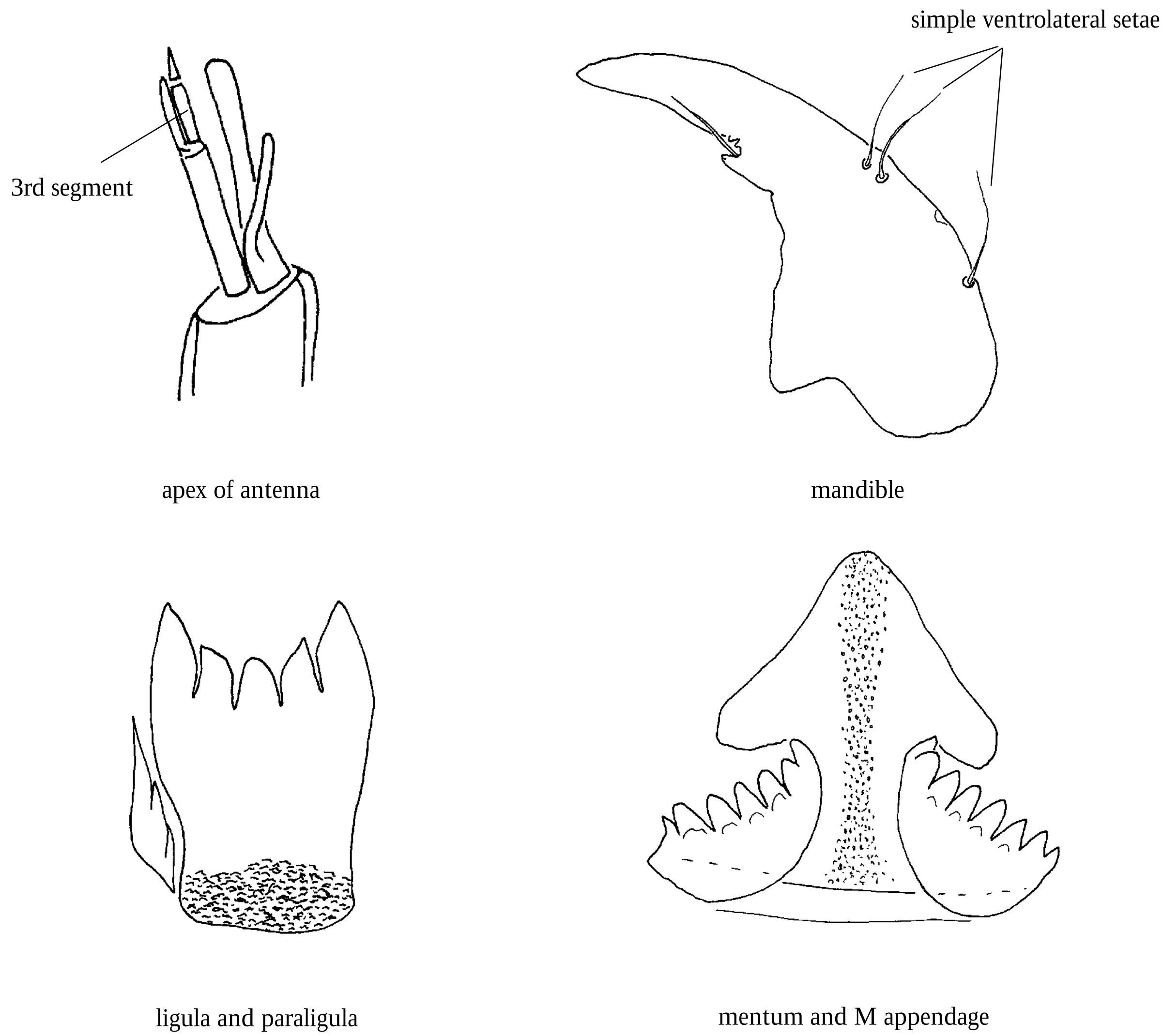
A. sp. A - A member of the subgenus *Karelia* known only from Florida. Epler (1995) considered two undescribed taxa (sp. A and sp. B) to be present in south Florida. However, further examination of reared material showed overlap of measurements; based on material currently available, it appears that *A.* sp. A and sp. B should be lumped as *A.* sp. A. This taxon is very similar to *A. idei* and *A. illinoensis*, but based on adult male genitalia, appears to be an undescribed species.

Genus *Alotanypus*

DIAGNOSIS: *Alotanypus* can be distinguished by the rounded head capsule; the long third antennal segment (at least twice as long as wide); yellow-brown ligula; maxillary palp with ring organ near middle; well developed dorsomental plates with 5-7 large and 1 or 2 small teeth; mandible with all ventrolateral setae simple; and the lateral fringe of setae on the body.

NOTES: One species, *A. aris*, occurs in the eastern United States. It is recorded from Alabama, northern Florida, Georgia and North and South Carolina in the Southeast. Larvae of this uncommon species have been found in acid water (pH 3.9-4.0) in springs, seeps and bogs (Roback 1978; 1987b). Note that the dorsomental plates on the specimen illustrated below have six large teeth on one side, five on the other; five large teeth is the normal number for *A. aris*. A western species, *A. venustus* (Coquillett), has six large teeth on its dorsomental plates.

ADDITIONAL REFERENCES: Roback 1971, 1978a, 1987b.



Alotanypus sp. larval structures

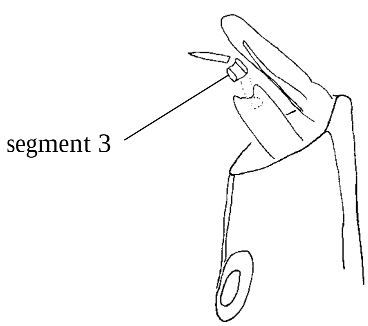
Genus *Apsectrotanypus*

DIAGNOSIS: This genus is recognized by the rounded head capsule; the short antennal segment 2 (about twice as long as wide) and very small segment 3; yellowish-brown ligula with inner teeth turned out; well developed dorsomental tooth plates, each with 4 large and 1 small tooth; maxillary palp with ring organ near its middle; the branched ventrolateral setae 2 and 3 of the mandible; posterior parapod without a small claw with an expanded base; and the lateral setal fringe of the body.

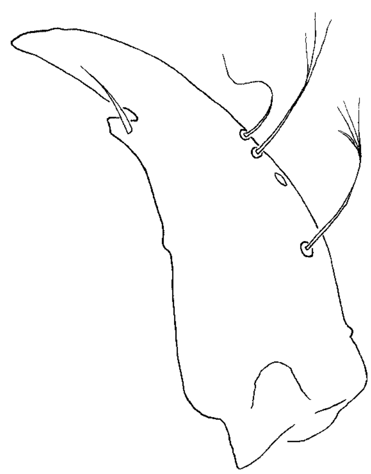
NOTES: Only one species, *A. johnsoni*, is known from the eastern U.S. In the Southeast, it has been recorded from the Carolinas, Georgia and northern and western Florida. *Apsectrotanypus* larvae are usually found in cool mountain streams, but have been found on the Piedmont and Costal Plain.

Once considered a member of *Macropelopia* and *Psectrotanypus*, *Apsectrotanypus* has also been confused with *Bethbilbeckia*; the characters given in the diagnosis above will distinguish *Apsectrotanypus* from those taxa.

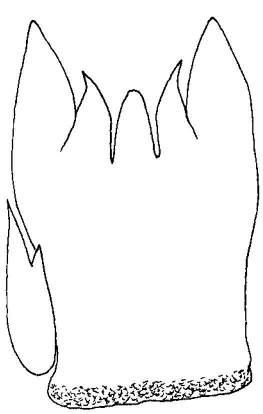
ADDITIONAL REFERENCES: Roback 1971, 1978a.



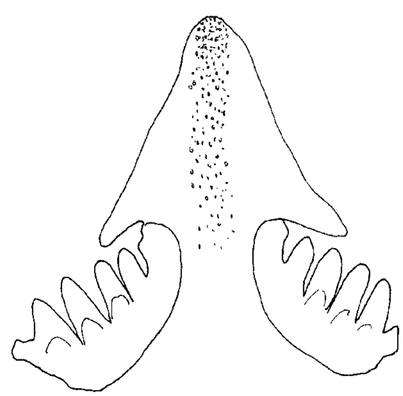
antennal apex



mandible



ligula and paraligula



mentum and M appendage

Apsectrotanypus johnsoni, larval structures

Genus *Bethbilbeckia*

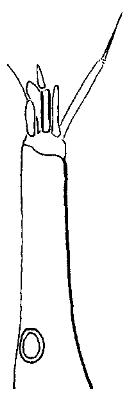
DIAGNOSIS: Distinguished by the rotund head capsule; ring organ in bottom third of maxillary palp; yellow-brown ligula with inner teeth directed forward; and dorsomental plates with 6 (5 large, 1 small) teeth each and with a medial extension that reaches or almost reaches the pseudoradula; and the weak lateral fringe of setae along the body.

NOTES: Only one species, *B. floridensis*, is described for this genus; it has been confused with *Apsectrotanypus* and *Macropelopia*. Howevere, an additional undescribed larva (with pharate pupa) has been found in eastern North Carolina; unless associated with an adult or pupa, larvae should be identified as "*Bethbilbeckia* sp.". Originally described from northern Florida, *B. floridensis* has also been collected in Georgia and South Carolina in the Southeast. Its presence in Ohio (Bolton 1992) and Virginia (collection of Charles Watson) indicates that it should also be found in North Carolina; it has been collected in the Coastal Plain, Piedmont and Mountain regions from blackwater streams, seeps and small mountain streams.

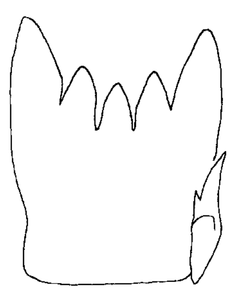
Fittkau & Murray (1988) stated that mandibular ventrolateral seta 3 is simple. However, their illustration (fig. 15) shows this seta as bifid. On one unassociated larval specimen from Florida that I've examined this seta is multibranched. This specimen also has 6 large teeth on one side of the mentum; the lateral fringe of body setae is weak.

Fittkau & Murray (1988) and Epler (1995) described the antenna as 5 segmented. However, Charles Watson has pointed out to me that the antenna is actually 4 segmented. In all specimens I've examined in which the antennal segments are clearly visible, there is an extended membranous area between segments 2 and 3; apparently the base of the style (or a wide peg sensillum or Lauterborn organ?) seen through this membranous area has been mistaken for a third segment.

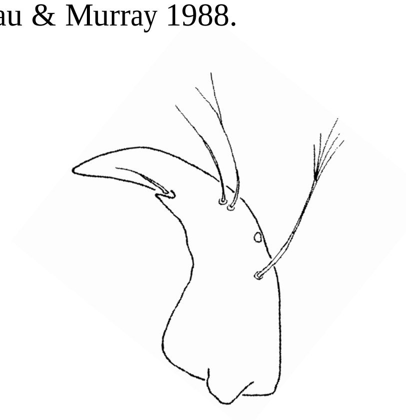
ADDITIONAL REFERENCES: Fittkau & Murray 1988.



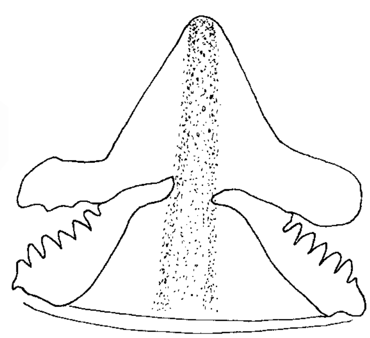
maxillary palp



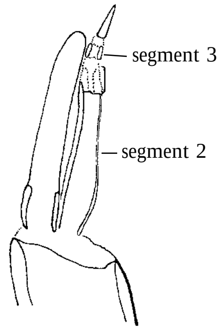
ligula and paraligula



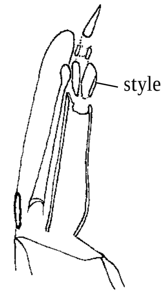
mandible



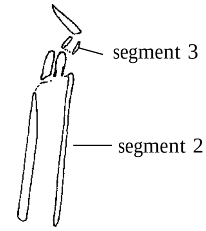
mentum and M appendage



antennal apex, ventral



antennal apex, dorsal



antennal segments 2-4 of another specimen

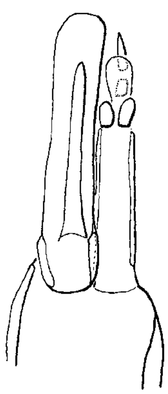
Genus *Brundiniella*

DIAGNOSIS: Distinguished by the weak lateral setal fringe on the body; maxillary palp with ring organ near middle; rounded head capsule; yellow-brown ligula with inner teeth directed more or less straight forward; well developed dorsomental plates each with 5 large teeth and two smaller teeth, and with a thin, pointed, medial extension that reaches or almost reaches the pseudoradula; and the expanded base of the small claw of the posterior parapod.

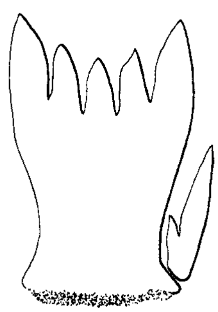
NOTES: One species, *B. eumorpha*, is known from the Carolinas and Georgia in the Southeast, where it may be relatively common in mountain and upper Piedmont streams. The species was formerly placed in *Psectrotanypus*; Roback (1978a) established a new genus, *Brundinia,* for it but it was later (Roback 1978b) discovered that the name was preoccupied and it was replaced by the name *Brundiniella*.

Roback (1978a) and Fittkau & Roback (1983) illustrated ventrolateral setae 2 and 3 of the mandible as multibranched. However, in one specimen I've examined (and figured below) from North Carolina all the ventrolateral setae are simple.

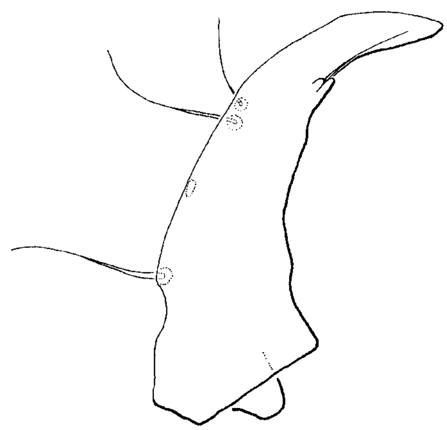
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1978a, 1978b.



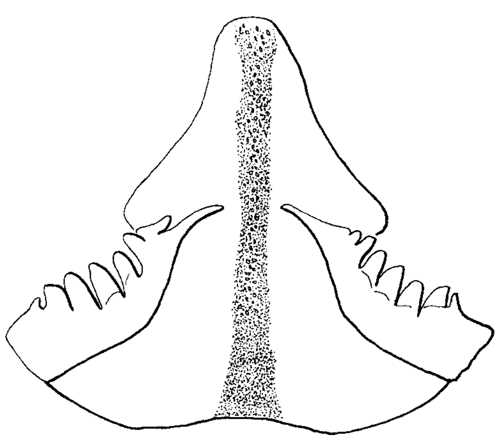
antennal apex



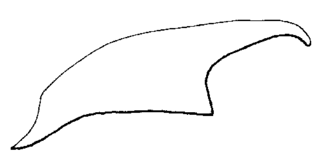
ligula and paraligula



mandible



mentum and M appendage



small claw of posterior parapod

Brundiniella eumorpha, larval structures

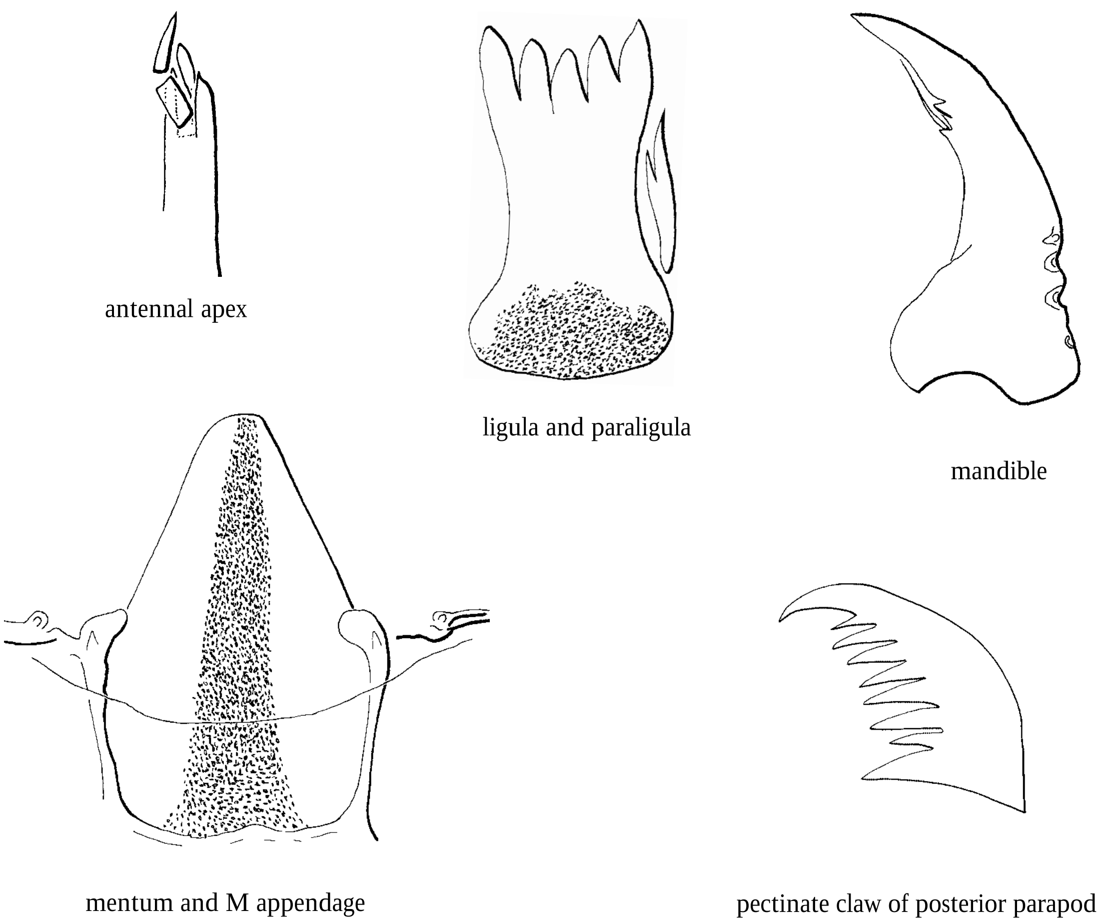
Genus *Cantopelopia*

DIAGNOSIS: This genus is distinguished by the large, well sclerotized Lauterborn organs at the apex of antennal segment 2 that resemble a tuning fork; the triangular rugose area at the base of the ligula; the lack of well-developed dorsomental teeth; and posterior parapods with transparent claws and three smaller claws on each parapod with large inner teeth.

NOTES: One species, *C. gesta*, occurs in the Southeast US. Larvae have been collected from a creek in Georgia, from creeks and ponds in northern Florida and from sphagnum mats in an Ohio bog.

Until recently, the immature stages of *C. gesta* were unknown. The larva referred to as an “apparently undescribed, species of *Monopelopia*” in Epler & Janetzky (1999: 222) is the larva of *C. gesta*. This presents a problem in tanypod taxonomy, because the larva and pupa of *C. gesta* are very similar to those of some *Monopelopia* (e.g., *M. tillandsia* from Florida and *M. mikeschwartzi* from Jamaica), and it had been assumed that *Cantopelopia* was more closely related to *Paramerina*. However, the only differences noted between adult male *Cantopelopia* and *Monopelopia* are the two tibial spurs of *Cantopelopia* (*Monopelopia* bears a single tibial spur) and the apically wide gonstylus of *Cantopelopia* compared to the apically attenuated gonostyli of all described *Monopelopia* species. Perhaps *Cantopelopia* should be considered at most to be a subgenus of *Monopelopia*.

ADDITIONAL REFERENCES: Roback 1971; Epler & Janetzky 1999.



Cantopelopia gesta, larval structures

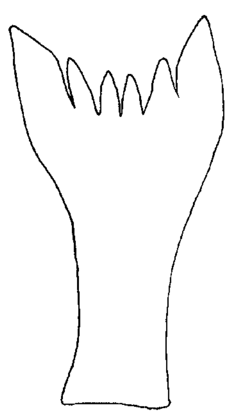
Genus *Clinotanypus*

DIAGNOSIS: This genus is distinguished by the strongly hooked apical tooth and large pointed inner tooth of the mandible; dorsomental teeth in longitudinal rows on the M appendage; ligula usually with an even number of teeth, with outer pairs not closely appressed; absence of sclerotized hooks on the dorsal anterior margin of body segment 4 (abdominal segment 1); and well developed lateral setal fringe.

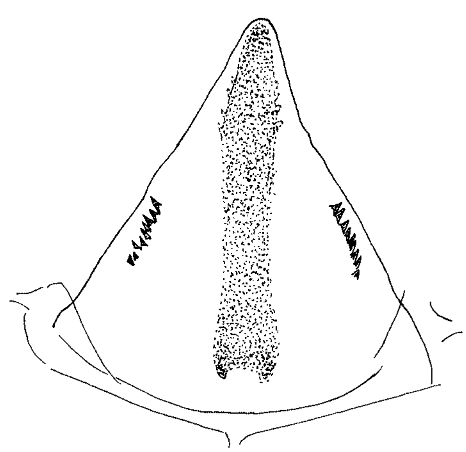
NOTES: Larvae occur in ponds and lakes as well as streams and rivers. They prefer soft sediments and can be found in "clean" water or water that has been organically enriched. Roback (1976) recorded the following water chemistry parameters for the genus: pH < 4.0-9.0, with a mean of 6.2; total hardness 0-300 ppm, mean 69.8; alkalinity 0-200, mean 47.8; specific conductivity 0-600 µmhos @ 25 °C, mean 140.6. It has been found in water with a dissolved oxygen level of less than 4 ppm (Roback 1974b).

One species, *C. pinguis*, is widely distributed in the eastern United States, and is the only species recorded from the Carolinas, where it is most common on the Coastal Plain. Three additional species are recorded from Florida. Because these 3 species are so poorly known, and because few workers collect or identify adults, any of these 3 species may also occur in the Carolinas. The immature stages of *C. aureus* were described by Roback (1976) from a single reared specimen from silt in a small, slow stream at the bottom of Devil's Millhopper, a large sinkhole near Gainesville, FL. I have reared a single specimen of *C. wirthi* from a small stream feeding a lake in south central Florida. Roback (1976) separated the larvae of *C. aureus* and *C. pinguis* on measurements of the first antennal segment and the maxillary palpus; the single associated larva of *C. wirthi* has a longer first antennal segment (790 µm) than those measurements given by Roback (1976: 197) for *C. pinguis*; the basal palpal segment fits in the range for *C. pinguis*. With such a small sample size, the range of variation is unknown; all of these species may be variants of a single species. Adults are necessary for species level identification; unless reared, all *Clinotanypus* larvae should be identified as "*Clinotanypus* sp.".

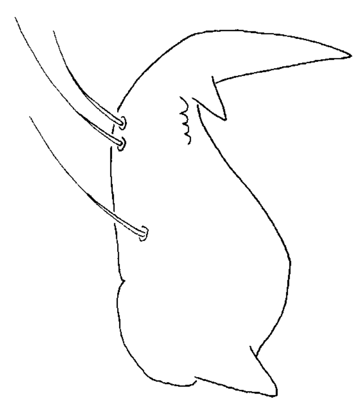
ADDITIONAL REFERENCES: Boesel 1974; Kowalyk 1985; Roback 1971, 1976.



ligula



mentum and M appendage



mandible

Genus *Coelotanypus*

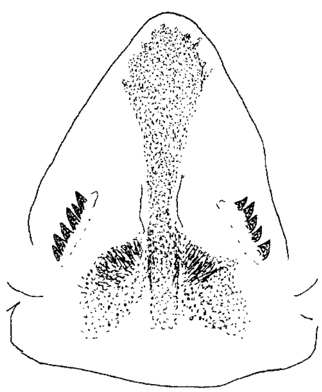
DIAGNOSIS: The well developed lateral setal fringe; smoothly curved apical tooth with low, rounded basal tooth of the mandible; dorsomental teeth in longitudinal rows; ligula usually with an odd number of teeth, with outer pairs closely appressed; and a pair of small, sclerotized hooks on the dorsal anterior margin of body segment 3 (abdominal segment 1) will distinguish this genus.

NOTES: Three species of *Coelotanypus* are recorded from the eastern United States; two additional species, undescribed as larvae, are found from Louisiana north to the Great Plains and westward. *Coelotanypus* larvae are found in or on bottom sediments in marshes, ponds, lakes and the slower portions of streams and rivers. At least one species, *C. concinnus*, can be found in, but is not necessarily limited to, extremely eutrophic water bodies.

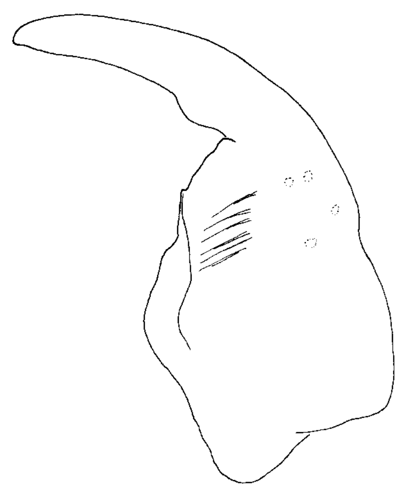
Although most *Coelotanypus* larvae possess a ligula with an odd number of teeth, specimens are often found with an even number of teeth. The converse may also be true with the closely related genus *Clinotanypus*. Note that the sclerotized spurs on the dorsal anterior margin of body segment 4 can be observed on larger specimens while under a dissecting microscope.

The key which follows is constructed from data in Roback (1974a); the data are based on 4th instar larvae which were reared to the adult stage. The antennal ratios should work for most 3rd instar larvae as well, but measurements of the basal segment of the maxillary palpus will hold true only for 4th instar larvae.

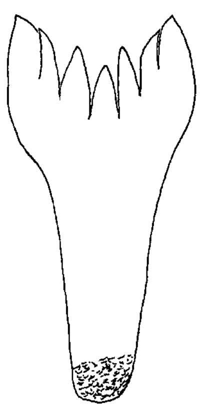
ADDITIONAL REFERENCES: Boesel 1974; Kowalyk 1985; Roback 1971; 1974a.



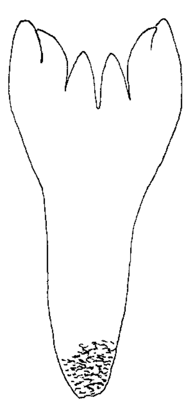
mentum and M appendage



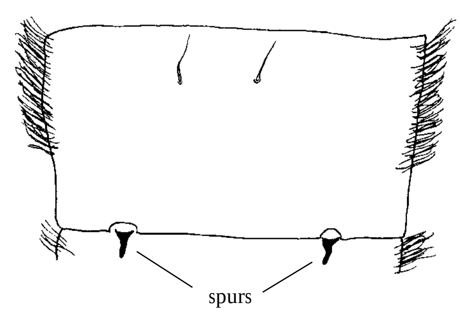
mandible



normal ligula



aberrant ligula

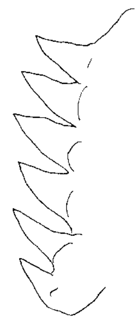


body segment 3 with anterior sclerotized spurs on segment 4

Key to *Coelotanypus* larvae of the eastern United States

1 Mentum with 9 or more teeth on each side .... ***C. tricolor***

1' Mentum with 5-8 teeth on each side 2



2 (1') AR = 7.0 or more; basal segment of maxillary palp > 70 µm (4th instar larvae only!) .... ***C. concinnus***

2' AR < 6.7; basal segment of maxillary palp < 70 µm (4th instar larvae only!) .... ***C. scapularis***

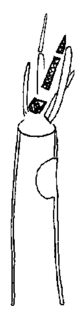
Genus ***Conchapelopia***

DIAGNOSIS: *Conchapelopia* larvae are distinguished by long scattered body setae; first antennal segment < 370 µm; the 3 segmented b sensillum on the maxillary palp; ring organ in distal third of maxillary palp; basal segment of maxillary palp < 70 µm; mandible with small basal and accessory teeth; ratio of maxillary palp length/width at ring organ 4.4 or less; pseudoradula with 8-12 rows of coarse granules; central tooth of ligula about twice as long as wide; and the simple subbasal seta of posterior parapod.

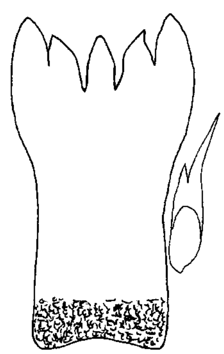
NOTES: Five species are recorded from the Carolinas; species separation of unassociated larvae is not practically possible. *Conchapelopia* is a member of the *Thienemannimyia* group. Separation of the larvae of the genera of this group, which in the Carolinas includes *Conchapelopia*, *Hayesomyia*, *Helopelopia*, *Meropelopia*, *Rheopelopia* and perhaps *Telopelopia* and *Thienemannimyia*, can be difficult. Late 4th instar *Conchapelopia* larvae can be positively identified if the developing pupal thoracic horn is visible (see figure below); note the large plastron plate. Fittkau & Murray (1983) stated that *Conchapelopia* larvae have a pseudoradula of about 8 longitudinal rows of granules. This character may be difficult to discern, and many associated larvae I've examined have about 10-12 rows of granules in the pseudoradula.

Conchapelopia larvae have been recorded from waters with a pH range of 5.1-8.0, with most records at a pH of < 7.0; specific conductivity ranged from 0-400 µmhos @ 25°C, with most records below 300; total hardness from 0-250+ ppm, most records below 200; alkalinity 0-200 ppm, most below 40; and water temperatures ranged from 9-28°C.

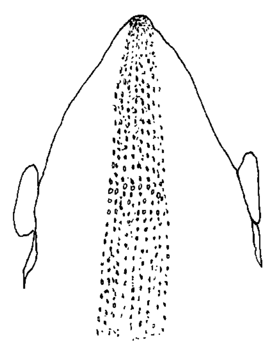
ADDITIONAL REFERENCES: Beck & Beck 1966; Roback 1971; 1981.



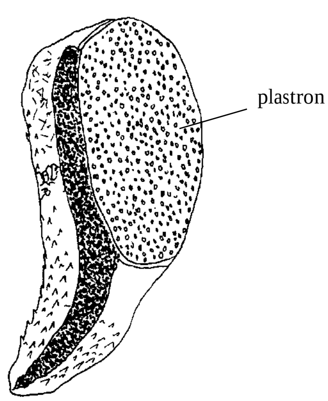
maxillary palp



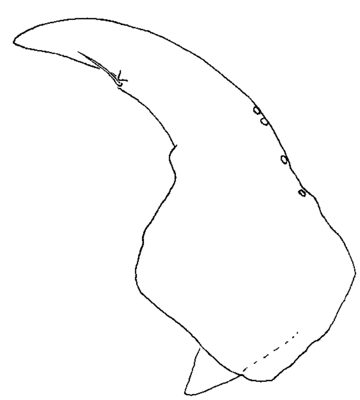
ligula and paraligula



mentem and M appendage



pupal thoracic horn



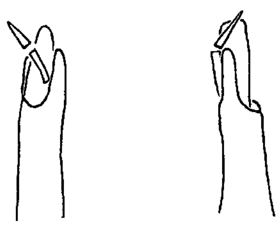
mandible

Genus *Denopelopia*

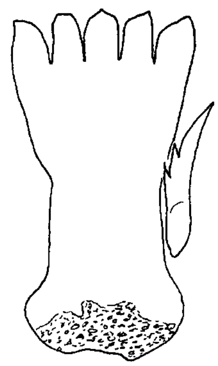
DIAGNOSIS: *Denopelopia* larvae are distinguished by the large Lauterborn organs “fused” to the apex of antennal segment 2, giving a tuning fork appearance; the trifid paraligula; lack of well developed dorsomental tooth plates; 2 small claws of posterior parapod with a large inner tooth; and all claws of posterior parapod pale.

NOTES: One species, *D. atria*, is described for this genus. *Denopelopia* has not been recorded from the Carolinas, but it may eventually be found on the Coastal Plain in South or North Carolina. The northernmost specimens I’ve seen are from the Orlando, Florida, area. I’ve also reared this species from a vegetation-choked pond in a cattle pasture in southwestern Costa Rica. The immature stages occur in shallow water and can withstand low DO (0.3 mg/l) and high iron (108 mg/l) levels.

ADDITIONAL REFERENCES: Roback & Rutter 1988.

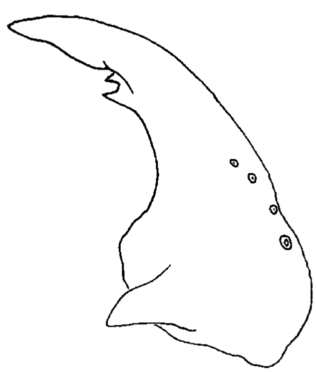


apex of antenna, dorsal and lateral



ligula and paraligula

paraligula



mandible

small claw of posterior parapod

Denopelopia atria, larval structures

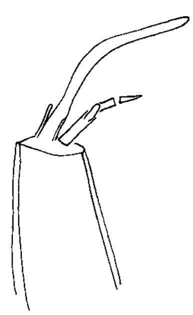
Genus *Djalmabatista*

DIAGNOSIS: This genus closely resembles *Procladius*, but may be separated by the long antennal blade, which is about twice (or more) the length of the flagellum (segments 2-4); the apically bilobed basal tooth of the mandible; and by its (usually) 4 toothed ligula. Like *Procladius*, it has a well developed lateral setal fringe and well developed dorsomental teeth arranged on plates.

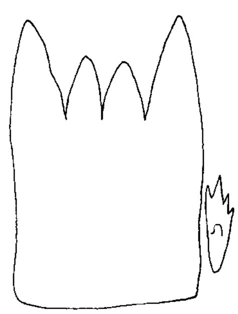
NOTES: One species, *D. pulchra*, is known from North America. It was formerly placed in the genus *Procladius*, subgenus *Calotanypus*, as *P. (C.) pulcher*; *P. (C.) maculatus* is considered a junior synonym. Although this species usually has a 4 toothed ligula, 5 toothed "variants" may be encountered. Roback (1980) noted that some South American species of *Djalmabatista* had 5 toothed ligulae. Thus, some 5 toothed "variants" may represent a different species; Caldwell et al. (1997) list 5 toothed larvae as an undescribed species. Tennessen & Gottfried (1983) found high variation in ligula tooth numbers in *D. pulchra* from northern Alabama, but apparently none of their material was reared and no analysis of pupal and adult characters was done. I have examined a single reared male collected from Greenville Co., SC, by Charles Watson; the adult is apparently inseparable from *D. pulchra*; the pupa bears more taeniate setae (about a dozen) on the anterolateral margin of T III than described for *D. pulchra*. However, until more material is reared and the range of character variation is assessed, no definite statements on the taxonomic position of larvae with 5 toothed ligulae can be made. It may be wisest to note the existence of these 5 toothed taxa as "*Djalmabatista pulchra* variant".

Djalmabatista larvae occur in ponds, lakes, streams and rivers. They apparently prefer soft water, low alkalinity, a slightly acidic to circumneutral pH, and are tolerant of moderate levels of iron (Roback & Tennessen 1978).

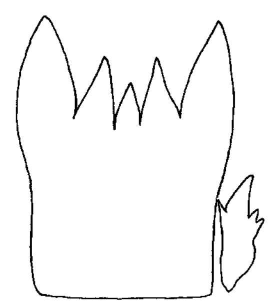
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971, 1980, 1989; Roback & Coffman 1977; Roback & Tennessen 1978; Tennessen & Gottfried 1983.



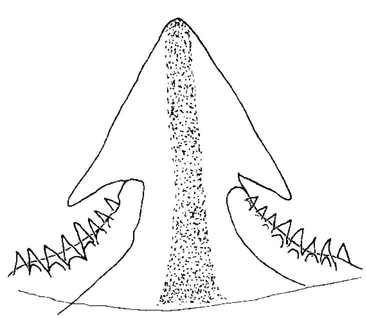
apex of antenna



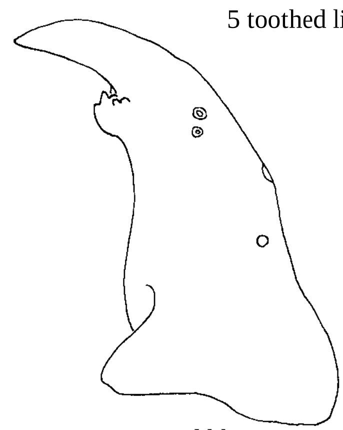
4 toothed ligula



5 toothed ligula



mentum and M appendage



mandible

Genus *Fittkauimyia*

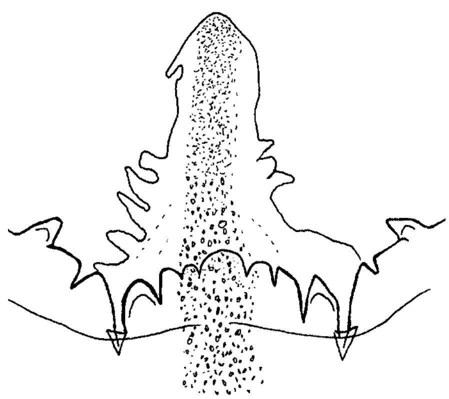
DIAGNOSIS: *Fittkauimyia* is easily diagnosed by the dorsomental teeth arranged in a concave arc; multiple dorsal and ventral accessory teeth on the mandible; and its distinctive ligula.

NOTES: One species, *Fittkauimyia serta*, is known from North America, where it is found as far west as Texas and Oklahoma and at least as far north as North Carolina (New Hanover Co.) in the East. The larva still has not been conclusively associated with the adult, which was formerly classified in the monotypic genus *Parapelopia*. *Parapelopia* was tentatively synonymized with *Fittkauimyia* by Roback (1982b), based on associated specimens of another species from Australia; Oliver et al. (1990) list *Parapelopia* as a junior synonym of *Fittkauimyia*. Roback's (1982b) larval species *Fittkauimyia* sp. 2 is the only species known (as a larva) from the SE US and is most likely the larva of *F. serta*.

Fittkauimyia larvae are found in marshes, ponds, lakes, streams and rivers.

ADDITIONAL REFERENCES: Davis 1992; Roback 1971; 1982b.

ligula and paraligula



mentum and M appendage

mandible

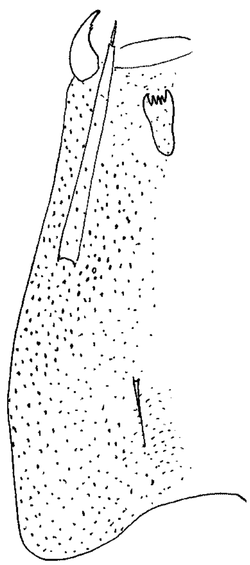
Genus ***Guttipelopia***

DIAGNOSIS: The granulose surface of the head capsule; longitudinally wrinkled body surface; posterior parapods with 2-3 small claws, each with 3 or more inner teeth; and at least 3 darker claws on the posterior parapods distinguish *Guttipelopia*.

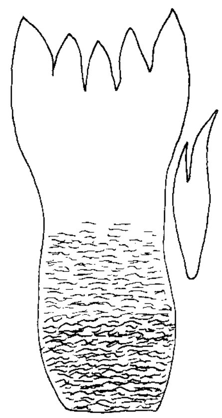
NOTES: One species, *Guttipelopia guttipennis*, occurs in the Southeast US. It was formerly considered a separate species, *G. currani*, but was synonymized by Bilyj (1988). A second species occurs in Canada in Manitoba and Ontario.

Larvae are most often found in sphagnum bogs, ditches, ponds and lakes, but may occur in streams on the Coastal Plain.

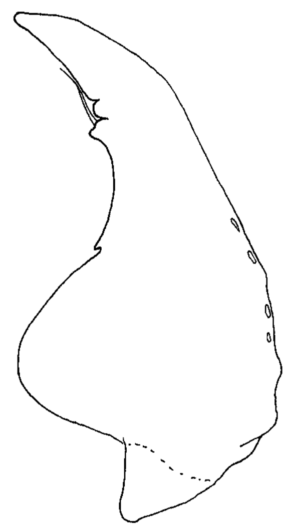
ADDITIONAL REFERENCES: Beck & Beck 1966; Bilyj 1988; Kowalyk 1985; Roback 1971.



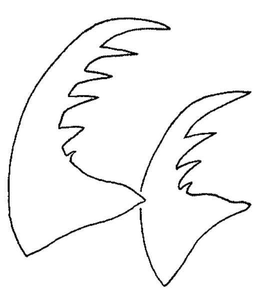
head capsule



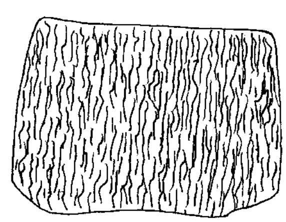
ligula and paraligula



mandible



small claws of posterior parapod



body segment

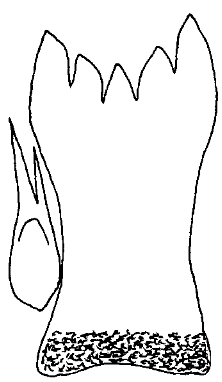
Genus *Hayesomyia*

DIAGNOSIS: Larvae of this genus are distinguished by the 2 segmented b sensillum of the maxillary palp; ring organ in distal third of basal segment of maxillary palp; second antennal segment length about 50-60 µm; length of basal antennal segment divided by mandible length less than or equal to 1.8; sclerotized base of the antennal blade almost twice as long as wide; AR <5.0; small basal and accessory teeth of the mandible; and the long scattered body setae. The pupal thoracic horn has a distinct aeropyle surrounded by a corona, respiratory atrium with only one or two convolutions.

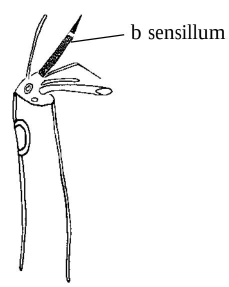
NOTES: One species, *Hayesomyia senata*, is described from North America; it occurs throughout the continental US. A member of the *Thienemannimyia* group, *H. senata* was formerly placed in *Thienemannimyia* (q.v.). *Hayesomyia* larvae are extremely difficult to separate from those of *Meropelopia* and *Thienemannimyia*, and one may have to be content with an identification of "*Thienemannimyia* group sp." or "*Hayesomyia/Meropelopia* sp." for many specimens encountered. Late fourth instar larvae with a pharate, internally developed pupal thoracic horn may be positively identified; note the distinctive aeropyle and corona. The dark coloration on the caudal margin of the head capsule referred to by Epler (1992, 1995) is variable; some *Hayesomyia* head capsules are pale or only slightly darkened on the posterior margin of the small triangular posteroventral sclerite.

Hayesomyia senata larvae are most often found in rivers. Roback (1981) supplied the following water chemistry data: specific conductivity 301-400 µmhos @ 25°C; pH 7.1-8.0; total hardness 51-150 ppm; alkalinity 41-200 ppm; temperature 19-28°C.

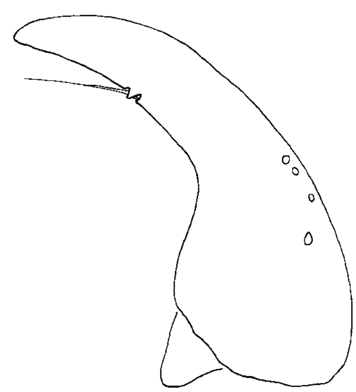
ADDITIONAL REFERENCES: Murray & Fittkau 1985; Roback 1971; 1981.



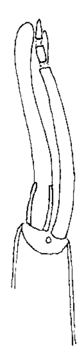
ligula and paraligula



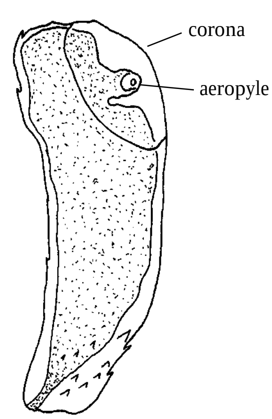
maxillary palp



mandible



antennal apex



pupal thoracic horn

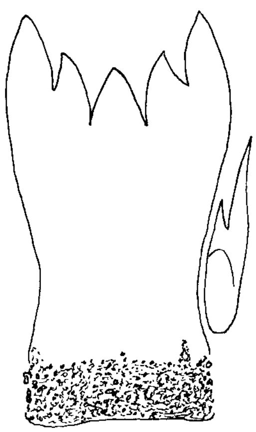
Genus *Helopelopia*

DIAGNOSIS: *Helopelopia* is similar to *Conchapelopia* in having a 3 segmented b sensillum on the maxillary palp; ring organ in distal third of palp; and small basal and accessory teeth on the mandible. It may be separated by the longer first antennal segment (> 375 µm) and basal segment of the maxillary palp (> 70 µm); smaller central tooth of the ligula (about as long as wide); ratio of length of maxillary palp/width at ring organ 4.6 or more; and pseudoradula with about 12 longitudinal rows of coarse granules.

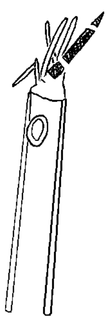
NOTES: This genus, a member of the *Thienemannimyia* group of genera, was formerly included as a subgenus of *Conchapelopia*. Two species are known from the Nearctic; both occur in the Carolinas. Species level identification of larvae without associated adults is not possible for only *H. cornuticaudata* is described in the immature stages. Positive separation of *Helopelopia* from *Conchapelopia* may be achieved with late 4th instar larvae; note that the developing pupal thoracic horn has a much smaller plastron plate. Also note that the corona in *Conchapelopia* is quite variable in size.

Helopelopia cornuticaudata larvae are found over a wide range of total hardness (0-250 ppm) and alkalinity factors (0-200 ppm); they are found in waters with a pH of 5.1-> 8.1 and at water temperatures from 14-28°C (Roback 1981). They are most often found in small streams to large shallow streams.

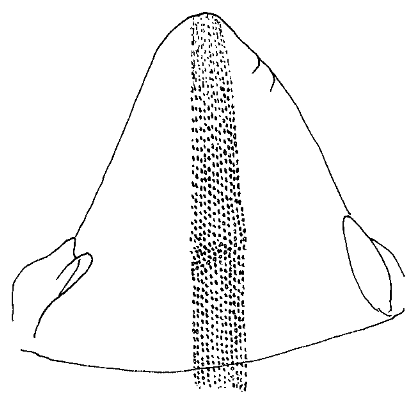
ADDITIONAL REFERENCES: Roback 1971; 1981.



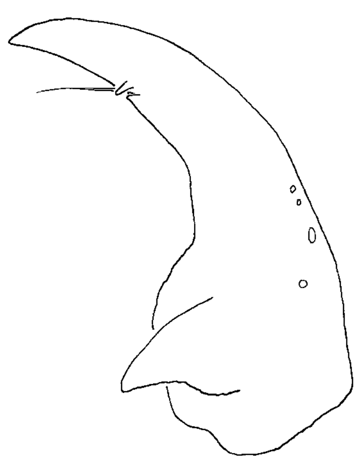
ligula and paraligula



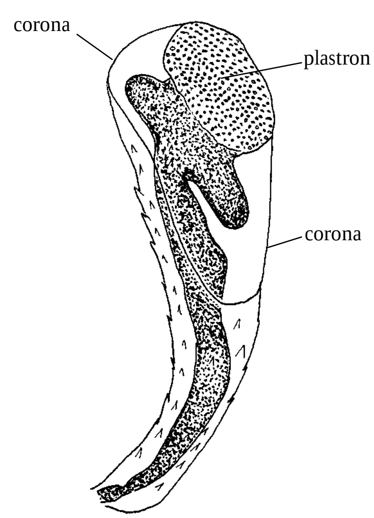
maxillary palp



mentum and M appendage



mandible



pupal thoracic horn

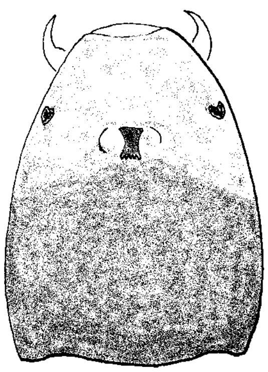
Genus *Hudsonimyia*

DIAGNOSIS: The lack of well developed dorsomental tooth plates, each with three small teeth and apicomedial margin rounded; maxillary palp with ring organ proximal to or at middle of segment; small accessory and basal teeth on mandible; basal outer margin of larger posterior parapod claws not extensively lamellate; procercus about 4 times as long as wide; and lack of a setal fringe will distinguish this genus.

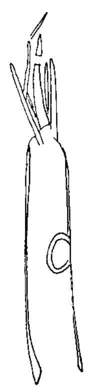
NOTES: Two species are described from the Southeast; *H. karelena* from both Carolinas and Georgia, and *H. parrishi* from northern Georgia. Larvae of *H. parrishi* were collected from shallow (1 cm) water flowing over granitic bedrock covered with moss, algae and detritus; *H. karelena* larvae collected in South Carolina were found in a blue-green algae mat on steep granite outcrops with a low flow of water. The two species may be separated by coloration: the head capsule and posterior parapod claws of *H. parrishi* are yellowish brown; the head capsule and posterior parapod claws of *H. karelena* are brown, with the posterior portion of the head capsule usually much darker than the anterior. An apparent third species reported from NW Florida by Epler (1995) is not a *Hudsonimyia*, but is a *Thienemannimyia* group member, probably a *Meropelopia*.

Sublette & Sasa (1994) relegated *Hudsonimyia* to subgeneric status under *Pentaneura*; immature stages linked to adults of a new species described from Guatemala were only provisionally associated and present an apparent mix of characters. Given the substantial differences between the two taxa in the larval and pupal stages, for the present I'm retaining the generic status of *Hudsonimyia*, a position also adopted by Caldwell et al. (1997).

ADDITIONAL REFERENCES: Caldwell & Soponis 1982; Kowalyk 1985; Roback 1971; 1979a; Sublette & Sasa 1994.

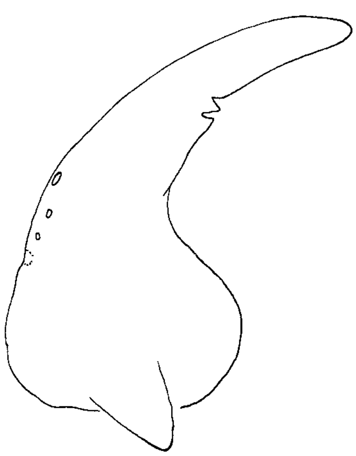


H. karelena, head capsule

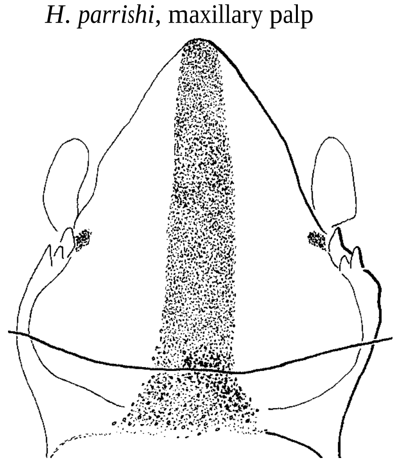


H. parrishi, maxillary palp

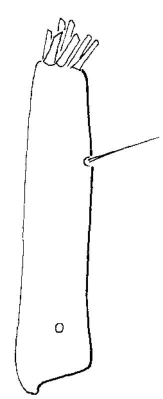
H. parrishi, ligula and paraligula



H. parrishi, mandible



mentum and M appendage



procercus
(anal setae abbreviated)

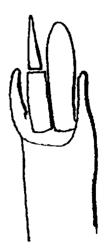
Genus *Krenopelopia*

DIAGNOSIS: *Krenopelopia* larvae may be distinguished by the large Lauterborn organs on the apex of antenna segment 2, giving the appearance of a tuning fork; bifid paraligula; pseudoradula with small coarse granules in longitudinal bands; ligula with granulose area forming a basal band; lack of well developed dorsomental tooth plates; large basal tooth on the mandible; and the lack of any lateral setal fringe on abdominal segments (lateral setae are present, but none in fringe rows).

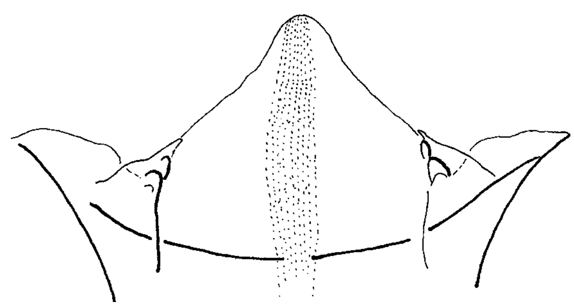
NOTES: Larvae of the only described southeastern species, *K. hudsoni*, were reported from South Carolina living in muddy seeps along the borders of small springs or spring-fed streams (Roback 1983). Caldwell et al. (1997) reported *K. hudsoni* from North Carolina; I've also examined material from a spring near a bog in Ohio.

The single larval specimen of an apparently undescribed species of *Krenopelopia* from northern Florida reported by Epler (1995) is a *Natarsia* (aberrant?) with extremely long Lauterborn organs (see *Natarsia*).

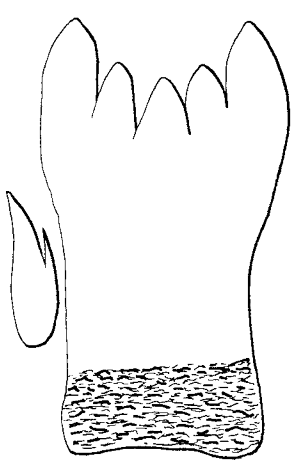
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1983.



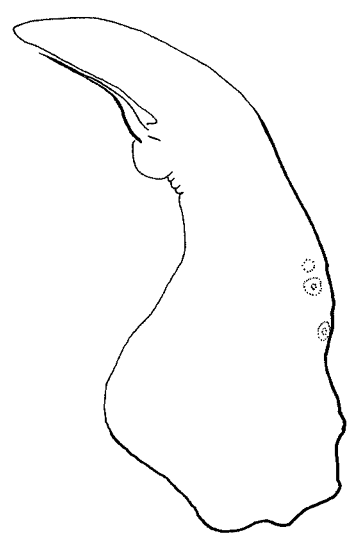
apex of antenna



mentum and M appendage



ligula and paraligula



mandible

K. hudsoni, larval structures

Genus *Labrundinia*

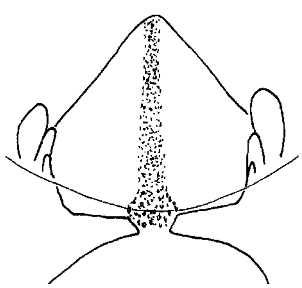
DIAGNOSIS: This genus is distinguished by the median tooth of the ligula usually longer than the inner teeth (one species in FL has the median tooth equal to or less than inner teeth); head capsule usually covered with spinules/nodules/granules **or** with small to large lateral spines along the side of the head near the middle (one species in FL with no lateral spines), **or** with both head nodules and lateral spines; pseudoradula slightly broadened posteriorly; mandible with large basal tooth; one small bifid claw on posterior parapod; and anal tubules shorter than posterior parapods.

NOTES: *Labrundinia* larvae are found in herbaceous marshes, ponds, lakes and the slower moving portions of streams and rivers. Roback (1987a) noted larvae occurring at the following water chemistry parameters: pH 4.5-7.2 (most around 7.0); total hardness 19-94 ppm; alkalinity 0-82 ppm; specific conductivity 48-197 µmhos @ 25°C; temperature 19-24°C.

As can be seen from the diagnosis above, no one character will identify all *Labrundinia* larvae. Contrary to the diagnosis provided in Fittkau & Roback (1983), the pseudoradula is broadened posteriorly in many species, but not to the extent shown in *Nilotanypus*, a genus which may be confused with *Labrundinia.*

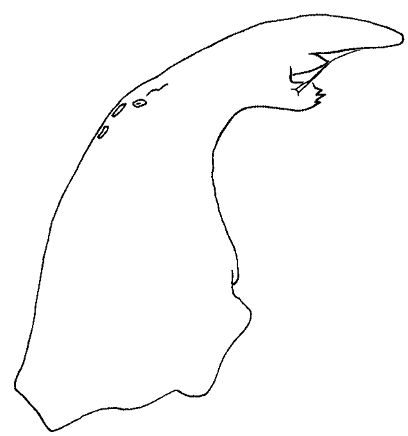
Roback (1987a) reviewed the genus and recorded 6 described species from the Southeast; all are found in the Carolinas. Two additional larval species which he gave number designators (sp. 3 nr *virescens* (see Notes) and sp. 6) also occur in the Carolinas. I've examined material very similar to Roback's *L.* sp. 8 from Florida; these three species and three additional unnamed taxa (*L.* spp. A, B and C) from Florida are included in the following key. A species known only from pupae, *L.* sp. 10, occurs in Georgia. The existence of at least six unassociated larval taxa indicates that more work on the genus is needed. Benthic workers can contribute greatly by attempting to rear these taxa.

ADDITIONAL REFERENCES: Beck & Beck 1966; Kowalyk 1985; Roback 1971, 1987a.

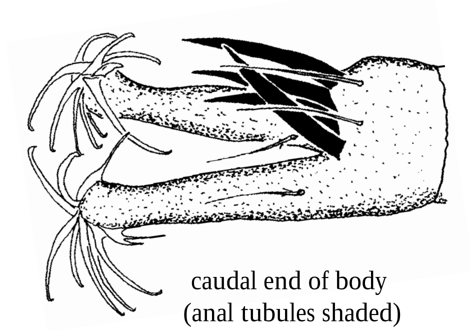


mentum and M appendage

ligula and paraligula



mandible

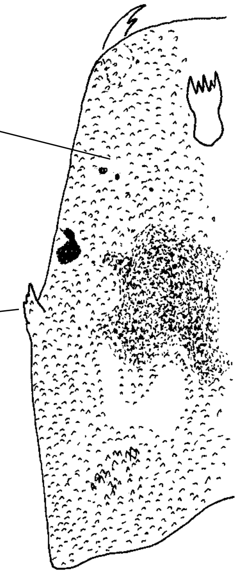


caudal end of body
(anal tubules shaded)

L. pilosella, bifid claw
of posterior parapod

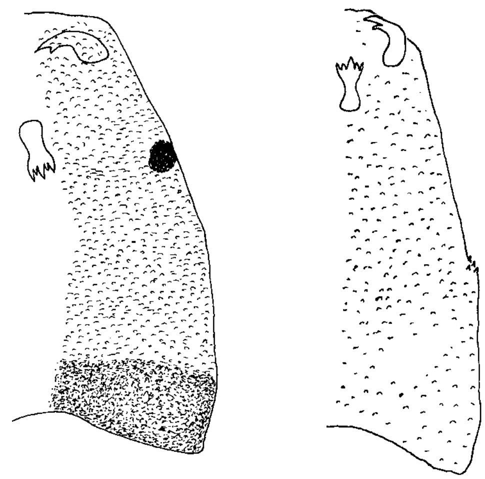
Key to *Labrundinia* larvae of the southeastern United States

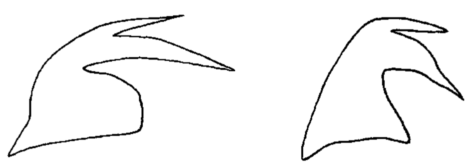
1 Surface of head capsule covered with small spinules or nodules; lateral spines present or absent near middle side of head 2



1' Surface of head capsule smooth; lateral spines or spurs usually present (lacking in one species) near middle side of head 7

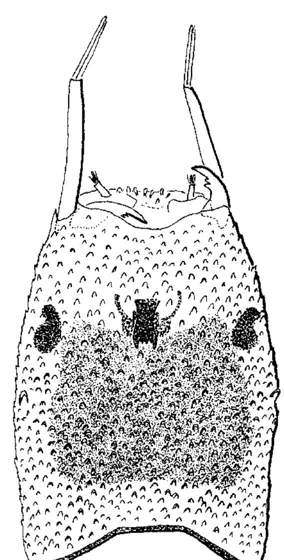
2 (1) Head without ventral darker area near center of head, although caudal margin of head may be darkened; lower spur of bifid posterior parapod claw longer than upper 3

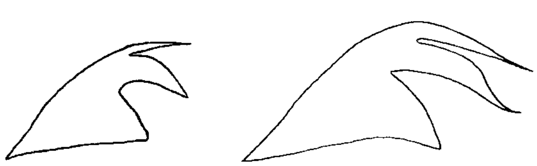


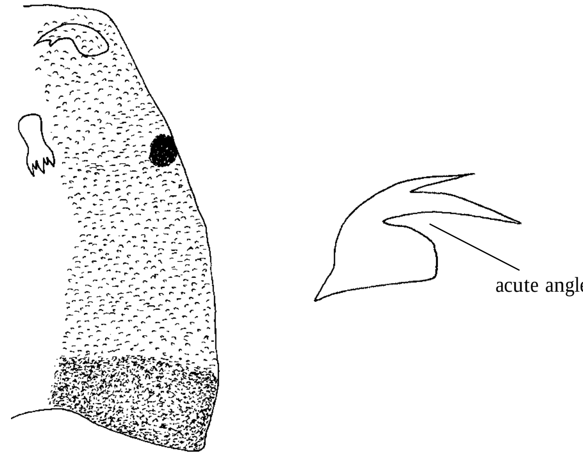


posterior parapod claws

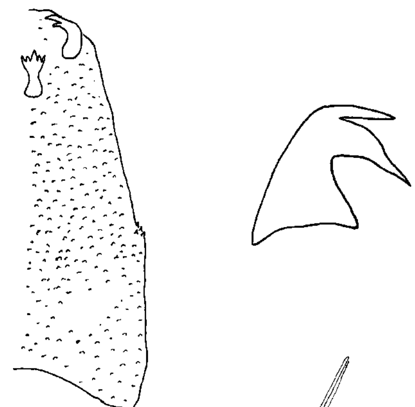
2' Head with ventral darker area near center of head; lower spur of bifid posterior parapod claw subequal to or shorter than upper 4



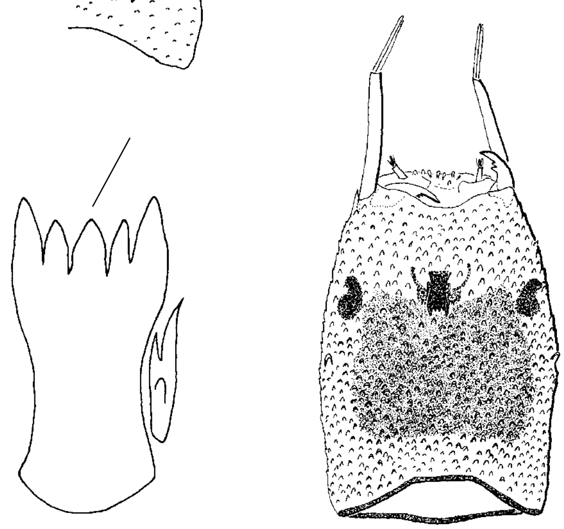




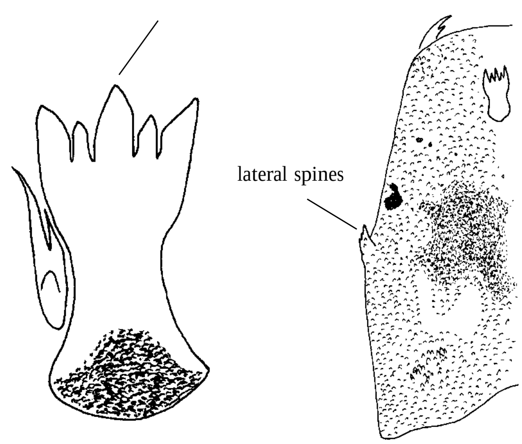
3 (2) Head without lateral spines; caudal margin of head may be darkened; lower groove of bifid posterior parapod claw forming an acute angle .... ***L. pilosella***



3’ Head with small lateral spines; caudal margin of head not darkened; lower groove of bifid posterior paarapod claw forming a U-shaped angle .... ***L. maculata***

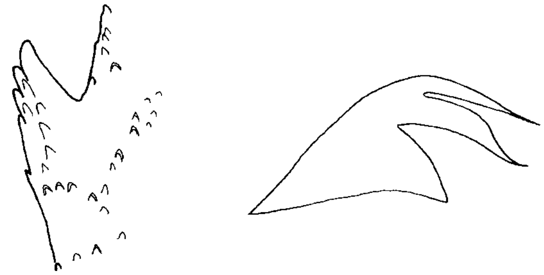


4 (2’) Median tooth of ligula subequal to or shorter than inner teeth; lateral spines of head weakly developed .... ***L.* sp. A**
(not recorded from the Carolinas)

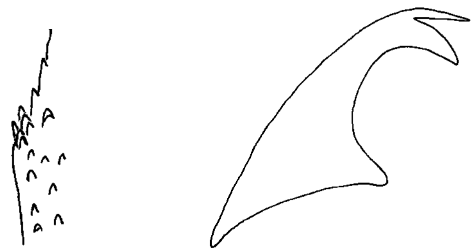


4’ Median tooth of ligula much longer than inner teeth; lateral spines/spurs of head weakly or well developed 5

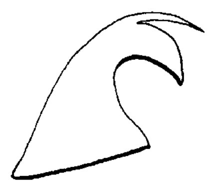
5 (4’) Lateral spine group of head consists of a large spur; lower groove of bifid posterior parapod claw forms an acute angle .... ***L.* sp. B**
(not recorded from the Carolinas)



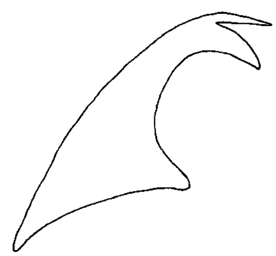
5’ Lateral spine group of head consists of several small spines; lower groove of bifid posterior parapod claw broadly U-shaped 6



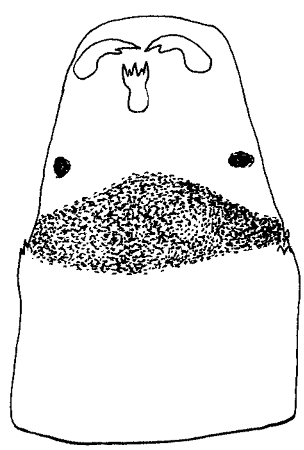
6 (5’) Bifid claw of posterior parapod short .... ***L.* sp. 8**
(not recorded from the Carolinas; see Notes)



6’ Bifid claw of posterior parapod more elongate .... ***L.* sp. 6**



7 (1’) Head with medial brown transverse band ... . ***L. johannseni***



7’ Head without dark medial transverse band, although caudal margin may be darkened 8

8 (7') Head without a lateral spur or group of spines .... ***L.* sp. C**
(not recorded from the Carolinas; see Notes)

8' Head with a single large lateral spur or group of small spines 9

9 (8') Bifid claw of posterior parapod with U-shaped lower groove and lower tooth broad .... ***L. neopilosella***

9' Bifid claw of posterior parapod with V-shaped lower groove and lower tooth narrower 10

10 (9') Lateral spine group of head consists of a single large spur about 20-25 µm long .... ***L.* sp. 3 nr. *virescens***

10' Lateral spine group of head consists of about 2-7 small spines 11

11(10') Lower spur of bifid posterior parapod claw short .... ***L. becki***

11' Lower spur of bifid posterior parapod claw elongate .... ***L. virescens***

Notes on species

L. becki - A relatively common species known to occur from Florida north to Pennsylvania. Roback (1971) noted that Beck & Beck (1966) had misinterpreted *L. pilosella*; he described this taxon as new. It is not keyed correctly in Beck & Beck (1966) and Beck (1976, 1979).

L. johannseni - An easily recognized species because of the distinctive dark band across the middle of the head capsule. Recorded from Florida to Tennessee.

L. maculata - An apparently uncommon species. Roback (1987a) recorded it from California, Kansas, North Carolina and Texas; it has also been found in Florida and Georgia. The nodules/spinules of the head capsule may be weakly developed; use caution when keying any *Labrundinia* larva!

L. neopilosella - A common species found throughout the Southeast. The middle tooth of the ligula is almost always longer than the other teeth; however, this character state may occur in other *Labrundinia* species. Roback (1987a) described five varieties (including the nominal species) of this species; two (varieties 1 and 2) are recorded only from Alaska and Canada; var. 3 is known from Louisiana and Florida, var. 4 from Florida and Kentucky. The forms are separated on the basis of minor differences in the bifid posterior parapod claws, subbasal setae of the posterior parapods and the number of head capsule spines; see Roback (1987a) for more information.

L. pilosella - The most common and widespread of *Labrundinia* species in the eastern US. It is keyed as *L. floridana*, a junior synonym, in Beck & Beck (1966) and Beck (1976, 1979). In North Carolina, most stream records of *Labrundinia* are for *L. pilosella*; other species are less common, usually lentic and are usually found on the Coastal Plain.

L. virescens - Hudson et al. (1990) stated that this species, along with *L. pilosella* and *L. neopilosella*, was among the most common and widespread *Labrundinia* in North Carolina. However, Roback (1987a) and Epler (1995) found this species to be scarce and uncommon; material that I've examined from North Carolina determined as *L. virescens* has been misidentified *L. becki* and *L. pilosella*.

L. sp. 3 nr. *virescens* - This species was described (Roback 1987a) from pupae only; Caldwell et al. (1997) reported that associated material showed that this taxon is the same as Roback's *L*. sp. 4 (described from larvae only). It is found throughout the Southeast; Hudson et al. (1990) reported *L*. sp. 4 to be common in Mayo Reservoir in North Carolina.

L. sp. 6 - Recorded from Florida, Georgia, Kentucky, North Carolina and Tennessee.

L. sp. 8 - I've examined a larva from south Florida that is probably this species, described by Roback (1987a) from Cuba. The specimen does not appear to have the apparent spur on the mandible below the inner teeth. Roback noted that this taxon may be the same as his *L*. sp. 7 from Colombia (which lacks the apparent spur on the mandible).

L. sp. A - Known only from Florida, it is unusual for Nearctic species in that the middle tooth of the ligula is subequal to or shorter than the other ligula teeth. Since this species and *L*. sp. B occur in northern Florida, they will probably eventually be found on the Coastal Plain in the Carolinas.

L. sp. B - Known only from Florida; found throughout the peninsula.

L. sp. C - Known only from Florida. This taxon is very similar to *L. becki* (similar bifid posterior parapod claws) and may be a variety of that species that lacks lateral spine groups on the head.

Labrundinia sp. 10 is a pupal species recorded only from Georgia (Roback 1987a).

Genus *Larsia*

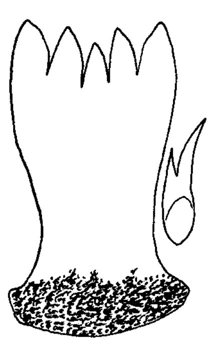
DIAGNOSIS: The basal segment of maxillary palp with ring organ located near the middle to near the distal end of segment; apical portion of dorsomentum directed medially; large basal tooth of mandible; long antennae (½ length of the head and at least 3X mandible length); AR 3.5-5.0; ring organ of basal antennal segment near middle; and the lack of any setal fringe will distinguish species of *Larsia*.

NOTES: Four described species are known from North and South Carolina; *L. decolorata* and *L. berneri* appear to be the most common species encountered in the Southeast. At least two undescribed species are known from the Carolinas; both are included in the following key. The South Carolina record for *L. planensis* in Hudson et al. (1990) and Caldwell et al. (1997) is unconfirmed; it is not included in the following key. *Larsia lurida*, described and keyed in Beck & Beck (1966), is a junior synonym of *L. decolorata* (Roback 1971). Although Oliver et al. (1990) follow Roback (1971) and list *L. indistincta* as a junior synonym of *L. decolorata*, Bilyj (pers. comm.) considers it a valid species; it is treated as a distinct species in this manual.

Larsia larvae are most often found in marshes, ponds and the littoral zone of lakes, but can also be found in the slower moving portions of rivers and streams; at least one species has been collected from hot springs in Colorado.

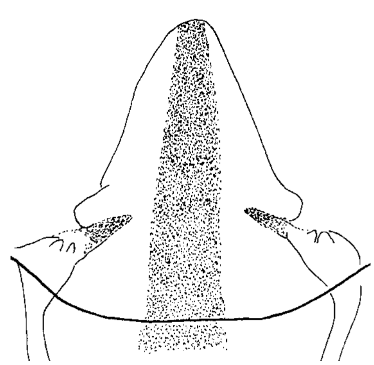
Larsia is currently being revised by B. Bilyj (BIOTAX, Etobicoke, Ontario, Canada). He has graciously provided much of the following information. I have adapted a key to species he has provided; head capsule figures are adapted from his illustrations. The placement of ventral head capsule setae S9 and S10, and the ventral pore (VP), are of importance in separating *Larsia* species; Kowalyk (1985) provides an in-depth study of the setae of the tanypod head.

ADDITIONAL REFERENCES: Beck & Beck 1966; Bilyj 1984; Kowalyk 1985; Roback 1971; Sublette & Sasa 1994.



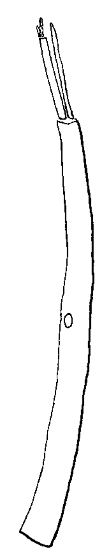
ligula and paraligula

maxillary palp



mentum and M appendage

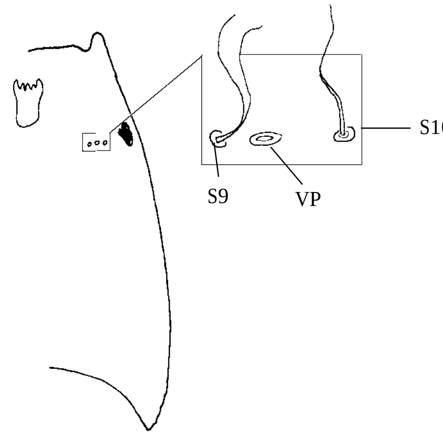
mandible



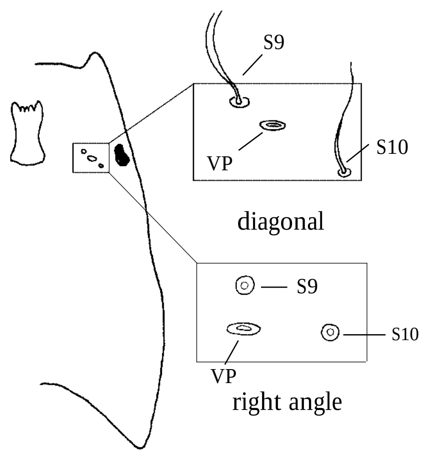
antenna

Key to *Larsia* larvae of the southeastern United States

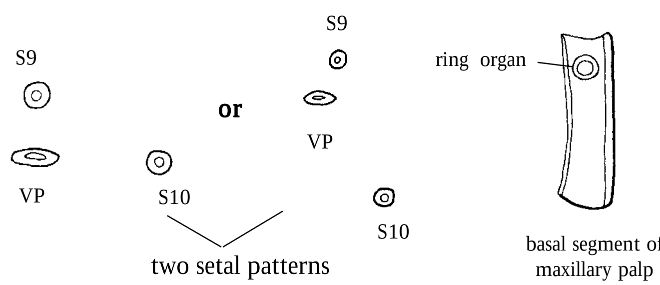
1 Ventral cephalic setae S9 and S10 and ventral pore (VP) forming a more or less straight line perpendicular to longitudinal axis of head capsule .... ***L. berneri***



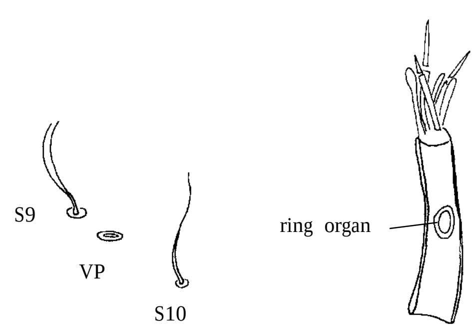
1’ S9, S10 and VP forming a right angle **or** a straight line diagonal to longitudinal axis of head capsule 2



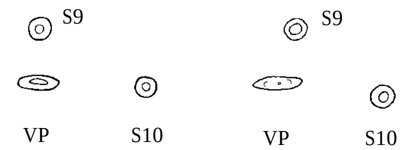
2(1’) S9, S10 and VP forming an approximate right angle; if angle > 90°, then S9 is directly anterior or anterolateral to VP; ring organ of maxillary palp located 0.6-0.8 from base 3



2’ S9, S10 and VP forming a diagonal straight line; if angle < 180°, then S9 is anteromedial to VP; ring organ of maxillary palp located 0.5-0.6 from base 5

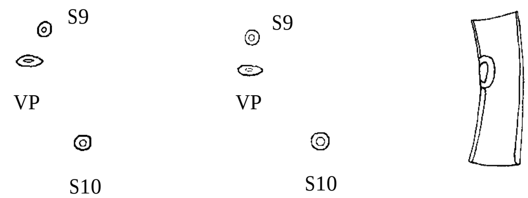


3(2) S9, S10 and VP forming an 80°-90° angle with S9 usually anterior to VP, but if slightly anterolateral then S10 more or less lateral to VP; ring organ of maxillary palp located 0.52-0.56 or 0.73-0.81 from base 4



variation in ventral setae

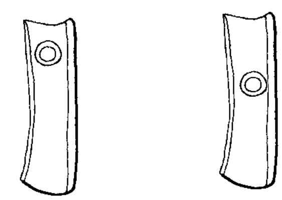
3’ S9, S10 and VP forming a 90°-110° angle with S9 anterolateral to VP and S10 distinctly posterior to VP; ring organ of maxillary palp located 0.60-0.68 from base .... ***L.* sp. A**



variation in ventral setae

4(3) Ring organ located 0.73-0.81 from base ...... ***L. canadensis***

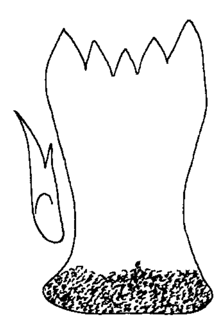
4’ Ring organ located 0.52-0.56 from base .... ***L.* sp. B**



L. canadensis *L.* sp. B

5(2’) Ligula with inner lateral teeth subequal to outer teeth and turned slightly inward (ligula must be flat to observe this!) .... ***L. decolorata***

5’ Ligula with inner lateral teeth distinctly shorter and parallel to outer teeth (ligula must be flat to observe this!) .... ***L. indistincta***

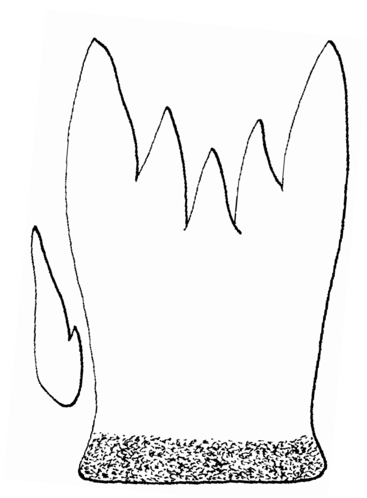


Genus *Macropelopia*

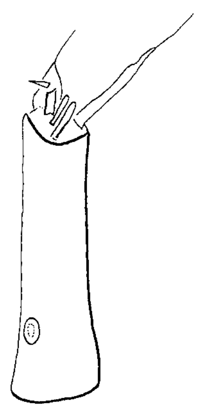
DIAGNOSIS: Distinguished by the rotund head capsule; pseudoradula composed of coarse granules that fade away basally; maxillary palp with ring organ near base; reddish-brown ligula with 5 teeth; dorsomental plates with medial apex not reaching pseudoradula, each plate with 6 larger teeth with a smaller tooth at each end; small claws of posterior parapods without expanded bases; and the weak lateral setal fringe.

NOTES: Only one species, *M. decedens*, is known from the eastern United States. I have not seen any adults or pupae from the Carolinas but have seen *Macropelopia* larvae from a bog and streams in and around Great Smoky Mountains National Park, from a tributary to the South Toe River in Yancey County and the Elk River in Avery County in North Carolina. These are the southernmost records for the genus in the eastern United States; records of *Macropelopia* from Florida in Oliver et al. (1990) refer to *Apsectrotanypus* or *Bethbilbeckia* (see Epler 1995). *Macropelopia* larvae may be found in springs, small streams, ponds and bogs.

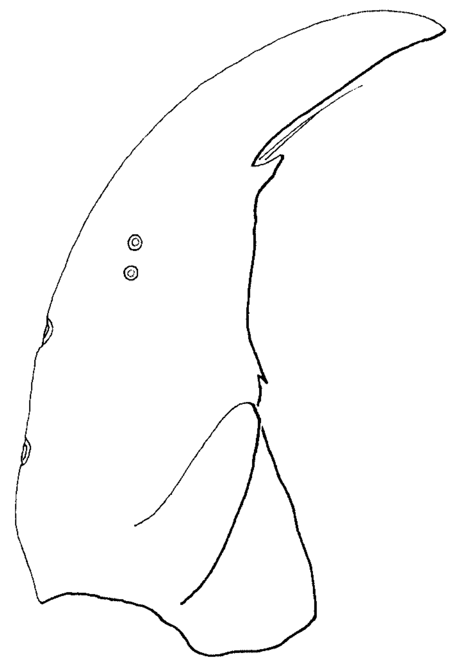
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971, 1978a.



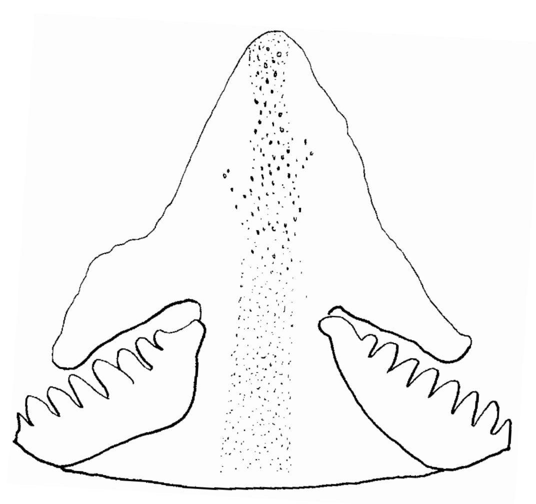
ligula and paraligula



maxillary palp



mandible



mentum and M appendage

Genus *Meropelopia*

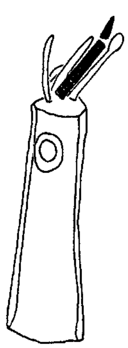
DIAGNOSIS: *Meropelopia* larvae are distinguished by the long scattered body setae; pale posterior margin of head caapsule; 2 segmented b sensillum of the maxillary palp; ring organ in distal third of maxillary palp; basal segment of maxillary palp equal to or longer than second antennal segment; length of basal antennal segment/mandible length greater than 1.75; sclerotized base of the antennal blade about twice as long as wide; and mandible with small basal and accessory teeth.

NOTES: Two species, *M. americana* and *M. flavifrons*, are described from North America; both occur in the Carolinas. Larvae of the two species are separable only by size (data from ***reared 4th instar*** larvae from Roback (1981): *M. flavifrons* has basal segment of maxillary palp < 60 µm, first antennal segment < 300 µm; *M. americana* is larger); pupae and adults are more easily separated. Species level identification of *Meropelopia* larvae would be suspect without associated pupae or adults. Consider yourself fortunate if you can identify these larvae to genus, let alone species!

Meropelopia was formerly considered a subgenus of *Conchapelopia*, from which it is easily separated by the 2 segmented b sensillum of the maxillary palp (*Conchapelopia* has a 3 segmented b sensillum). It is more difficult to separate *Meropelopia* from *Hayesomyia* and *Thienemannimyia*, and one may have to be content with an identification of "*Thienemannimyia* group sp." for many specimens. As with other members of the *Thienemannimyia* group, mature 4th instar larvae may be identified to genus with certainty if the developing pupal thoracic horn is visible; note the lack of a corona.

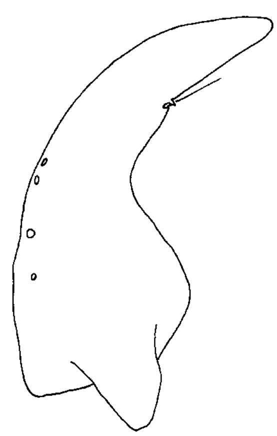
Meropelopia flavifrons occurs in streams and rivers. Roback (1981) recorded the following water chemistry data for *Meropelopia*: total hardness 0-150 ppm, most < 50; alkalinity 0-80 ppm, most < 40; specific conductivity 0-300 µmhos @ 25° C, most < 100; pH 4.1-8.0, most from 6.1-7.0; temperature 9-28° C, most from 9-18.

ADDITIONAL REFERENCES: Roback 1971, 1981.

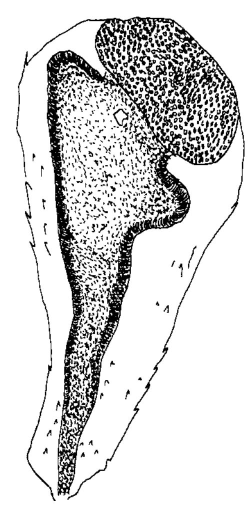


maxillary palp
(b sensillum shaded)

ligula and paraligula



mandible



thoracic horn of pupa

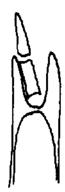
Genus *Monopelopia*

DIAGNOSIS: This genus is distinguished by the large, well sclerotized Lauterborn organs at the apex of antennal segment 2 that resemble a tuning fork; the triangular rugose area at the base of the ligula; the lack of well-developed dorsomental teeth; and posterior parapods with at least one dark claw or with all claws transparent; if all claws transparent then smaller claws have large inner teeth and only two such claws present on each parapod (this last character only found on a Jamaican species not known from the US).

NOTES: Only one species of *Monopelopia*, *M. boliekae*, is known for certain from the Carolinas. Two other described species are recorded from Florida and another species is known from phytotelmata in Jamiaca. The larva of *Cantopelopia gesta* is very similar and is included in the following key; see also *Cantopelopia*.

Monopelopia larvae are usually found in small bodies of water such as ponds and marshes; they are also sometimes encountered in streams. Two species, *M. tillandsia* (Nearctic and perhaps Neotropical), and *M. mikeschwartzi* (Jamaica) live (exclusively?) in bromeliad phytotelmata.

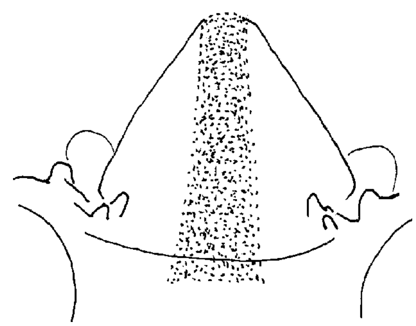
ADDITIONAL REFERENCES: Beck & Beck 1966b; Epler & Janetzky 1999; Kowalyk 1985; Roback 1986a, 1987c.



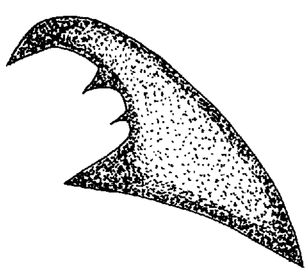
antennal apex, dorsal

antennal apex, lateral

mandible

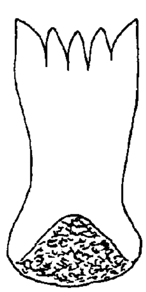


dorsomentum and M appendage

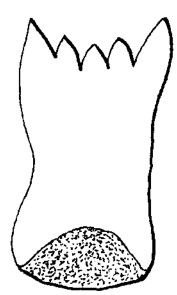


M. boliekae, dark small claw of posterior parapod

M. tillandsia, small claw of posterior parapod



M. boliekae, ligula



M. tenuicalcar, ligula

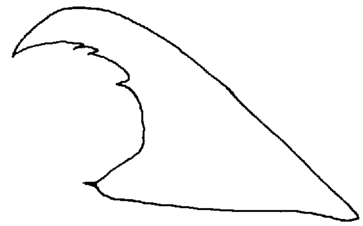
M. tillandsia, ligula

Key to *Monopelopia* larvae of the southeastern United States

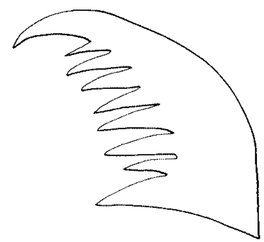
1 All claws of posterior parapod pale yellow-brown or colorless 2

1' At least one dark claw on posterior parapod 3

2(1) Small claws of posterior parapod with at most a few small teeth on inner surface .... ***M. tillandsia***
(not known from the Carolinas)

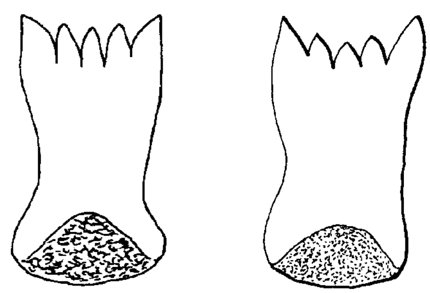


2' Three small claws on posterior parapod with many large inner teeth ...... ***Cantopelopia gesta***



3(2') Teeth of ligula in relatively straight line; procercus length/width 3.0 or less; relatively common .... ***M. boliekae***

3' Teeth of ligula in concave arc; procercus length/width > 4.0; rare .... ***M. tenuicalcar***
(not known from the Carolinas)



M. boliekae *M. tenuicalcar*

Notes on species

M. boliekae - The only species in the genus known from the Carolinas; found on the Coastal Plain; also known from Cuba. It apparently is most common in weedy ponds, but also occurs in streams.

M. tenuicalcar - This Holarctic species is recorded only from Florida in the SE U.S. Roback (1986a) also recorded this species from New Brunswick, Newfoundland and Ontario in eastern Canada, and I've examined material from Ohio; given such a distribution, it should also occur in the Carolinas.

M. tillandsia - Recorded with certainty only from southern Florida, where it lives in bromeliad phytotelmata. An additional phytotelmatic species, *M. mikeschwartzi*, is known from Jamaica. The larva of *M. mikeschwartzi* can be separated from *M. tillandsia* and *C. gesta* by the 2 pectinate smaller claws on each of its posterior parapods. Records of *M. tillandsia* from North Carolina (Caldwell et al. 1997) probably refer to *C. gesta*.

Cantopelopia gesta, known from Florida, Georgia and South Carolina in the SE US, is included in the key above because of its similarity to *Monopelopia* larvae; see *Cantopelopia* for more information.

Genus *Natarsia*

DIAGNOSIS: The short antennae (about 1/3 length of head and twice the length of the mandible); large basal tooth of the mandible; absence of well developed dorsomental tooth plates; pseudoradula with fine granules not in longitudinal rows; basal segment of maxillary palp with ring organ in apical third; and the anterolateral fringe of 4 larger setae on body segments 4-10 are distinctive.

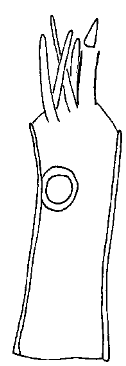
NOTES: Two taxa of the genus *Natarsia* are known from the Southeast; both have been recorded from the Carolinas. However, the taxonomy of the two species, *N. baltimorea* and N. sp. A, is unclear. Although most larvae of the two taxa are distinctive, pupa and adults can only be separated by size. Roback (1978) also described larval variants of each species; a variant of *N. baltimorea* had a long, thin spine on the apex of antennal segment 2 (Roback 1978: 196); while a variant of *N*. sp. A (based on a larva with discernable pupal characters; these pupal characters placed the specimen in *N*. sp. A) possessed a ligula with apically even teeth. Additional variants are discussed under Notes on species.

The Lauterborn organs of some *Natarsia* sp. A type larvae are extremely elongate, surpassing antennal segment 3 and, as in one specimen illustrated below, most of the length of antennal segment 4. These long Lauterborn organs may cause workers to confuse such specimens with *Krenopelopia* (q.v.) or other taxa.

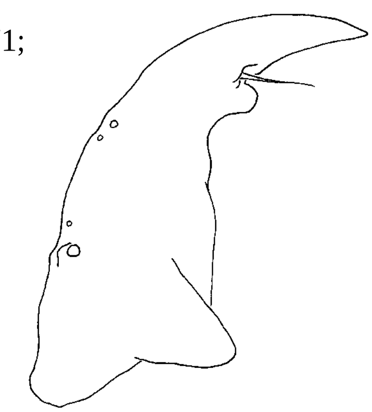
Natarsia larvae are found in streams and marshes; they can apparently withstand organic and toxic discharges, especially sewage (Hudson et al. 1990). Roback (1978) gave the following water chemistry data for *N*. sp. A: pH 5.1-7.0; total hardness 0-100 ppm; alkalinity 0-40; specific conductivity 0-300 µm @ 25°C; temperature 14-28°C.

ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971;

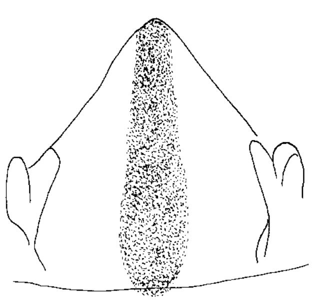
N. sp. A ligula and paraligula



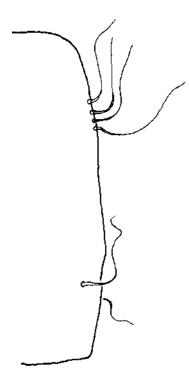
N. sp. A maxillary palp



mandible



mentum and M appendage

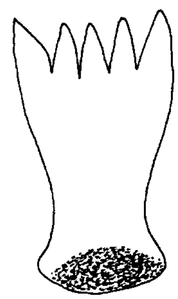


body segment showing anterolateral fringe of 4 setae

Key to *Natarsia* larvae of the southeastern United States

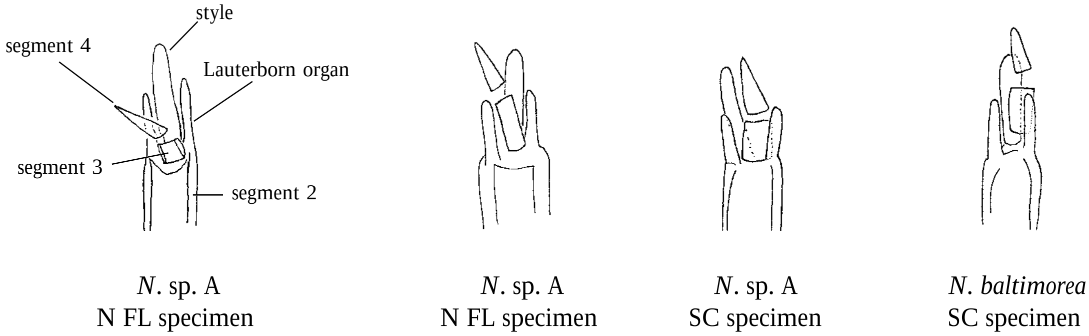
1 Ligula apically concave .... ***N.* sp. A**

1' Ligula apically straight .... ***N. baltimorea***



Notes on species

N. sp. A - Roback (1971) had concluded that larger specimens incorrectly identified by Malloch (1915) as *Tanypus hirtipennis* represented a junior synonym, in part, of *N. baltimorea*. Because of differences in the larvae, Roback later (1978) believed that these larger specimens of *N. baltimorea* represented another species and tentatively named them *Natarsia* sp. A. More reared material is needed before this taxon can be redescribed and, if it represents a new species, given a new name. This taxon displays some variation in the length of the Lauterborn organs and antennal segment 3. Variations I've observed are illustrated below. Larvae with very long Lauterborn organs have been mistaken for *Krenopelopia*. It is not known if larvae with long Lauterborn organs and/or a short antennal segment 3 represent another species of *Natarsia* or are just the extreme end of a range of variation.



Antennal apices of *Natarsia* species

Genus *Nilotanypus*

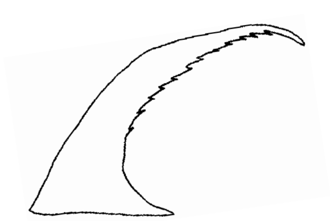
DIAGNOSIS: This genus is distinguished by its small size; head without nodules/spinules or lateral spines; ligula with the median tooth longer than the inner teeth; at least one small or medium claw of the posterior parapod pectinate or with several small spines; pseudoradula with fine granules and greatly broadened posteriorly; and the long anal tubules that exceed the posterior parapods.

NOTES: Four taxa assigned to *Nilotanypus* have been recorded from the US (Roback 1986b). Two species, *N. americanus* and *N. fimbriatus*, are known from North and South Carolina. I have also seen an adult male specimen from SE Alabama which fits the description for *N. kansensis*; this species may also occur in the Carolinas. Some taxonomic uncertainty exists, for the male of *N. americanus* remains undescribed. Roback (1986b) also described a larval type from Texas (incorrectly located on his map, fig. 91). Species separation of the larvae of *N. americanus* and *N. kansensis* is difficult and impossible without 4th instar larvae (which should be reared to confirm identification); the pectinate small claw on the posterior parapod of *N. fimbriatus* easily distinguishes that species. Specimens of *Nilotanypus* which are not clearly assignable to *N. fimbriatus* should be identified as "*Nilotanypus* sp."

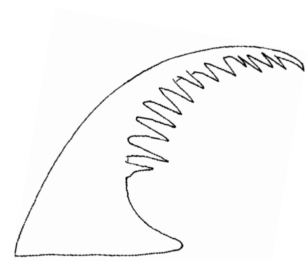
Nilotanypus can be confused with some *Labrundinia* larvae because of the similar ligula morphology; the two may be difficult to separate if the posterior portion of the body is missing. Note that the mandible's basal tooth is much larger in *Labrundinia* than in *Nilotanypus.*

Nilotanypus larvae are usually found in clean, relatively shallow sand bottomed streams, but also occur commonly in large coastal plain rivers. Some populations are apparently not tolerant of some forms of pollution, and may serve as indicators of good water quality. Roback (1986b) gave the following water chemistry data associated with *N. americanus*: alkalinity < 20 ppm; DO 4.6-9.4 mg/l; pH 4.7-7.0; total hardness 16-44 ppm; specific conductivity 32-92 µmhos @ 25°C; temperature 15-18° C. The larva of *N. kansensis* is known from moss along the margins of springs.

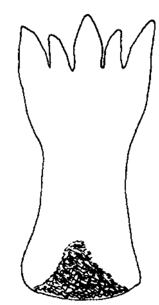
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971; 1986b.



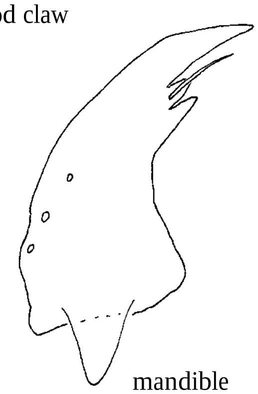
N. americanus posterior parapod claw



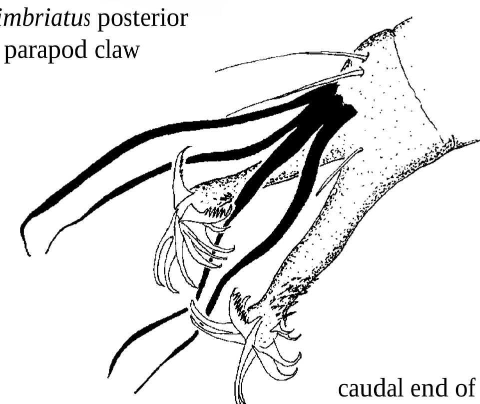
N. fimbriatus posterior parapod claw



ligula



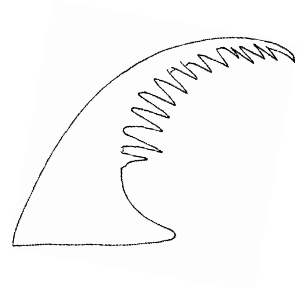
mandible



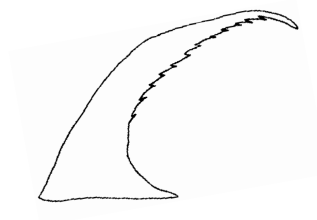
caudal end of body (anal tubules shaded)

Key to *Nilotanypus* larvae of the southeastern United States

1 One medium claw of posterior parapod pectinate .... ***N. fimbriatus***



1' One or more medium claws of posterior parapod with inner row of small spines/serrations, never pectinate 2



NOTE:
4th instar larvae are necessary for accurate measurements!!

2 Length of antenna segment 2 < 44µm; head length usually < 326 µm .... ***N. americanus***

2' Length of antenna segment 2 > 44µm; head length usually > 326 µm .... ***N. kansensis***
(not known from the Carolinas)

Genus *Paramerina*

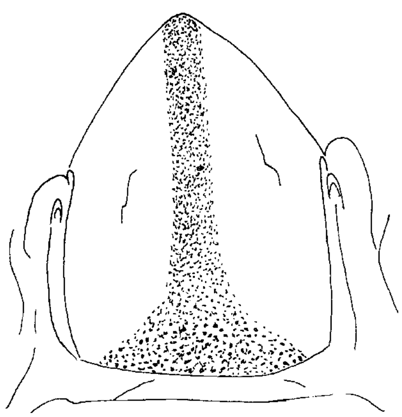
DIAGNOSIS: Larvae of this genus are distinguished by the large basal tooth of the mandible; the two segmented maxillary palp, with the proximal segment < ½ length of the distal segment; and the pseudoradula broadened posteriorly, appearing attached to a transverse bar and consisting of small granules not arranged in parallel rows.

NOTES: Three species are known from the Southeast; two species are known from the Carolinas: *P. anomala* and *P. fragilis*. A third species recorded from Florida and Texas, *P. testa*, may occur in the Carolinas. The immature stages of the latter two species are undescribed; the larva of P. *anomala* was described by Beck & Beck (1966). It *may* be possible to distinguish *P. anomala* by the darkened caudal margin of the head capsule; however, specimens should be reared for correct identification. Note that identifications based solely on unassociated larvae can not be positive. Unless reared and identified to species as adults, larvae should be identified as "*Paramerina* sp."

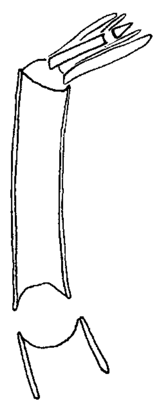
Although Fittkau & Roback (1983) stated that the claws of the posterior parapods were simple, some species possess bifid small claws.

Larvae are found in marshes and streams.

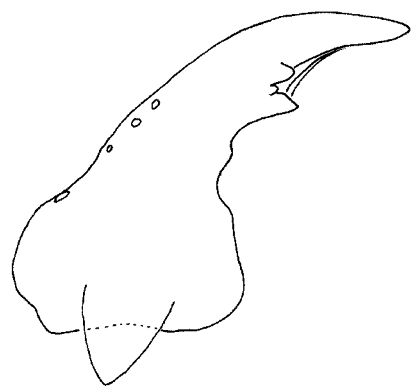
ADDITIONAL REFERENCES: Beck & Beck 1966; Kowalyk 1985; Roback 1971; Sublette & Sasa 1994.



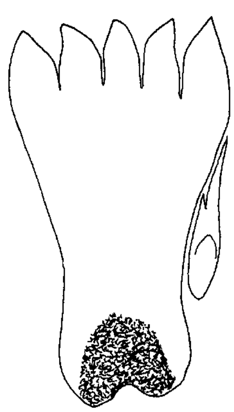
mentum and M appendage



maxillary palp



mandible



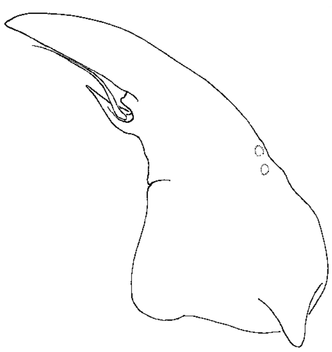
ligula and paraligula

Genus *Pentaneura*

DIAGNOSIS: Larvae are distinguished by the sclerotized tubercle at the base of each supraanal seta, long procerci (6 or more times as long as wide) and lack of a setal fringe. The common species *P. inconspicua* is distinguished by the large, pointed, apically directed basal tooth of the mandible; apices of ligula teeth even or almost so; ring organ in apical third of basal maxillary palp segment; lack of well developed dorsomental teeth; one dark claw on each posterior parapod; and anal tubules longer than posterior parapods.

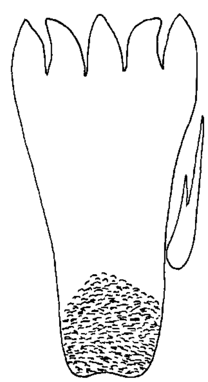
NOTES: One species, *P. inconspicua*, is common throughout the Southeast in rivers and streams. The species *P. inculta* was synonymized with *P. inconspicua* by Roback (1971). Mike Bolton (Ohio EPA) has provided a reared female and additional larva of another species from Ohio which may belong in *Pentaneura*, tentatively included here as *Pentaneura* sp. A. This species lacks the pointed basal tooth of the mandible, long anal tubules, dark claw on the posterior parapod and the ligula is different from *P. inconspicua*. Pupal characters place this enigmatic taxon in *Pentaneura*; more material is needed. This species has not been found in the Southeast, but Hudson et al. (1990) noted an undescribed species based on an adult from South Carolina's Savannah River Plant. I have not seen this specimen and do not know if it is conspecific with *P.* sp. A.

ADDITIONAL REFERENCES: Beck & Beck 1966; Kowalyk 1985; Roback 1971.

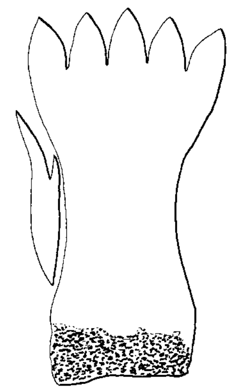


P. inconspicua
mandible

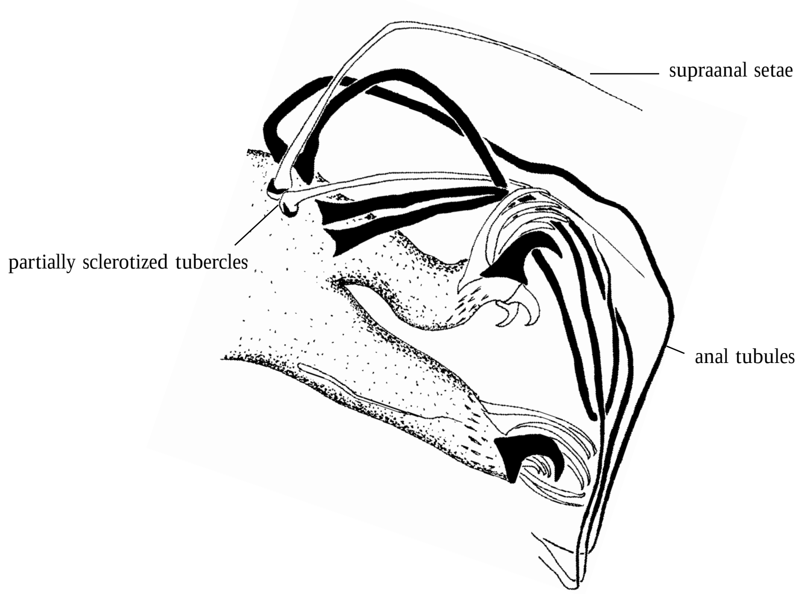
P. sp. A
mandible



P. inconspicua
ligula and paraligula



P. sp. A
ligula and paraligula



P. inconspicua, caudal end of body

Genus *Procladius*

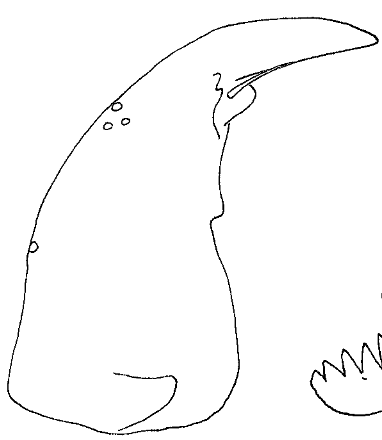
DIAGNOSIS: *Procladius* larvae are distinguished by the rotund head capsule; well developed dorsomental tooth plates; mandible with large blunt basal tooth; black/dark brown five toothed ligula; paraligula with numerous small teeth; antennal blade subequal to the flagellum; and body with well developed lateral setal fringe.

NOTES: Four *Procladius* species are recorded from the Carolinas. Two subgenera occur in the Southeast: *P. (Psilotanypus)* with one species, *P. bellus;* and *P. (Holotanypus)* [referred to as *P. (Procladius)* in Roback (1980) and Webb & Brigham (1982)] with three species, *P. denticulatus*, *P. freemani* and *P. sublettei*; *P. wilhmi* is known from Arkansas and Tennessee and may also occur in the Carolinas. Note that characters of the pecten hypopharyngis used to separate subgenera in Webb & Brigham (1982: 11.61) will not work consistently. The length of the apical tooth of the paraligula is variable, and may not be useful as a character to separate the two subgenera in the Southeast, contrary to the key in Fittkau & Roback (1983: 64). Some larvae may be identified to subgenus, but with the exception of *P. bellus*, species identification of unreared larvae is not possible. *Procladius bellus* and *P. sublettei* are by far the most common species in the Southeast. Earlier records of *P. culiciformis* from the Southeast (Florida) are most likely referable to *P. freemani* or *P. sublettei*.

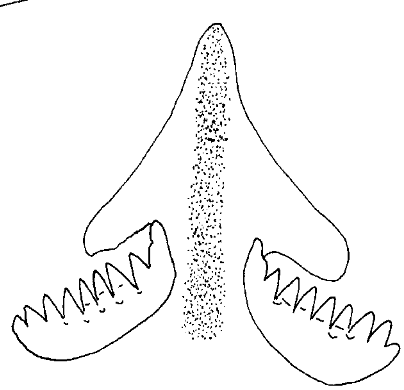
Procladius larvae are found in the bottom sediments of bogs, ponds, lakes and the slower moving portions of streams and rivers. Roback (1980) recorded the following water chemistry data: pH , 4.1-8.0; total hardness (ppm $CaCo_3$) < 50-260, with most records < 51; alkalinity < 40-200, with most < 41; specific conductivity < 100-500 µmhos @ 25°C, with most < 200; and water temperature < 8-28°C, with most records for 19-23°. Larvae may be found in heavily polluted conditions, and are subject to numerous deformities (see Warwick 1989; 1990).

Larvae with a 4 toothed ligula may be confused with *Djalmabatista*, but may be separated by the shorter antennal blade in *Procladius*. The small claws of the posterior parapod do allow identification of some forms of *P. bellus;* other specimens are best identified as *"Procladius* sp."

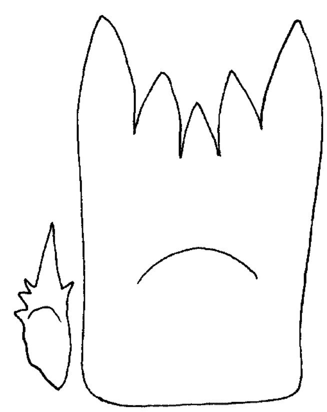
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971, 1980; Sublette et al. 1998; Warwick 1989, 1990.



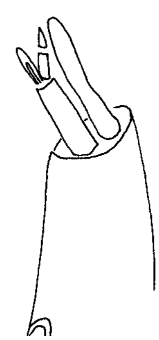
mandible



mentum and M appendage



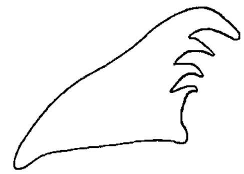
ligula and paraligula



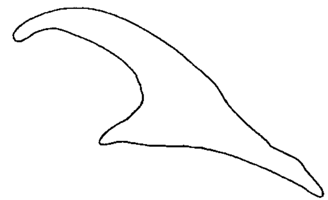
apex of antenna

Key to *Procladius* larvae of the southeastern United States

1 One or two of the smallest claws on the posterior parapods with large inner teeth ...... ***P. bellus*** (in part) 2



1' Smallest claws of posterior parapods without large inner teeth 3



2(1) Each posterior parapod with 1 toothed small claw .... ***P. bellus* var. 2**

2' Each posterior parapod with 2 toothed small claws .... ***P. bellus* var. 3**

3(1') Apices of several larger claws of posterior parapod drawn out to hair-like extension and smallest claws without expanded bases .... ***P. (Holotanypus)* sp.**

3' Apices of larger claws of posterior parapod with simple point and smallest claws with expanded bases .... ***P. bellus* var. 1**

Notes on species

P. bellus - A widespread and abundant species. Roback (1980) noted three varieties of *P. bellus*, all of which have been found in the Southeast; some of these may represent different species (see Hudson et al. 1990), but much more work is needed. Roback (1971) noted that the holotype of *P. riparius* was different from the rest of the type series; he partially synonymized *P. riparius* with *P. bellus*. Oliver et al. (1990) listed *P. riparius* as a separate species. Sublette et al. (1998) synonymized *P. riparius* with *P. bellus*, noting that the slide of the *P. riparius* holotype's genitalia was actually that of a *Coelotanypus*. Charles Watson (pers. comm.) has pointed out the hair-like apices of some of the large claws of the posterior parapod of *P. (Holotanypus)* species; use caution when identifying larvae for it is not known if that character is found in all species. Reared material is a definite asset, and in most cases a necessity, for the identification of *Procladius* larvae to the species level.

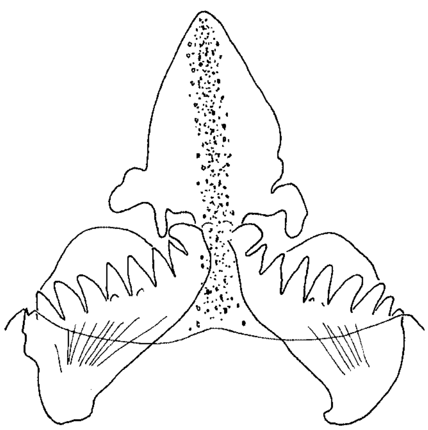
Genus ***Psectrotanypus***

DIAGNOSIS: Distinguished by the well developed, transverse dorsomental tooth plates; mandible with several large inner teeth; a pale ligula with 4 even teeth; numerous long apicolateral branches on the paraligula; and body with a lateral setal fringe.

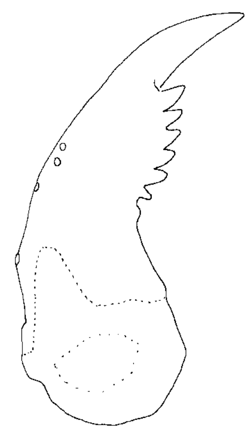
NOTES: Two taxa, *Psectrotanypus dyari* and *Ps.* sp. A, are known from the Carolinas; a third species, *Ps. discolor*, may also occur. *Derotanypus*, in the US found mostly in the northern west, is similar to *Psectrotanypus*, but differs mainly in possessing numerous small dorsal teeth on the mandible and the ventromental plates are concave, not straight as in *Psectrotanypus*.

Larvae are found in bogs, ponds, springs, streams and small rivers. *Psectrotanypus dyari* is tolerant of organic pollution.

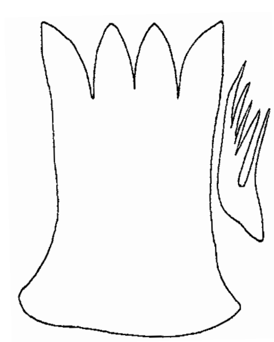
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971; 1978a.



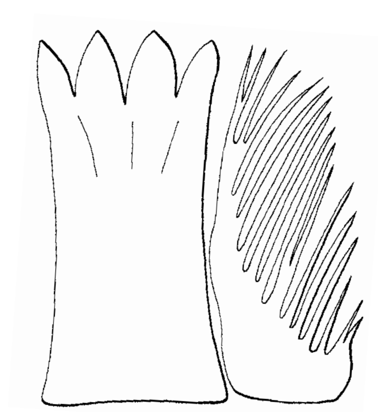
Ps. dyari mentum and M appendage



Ps. dyari mandible



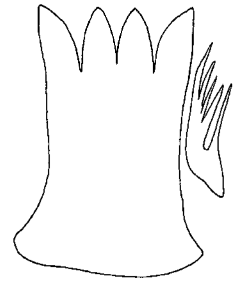
Ps. dyari ligula and paraligula

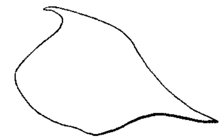


Ps. sp. A ligula and paraligula

Key to *Psectrotanypus* larvae of the southeastern United States

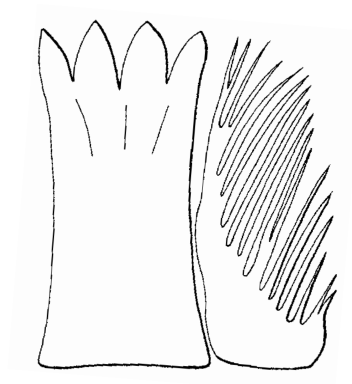
1 Ligula short and squat; paraligula with 10 or fewer lateral branches; small claw of posterior parapod with ovoid base .... ***Ps. dyari***





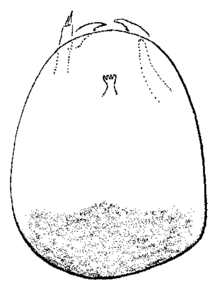
posterior parapod claw

1’ Ligula longer and narrower; paraligula with more than 12 branches; small claw of posterior parapod simple 2



posterior parapod claw

2(1’) Head capsule yellow-brown, with a posterior dark dorsal mark .... ***Ps.* sp. A**



2’ Head capsule yellowish-brown, without dark marking .... ***Ps. discolor***
(not known from the Carolinas)

Notes on species

Ps. discolor - Not recorded from the Carolinas, but known from West Virginia and may eventually be found in the Smoky Mountains. Roback (1978a) found *Ps. discolor* larvae in a sphagnum bog and nearby stream, in acid conditions (pH 3.9-4.0); I’ve collected it from peat bogs in Maine. See also *Ps*. sp. A below.

Ps. dyari - Found throughout the eastern US, usually in organically enriched water. Roback (1978) noted that *P. dyari* appeared to be the only member of its tribe (the Macropelopiini) tolerant of high levels of organic pollution. He gave the following water chemistry parameters for the species: pH 6.1-8.0; total hardness 51-200 ppm; alkalinity < 40-200 ppm; specific conductivity < 100-400 µmhos @ 25°C; temperature 9-23°C.

Ps. sp. A - Charles Watson (pers. comm.) has reared this cold stenotherm species from depositional areas of springs and headwater streams in Virginia, Tennessee and both Carolinas. *Psectrotanypus* sp. A may be a southern variant of *Ps. discolor* but it differs in coloration in all life stages and is probably specifically distinct from that species. Pupae show the only structural differences, mainly in the shape of the anal fin, which is asymmetrical in *Ps.* sp. A and symmetrical in *Ps. discolor.*

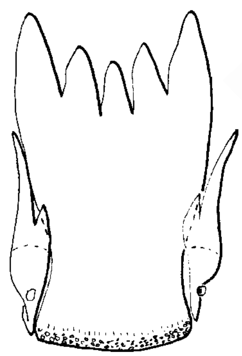
Genus *Radotanypus*

DIAGNOSIS: Distinguished by the rotund head capsule; ring organ near middle of maxillary palp; ligula with inner teeth directed forward; dorsomental plates with 5 large teeth, a bifid innermost tooth and a small outer tooth, plates without medial extension; small claw of posterior parapod without an expanded base; and the lateral setal fringe on the body.

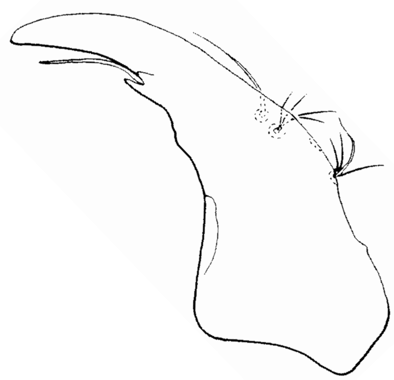
NOTES: *Radotanypus* has not been collected in the Southeast, but its presence in Ohio (Bolton 1992) indicates that it may eventually be found in the mountains. There appears to be only one species in the Nearctic, *R. florens* (Johannsen) (formerly placed in *Apsectrotanypus*); B. Bilyj (pers. comm.) considers *R. submarginella* (Sublette) to be a junior synonym. *Radotanypus* larvae are very similar to *Apsectrotanypus, Bethbilbeckia* and *Brundiniella*.

Larvae have been collected in a stream and a small river in Wyoming, and from a spring and streams in an alkaline fen in Ohio.

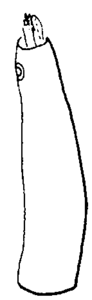
ADDITIONAL REFERENCES: Fittkau & Murray 1985; Epler 1986b.



ligula and paraligula

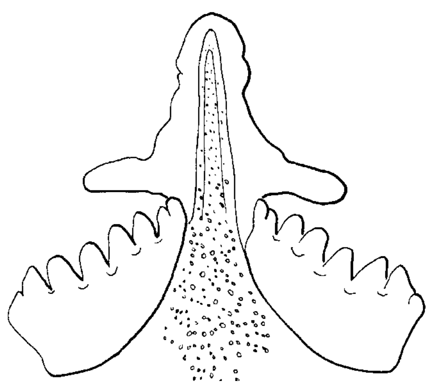


mandible



antenna

apex of antenna



mentum and M appendage

small claw of
posterior parapod

maxillary palp

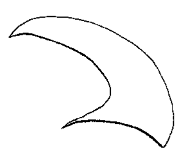
Genus *Reomyia*

DIAGNOSIS: Larvae of this genus are not readily separable from *Zavrelimyia;* associated pupae will aid in accurate identification. Larvae are distinguished by the elongate, smooth head capsule; lack of well developed dorsomental teeth; pseudoradula with moderately fine, scattered granulation and broad base; long, thin basal segment of the maxillary palp (5.8-6.0 times as long as wide) with ring organ 0.30-0.39 from base; large basal tooth on the mandible; AR 2.4-2.6; posterior parapods with or without one small to medium claw with an inner tooth; and body without a fringe of swim setae.

NOTES: At least one undescribed species is known from the Southeast that can provisionally be placed in *Reomyia*. Broughton Caldwell (pers. comm.) has reared this species from Coweeta in North Carolina; Leeper & Taylor (1998) recorded a *Reomyia* from South Carolina near the Savannah River Site.

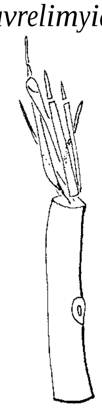
Reomyia wartinbei, a western North American species and the type species of the genus, was originally described as a *Zavrelimyia* (Roback 1984) but elevated to generic status in Roback (1986c). The pupa of *Reomyia* was included in Fittkau & Murray (1986) as Tanypodinae genus III; the larva has remained undescribed. *Reomyia* is very similar to *Zavrelimyia* and may not be separable from that genus in the larval stage. The North Carolina *Reomyia* sp. A material has a mix of characters that confuse the boundaries of *Reomyia* and *Zavrelimyia*; pupal characters such as the thin, elongate D setae will place it in *Reomyia* (these setae are shorter and rounded in true *Zavrelimyia).* In the adult Coweeta *Reomyia* specimens, wing vein R_3 does not attain the costa, a scutal tubercle is present (however, at least one species of *Zavrelimyia* has a scutal tubercle (B. Bilyj, pers. comm.)) and the lengths of the fourth and fifth tarsomeres of the mid leg fit within the limts of *Reomyia*. There is variation in the larvae of *R*. sp. A; some (two female larvae with *Reomyia*-type pupae) possess a posterior parapod claw with an inner tooth, while apparently conspecific specimens (two male larvae with *Reomyia*-type pupae) do not; however, another female larva was reared without the inner tooth. A revision of *Zavrelimyia* is needed to clearly define the generic limits of *Reomyia* and *Zavrelimyia*; it is likely that *Reomyia* may be considered at most a subgenus of *Zavrelimyia*.

ADDITIONAL REFERENCES: Roback 1984, 1986c.

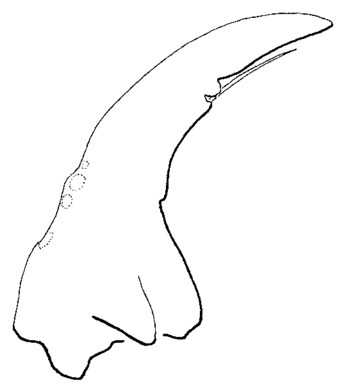


male posterior parapod claw

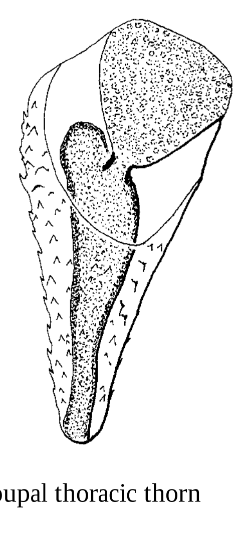
female posterior parapod claw



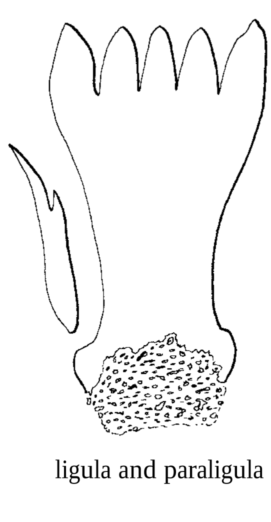
maxillary palp



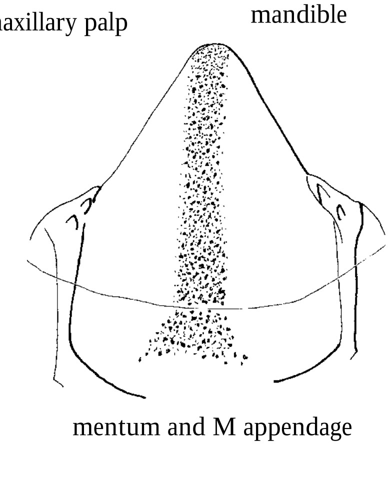
mandible



pupal thoracic thorn



ligula and paraligula



mentum and M appendage

Genus ***Rheopelopia***

DIAGNOSIS: Distinguished by the lack of dorsomental teeth; 2 or 3 segmented b sensillum; maxillary palp with ring organ in distal third; basal portion of maxillary palp usually shorter than antennal segment 2; mandible with an extremely reduced basal tooth and apparently absent accessory tooth; and the long, thick, radially arranged body setae;.

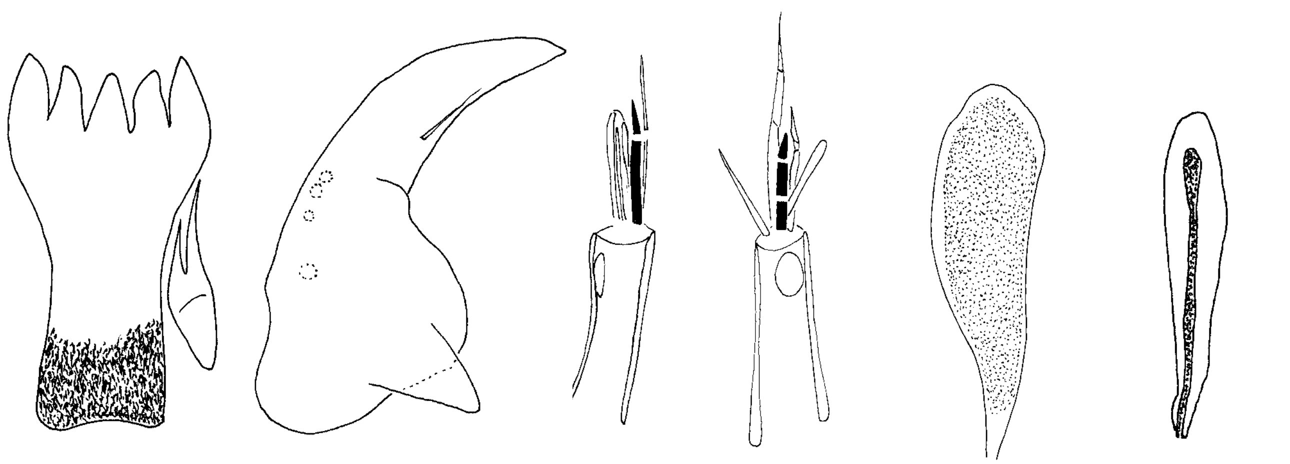
NOTES: The taxonomy of larval *Rheopelopia* is poorly understood. At least three taxa are known from the Carolinas, but only one, *Rh. acra*, is known from adult specimens; the other taxa, a probable *Rh. paramaculipennis* and *Rh*. sp. 3 Roback, are known only from unassociated larvae. Two other "species" of *Rheopelopia* are known from the Southeast: *Rh*. sp. A Epler is known from the Suwannee River system in northern Florida (Epler 1992, 1995) and *Rh.* sp. 2 Roback is known from Georgia and Canada (Roback 1981). *Rheopelopia* sp. A may be a southern form of *Rh. paramaculipennis* with a darker head capsule. Note that the latter two taxa have a 2 segmented b sensillum of the maxillary palp, rather than the 3 segmented b sensillum diagnosed in Fittkau & Roback (1983).

The *Rheopelopia acra* group is apparently the most commonly encountered taxon of the genus in the Carolinas. There are at least two species in this group, *Rh. acra* and *Rh. perda*; only *Rh. acra* has been recorded from the Southeast. The two taxa may be variants of the same species (Roback 1981). I've examined one larva that may be *Rh. paramaculipennis* from the Dan River in Caswell Co., NC; *Rheopelopia* sp. 3 is rare in mountain streams.

Rheopelopia larvae may be difficult to separate from other members of the *Thienemannimyia* group, although the almost toothless mandible is distintinctive; developing pupal structures within the larval cuticle will help in identification. The spineless, saccoid type of pupal thoracic horn illustrated below is found in *Rh. paramaculipennis*, *Rh*. sp. A and *Rh*. sp. 2; the thoracic horn of the *Rh. acra* group species bears small spines apically (see also Roback 1981: 115).

Rheopelopia larvae are usually, as their name implies, found in running water.

ADDITIONAL REFERENCES: Roback 1971, 1981.

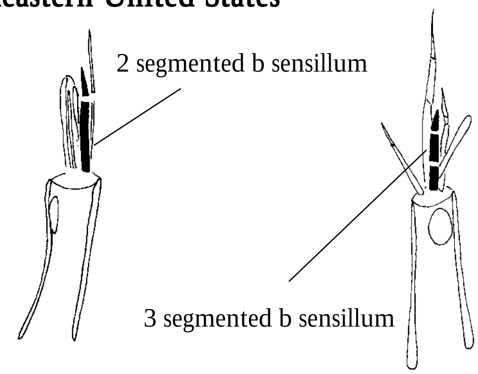


ligula and paraligula — mandible — *Rh*. sp. A maxillary palp — *Rh. acra* grp. maxillary palp — *Rh*. sp. A pupal thoracic horn — *Rh. acra* pupal thoracic horn

Key to *Rheopelopia* larvae of the southeastern United States

1 Maxillary palp with b sensillum 2 segmented .. 2

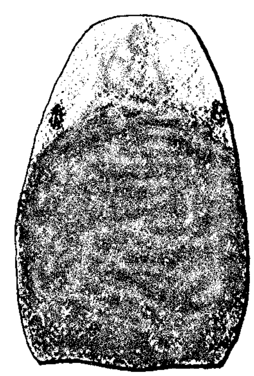
1' Maxillary palp with b sensillum 3 segmented .. 3



2(1) Head capsule light yellow-brown .... ***Rh. paramaculipennis***

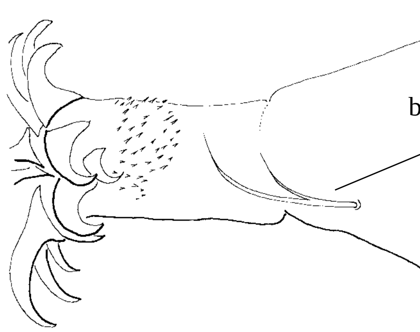
2' Head capsule brown .... ***Rh.* sp. A**
(not recorded from the Carolinas)

3(1') Posterior 2/3 of head capsule dark brown .. ***Rh.* sp. 3**



3' Dark brown coloration, if present, limited to posterior margin of head capsule 4

4(3') Subbasal seta of posterior parapod unevenly bifid .... ***Rh. acra* group**



4' Subbasal seta of posterior parapod simple .... ***Rh.* sp. 2**
(not recorded from the Carolinas)

Genus *Tanypus*

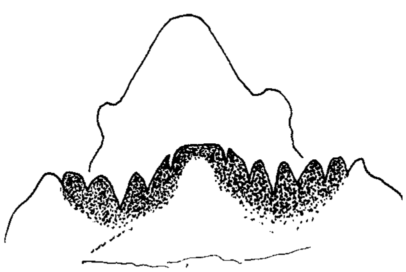
DIAGNOSIS: *Tanypus* larvae may be distinguished by the stout mandible (the apical tooth appears small in relation to the remainder of the mandible); well developed, transverse dorsomental teeth; lack of a pseudoradula; and the well developed lateral setal fringe on the body.

NOTES: Six *Tanypus* species are recorded from the Carolinas; a seventh species, *T. telus* Roback, is known only from Florida; its larva is undescribed. In the Carolinas, *Tanypus* is basically a genus of the Piedmont and Coastal Plain regions.

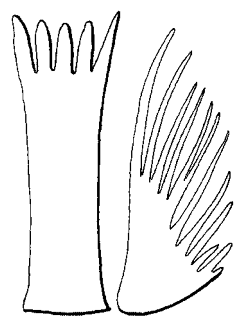
Larvae are usually found in or on soft sediments of marshes, ponds and lakes but also occur in the slower portions and side pools of streams and rivers. *Tanypus carinatus* and *T. neopunctipennis* can be common in organically enriched systems. Data in Roback (1977) indicate that *Tanypus* larvae are found in a pH range of <4-8.0, an alkalinity range of <40-160 ppm, a total hardness range of <50-200 ppm and a specific conductivity range of <100-400 µmhos @ 25°C. The larvae feed on the soft parts of chironomid larvae (the head capsule is not engulfed as in many other Tanypodinae), worms, diatoms and plant parts.

Larvae of four southeastern species (*T. carinatus, T. concavus, T. punctipennis* and *T. stellatus*) possess a pair of ventral "lobes" posterolaterally on abdominal segment VI; the two other species (*T. clavatus* and *T. neopunctipennis*) have a more simple, mesally infolded line of setae at the same position.

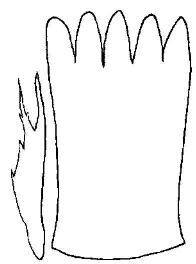
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1969, 1971, 1977.



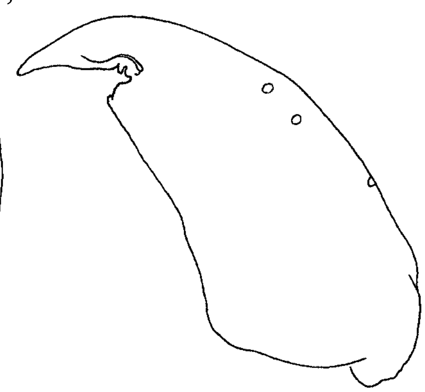
mentum and M appendage



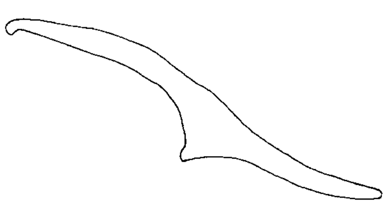
T. concavus, ligula and paraligula



T. carinatus, ligula and paraligula

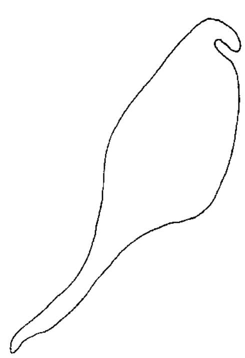


mandible



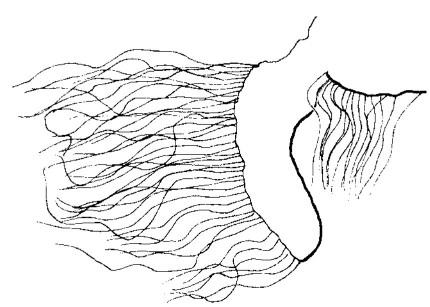
T. carinatus

T. stellatus



T. neopunctipennis

small claws of posterior parapod

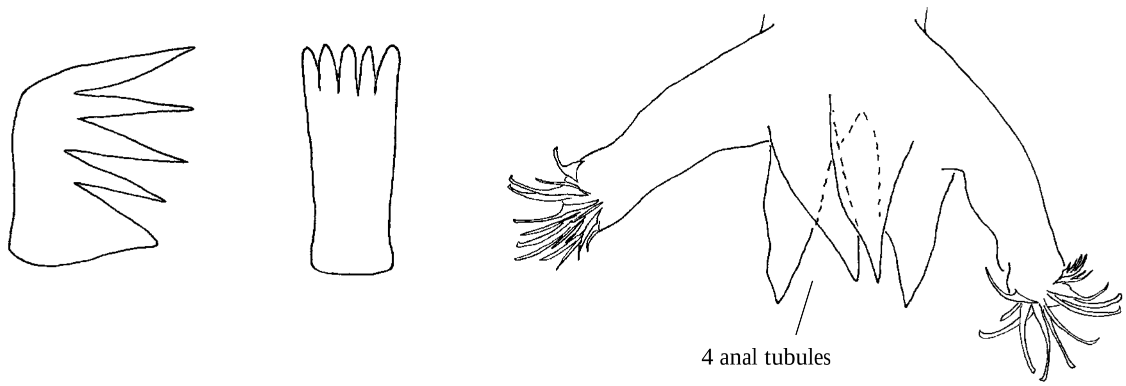


lobe on abdominal segment VI of *T. concavus*

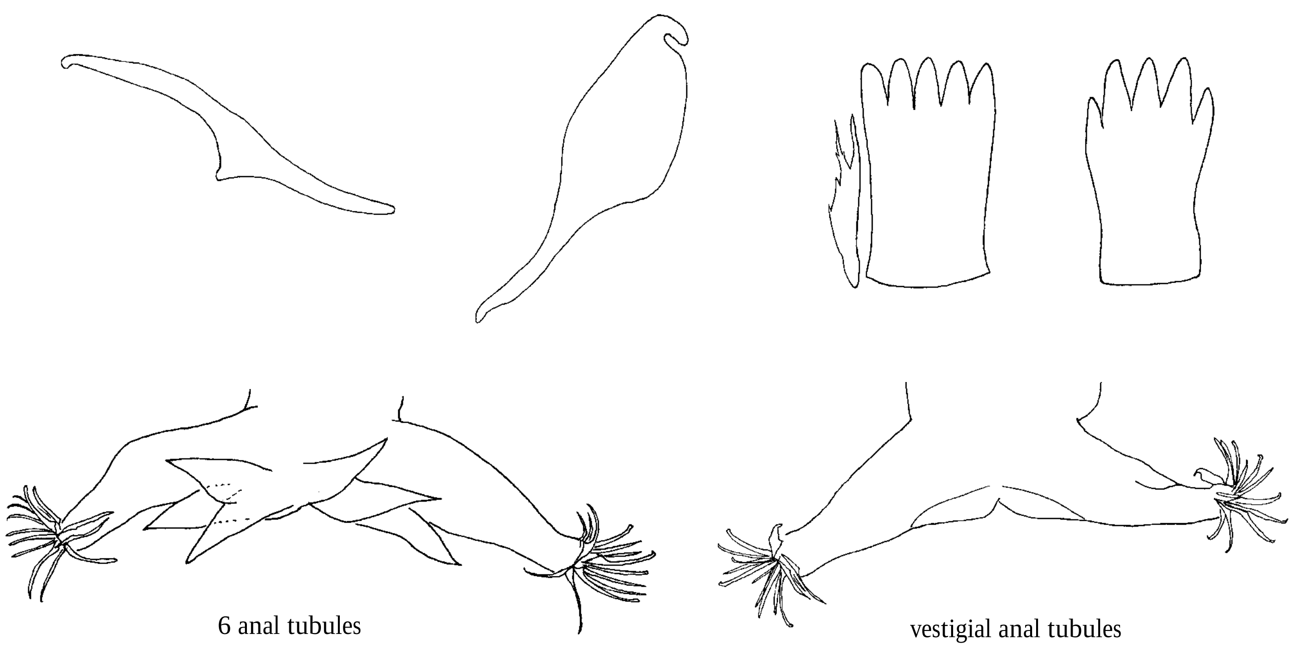
Key to *Tanypus* larvae of the southeastern United States

(the larva of *T. telus*, a Florida species, is undescribed)

1 Smaller claws of posterior parapods pectinate; ligula pale, relatively long and narrow; 4 anal tubules present 2

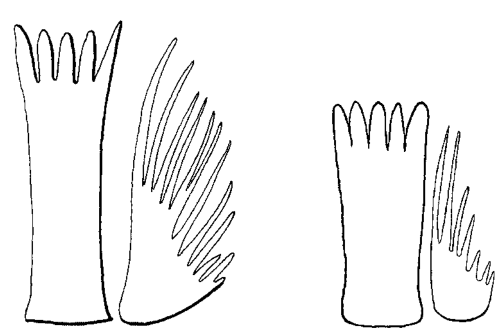


1’ Smaller claws of posterior parapods simple or expanded, with at most a serrate inner margin; ligula darker, shorter and wider; 6 anal tubules present **or** tubules vestigial 3



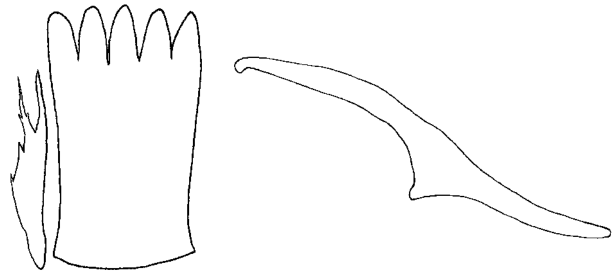
2(1) Ligula long and narrow, about 5 times as long as width near middle; paraligula with 8 or more branches .... ***T. concavus***

2’ Ligula shorter and not as narrow, about 2-3 times as long as width near middle; paraligula with 7 or fewer branches .... ***T. stellatus***

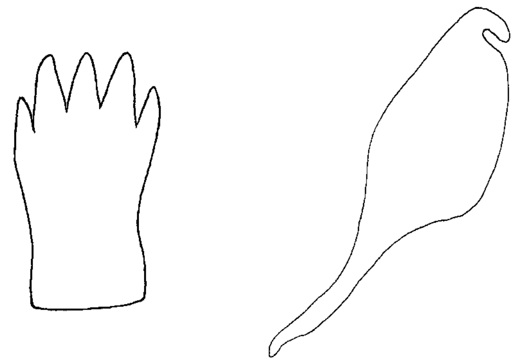


T. concavus *T. stellatus*

3 (1') Teeth of ligula in even arc; smaller claws of posterior parapods simple 4

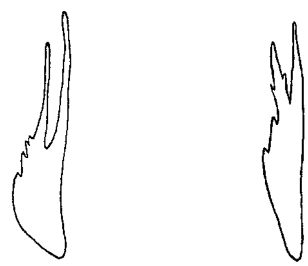


3' Median 3 teeth of ligula much longer than outer teeth; smaller claws of posterior parapods with expanded base 5



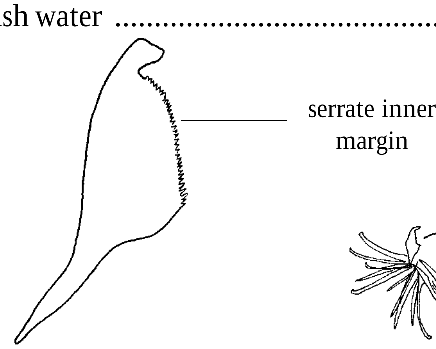
4(3) Paraligula deeply divided to about 1/2 its length; head capsule pale ... ***T. punctipennis***

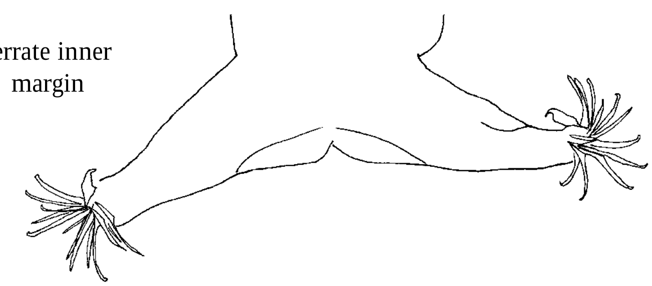
4 Paraligula not as deeply divided, at most about 1/3 if its length; head capsule darkened .... ***T. carinatus***



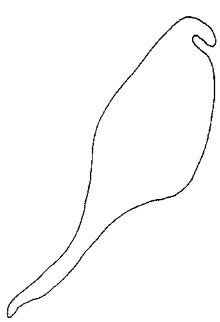
T. punctipennis *T. carinatus*

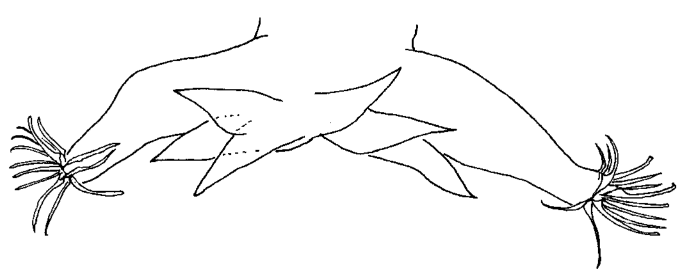
5(3') Smaller claws of posterior parapod with serrate inner margin; anal tubules reduced; usually found in brackish water .... ***T. clavatus***





5' Smaller claws of posterior parapod with smooth inner margin; 6 anal tubules present; not commonly found in brackish water .... ***T. neopunctipennis***





Notes on species

T. carinatus - A common and widespread species; Roback (1977) noted that it occupied the widest range of physicochemical parameters in the genus. I've encountered it most often in waters with low dissolved oxygen and high organic content.

T. clavatus - Apparently a brackish water species, although Oliver et al. (1990) list it for Kentucky. As with their putative record of *Thalassomya bureni* from Kentucky (see p. 2.3), the Kentucky record is probably a misidentification. They also record *T. clavatus* for North Carolina. Although I've seen no specimens from the Carolinas, with its salt marsh Atlantic shore line, their record for North Carolina is probably valid; if true, it should also occur in South Carolina. Roback (1977) gave a salinity range of 5-25 0/00 for this species. As with many brackish water species of Chironomidae, the anal tubules are vestigial.

T. concavus - The larva of this species has still not been positively associated with the adult, but the taxon keyed here probably is *T. concavus;* (Roback (1977) called it *T.* poss. *concavus*. I've seen numerous adults from Pen Branch at the Savannah River Site in South Carolina and several larvae from North Carolina.

T. neopunctipennis - This species can apparently tolerate brackish water; Roback (1977) recorded it from water with a salinity of 4.45 0/00 in Florida. It often occurs with *T. carinatus* (Roback 1977; Epler 1995).

T. punctipennis - Roback (1977: 64) noted that *T. punctipennis* apparently tolerated a wide range of environmental conditions ranging from "a clean, clear, slightly brown-water stream to a large turbid river". Note that the taxon called *T. punctipennis* in the Nearctic is probably not the same as the species originally described from Europe; more revisionary work is needed.

T. stellatus - This species is often found in deeper water than other species of the genus. Roback (1977) recorded it from depths of up to 14 meters in Tennessee.

Genus *Telopelopia*

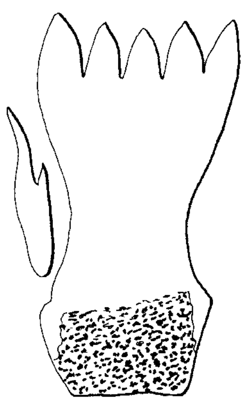
DIAGNOSIS: This genus is distinguished by the lack of dorsomental teeth; 2 segmented b sensillum; maxillary palp with ring organ in distal third; apical portion of dorsomentum directed apically; large basal tooth of the mandible; AR around 3.8; ring organ of basal antennal segment in distal third; and lack of a setal fringe (long, thin scattered body setae present).

NOTES: One species, *T. okoboji* (Walley), is known from the United States. The larval stage is the most easily distinguished member of the *Thienemannimyia* group because of the large basal tooth of the mandible. It has not been collected in the Carolinas but its presence in Ohio, Maryland and Virginia (Oliver et al. 1990) indicates that it may eventually be collected in the Carolinas.

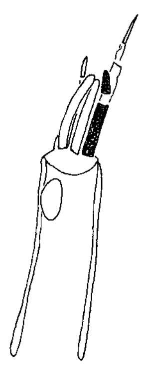
Roback's (1981) larval description and the diagnosis in Fittkau & Roback (1983) stated that the b sensillum of the maxillary palp is two segmented. However, Fig. 5.33F in Fittkau & Roback (1983) shows the b sensillum as three segmented. The b sensillum was two segmented on the only specimen I've examined, a larva (with a well developed pharate pupa within) from Ohio, illustrated below. The pupal thoracic horn is similar to that of *Conchapelopia*, *Hayesomyia*, *Helopelopia* and *Meropelopia*, but pupae can be distinguished by the well developed thoracic comb of *Telopelopia*.

Telopelopia larvae are apparently most often found in rivers, but also occur in lentic situations.

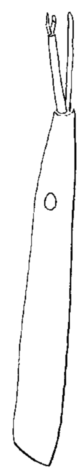
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971, 1981.



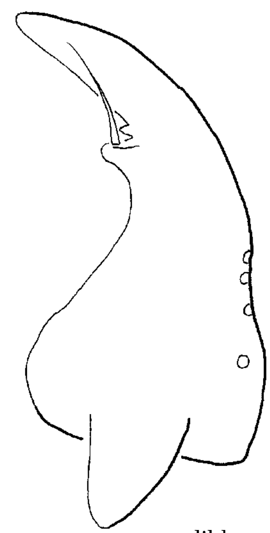
ligula and paraligula



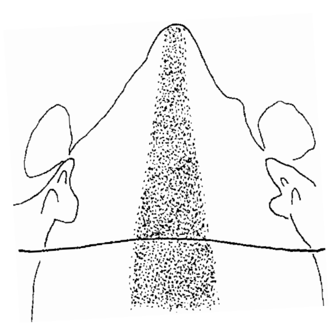
maxillary palp
(b sensillum shaded)



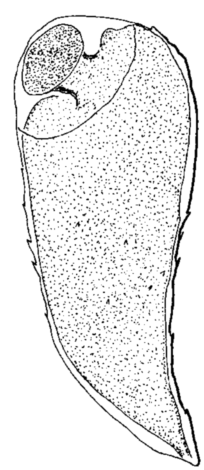
antenna



mandible



mentum and M appendage



pupal thoracic horn

Genus ***Thienemannimyia***

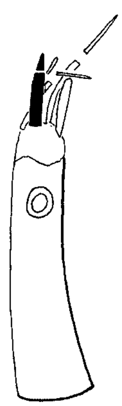
DIAGNOSIS: Distinguished by the lack of well developed dorsomental teeth; ring organ in distal third of maxillary palp; 2 segmented b sensillum; antennal segment 2 length about 40 µm, shorter than basal segment of maxillary palp; sclerotized base of the antennal blade as long as wide; AR 5.3 or more; mandible with small basal and accessory teeth; and the long scattered body setae. The pupal thoracic horn lacks a corona; respiratory atrium with numerous convolutions.

NOTES: Following the reassignment of *Th. senata* to *Hayesomyia* (q.v.), there are no described species of *Thienemannimyia* known from the Southeast. The single described eastern US species, *Th. norena* (Roback), has not been recorded south of Pennsylvania in the eastern US. It may eventually be found in the mountains of the Carolinas; Caldwell et al. (1997) report an undescribed *Thienemannimyia* from Alabama.

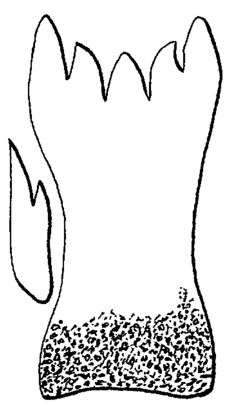
Head capsule coloration mentioned in the literature may be deceiving. Roback (1981) stated in couplet 3 of his key "caudal margin of head dark brown". None of Roback's material that I examined had head capsules with the entire caudal margin dark brown; all were light brown with only the posterior margin of the small triangular posteroventral sclerite a dark brown. Note that of the characters given in couplet 1 in the revised key offered by Murray & Fittkau (1985), only the AR of 6 and the length/width of the basal sclerotized area of the antennal blade may be useful to separate *Thienemannimyia* larvae from those of *Hayesomyia* or *Meropelopia* in the material that I've examined.

Larvae of *Thienemannimyia* are recorded from creeks, streams and rivers.

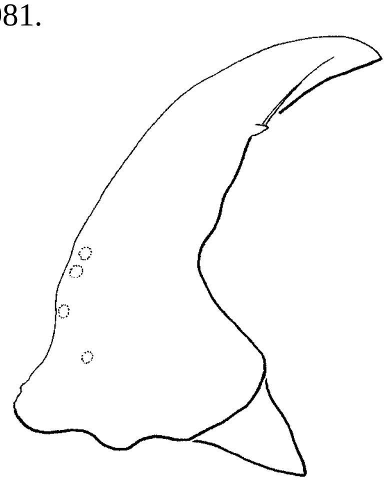
ADDITIONAL REFERENCES: Roback 1971, 1981.



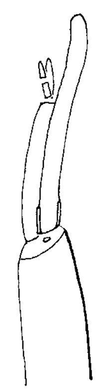
maxillary palp



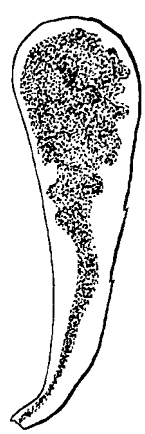
ligula and paraligula



mandible



antennal apex



pupal thoracic horn

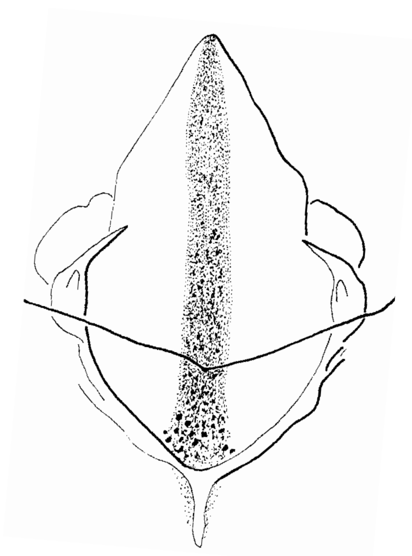
Genus *Trissopelopia*

DIAGNOSIS: This genus is distinguished by the long, slender basal segment of the maxillary palp, with ring organ near middle; apicomedial margin of dorsomentum produced as a single fine point; long, slender mandible; procercus 2.5-3.5 times as long as wide; basal outer margin of some posterior parapod claws flattened as a lamella; and lack of a setal fringe.

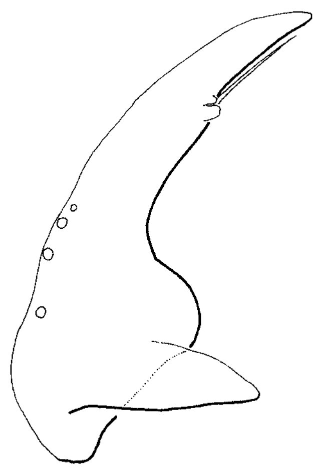
NOTES: One species, *T. ogemawi*, is known from the eastern United States; in the Southeast, it has been recorded from Georgia and both Carolinas.

Larvae are usually found in seeps, springs and cool streams.

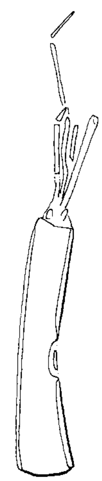
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971.



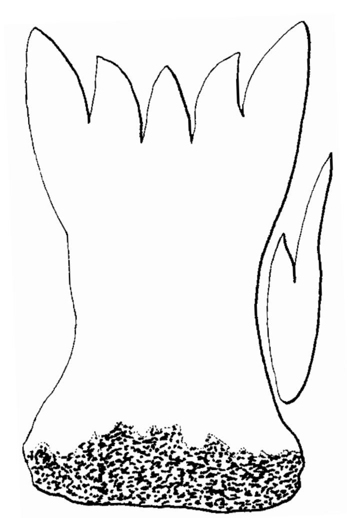
mentum and M appendage



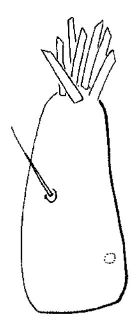
mandible



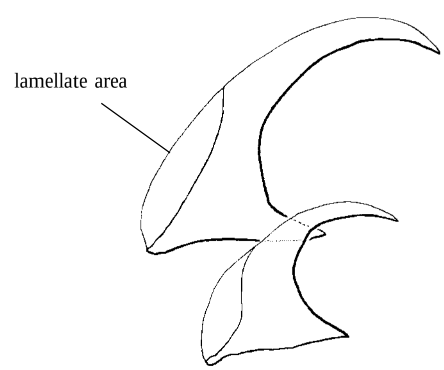
maxillary palp



ligula and paraligula



procercus
(anal setae abbreviated)



posterior parapod claws

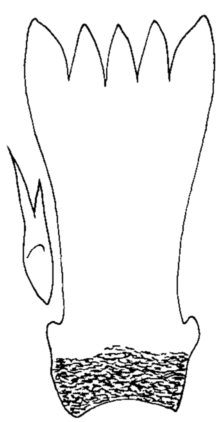
Genus *Zavrelimyia*

DIAGNOSIS: This genus may be distinguished by the lack of well developed dorsomental teeth; maxillary palp with ring organ 0.52 or more from base; basal segment of maxilla about 4 times as long as wide; ligula usually with small lateral projections near base; mandible with large basal tooth; AR 2.4-3.4; one small claw on each posterior parapod usually (some taxa lack this claw) with an inner tooth; and body lacking a setal fringe. See also *Reomyia*.

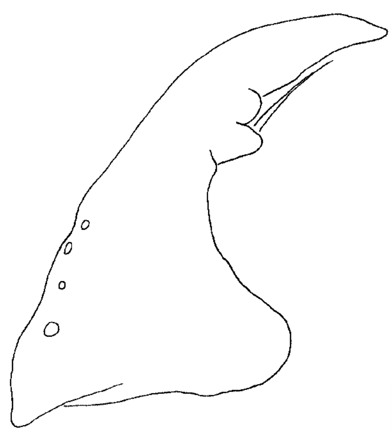
NOTES: Caldwell et al. (1997) list three taxa for the Carolinas; however, *Z. sinuosa* and *Z. thryptica* both apparently represent species complexes. *Zavrelimyia* is in great need of taxonomic revision; it will be difficult to determine how many species are present in the Carolinas until such a revision is completed. The situation is further complicated by the presence of at least one species that conforms to the closely related genus *Reomyia* in the Southeast; larvae of the two genera are very difficult to separate, but ***may*** be distinguishable by the position of the ring organ of the maxillary palp, which is closer to the base in *Reomyia* (see *Reomyia*). The inner tooth found on a small claw of the posterior parapod, long considered a key character for identifying *Zavrelimyia* larvae, is absent in *Z. bifasciata* and some *Z. thryptica* complex specimens; this inner tooth also may be present or absent in *Reomyia*.

Zavrelimyia larvae are found in springs, spring-fed streams and pools, and the littoral zone of lakes; they are relatively common in streams and rivers throughout North Carolina. I've collected and reared larvae of the *Z. sinuosa* complex from amphibian egg masses in a bog in Maine.

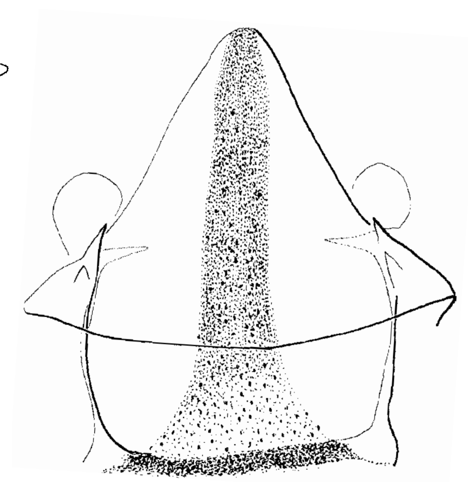
ADDITIONAL REFERENCES: Kowalyk 1985; Roback 1971.



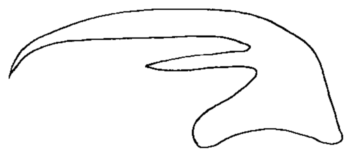
ligula and paraligula



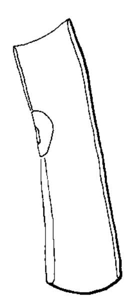
mandible



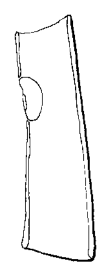
mentum and M appendage



small claw of posterior parapod



Z. sinuosa complex, basal segment of maxillary palp

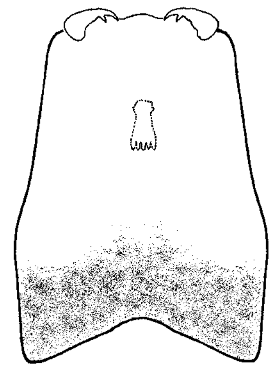


Z. thryptica complex, basal segment of maxillary palp

Preliminary key to *Zavrelimyia* larvae of the southeastern United States

1 Posterior 1/4 of head capsule dark brown .... **Z. sp. A**

1’ Head capsule basically unicolorous 2

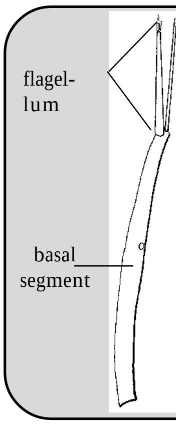


2(1’) Larger, head capsule length about 0.83 mm; AR 3.17; small claw of posterior parapod without inner tooth .... ***Z. bifasciata***

2’ Smaller, head capsule length 0.62-0.64 mm; AR less than 3.05; small claw of posterior parapod with or without inner tooth 3

3(2’) AR 2.42-2.68 .... ***Z. thryptica* complex**

3’ AR 2.70-3.04 .... ***Z. sinuosa* complex**



AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

Notes on species

Z. bifasciata - Apparently the largest species of *Zavrelimyia* in the eastern United States. Caution must be used in identifying this larva, because the data above are based on a single reared specimen from Ohio. AR 3.17, ring organ 0.54 from base.

Z. sinuosa complex - Apparently a complex of species (B. Bilyj, pers. comm.). Note that the two complexes are based on adult characters and may not correlate with larval characters, although there seems to be a range in the small sample of reared material examined. This “range” could disappear with more rearings!

Z. thryptica complex - This complex is more common than the *sinuosa* complex in the South. See the *sinuosa* complex above.

Z. sp. A - Based on a few unassociated larvae from North Carolina; AR 2.43-3.10, ring organ 0.56-0.59 from base. This taxon may belong to the *Z. sinuosa* complex, but is easily recognized by the head capsule coloration.

NOTES

SUBFAMILY
DIAMESINAE 5

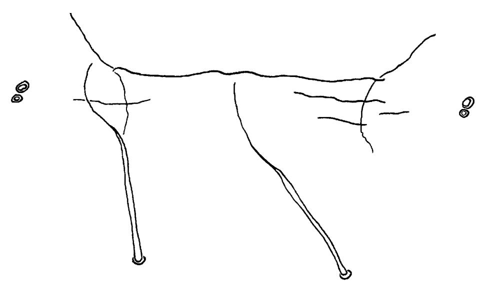
DIAGNOSIS: Antennae 5 segmented, 3rd segment annulated in Southeast US genera. **Labrum** with simple S setae (S III may be bifid). Labral lamellae present, may be obscure. Premandibles present. **Mentum** with 0 to more than 15 teeth; ventromental plates present, may be vestigial; beard absent. **Prementum** with setose median ligula and pair of paraligulae, appearing as 3 brushes. **Body** with well developed anterior and posterior parapods. Procerci present, vestigial or absent. Anal tubules present.

NOTES: Members of this subfamily tend to be, in general, cool-adapted, flowing water inhabitants, but some are also found in springs and lakes. Two additional diamesine genera that have not been found in the southeastern US, and are not included in the key below, are *Boreoheptagyia* and *Protanypus*. Serra-Tosio (1989) noted that the New York record for *B. lurida* (Garrett) was an error; this species apparently does not inhabit the eastern US. The larva is distinctive, with several tubercules on the head, patterned body and circular groups of spines on the posterior parapods. *Protanypus* is also distinctive with 4-segmented antennae (no annulate 3rd segment) and a head capsule beset with numerous short setae (see Sæther 1975b).

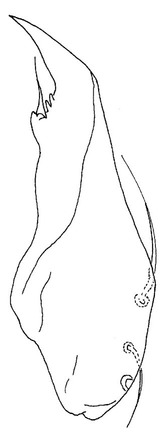
Key to the genera of larval Diamesinae of the eastern United States

1 Mentum without teeth; mandible without seta interna .... ***Potthastia*** (in part, *longimana* group)

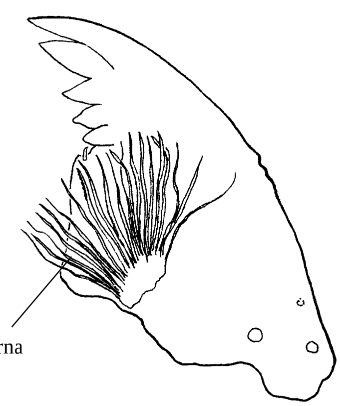
1' Mentum with teeth (may be hidden below ventromentum); mandible with well developed seta interna 2



Potthastia lomgimana mentum



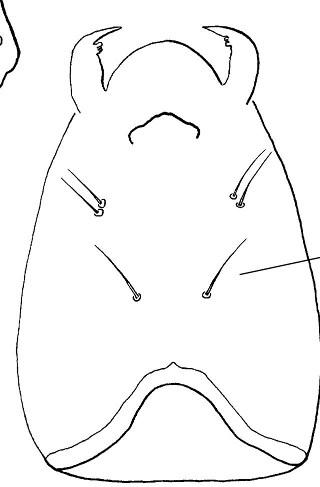
P. longimana mandible without seta interna



Diamesa mandible

2(1') Setae submenti displaced posteriorly, closer to postocciptal margin than mentum .... ***Pagastia***

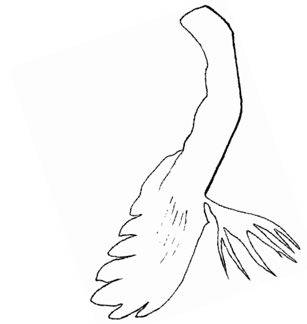
2' Setae submenti in normal position, closer to mentum than postoccipital margin 3



3 (2') Premandible apically simple, with at most 1-4 small inner teeth 4

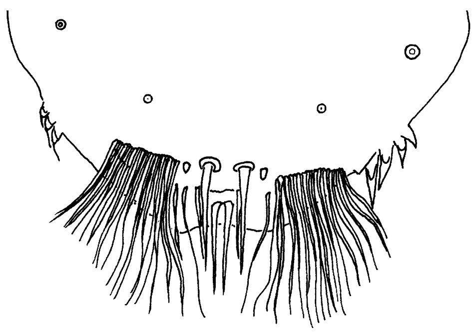
3' Premandible with numerous apical, preapical or inner teeth 7

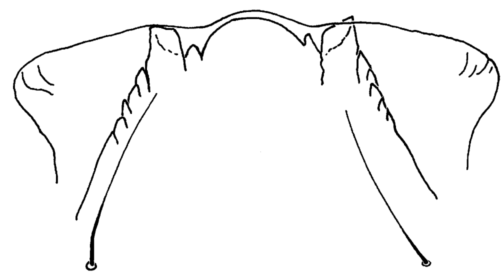
apically simple premandibles



premandible with multiple inner teeth

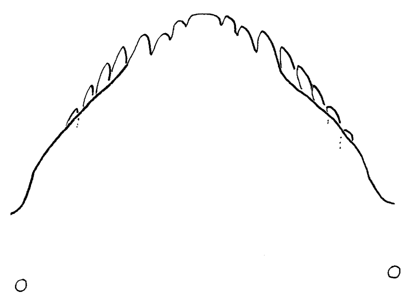
4(3) Labrum with numerous long, thin lamellae; teeth of mentum usually completely covered by ventromentum; mentum with broad ventromental plates .... **Diamesinae genus P**

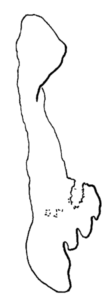




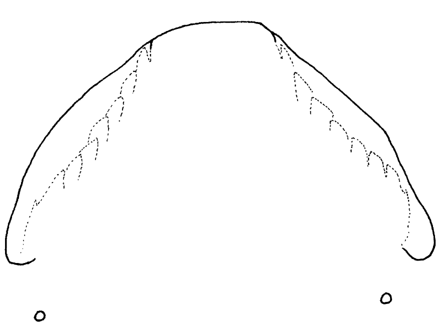
4' Labrum with various chaetae and lamellae, never almost completely covered by lamellae; if mental teeth covered by ventromentum, ventromental plates not as above 5

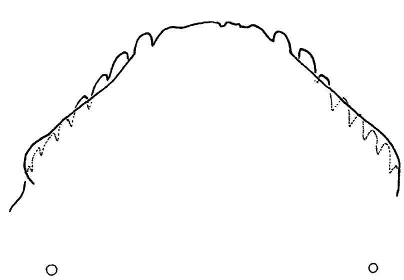
5(4') Median tooth of mentum about 2-3 times width of first lateral teeth; premandible with 3-4 inner teeth .... ***Lappodiamesa***
(not known from the Carolinas)

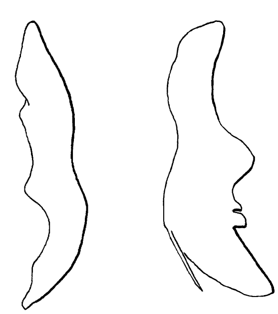




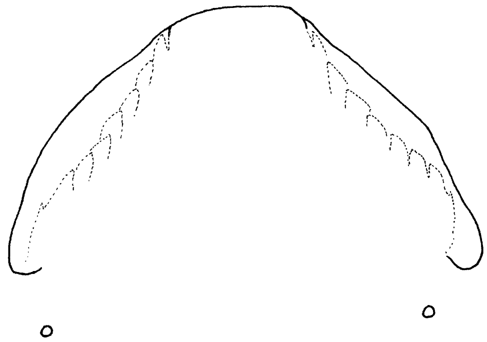
5' Median tooth of mentum 3 to more than 5 times greater than width of first lateral tooth, or median tooth weakly bilobed, premandible with 1-2 inner teeth, or none 6



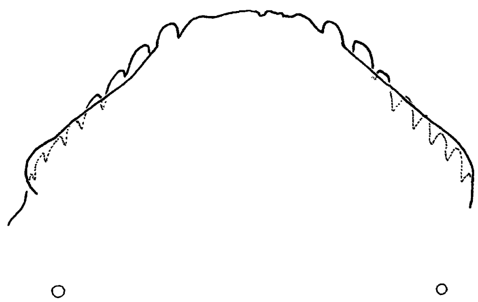


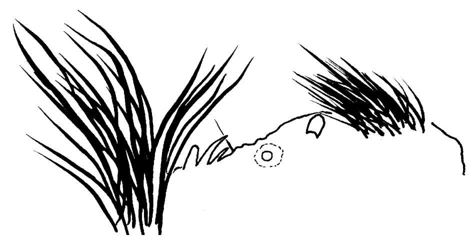


6(5') Median tooth of mentum at least 5X width of first lateral tooth; galea of maxilla with row of about 5-7 peg-like lamellae in addition to setae-like lamellae .... ***Potthastia*** (in part, *gaedii* group)

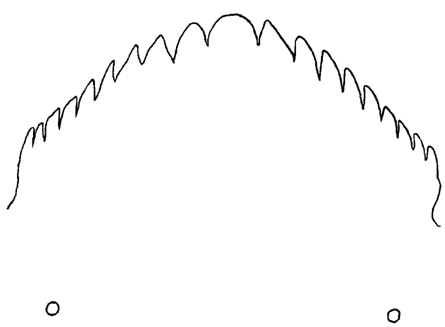


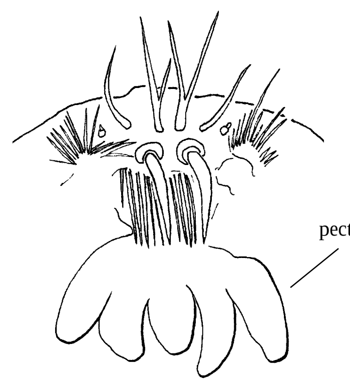
6' Median tooth of mentum less than 4X width of first lateral tooth, or median tooth weakly bilobed; maxilla with galea bearing mostly setae-like lamellae .... ***Sympotthastia***



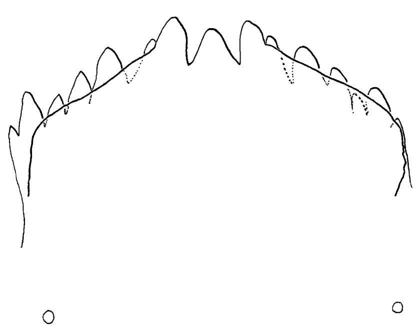


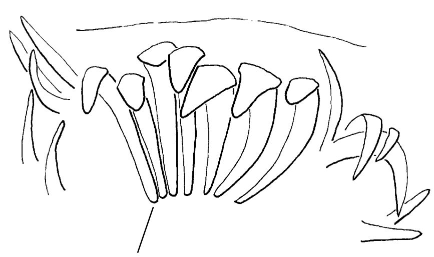
7(3') Mentum with median teeth subequal; pecten epipharyngis with 5 scales; procercus vestigial, at most a small sclerotized ring, bearing 4 (usually) anal setae .... ***Diamesa***





7' Mentum with 3 large triangular median teeth; pecten epipharyngis with 7 or more scales/spines; procercus well developed/sclerotized, with 5-9 anal setae .... ***Pseudodiamesa***
(not known from the Carolinas)





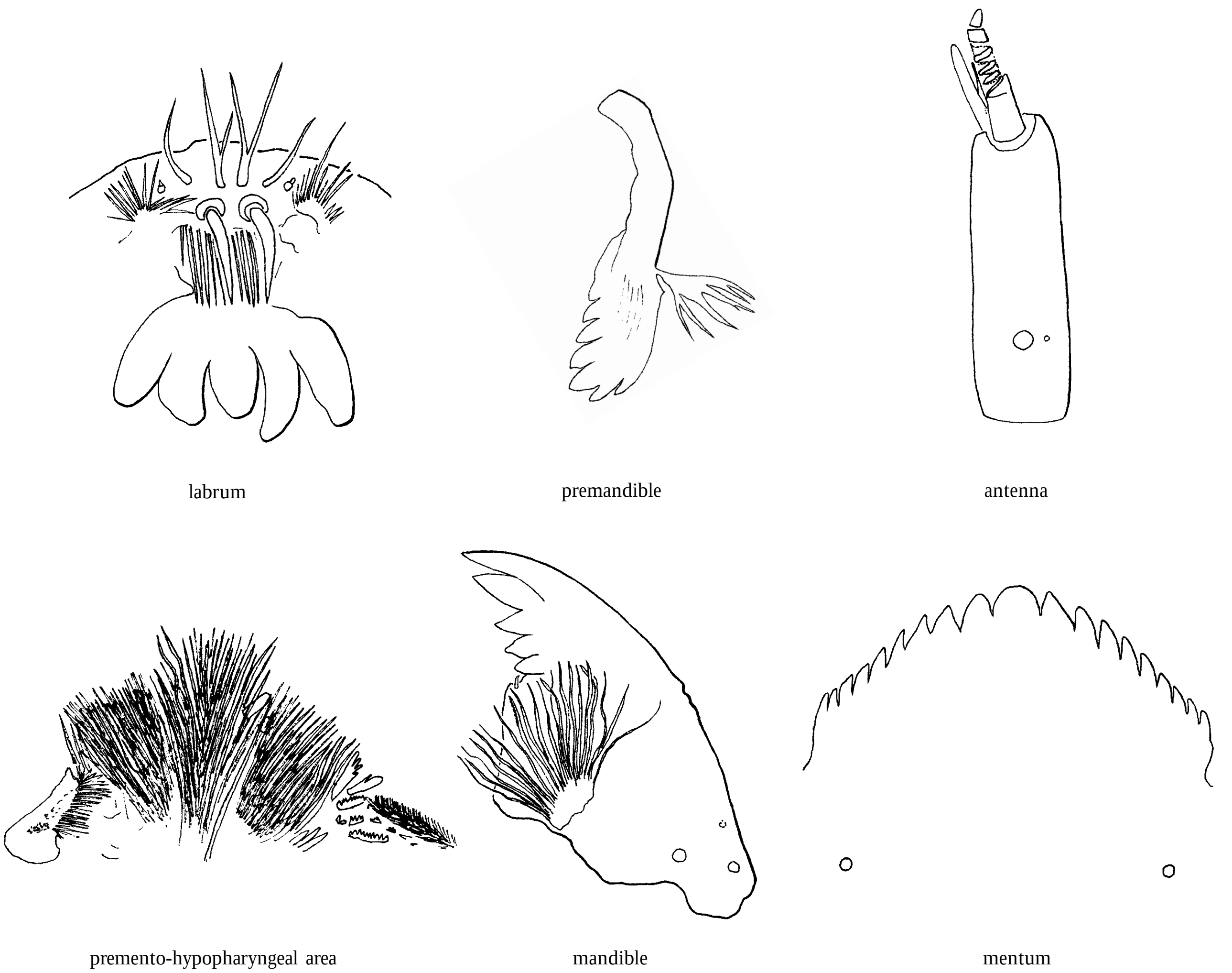
Genus *Diamesa*

DIAGNOSIS: The pecten epipharyngis with 5 scales; premandible with 5 or more teeth and a branched lateral spine; mentum with more than 15 teeth; and vestigial to reduced procerci will distinguish eastern Nearctic members of this genus.

NOTES: Caldwell et al. (1997) list two species of *Diamesa* for the Southeast, utilizing records of adult specimens. Based on a limited amount of larval material, none of it associated with adults, there appear to be at least three species of *Diamesa* in the Carolinas. Each of these taxa may represent more than one species. In the following key *Diamesa* sp. B is probably *D. nivoriunda*, but without associated adult specimens identification remains tentative.

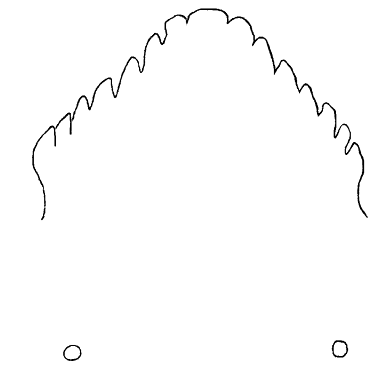
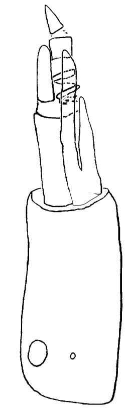
Diamesa larvae are usually found in cool running water. Hudson et al. (1990) noted that *D. nivoriunda* tolerates high turbidity and siltation.

ADDITIONAL REFERENCES: Doughman 1983; Hansen & Cook 1976; Makarchenko 1986.

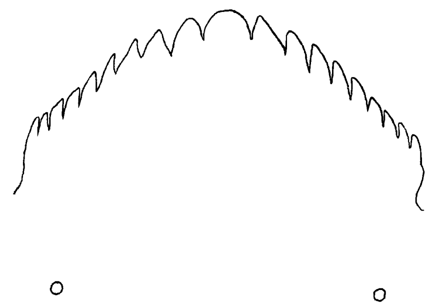
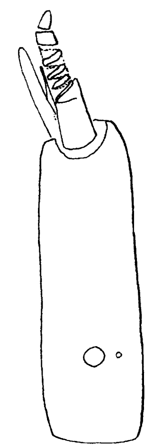


Diamesa larval structures

Key to *Diamesa* larvae of the Southeast United States

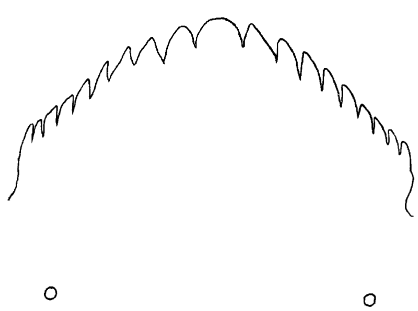



1 Head capsule very dark brown, almost as dark as postocciput; basal segment of antenna subequal to length of flagellum; mentum more strongly arched .... ***D*. sp. C**

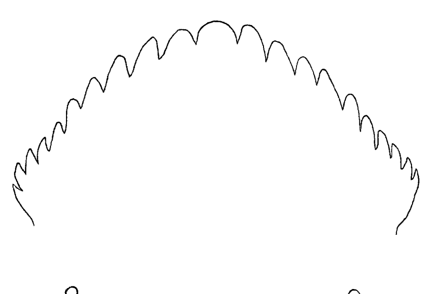



1’ Head capsule light brown to brown, postocciput much darker than remainder of head capsule; basal segment of antenna about twice as long as flagellum; mentum not as strongly arched 2

2(1’) S III bifid; mentum with 17-19 teeth .... ***D*. sp. B**



Diamesa sp. B mentum



2’ S III simple; mentum with 19-21 teeth .... ***D*. sp. A**

Diamesa sp. A mentum

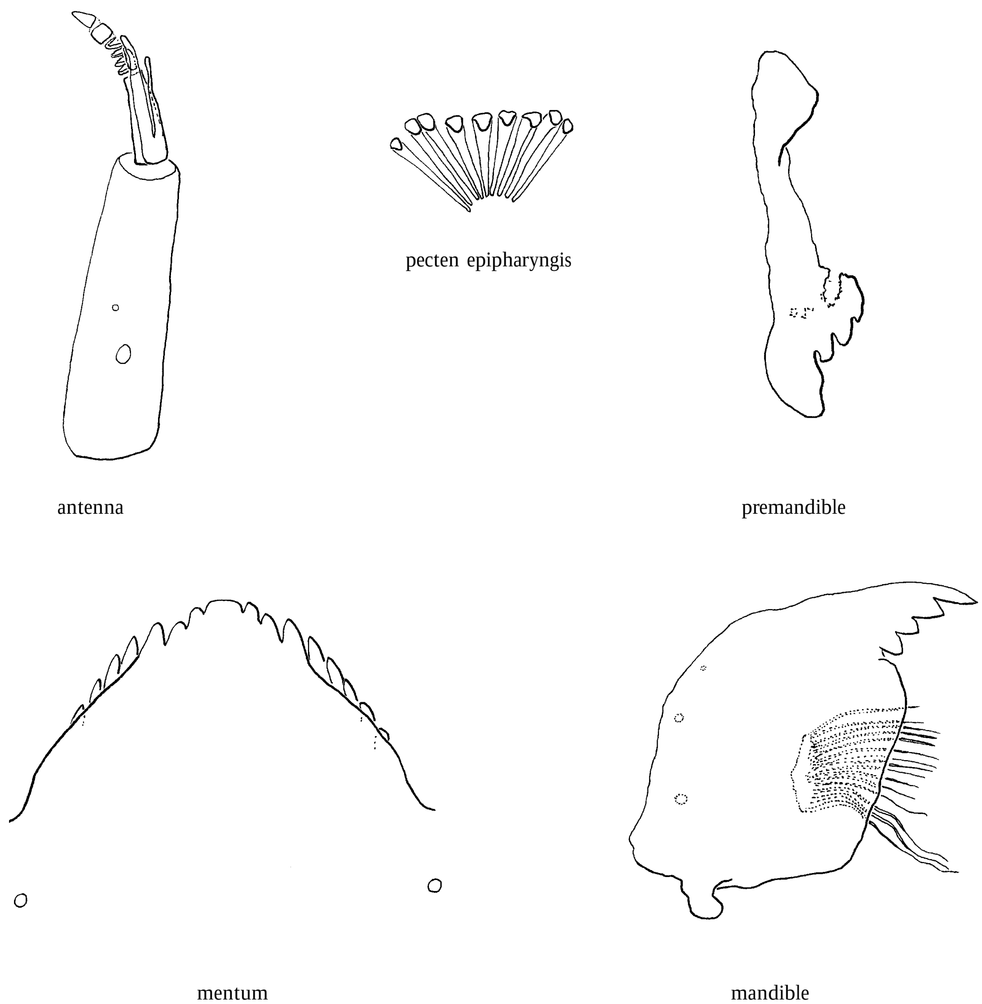
Genus *Lappodiamesa*

DIAGNOSIS: The 7-9 scaled pecten epipharyngis; premandible with simple apical tooth and 3-4 smaller inner teeth; mentum with convex median tooth flanked by smaller lateral teeth; and well developed procerci serve to distinguish this genus.

NOTES: This genus has not yet been found in the Carolinas, but the occurrence of *L. boltoni* Sæther & Willassen in Ohio indicates that this taxon may eventually be found in the SE US. In Ohio, M. Bolton (pers. comm.) found the species in shallow vernal woodland runs and pools.

Although Sæther & Willassen (1988) described the pecten epipharyngis with 7 scales, two larvae I've examined appear to possess 9 scales in the pecten epipharyngis.

ADDITIONAL REFERENCES: Sæther & Willassen 1988.



Lappodiamesa boltoni larval structures

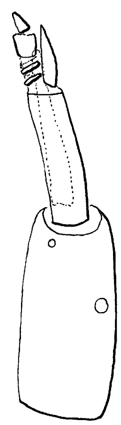
Genus *Pagastia*

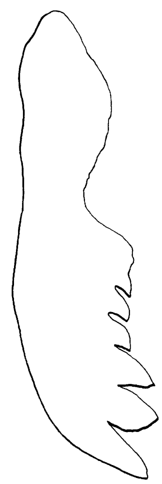
DIAGNOSIS: The mentum, with teeth almost completely coverd by the ventromentum; and the posteriorly displaced setae submenti will distinguish this genus from other eastern US diamesines.

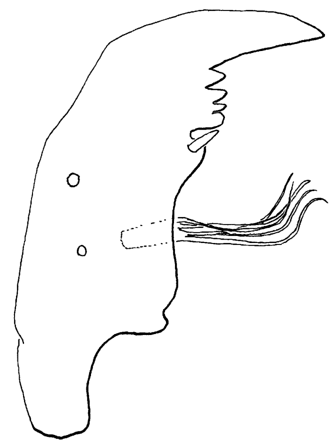
NOTES: One species, *P. orthogonia*, is known from the Southeast US. It occurs mainly in mountain streams, but also has been found in springs.

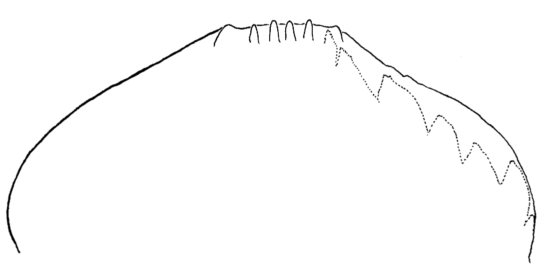
The teeth of the mentum are often difficult to discern because of the dark coloration of the ventromentum; note also the distinctive mandible of *P. orthogonia* (which is similar to that of the western Nearctic species *P. sequax* (Garrett)).

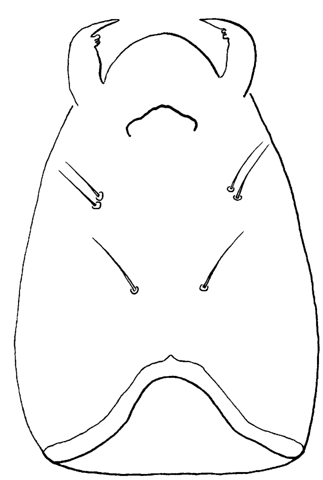
ADDITIONAL REFERENCES: Makarchenko & Makarchenko 2000; Oliver & Roussel 1982.


antenna


premandible


mandible


mentum


head capsule

Pagastia larval structures

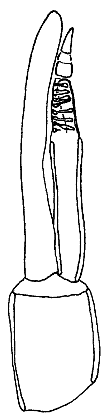
Genus *Potthastia*

DIAGNOSIS: Two larval types are included in this genus: the *longimana* group is characterized by the premandible with broad apex bearing numerous teeth; the complete absence of teeth on the mentum; and mandible without a seta interna. The *gaedii* group is characterized by the simple premandible, with no inner teeth; mentum with median tooth 5 or more times the width of first lateral tooth; maxilla with galea bearing about 5 peg-like lamellae. Both larval types have well sclerotized procerci.

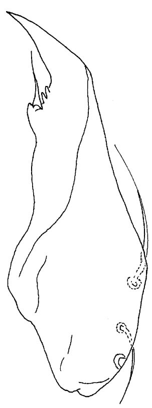
NOTES: Three species of *Potthastia* are found in the Southeast US; *P. longimana* appears to be the commonest and most widespread. It appears that our Nearctic representative of the *longimana* group is *P. longimana*. However, I am not convinced that the two species of the *gaedii* group found in the SE US are conspecific with the Palaearctic species *P. gaedii* and *P. montium*. I have seen reared males of a species which is close to *P. montium*, but with slightly different genitalia. I've also examined a NC male that appears similar to *P. gaedii*, but is slightly different; it bears a determination label by Sæther that reads "n. sp. nr. *gaedii*". Examination of more reared material from both the Nearctic and Palaearctic will be necessary to confirm identifications.

Note also that Oliver (1983) described the premandible of *gaedii* group larvae as being simple, with the lateral spine absent. However, the premandible of *P.* cf. *montium* bears a thin lateral spine, as figured below and by Doughman (1985a: fig. 30).

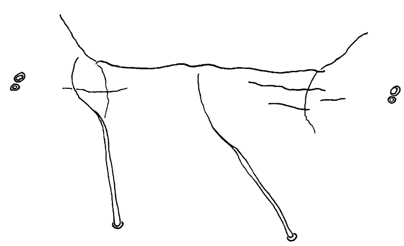
ADDITIONAL REFERENCES: Doughman 1985a.



P. longimana antenna

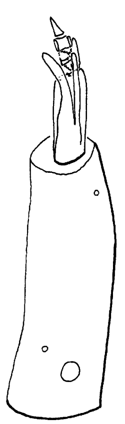


P. longimana mandible



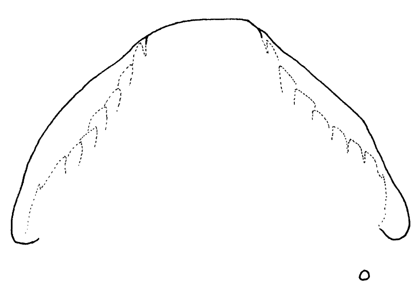
P. longimana mentum

P. cf. *montium* maxilla

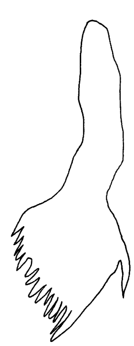


P. cf. *montium* antenna

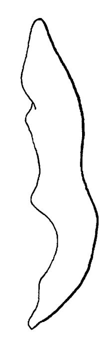
P. cf. *gaedii* mandible



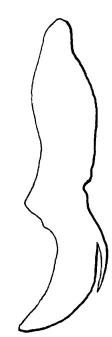
P. cf. *gaedii* mentum



P. longimana premandible



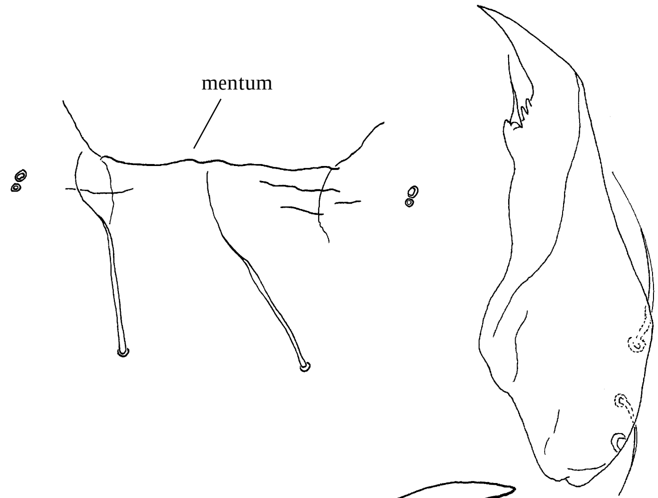
P. cf. *gaedii* premandible



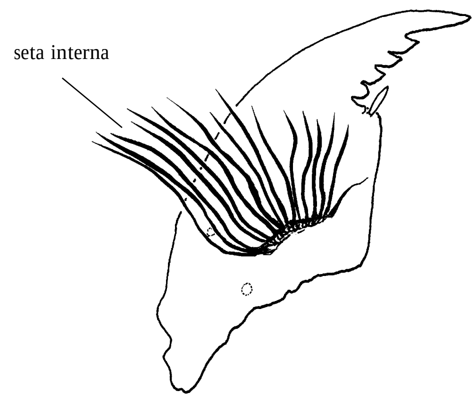
P. cf. *montium* premandible

Key to *Potthastia* larvae of the southeastern United States

1 Mentum without teeth; mandible without seta interna .... ***P. longimana***

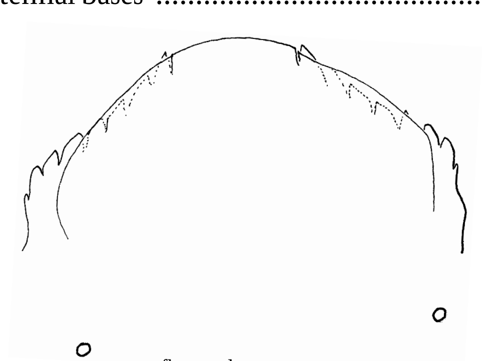


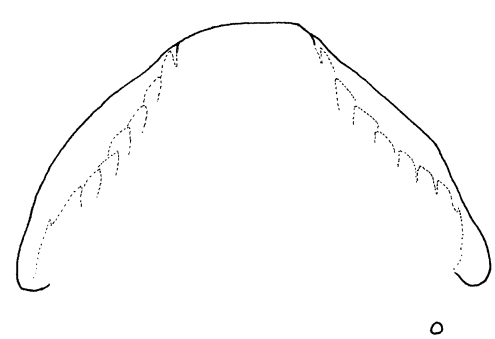
1’ Mentum with teeth; mandible with seta interna 2



2(1’) Median tooth of mentum as dark as lateral teeth; an irregular dark spot present between bases of antennae .... ***P.* cf. *montium***

2’ Median and first lateral teeth of mentum lighter than remaining teeth; no spot present between antennal bases .... ***P.* cf. *gaedii***


flattened mentum


unflattened mentum

Genus *Pseudodiamesa*

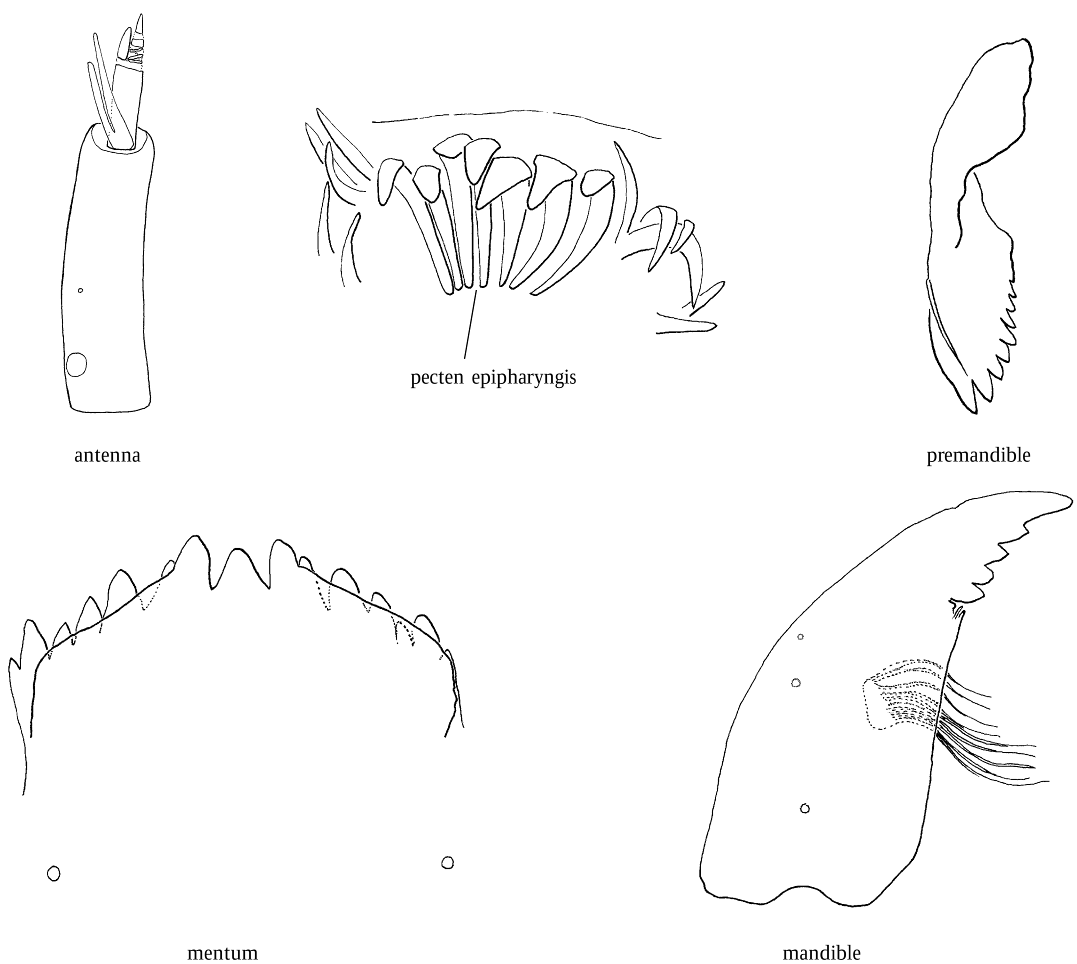
DIAGNOSIS: The 7-scaled pecten epipharyngis; multitoothed premandible; mentum with 3 large triangular median teeth and well developed ventromental plates (that may obscure the mental teeth); and well developed procerci identify this genus.

NOTES: *Pseudodiamesa* has not been recorded from the Carolinas. It is included here solely on the basis of a questionable record of a single larva of *Ps. pertinax* (Garrett) from a Tennessee quarry by Beck (1980); I have not examined this specimen nor seen any material of the genus from the eastern US. With the exception of Beck's record, the 3 Nearctic species of *Pseudodiamesa* are known only from the western and northern US and Canada.

Johannsen (1937a) was incorrect in stating that the larval ventromental plates (as "paralabial plates") were lacking in *Ps. pertinax*; they are present and well developed. Note that in the same publication, Johannsen also erroneously stated that ventromental plates were absent in *Sympotthastia* (as *Diamesa (Psilodiamesa)*) *fulva* (which has lead to some confusion; see *Sympotthastia*).

Larvae are known from springs, streams and lakes, including the profundal zone.

ADDITIONAL REFERENCES: Johannsen 1937a; Oliver 1959, 1976.



Pseudodiamesa pertinax larval structures

Genus *Sympotthastia*

DIAGNOSIS: This genus is distinguished by the premandible with simple apex, with 1-2 (4?) small inner teeth; maxilla with galea bearing mostly setae-like lamellae; median tooth of mentum less than 4X width of first lateral tooth, or median tooth weakly bilobed; and the well developed procerci.

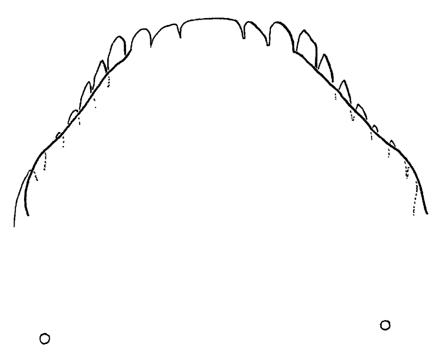
NOTES: Oliver et al. (1990) record *S. fulva* from NC and SC and *S. zavreli* from NC. However, Caldwell et al. (1997) did not accept the Carolinas record of *S. fulva* and listed *S. zavreli* "with reservations". It has not been conclusively demonstrated that NC *Sympotthastia* larvae are conspecific with the Palaearctic species *S. zavreli;* I know of no records based upon adult or pupal specimens that will corroborate Doughman's (1985b) identification of this species; thus it is treated in this manual as *S.* cf. *zavreli*.

Johannsen's (1937a) and Doughman's (1985b) descriptions of the larva of *S. fulva* are incorrect in stating that ventromental plates are absent. My examination of the allotype's larval exuviae revealed that the head capsule has been split in two and is excessively flattened. The lateral teeth of the mentum have been forced to the outside of the ventromentum, which is produced at its lateral edge as a ventromental plate.

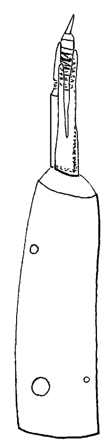
The maxilla of *Sympotthastia* may bear one or two peg-like lamellae or sensory bodies on the galea, but never the row of 4-5 peg-like lamellae found in members of the very similar *Potthastia gaedii* group.

ADDITIONAL REFERENCES: Doughman 1985b.

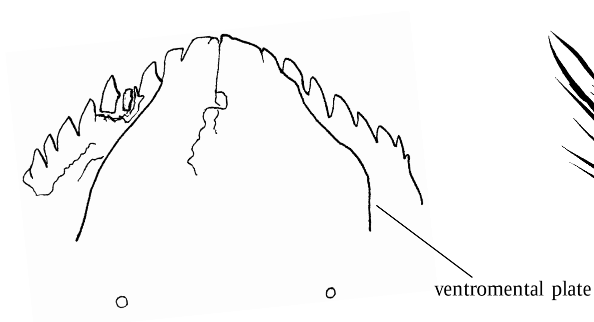
S. cf. *zavreli* mentum with worn median tooth, NC



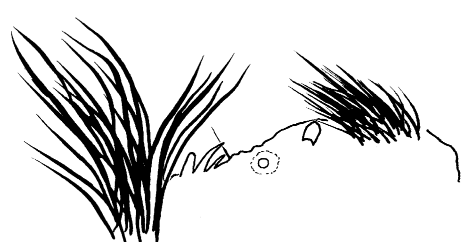
S. cf. *zavreli* mentum with intact median tooth, OH



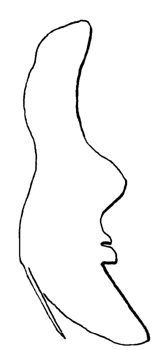
S. fulva antenna



reconstructed mentum of *S. fulva* allotype



S. cf. *zavreli* maxilla

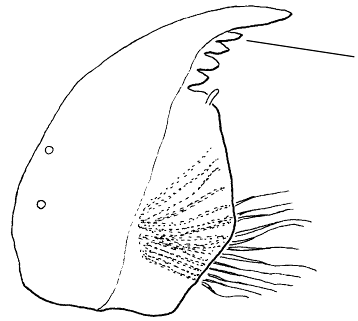


S. cf. *zavreli* premandible

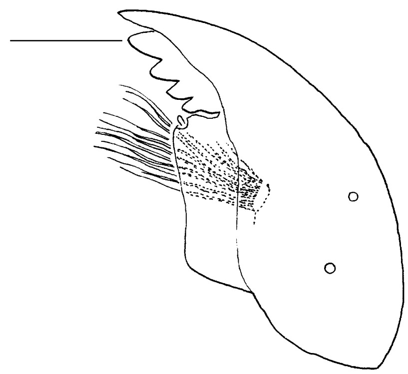
Sympotthastia spp. larval structures

Key to *Sympotthastia* larvae of the eastern United States

1 Mandible with distal inner tooth subequal to remaining inner teeth; AR about 1.50; procercal setae more than twice as long as supraanal setae .... ***S. fulva***
(not recorded from the Carolinas?)



1' Mandible with distal inner tooth larger than remaining inner teeth; AR 1.84-2.17; procercal setae 1.4-1.8 X length of supraanal setae .... ***S.* cf. *zavreli***

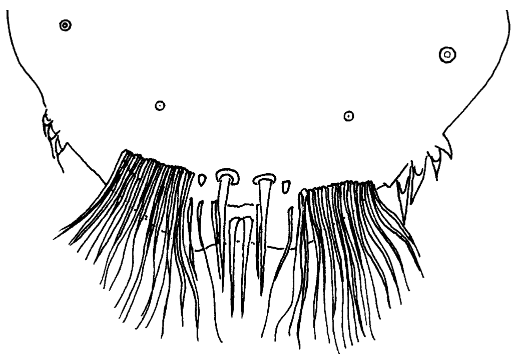


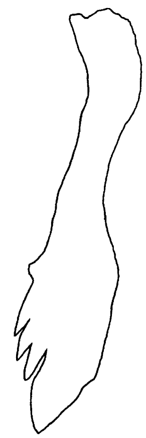
Diamesinae genus P

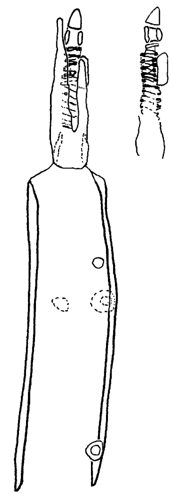
DIAGNOSIS: The labrum, with numerous long, thin lamellae; premandible with several inner teeth; mentum with 7 pairs of lateral teeth and dome-shaped median tooth, all teeth usually completely covered by ventromentum; broad ventromental plates; and well sclerotized procerci will distinguish this taxon.

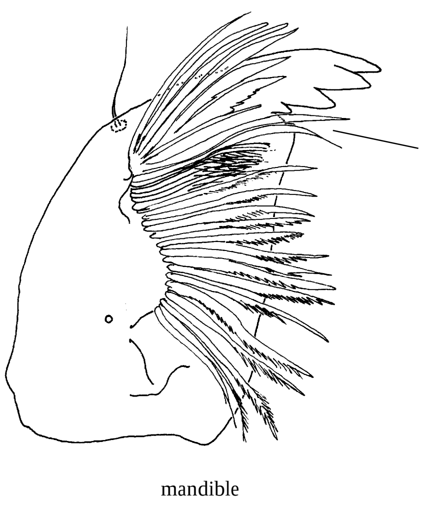
NOTES: This taxon has been reported from sand-bottomed streams in Alabama, Florida and Georgia in addition to North Carolina. Adults and pupae are unknown.

ADDITIONAL REFERENCES: Doughman 1985a.


dorsum of labrum

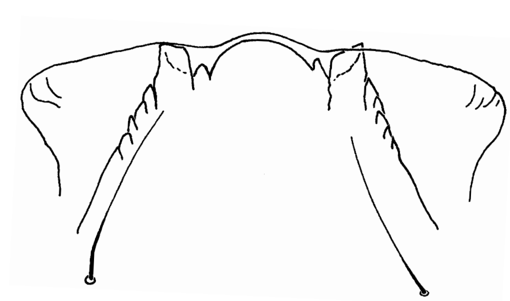

premandible


antenna




seta interna

mandible


mentum

Diamesinae genus P larval structures

NOTES

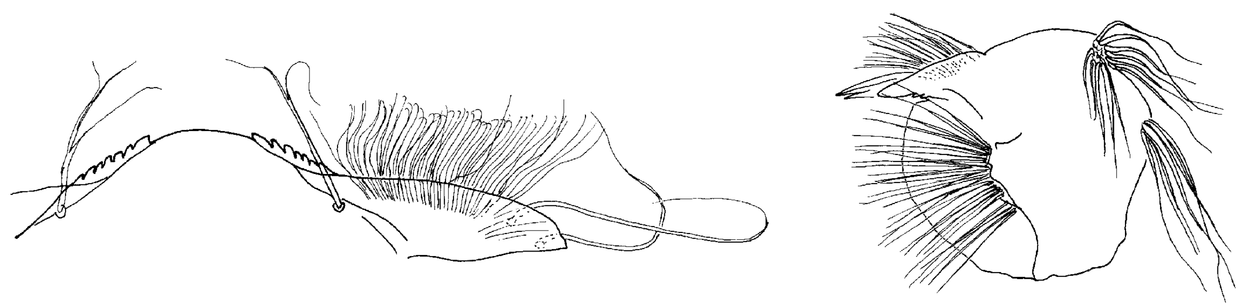
SUBFAMILY
PRODIAMESINAE 6

DIAGNOSIS: Antennae 4 segmented, not reduced; 3rd and 4th segments very small. **Labrum** with S I apically toothed or apicolaterally fringed; S II and S III simple; S IV normal or S IV A with long fringed terminal element mounted on long pedicellate base. Labral lamellae present. Premandibles present. **Mentum** with 15-18 teeth; ventromental plates large, with weak to well developed beard. **Prementum** without dense brush(es) of setae. **Body** with well developed anterior and posterior paropods, procerci and anal tubules.

NOTES: Larvae are found in freshwater habitats such as springs, streams/rivers, ponds and the littoral zone of lakes. Three genera, each with a single species, occur in the Carolinas, with the strong possibility of a fourth genus, *Monodiamesa*, also being found here eventually.

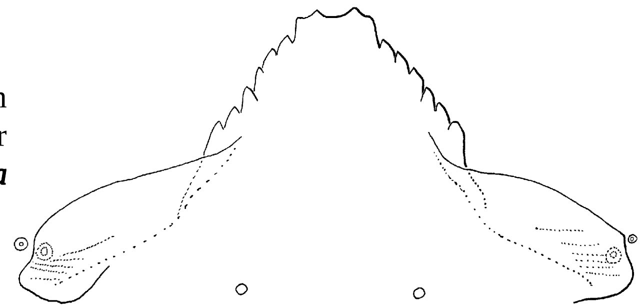
Key to the genera of larval Prodiamesinae of the eastern United States

1 Mentum with median tooth pale, single, convex; mandible inflated .... ***Odontomesa***



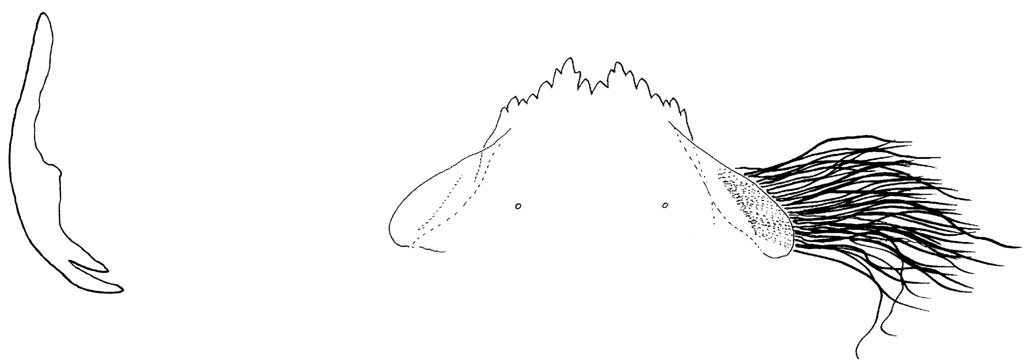
1' Mentum with median teeth dark, concave, or double; mandible not inflated as above 2

2(1’) Mentum with two projecting median teeth separated by a concave area (may not appear concave due to wear) .... ***Monodiamesa***

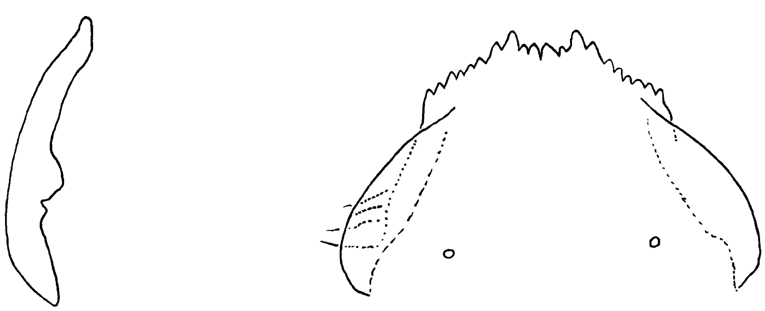


2’ Mentum with two deeply sunken median teeth 3

3(2’) Premandible apically bifid; ventromental beard well developed .... ***Prodiamesa***



3’ Premandible simple; ventromental beard weak .... ***Compteromesa***



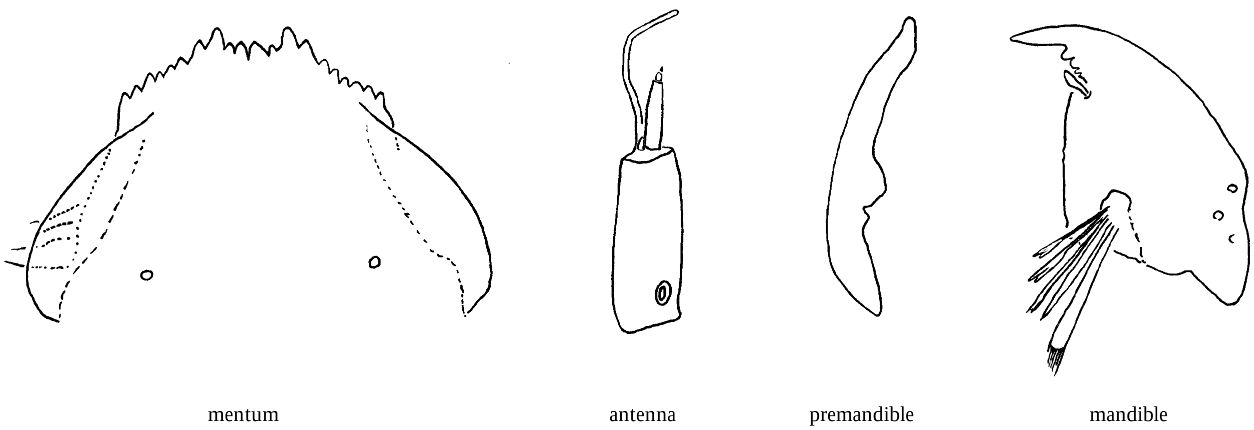
Genus ***Compteromesa***

DIAGNOSIS: This genus is distinguished by the premandible with a single apical tooth; mentum with median teeth lower than second lateral teeth; and weak ventromental beard.

NOTES: One species, *C. oconeensis*, is known from South Carolina. The immature stages are unknown. Adults have been collected near seeps and small streams in the upper Piedmont.

The immature stages of another species, *Compteromesa haradensis,* were recently described from Japan (Niitsuma & Makarchenko 1997). Larvae were collected from a bottom sample of decomposed emergent plants, in a stream flowing slowly through a rice paddy.

ADDITIONAL REFERENCES: Niitsuma & Makarchenko 1997; Sæther 1981a, 1985d.



C. haradensis larval structures
(adapted from Niitsuma & Makarchenko 1997)

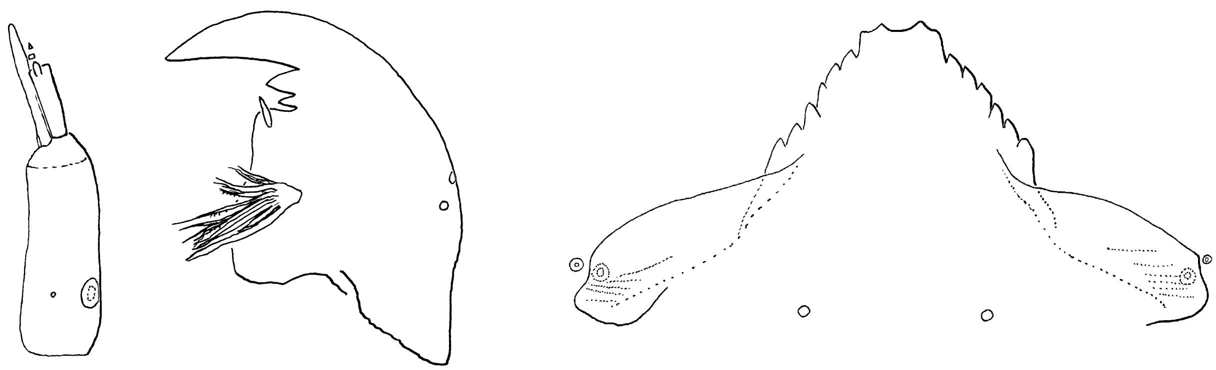
Genus *Monodiamesa*

DIAGNOSIS: Distinguished from other prodiamesines by the mentum with two projecting median teeth separated by a concave area; "normal" mandible; and weak ventromental beard.

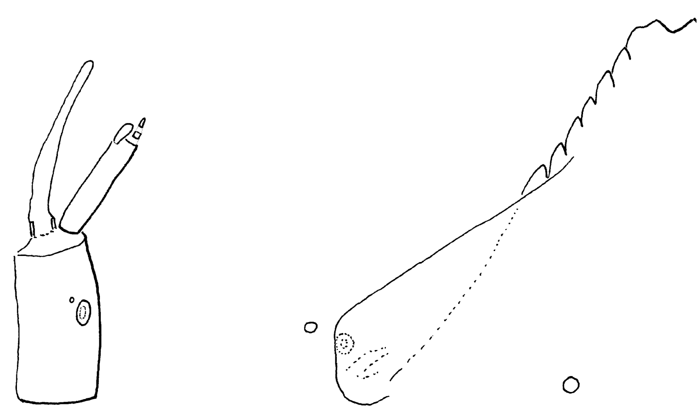
NOTES: Three species of *Monodiamesa* are recorded from the U.S. east of the Mississippi. In the Southeast, larvae have been collected in Alabama and North Carolina. Larvae of the genus are usually associated with littoral to profundal sandy substrata in mesotrophic to oligotrophic lakes; they have also been recorded from eutrophic lakes and in lotic situations.

I've examined a larva that is most probably *M. depectinata* from the Cullasaja River in the mountains of North Carolina and have also seen a larva from Mayberry Creek, Bibb Co., AL, that is probably *M. depectinata.* The Alabama specimen is apparently a 3rd instar; the basal segment of the antenna is much shorter in proportion to the second segment. The NC specimen has an AR of 1.82; the AL specimen's AR is 1.20; Sæther (1973) gives an AR of 1.39 for a 3rd instar *M. depectinata* and 2.03-2.25 for 4th instar larvae. The ventromental plates of both specimens are not concave posterolaterally, but have a generally straight outer margin.

ADDITIONAL REFERENCES: Sæther 1973.



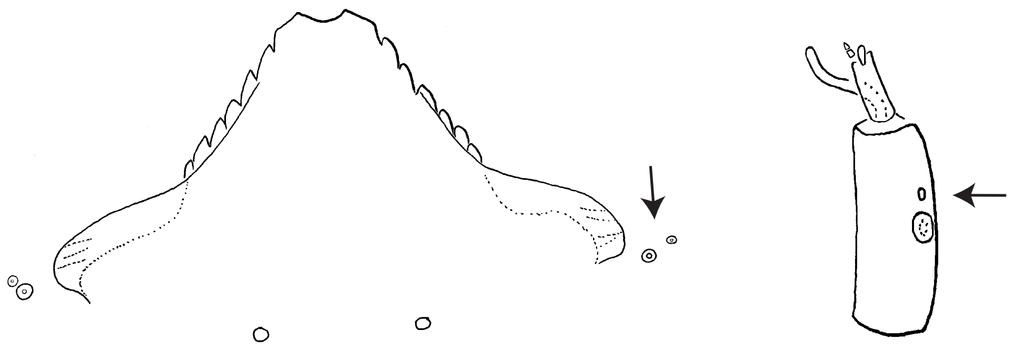
M. depectinata antenna, mandible, mentum



antenna and mentum of Alabama *Monodiamesa* specimen

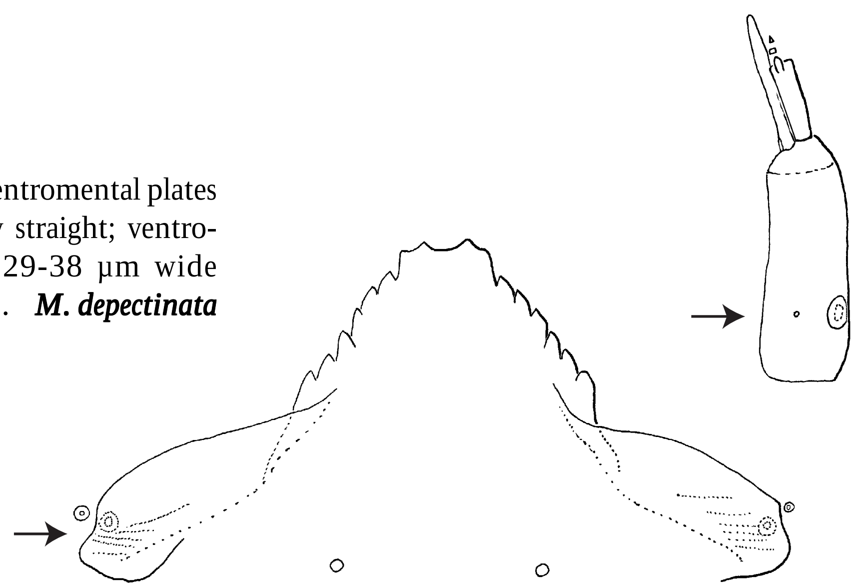
Key to *Monodiamesa* larvae of the eastern U.S.

1 Ventromental plates small and narrow; posterolateral margin of ventromental plate does not cover large genal seta; basal antennal segment with setal mark above ring organ .... ***M. tuberculata***



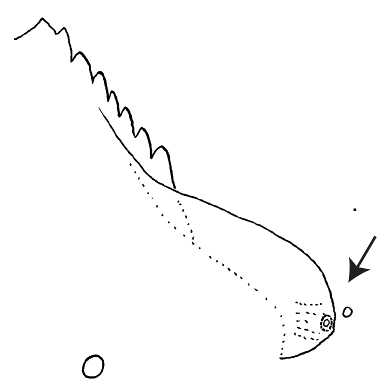
1’ Ventromental plates larger and wider; posterolateral margin of ventromental plate covers or almost covers large genal seta; basal antennal segment with setal mark at same level as ring organ 2

2(1’) Posterolateral margin of ventromental plates concave or approximately straight; ventromental plates broader, 29-38 µm wide .... ***M. depectinata***



NOTE: 4th instar larvae are necessary for accurate measurements!!

2’ Posterolateral margin of ventromental plates rounded; ventromental plates narrower, 24-26 µm wide .... ***M. bathyphila***



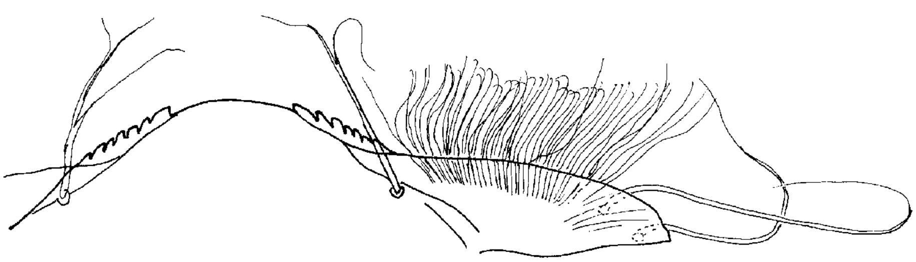
Genus *Odontomesa*

DIAGNOSIS: The unique S setae of the labrum (see illustration below); odd number of teeth on the mentum, with a single, pale convex median tooth; well developed ventromental beard and the inflated mandible will distinguish this genus.

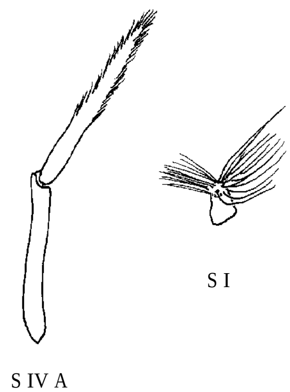
NOTES: A single species, *O. fulva*, occurs throughout the Southeast U.S. The larvae are filter feeders (Shilova 1966); they are usually encountered in sandy, lightly silted substrata in slowly flowing waters and in the littoral zone of lakes. The species is somewhat tolerant of pollution.

An additional species, *O. ferringtoni* Sæther, has been reported from Ohio (M. Bolton, pers. comm.). The larva can be separated from *O. fulva* by the basal external seta of the mandible: in *O. ferringtoni* this seta is single at the base and then split into 7-12 apical branches, while it is split to the base into 12-23 branches in *O. fulva* (see below).

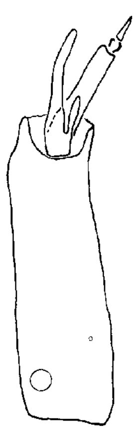
ADDITIONAL REFERENCES: Sæther 1985a; Shilova 1966.



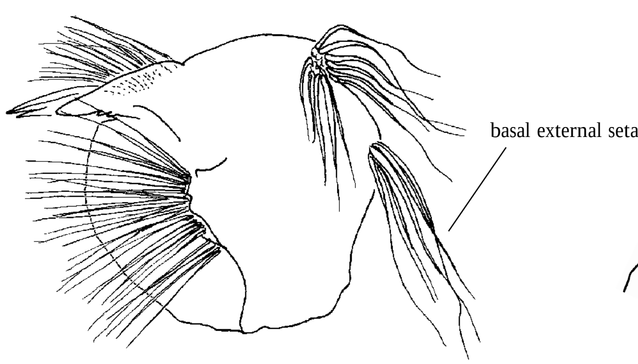
O. fulva
mentum



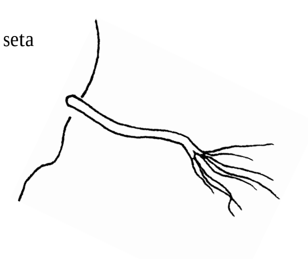
O. fulva labral setae



O. fulva
antenna



O. fulva
mandible



O. ferringtoni
basal external seta

O. fulva
premandible

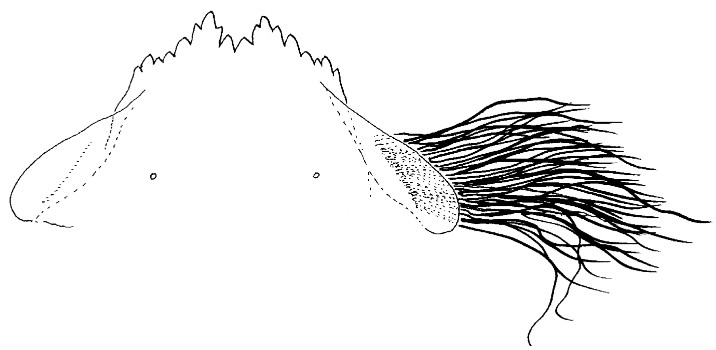
Odontomesa larval structures

Genus ***Prodiamesa***

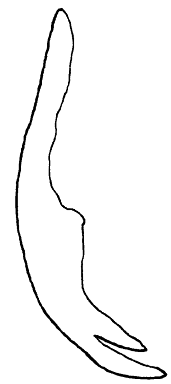
DIAGNOSIS: The simple S setae; apically bifid premandible; mentum with 14 dark teeth (18 apparent teeth if accessory teeth on first lateral teeth are counted) with the median 2 teeth deeply recessed; and "normal" mandible will distinguish this genus from *Odontomesa*. As in *Odontomesa*, the ventromental beard is well developed.

NOTES: A single species, *P. olivacea*, is recorded from the Carolinas and Georgia. Larvae inhabit springs, streams and rivers, ponds and the littoral zone of lakes; they are moderately tolerant of pollution.

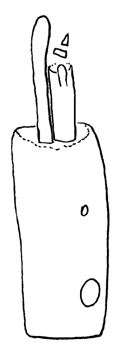
ADDITIONAL REFERENCES: Sæther 1985d.



mentum



premandible



antenna

mandible

P. olivacea larval structures

NOTES

SUBFAMILY
ORTHOCLADIINAE 7

DIAGNOSIS: **Antennae** with 3-7 segments; may be strongly reduced or may be longer than head capsule. **Labrum** with S I variable (simple, bifid, branched, serrated, palmate or plumose); S II usually simple but may be bifid, branched, palmate or plumose; S III simple (rarely bifid); S IV normal. Labral lamellae present or absent. **Mentum** usually well sclerotized, with several to more than 25 teeth; ventromental plates absent/vestigial to very large, without striae (occasionally with ridges in *Nanocladius*); beard present or absent. **Prementum** variably developed but never with dense well developed median brush of setae. **Body** with anterior parapods (sometimes reduced and/or fused); with posterior parapods well developed, separate or fused, or parapods reduced or absent. Setal fringe, setal tufts or long setae sometimes present. Anal tubules normally present, may be reduced or absent/vestigial.

NOTES: One of the most diverse of the chironomid subfamilies; orthoclad larvae are found in an amazing variety of habitats, running the gamut from terrestrial (corn fields, dung, greenhouses, leaf litter in hardwood forests) to seeps, springs, streams, rivers, ponds and lakes in freshwater, and coastal estuarine and littoral marine areas. Most larvae are scrapers, shredders or collectors-gatherers; some taxa are predators, some are parasites.

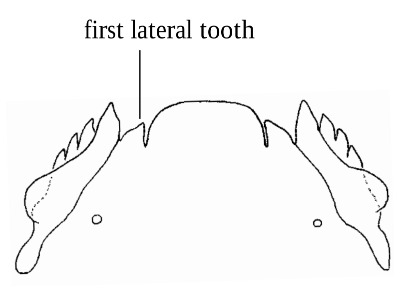
Key to the genera of larval Orthocladiinae of the southeastern United States

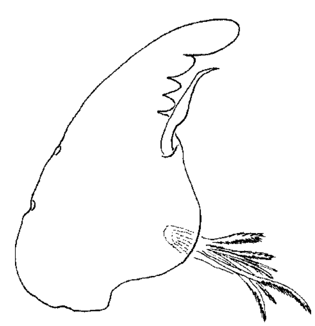
(larvae are unknown for *Apometriocnemus, Chasmatonotus, Diplosmittia, Lipurometriocnemus, Plhudsonia, Saetheriella, Sublettiella* and *Tavastia*)

1 Length of antennae at least 1/2 length of head capsule 2

1' Length of antennae less than 1/2 length of head capsule 8

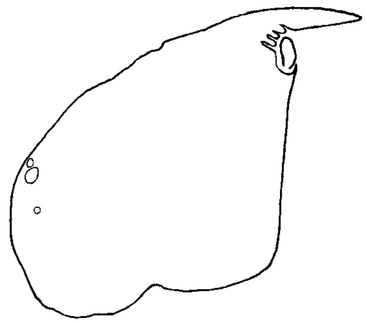
2(1) Mentum with wide, dome-like median tooth, first lateral tooth lower than median tooth and second lateral tooth; apical tooth of mandible long, rounded and expanded .... ***Heterotrissocladius*** (in part)

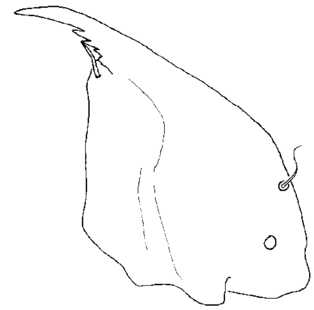




2' Mentum with bifid or trifid median tooth, or if single, not dome-like and first lateral tooth subequal to median tooth and second lateral teeth; apical tooth of mandible not as above 3

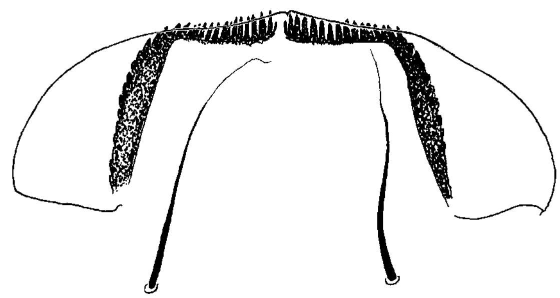
3(2') Well developed ventromental plates present (see figures in couplet 4); mandible with globose base 4



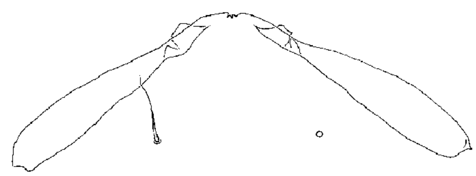


3' Ventromental plates weak or indistinguishable; mandible with normal base 5

4(3) Dorsomentum with numerous fine anterior and lateral teeth .... **Orthocladiinae sp. C**



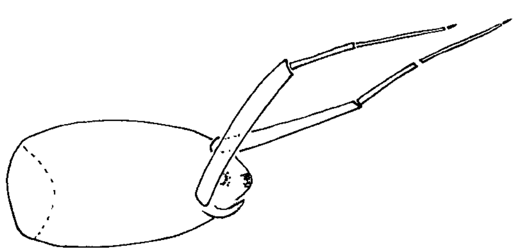
4' Dorsomentum with a few rudimentary median teeth .... ***Nanocladius*** (in part)

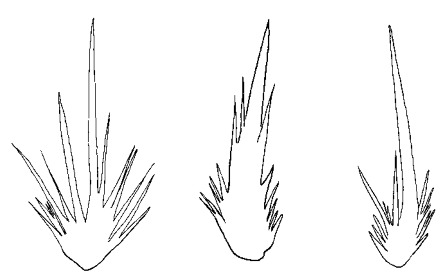


5(3') Last segment of antenna long, thin, whip-like .... ***Lopescladius***

5' Last segment of antenna short (but may have short hair-like extension, see figure couplet 7') .. 6

6(5') Antennae with 4 distinct segments and usually much longer than head; head capsule sometimes with surface sculpturing; seta at base of posterior parapod with accessory spinelets .... ***Corynoneura***

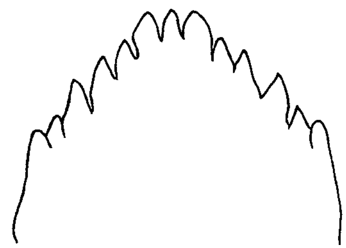


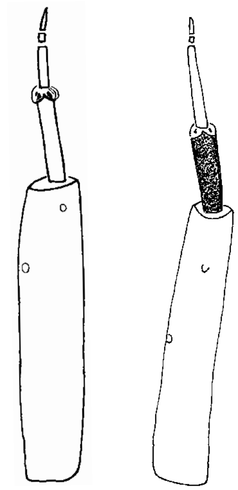


seta at base of posterior parapod of several *Corynoneura* species

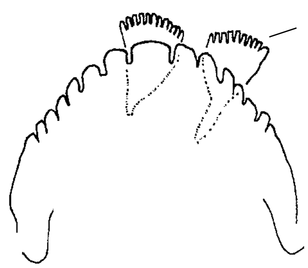
6’ Antennae with 5 distinct segments or 5-6 indistinct segments, at most as long as head, usually shorter; head capsule without surface sculpturing; seta at base of posterior parapod simple 7

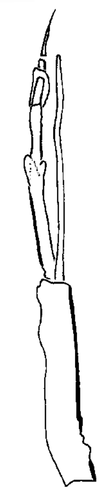
7(6’) Antennae with 5 distinct segments; mentum without a large pair of hypopharyngeal scales dorsal to it; a simple spine-like seta present at base of posterior parapod .... ***Thienemanniella***





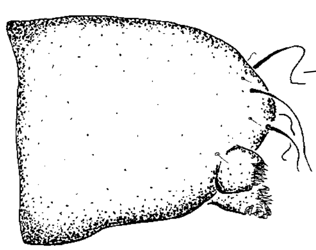
7’ Antennae with segment 2 unevenly sclerotized so that antennae may appear 6 segmented; mentum with a pair of large hypopharyngeal scales dorsal to it; no spine-like seta at base of posterior parapod .... ***Rheosmittia***

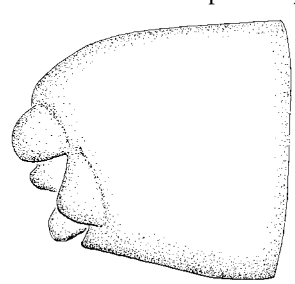


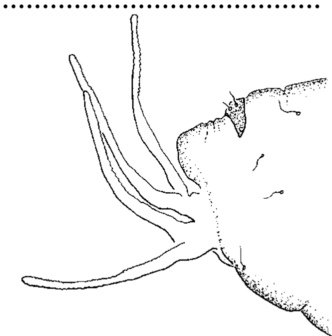


8(1’) Procerci absent, or at most a vestigial tubercle present, or if without procerci but strong anal seta present, then without anal tubules and in marine habitat 9

(most genera that will key here are marine, terrestrial/semi-terrestrial or parasitic)

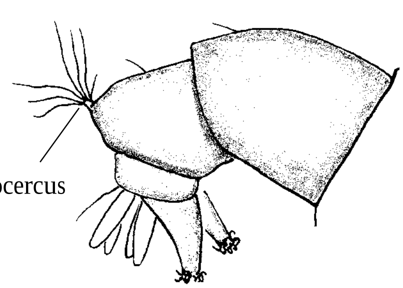


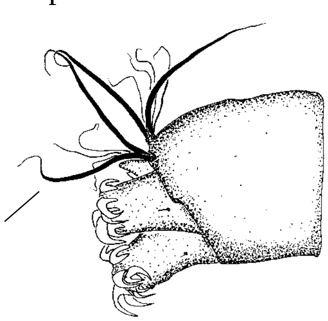




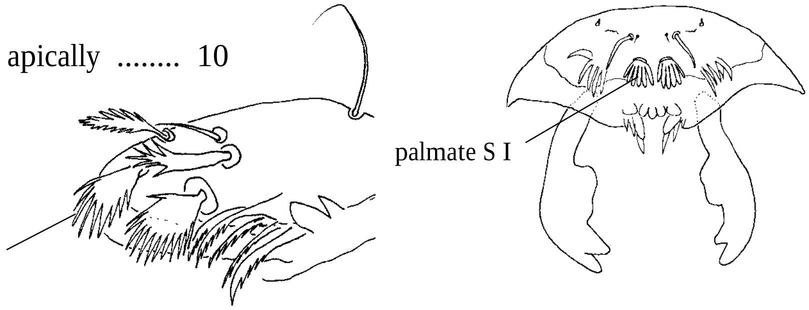
8’ Procerci present, but may be reduced - if reduced then strong anal setae present 21

(larvae found in a variety of habitats, but usually aquatic)

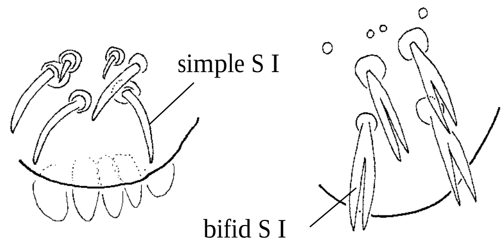




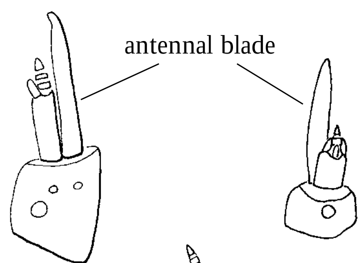
9(8) S I plumose, palmate or fringed apically 10



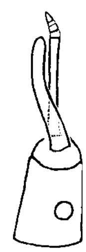
9’ S I simple or bifid (if simple, may be weakly serrate laterally 13

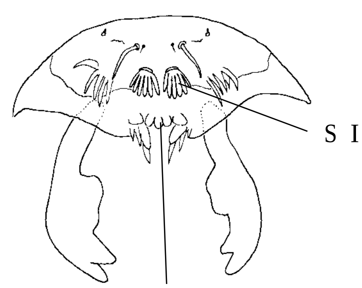


10(9) Antennal blade longer than flagellum 11



10’ Antennal blade subequal to or shorter than flagellum 12

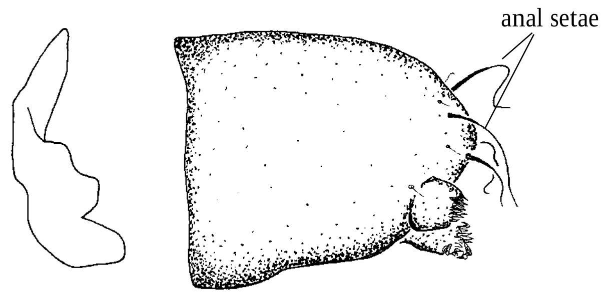




11(10) Pecten epipharyngis of 3 small scales; S I palmate .. .. ***Parasmittia***

11’ Pecten epipharyngis with about 6-8 teeth; S I coarsely pectinate .... ***Antillocladius***

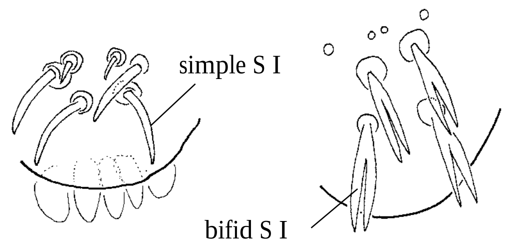
12(10') Marine; premandible apically simple; anal setae present .... ***Clunio***



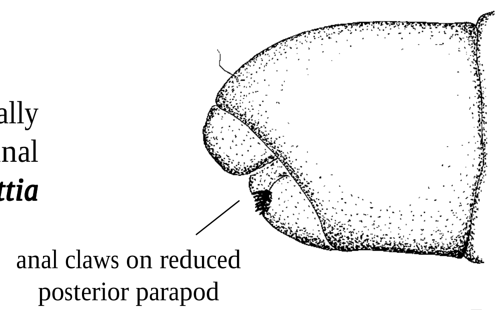
12' Not marine, but terrestrial or semi-aquatic; premandible apically bifid; no anal setae .... ***Smittia***

13(9') S I bifid 14

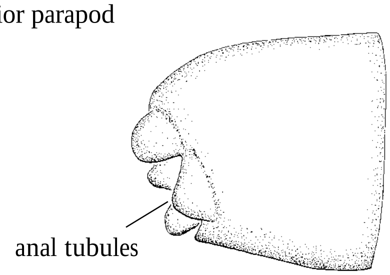
13' S I simple or weakly serrate laterally 15



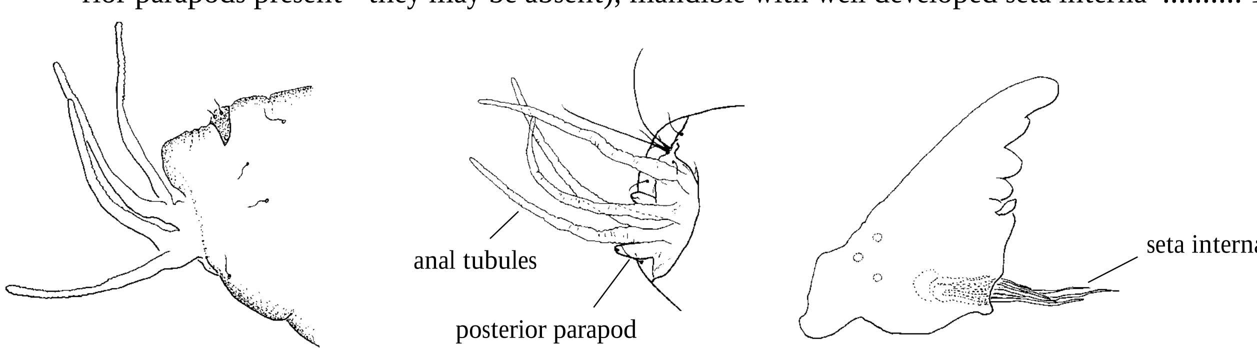
14(13) Anal claws and posterior parapods present, but occasionally claws absent and posterior parapods reduced; 1-3 weak anal setae present; premandible with brush .... ***Pseudosmittia***



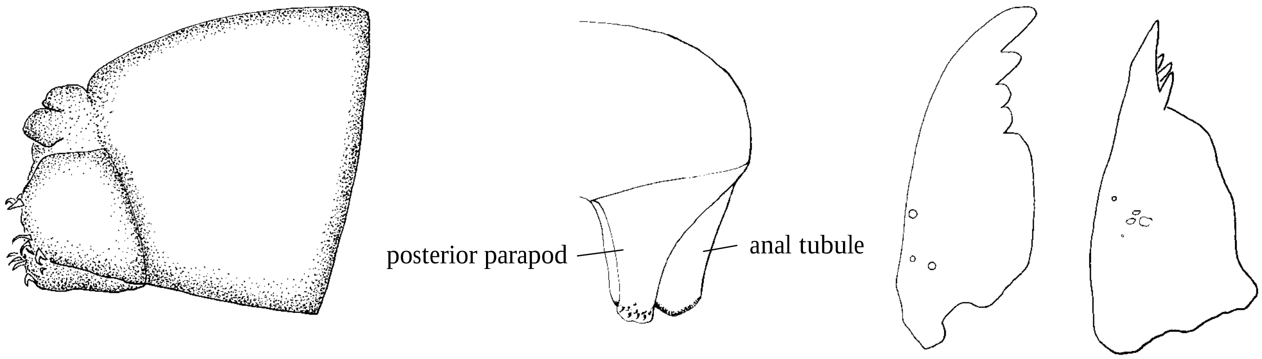
14' Anal claws, anal setae and posterior parapods absent; premandible without brush .... ***Camptocladius***



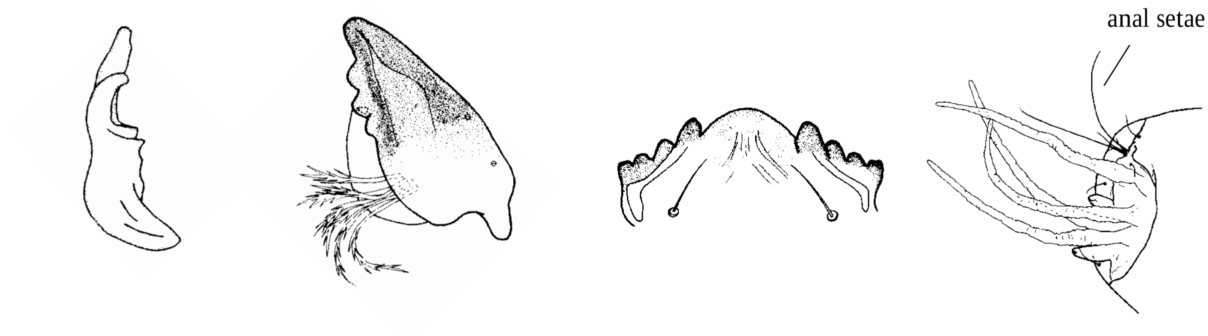
15(13') Anal tubules long, with numerous constrictions, always longer than posterior parapods (if posterior parapods present - they may be absent); mandible with well developed seta interna 16



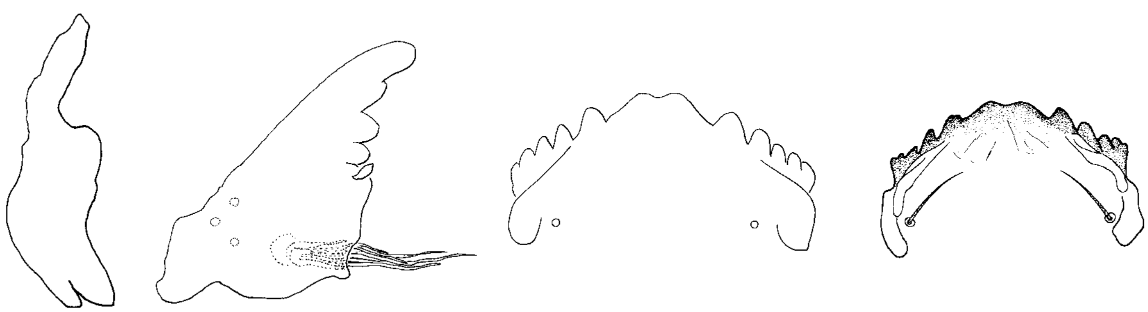
15’ Anal tubules absent or short and squat, shorter than or subequal to posterior parapods; mandible without seta interna 18



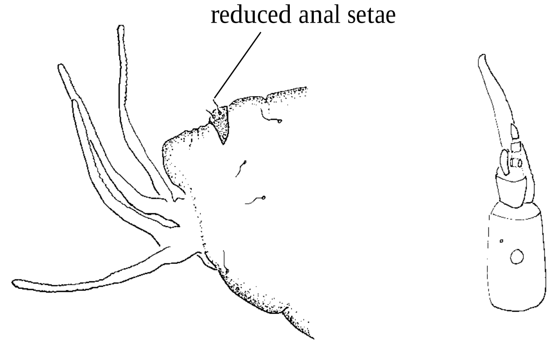
16(15) Premandible simple; mandible with 2 inner teeth; mentum with single, wide median tooth; anal setae well developed .... ***Georthocladius*** (in part)



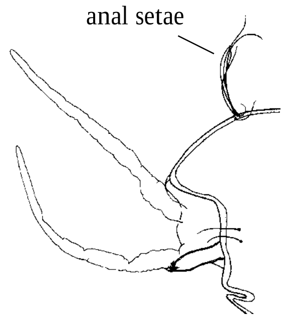
16’ Premandible apically bifid; mandible with 3 inner teeth; mentum with weakly divided median tooth; anal setae developed or reduced (see anal setae figures in couplet 17) 17

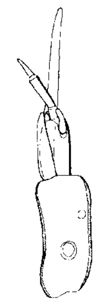


17(16’) Anal setae reduced; antenna with short 4th segment .... ***Georthocladius*** (in part)

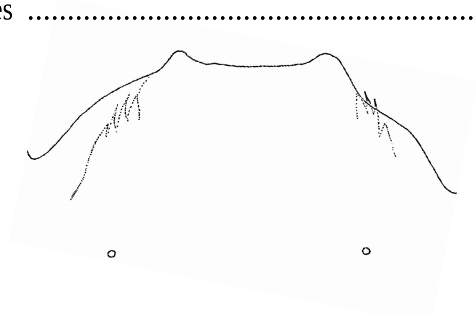


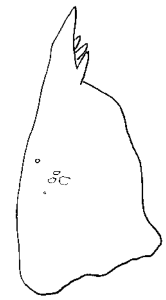
17’ Anal setae well developed; antenna with long 4th segment .... ***Doithrix***



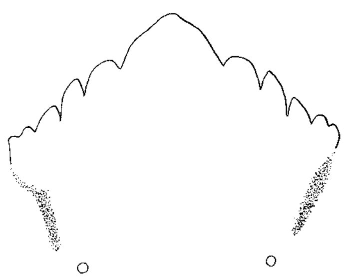


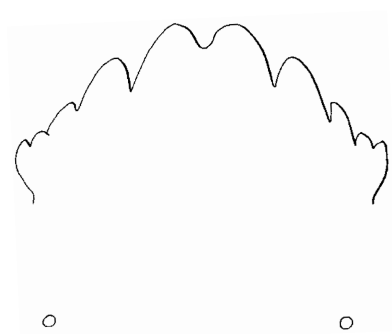
18(15’) Mentum without distinct median teeth, with 4-5 pairs of spine-like lateral teeth; antennae extremely reduced; mandible with a subapical cluster of sharply pointed teeth; ectoparasitic on mayflies .... ***Symbiocladius***

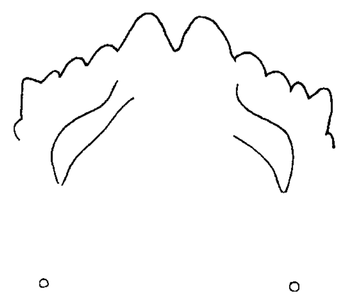




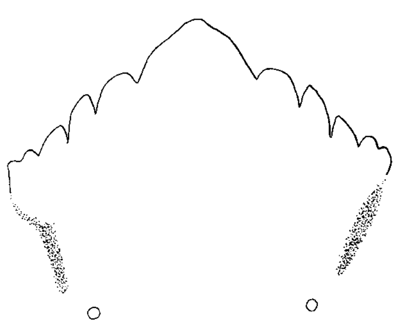
18’ Mentum with a distinct single or bifid median tooth, lateral teeth not spine-like; antennae not reduced as above; mandible with inner teeth not sharply pointed; free-living, semi-aquatic or terrestrial 19

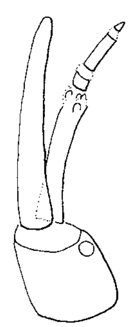


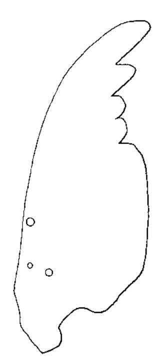




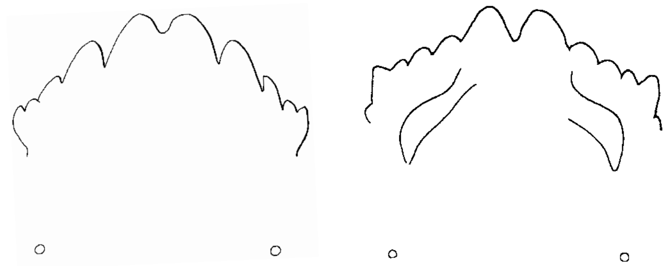
19(18’) Mentum with single median tooth .... ***Mesosmittia***



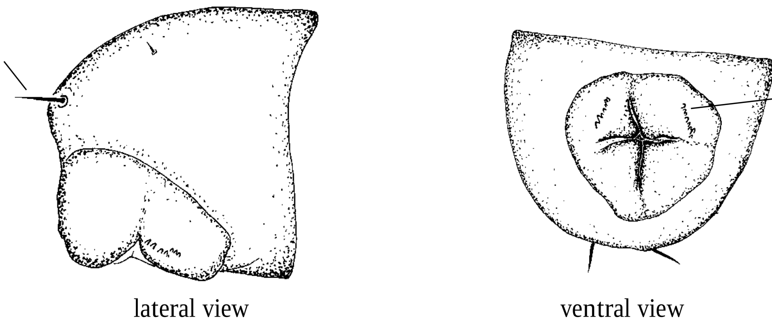




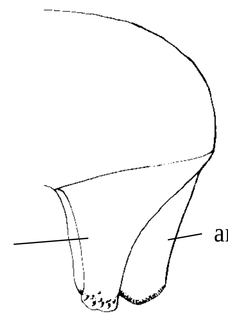
19’ Mentum with bifid median tooth (or 2 median teeth) 20



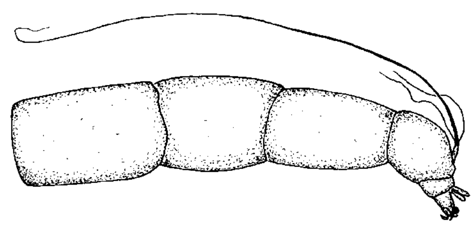
20(19’) Posterior parapods appearing divided, anterior portion with claws, posterior portion bare; anal setae usually present and well developed .... ***Gymnometriocnemus***



20’ Posterior parapods not divided; anal setae usually absent, but may be present .... ***Bryophaenocladius***

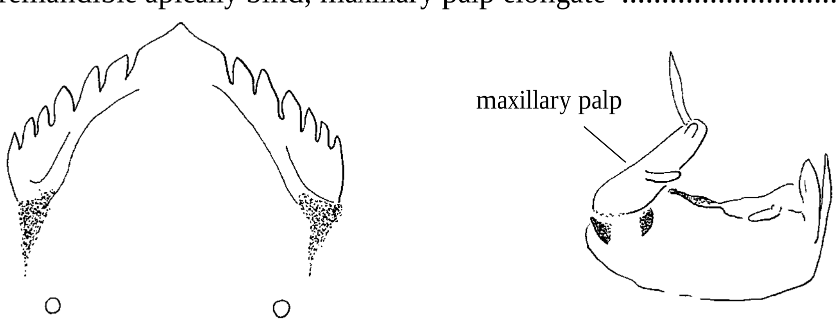


21(8’) Procercus with one seta at least 1/4 as long as body 22



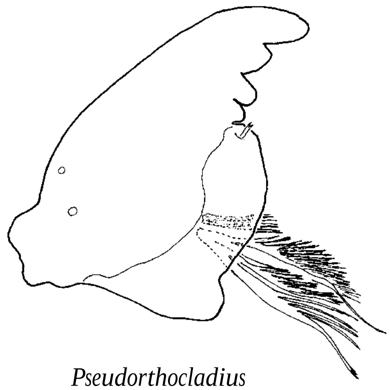
21’ Procercus without such a long seta 24

22(21) Mentum with 6 pairs of sharply pointed lateral teeth and single median tooth with small median projection; premandible apically bifid; maxillary palp elongate .... ***Krenosmittia***

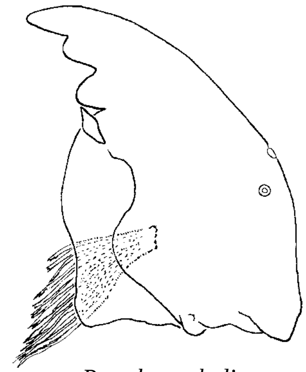


22’ Mentum with 4 pairs of lateral teeth, median tooth bifid or single, broad and without median projection; premandible simple; maxillary palp not elongate 23

23(22’) Mandible with 3 inner teeth .... ***Pseudorthocladius***



Pseudorthocladius



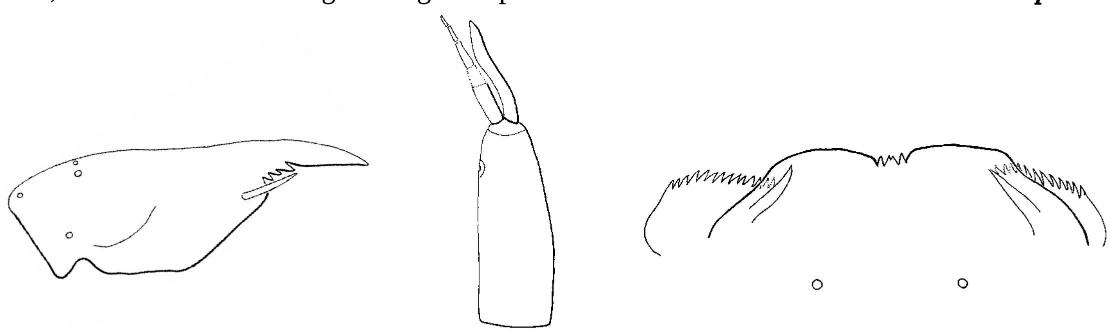
Parachaetocladius

23’ Mandible with 1-2 inner teeth .... ***Parachaetocladius***

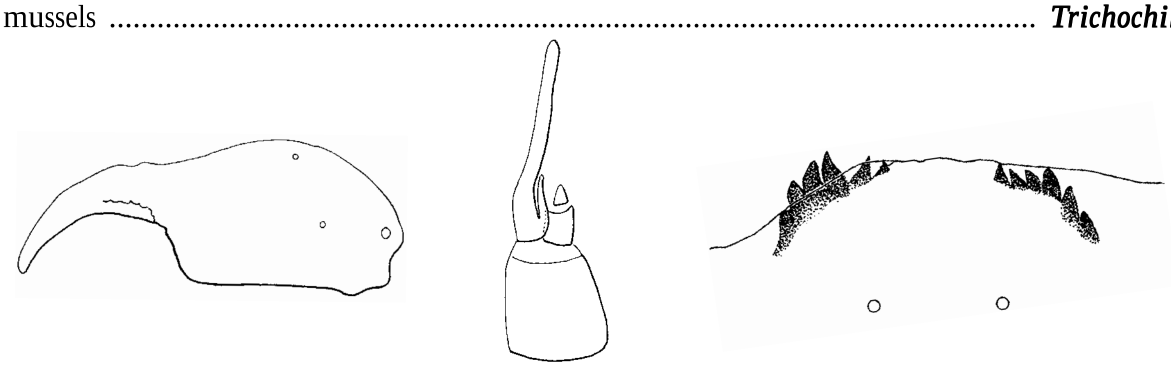
24(21’) Lateral teeth of mentum appearing to be on plates separate from and usually covered by ventromentum 25

24’ Lateral teeth appearing contiguous with median portion of mentum 26

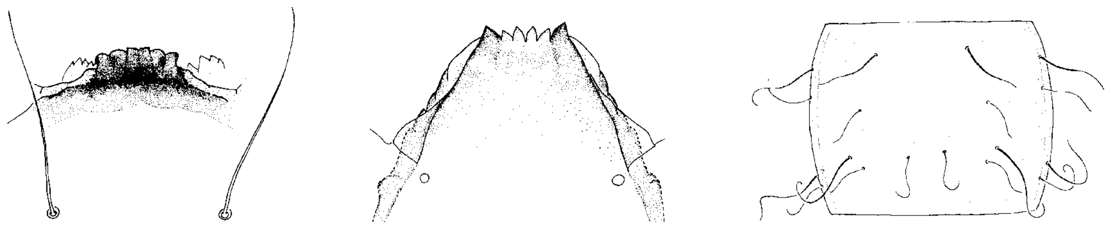
25(24) Mandible with small inner teeth; antennae more than 1/3 length of head capsule; mentum as figured; associated with blue-green algae or peat .... ***Acamptocladius***



25’ Mandible without inner teeth; antennae strongly reduced; mentum as figured; parasitic in unionid mussels .... ***Trichochilus***

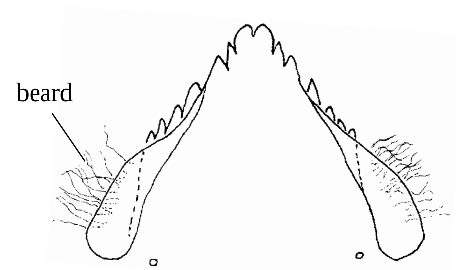


26(24’) Mentum strongly arched, with 4-8 median teeth; body with numerous long, stout setae; phoretic or parasitic on ephemerid mayflies .... ***Epoicocladius***



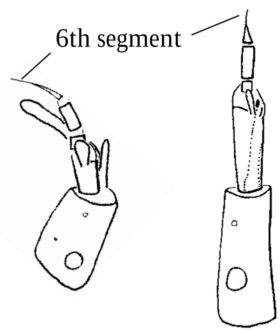
26’ Mentum not as above; if body has long, strong setae, then mentum with only 1 or 2 median teeth; free-living, except for some *Nanocladius* (couplet 38) 27

27(26’) Beard (group of setae) present beneath or adjacent to ventromental plates (may be only a few setae and may require observation at 1000X) 28



27’ Beard absent 37

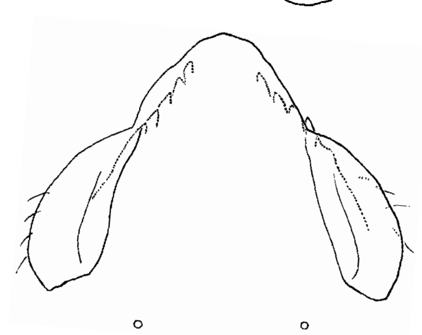
28(27) Vestigial, hair-like 6th antennal segment present and usually easily visible; mentum with single broad median tooth 29



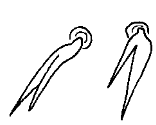
28’ Antennae with 5 apparent segments; if vestigial 6th segment visible (some *Zalutschia*), then mentum with 2-4 median teeth 30

29(28) Ventromental plates elongate, covering most of lateral teeth; S I simple or apically toothed .... ***Stilocladius***

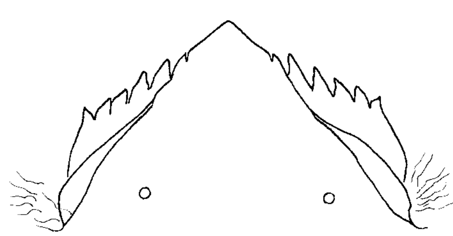
apically toothed S I



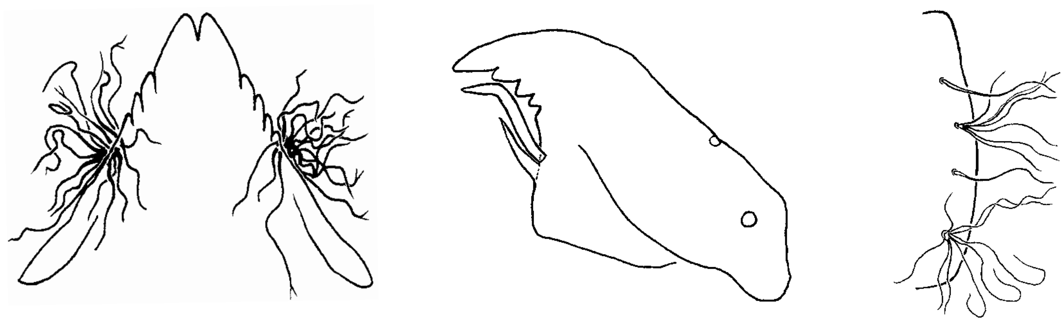
29’ Ventromental plates smaller; S I bifid .... ***Parakiefferiella*** (in part)



bifid S I

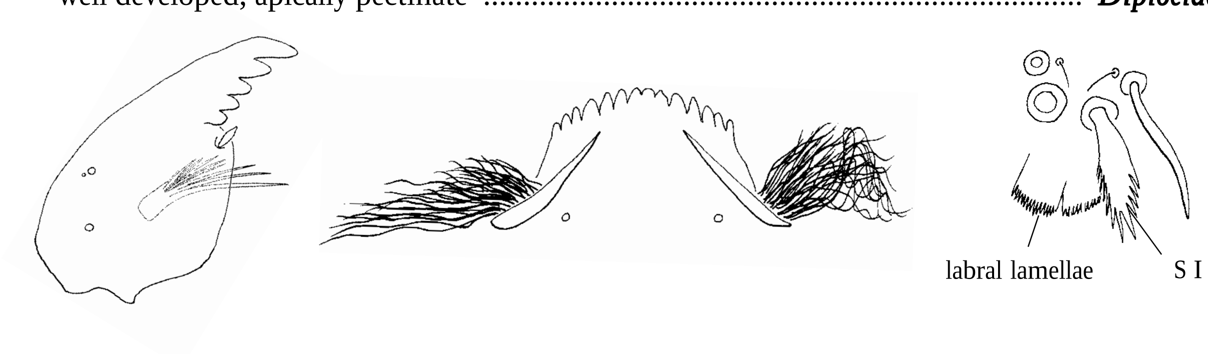


30(28’) S I simple; median teeth of mentum elongate; beard well developed with apically branched filamaents; mandible with large seta subdentalis and inner spine; abdominal segments with alternating simple and plumose setae .... ***Synorthocladius***



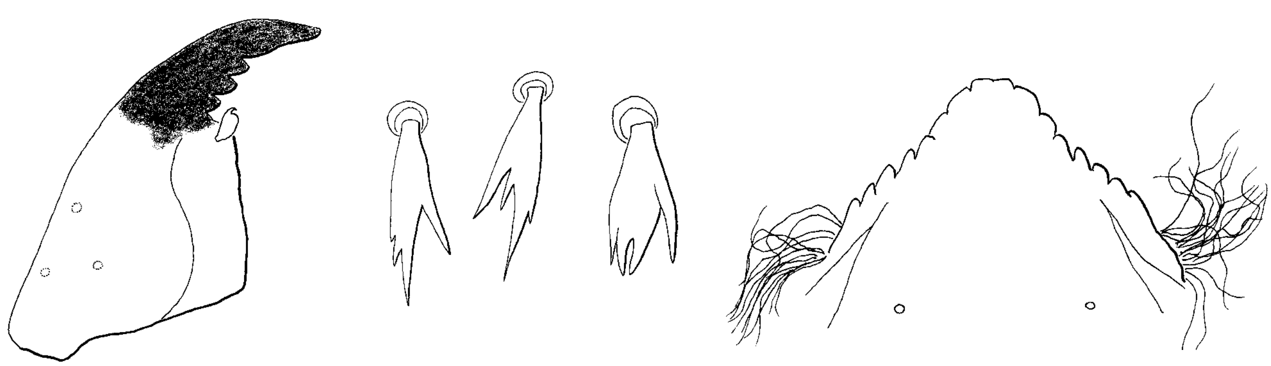
30’ S I simple, bifid, coarsely pectinate, palmate or plumose; mentum, beard and mandible not as above; abdominal segments without alternating simple and plumose setae (a single pair of setal tufts may be present posterolaterally) 31

31(30’) Mandible with 4 inner teeth; ventromental plates with dense beard; S I plumose; labral lamellae well developed, apically pectinate .... ***Diplocladius***

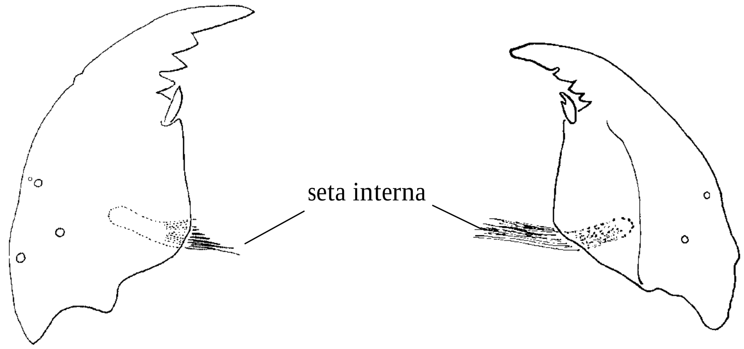


31’ Mandible with 3 or fewer inner teeth (do not mistake darkened molar area for a 4th tooth!); mentum, beard and S I variable; if labral lamellae present, weakly developed and never apically pectinate 32

32(31’) Mandible without seta interna; S I bifid (may be secondarily split into more teeth); mentum as figured .... ***Acricotopus***

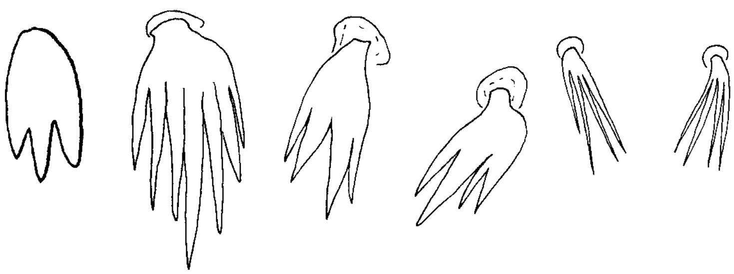


32’ Mandible with seta interna; ***IF*** mandible without seta interna, then S I broadly trifid 33

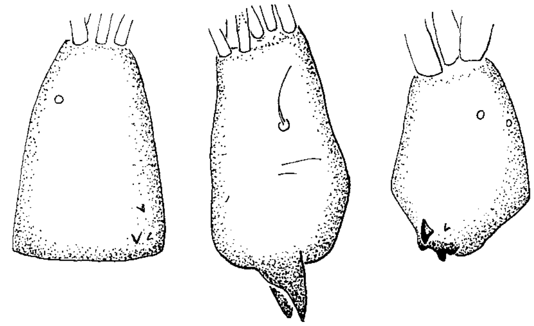


broadly trifid S I

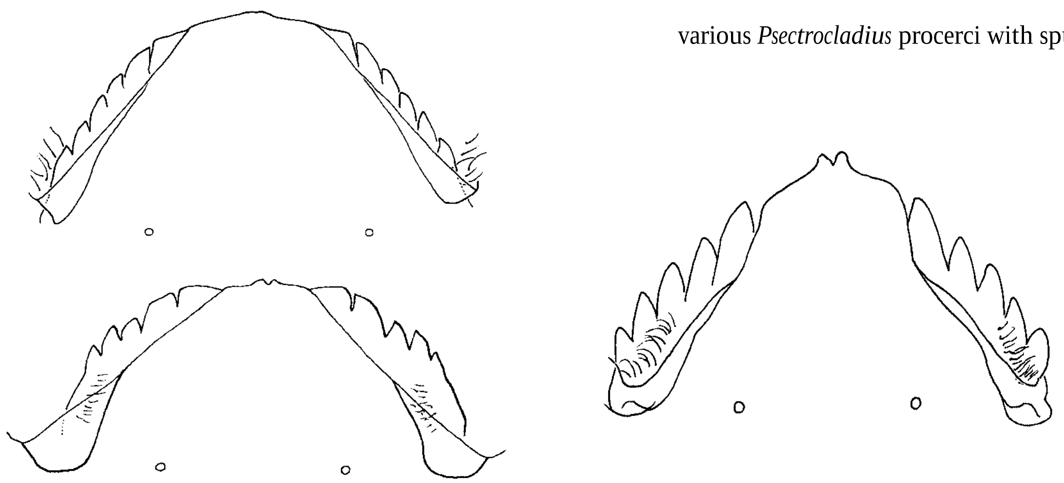
33(32’) S I broadly trifid, palmate or with about 4 long, narrow teeth; procercus with small to large spurs .... ***Psectrocladius*** (in part)



various *Psectrocladius* S I’s

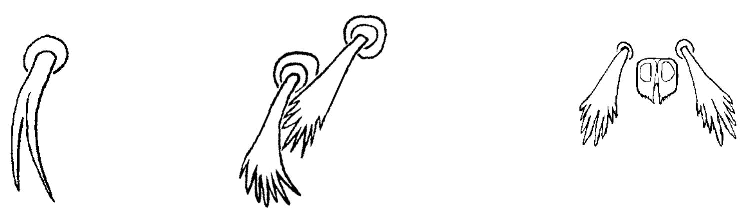


various *Psectrocladius* procerci with spurs

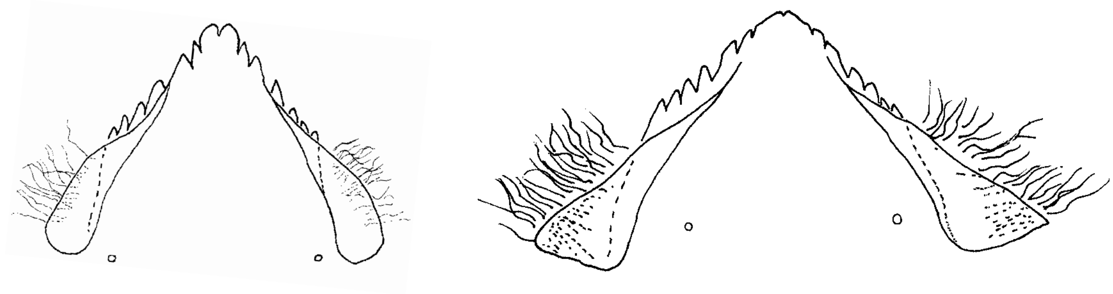


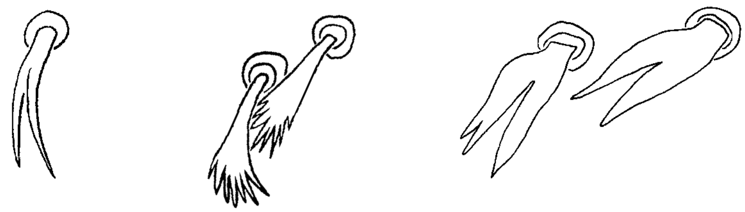
various *Psectrocladius* menta

33’ S I simple, bifid, apically split into 4 or more short teeth, plumose or coarsely serrate; if procercus with spurs, S I bifid or apically split into 4 or more short teeth 34



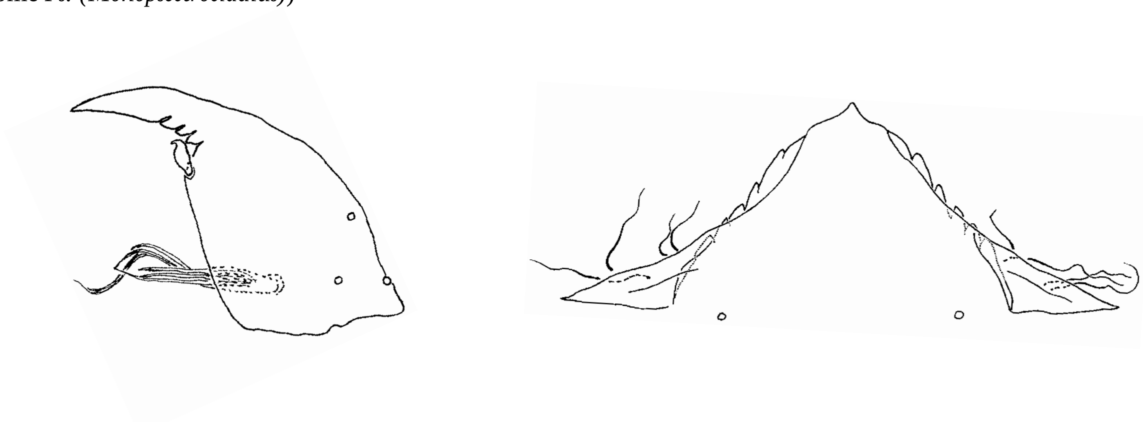
34(33') Beard well developed; S I bifid or apically split into 4 or more short teeth; procercus usually with spurs 35



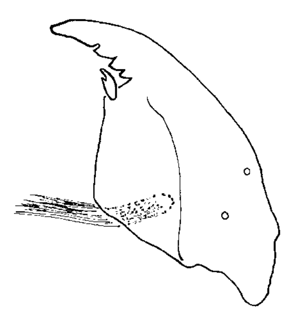


34' Beard weak to vestigial; S I simple, bifid, coarsely pectinate or plumose; procercus without spurs 36

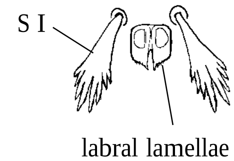
35(34) Apical tooth of mandible longer than width of 3 inner teeth; ventromental plates large and triangular; head capsule without ventral tubercules .... ***Psectrocladius*** (in part)
(some *Ps. (Monopsectrocladius)*)

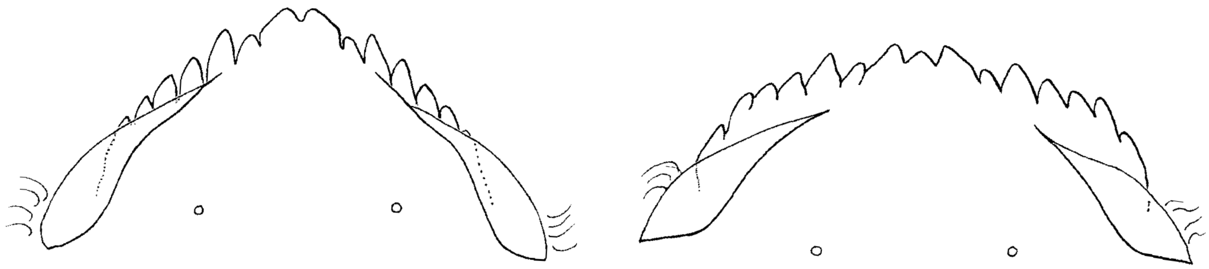


35' Apical tooth of mandible shorter than or subequal to width of 3 inner teeth; if ventromental plates large and triangular (as figured in couplet 34 above), then head capsule with pair of ventral tubercles .... ***Rheocricotopus***



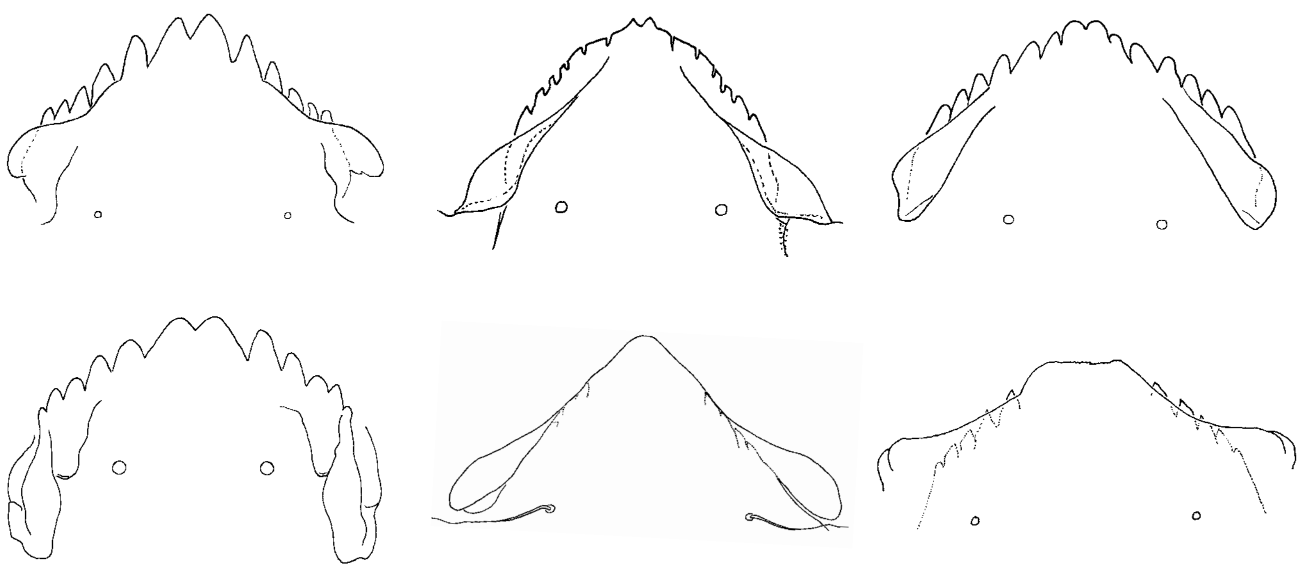
36(34') S I coarsely pectinate to plumose; weak labral lamellae present; mentum with 2-4 median teeth, which are usually lighter in color than lateral teeth .... ***Zalutschia***



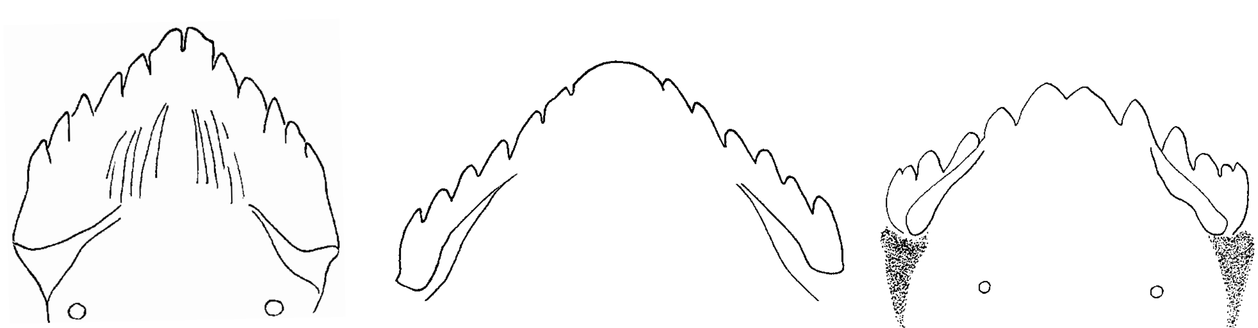


36' S I simple or bifid; mentum with single median tooth 37

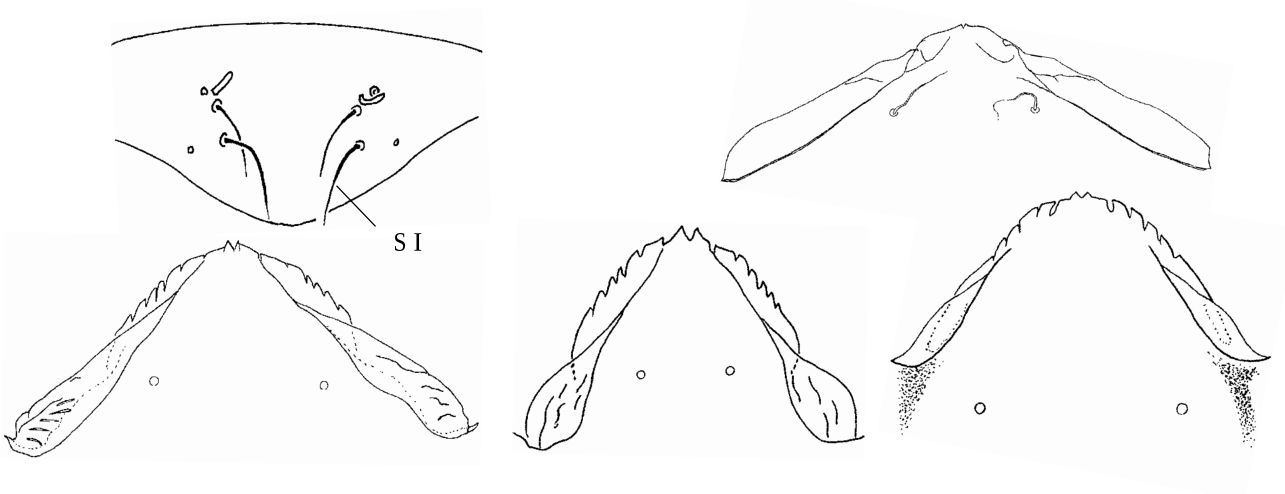
37(27', 36') Ventromental plates well developed, extending well beyond lateral margin of mentum 38



37' Ventromental plates absent/vestigial or, if present, do not extend beyond lateral margin of mentum (may extend to margin, but not far beyond, or plates very thin as in couplet 70) 47

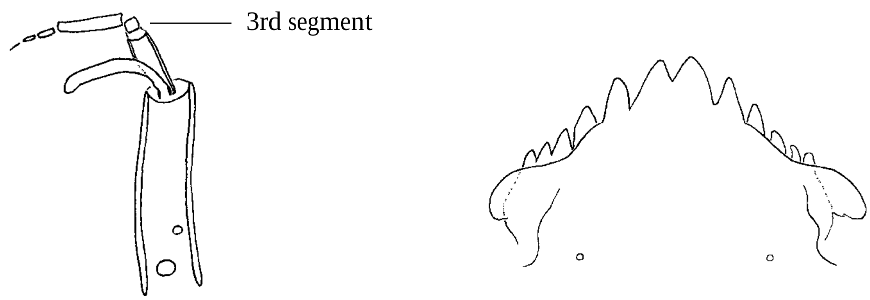


38(37) All S setae simple; mentum with a small pair of median teeth which are often well separated from the 0-6 pairs of lateral teeth (which may be small and fused or closely appressed to each other); ventromental plates elongate; some species phoretic or parasitic on a variety of aquatic insects .... ***Nanocladius*** (in part)



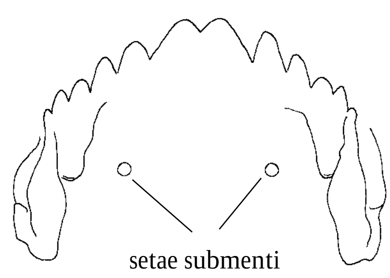
38' S I never simple; mentum not as above; not phoretic or parasitic on aquatic insects 39

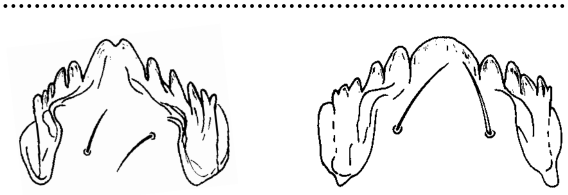
39(38') Antennae 7 segmented (7th segment hairlike, vestigial); 3rd antennal segment minute, < 1/3 length of 4th .... ***Heterotrissocladius*** (in part)



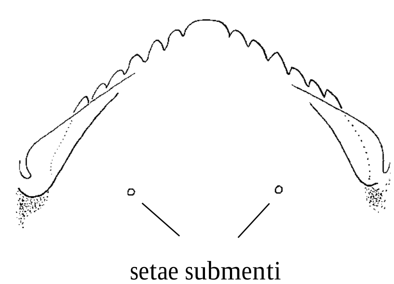
39' Antennae with 5-6 segments; 3rd segment never as small as <1/3 length of 4th 40

40(39') Ventromental plates appear double; setae submenti located well anterior to posterior margin of ventromental plates 41

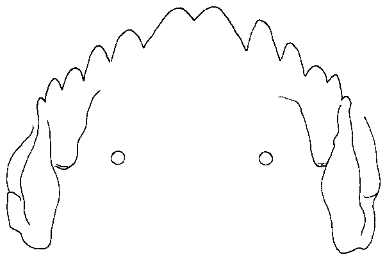




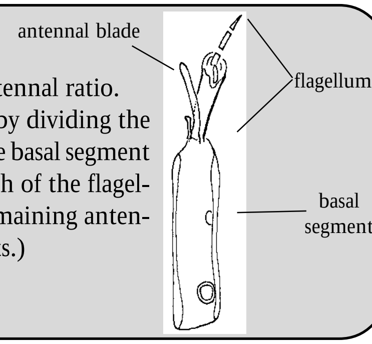
40' Ventromental plates single; setae submenti located near posterior margin of ventromental plates or more posteriad .. 42



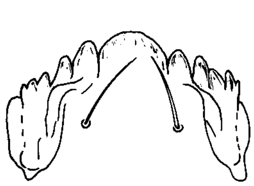
41(40) Mentum always with double median tooth; antenna with long basal segment, AR > 1.25; antennal blade shorter than flagellum .... ***Parametriocnemus***

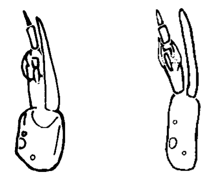


AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

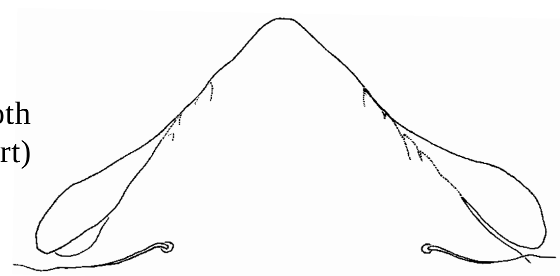


41’ Mentum with single or double median tooth; basal antennal segment shorter, AR 0.5-1.0; antennal blade subequal to or longer than flagellum .... ***Paraphaenocladius***



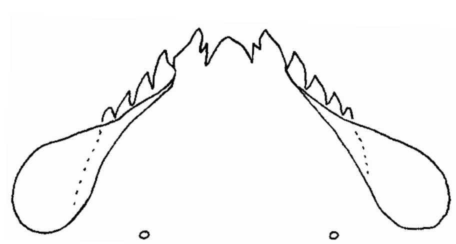


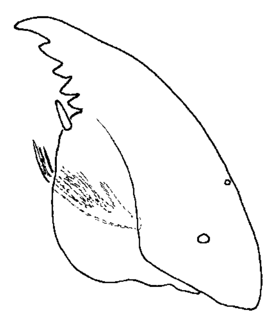
42(40’) Mentum with large, pale, dome-shaped median tooth .... ***Parakiefferiella*** (in part)



42’ Median tooth of mentum not as above 43

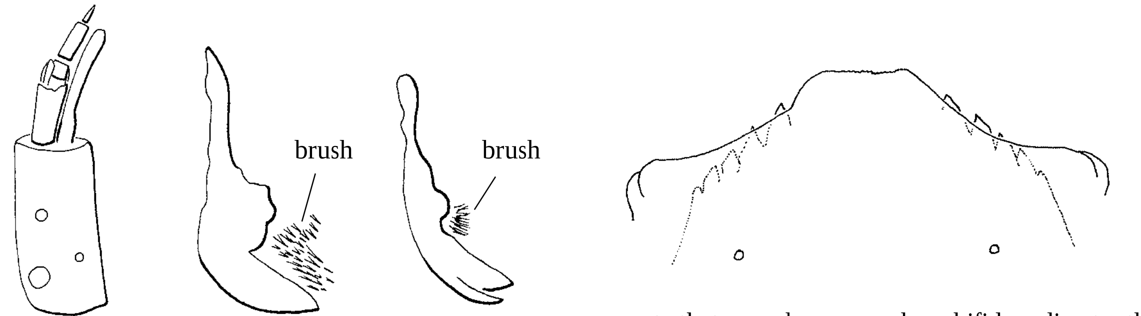
43(42’) Median tooth of mentum lower than 2nd lateral teeth; 1st lateral tooth reduced and fused to 2nd lateral tooth; mandible with 4 distinct inner teeth .... ***Unniella***





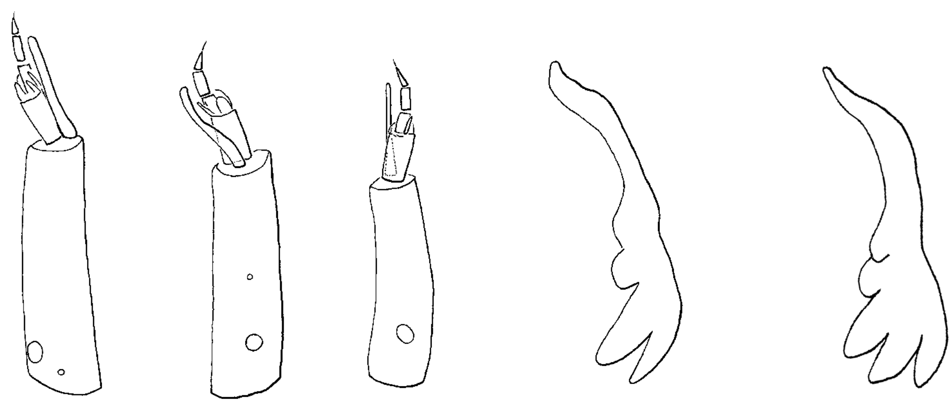
43’ Mentum not as above; mandible with 3 inner teeth 44

44(43') Antenna 5 segmented; premandible with brush (may be weak) .... ***Chaetocladius*** (in part)

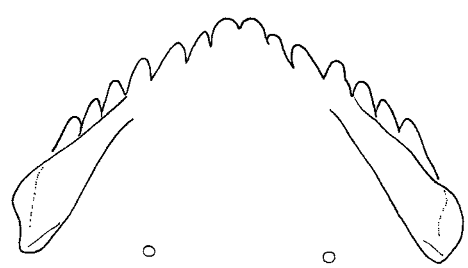


note that some larvae may have bifid median tooth

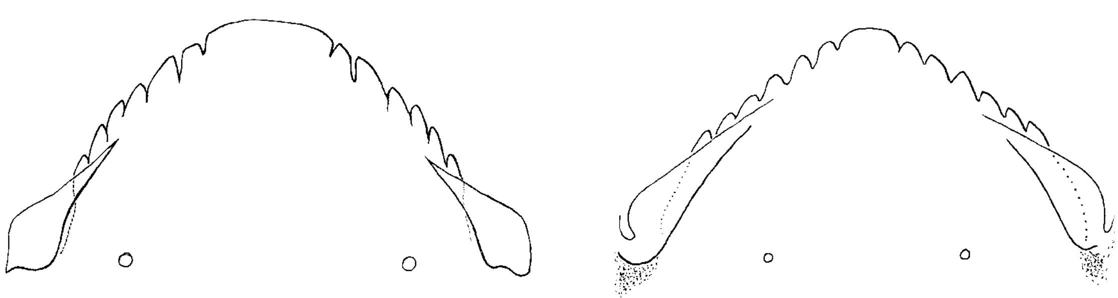
44' Antennae with 6 segments, 6th vestigial, hairlike; premandible without brush 45



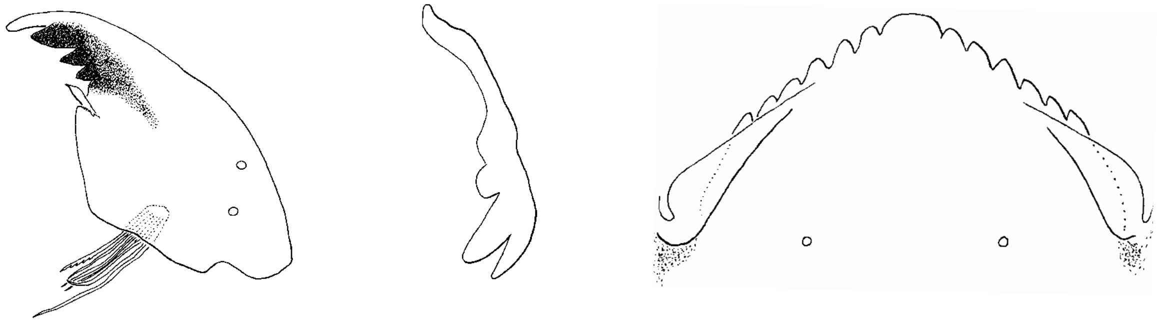
45(44) Mentum with bifid median tooth .... ***Hydrobaenus*** (in part)



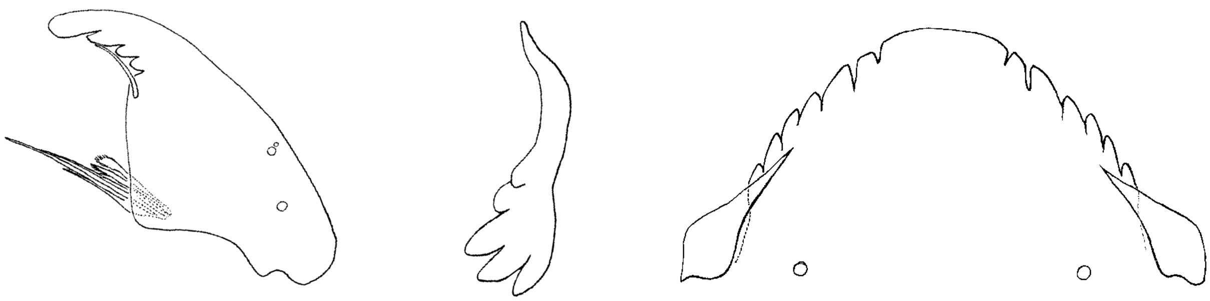
45' Mentum with single median tooth 46



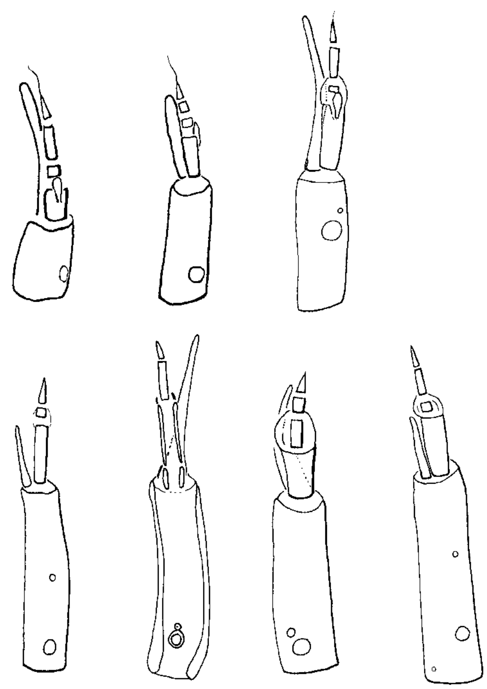
46(45’) Apical tooth of mandible thin; premandible with 2 large apical teeth; mentum as figured .... ***Hydrobaenus*** (in part)



46’ Apical tooth of mandible inflated; premandible with 3 large apical teeth; mentum as figured .... **Orthocladiinae genus I**



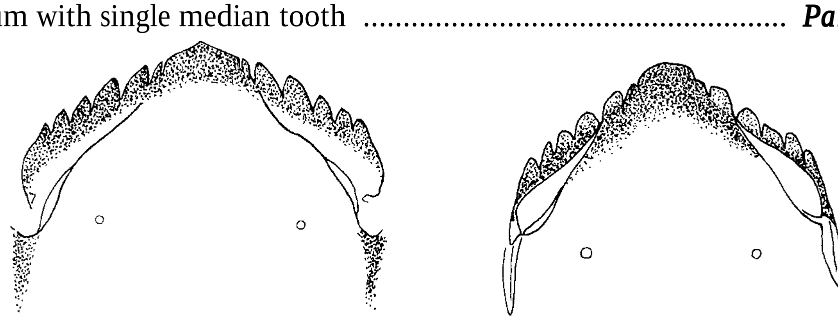
47(37’) Antennae with 6 segments, 6th segment vestigial, hairlike 48



NOTE: Some *Cricotopus* may have an apparent hair-like 6th segment and may key to *Parakiefferiella* below. Note that the 6th segment of *Parakiefferiella* is about as long as the 5th and is easily seen at 400X while the vestigial segment of *Cricotopus* is much smaller and difficult to observe at that magnification; *Parakiefferiella* usually have larger ventromental plates than most *Cricotopus.*

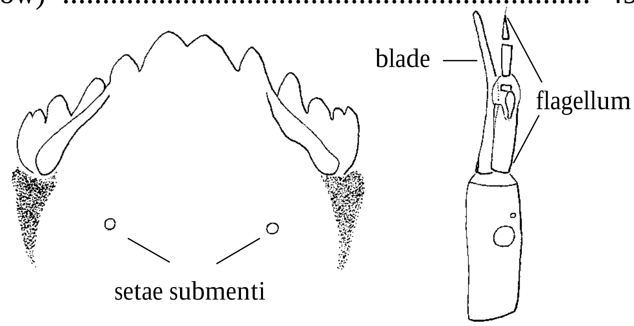
47’ Antennae with 5 or fewer segments, last segment not hairlike 50

48(47) Mentum with single median tooth .... ***Parakiefferiella*** (in part)

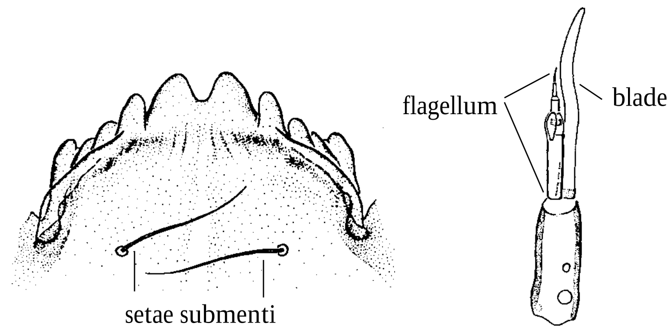


48’ Mentum with bifid median tooth (figures below) 49

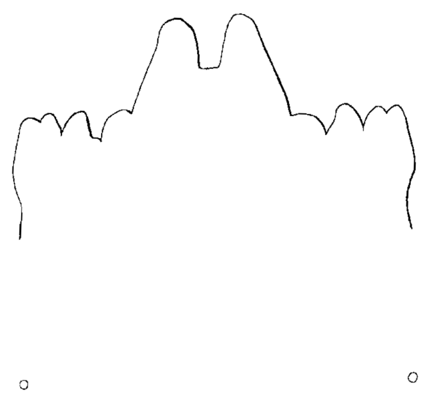
49(48’) Setae submenti well posterior to a line drawn between posterior margins of ventromental plates; antennal blade subequal to flagellum .... ***Psilometriocnemus***



49’ Setae submenti just posterior to a line drawn between posterior margins of ventromental plates; antennal blade much longer than flagellum .... ***Platysmittia***

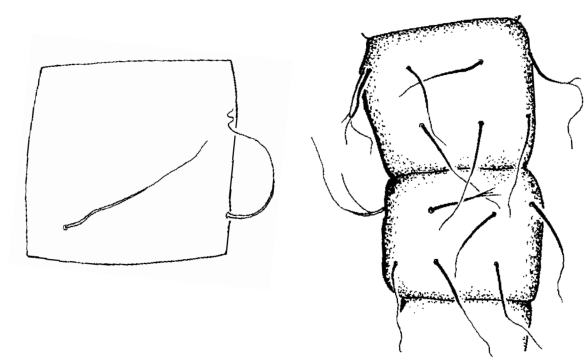


50(47’) Abdomen with a lateral fringe of setal tufts; mentum as figured; mining in submerged, partially decomposed wood .. ***Xylotopus***

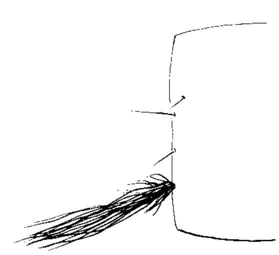


50’ Abdomen without fringe of setal tufts, although individual setal tufts or long setae may be present; mentum not as above 51

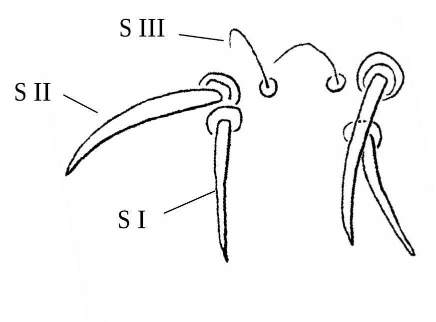
51(50’) Abdomen with long simple setae, at least ½ as long as the segment bearing them 52



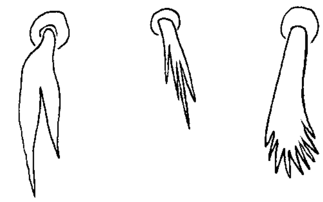
51’ Abdomen without long simple setae; ***OR*** if long setae present, they are arranged as a pair of single tufts, one on each side posterolaterally on body segments 56



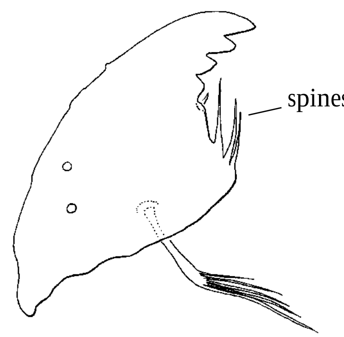
52(51) S I simple 53



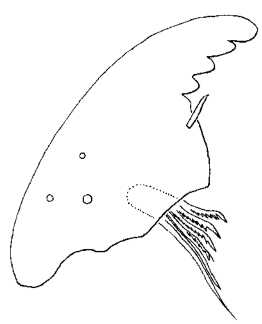
52’ S I bifid, or with several apical teeth, or plumose 54

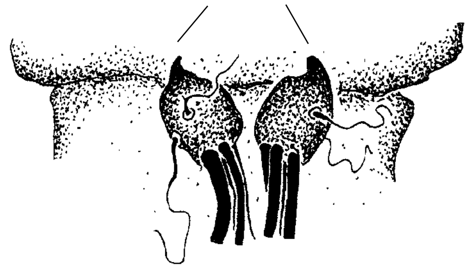


53(52) Inner margin of mandible with several spines; procerci without spurs .... ***Eukiefferiella*** (in part)

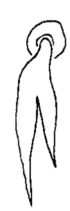


53’ Inner margin of mandible without spines; procerci with spurs .... ***Paracricotopus***

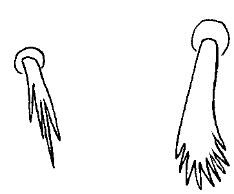




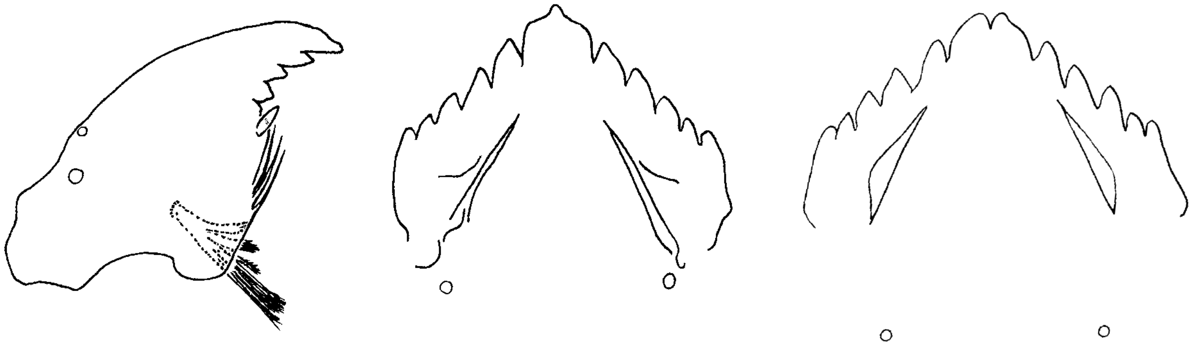
54(52’) S I bifid 68



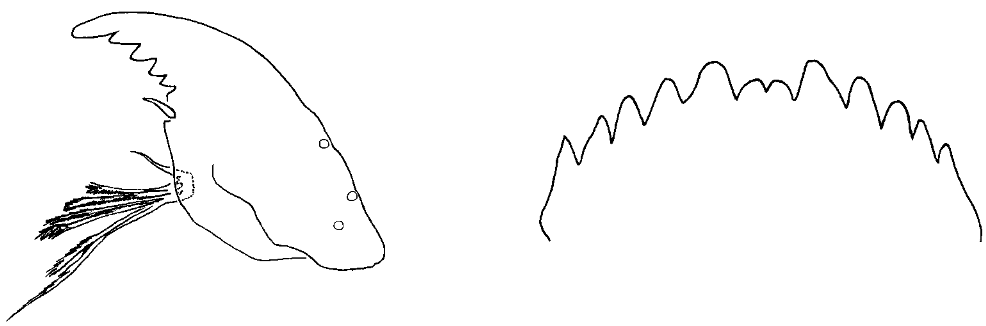
54’ S I with several apical teeth or plumose 55



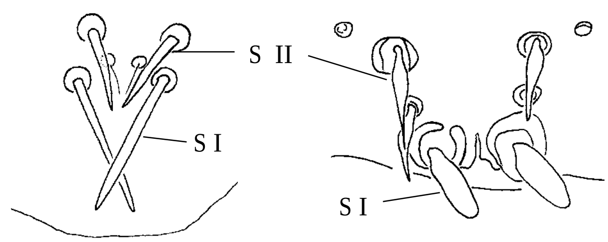
55(54') Mandible with 3 inner teeth and inner margin with several spines; common in streams and rivers .... ***Tvetenia***



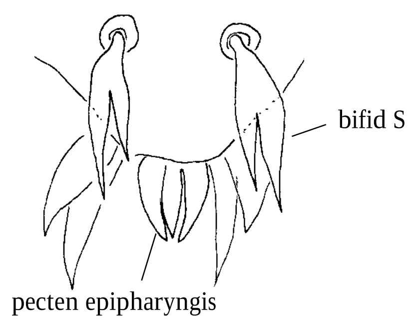
55' Mandible with 4 inner teeth and inner margin smooth; known only from bromeliads in peninsular Florida .... ***Metriocnemus*** (in part)



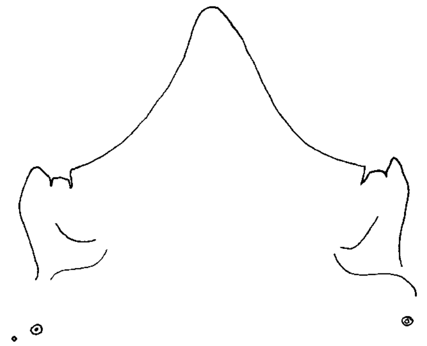
56(51') S I simple 57



56' S I bifid, serrate, pectinate or plumose 68

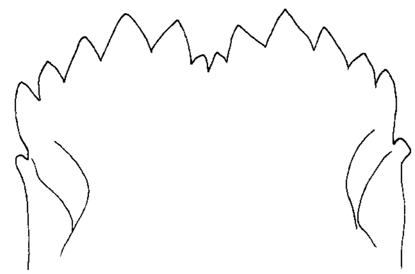


57(56) Mentum with huge median tooth and reduced lateral teeth .... ***Orthocladius*** (in part)
(*O. (S.) lignicola*)



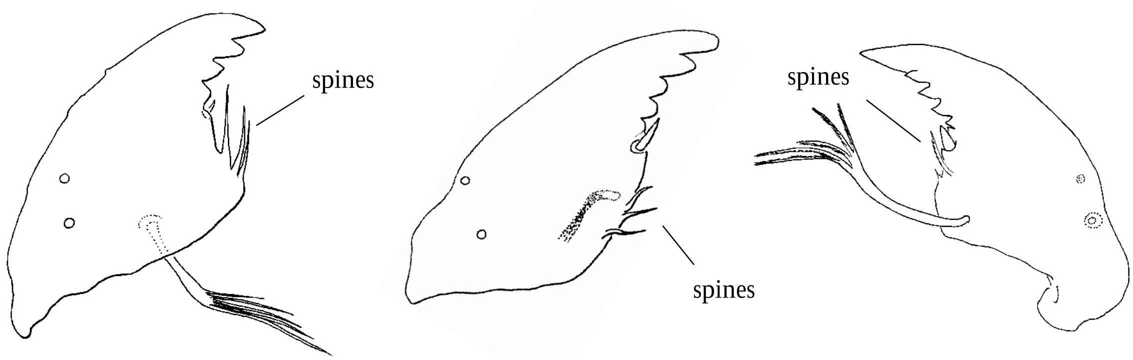
57’ Median tooth of mentum not as above 58

58(57’) Median teeth of mentum deeply recessed .... ***Metriocnemus*** (in part)
(*M. fuscipes*)



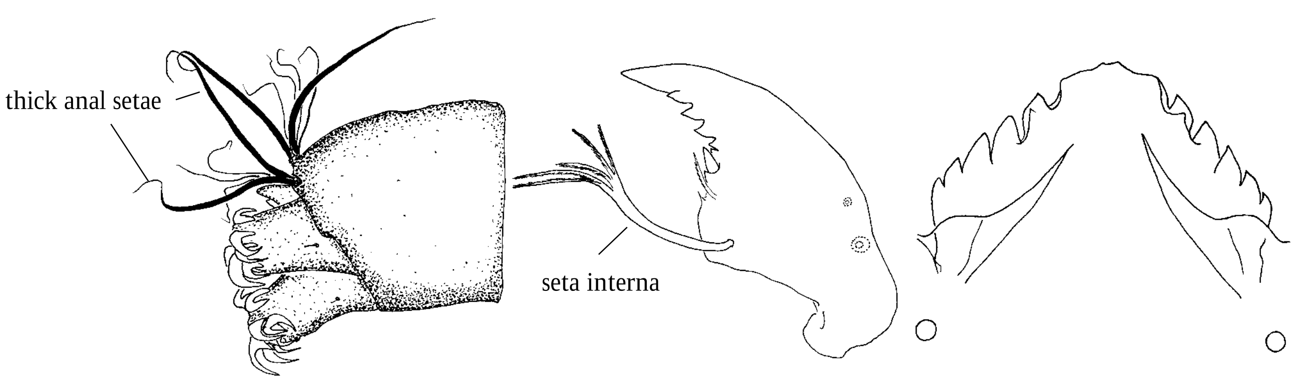
58’ Median teeth of mentum not deeply recessed as above 59

59(58’) Inner margin of mandible with spines (these may be small) 60

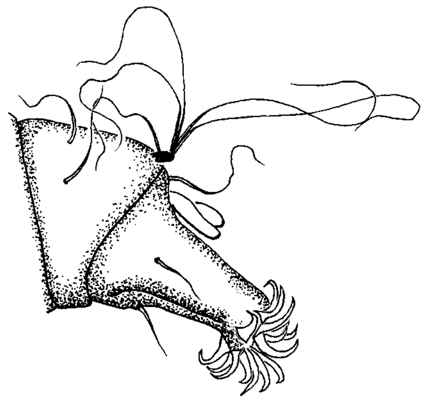


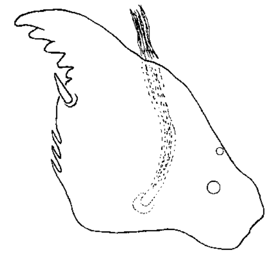
59’ Inner margin of mandible smooth 66

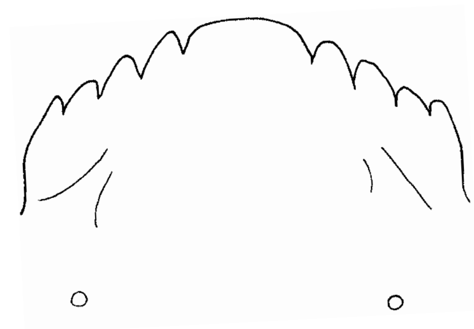
60(59) Procercus reduced, with 2 setae thicker than the rest on each procercus; seta interna of mandible with long stalk that branches near apex; mentum with 5 pairs of lateral teeth .... ***Cardiocladius*** (in part)



60’ Procercus at least as long as wide, setae about equally thick; seta interna usually divided to near base, but if divided near apex than mentum with 4 pairs of lateral teeth 61

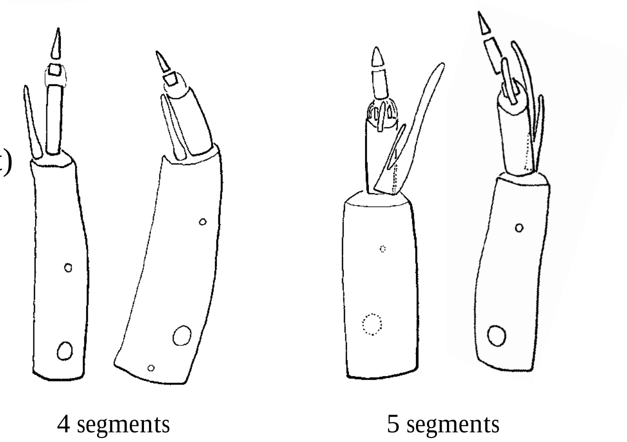






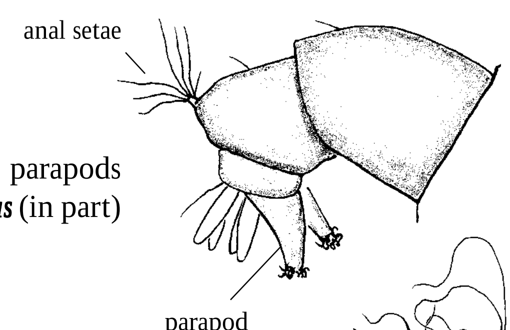
61(60’) Mentum with 4 pairs of lateral teeth .. .. ***Eukiefferiella*** (in part)

61’ Mentum with 5 pairs of lateral teeth .. 62

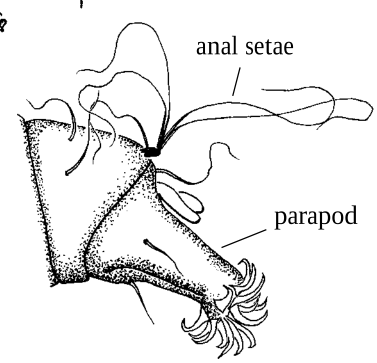


62(61’) Antenna with 4 segments .. ***Eukiefferiella*** (in part)

62’ Antenna with 5 segments 63



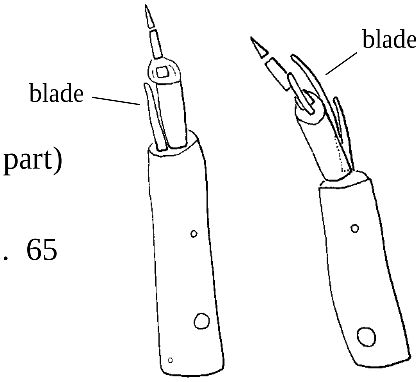
63(62’) Anal setae much shorter than posterior parapods .... ***Cardiocladius*** (in part)



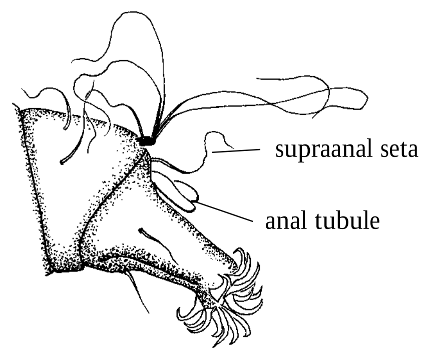
63’ Anal setae longer than posterior parapods 64

64(63’) Antennal blade subequal to segment 2 ... ***Eukiefferiella*** (in part)

64’ Antennal blade extends past segment 2 65

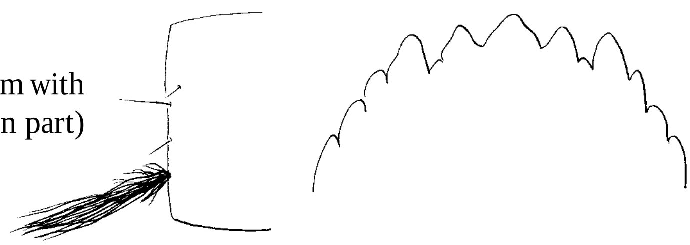


65(64’) Supraanal setae much longer than anal tubules; abdomen with long setae, about 1/2 as long as segment bearing them .... ***Eukiefferiella*** (in part)



65’ Supraanal setae shorter than anal tubules; abdominal setae short .... ***Tokunagaia***

66(59’) Body with posterolateral setal tufts; mentum with single median tooth .... ***Cricotopus*** (in part)

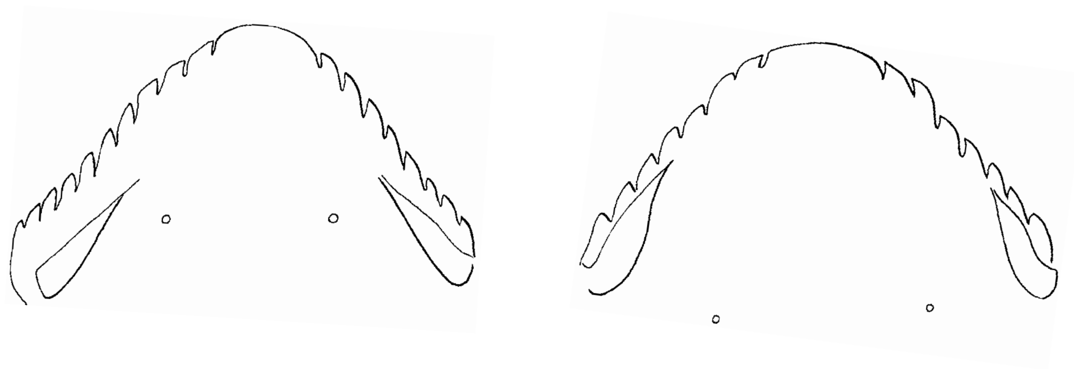


66’ Body without setal tufts; mentum with bifid median tooth (see below) 67

67(66’) Premandible apically simple; mentum with median teeth strongly projecting anteriorly, without rounded ventromental plates posterolaterally .... ***Chaetocladius*** (in part) (*Ch. ligni*)

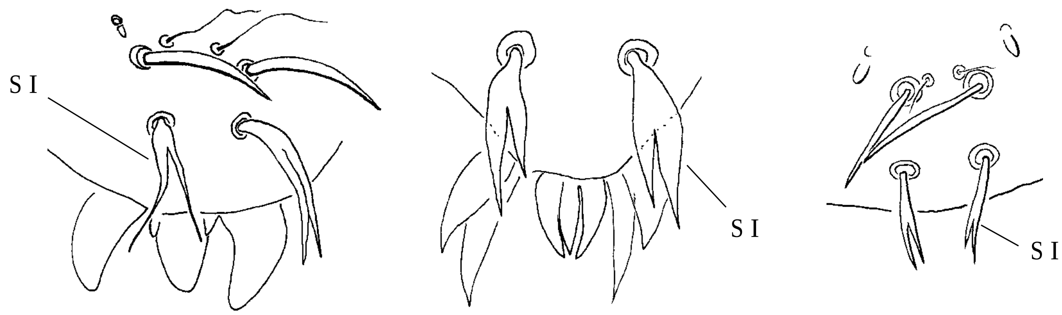
67’ Premandible apically bifid; median teeth of mentum do not extend as far forward as above; mentum with rounded ventromental plates posterolaterally .... ***Limnophyes*** (in part) (although the S I of *Limnophyes* is serrated, serrations may be weak and S I may appear simple; thus some specimens will key here)

68(54, 56’) Mentum with 15 or more teeth .... ***Orthocladius*** (in part)



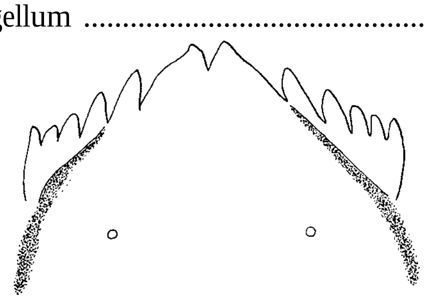
68’ Mentum with at most 13 teeth 69

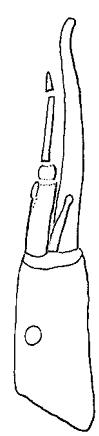
69(68’) S I bifid 70



69’ S I serrated, apically fringed/toothed, pectinate or plumose 86

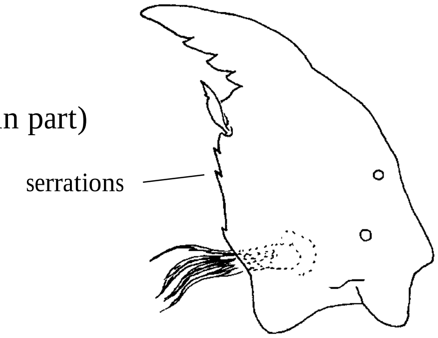
70(69) Mentum with 2 median teeth; antenna with long 4th segment and antennal blade much longer than flagellum .... ***Mesocricotopus***





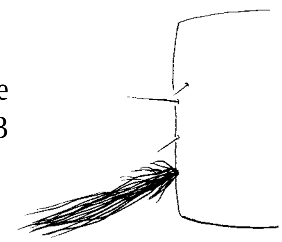
70’ Mentum with single median tooth; 4th antennal segment subequal to 3rd and antennal blade at most subequal to flagellum 71

71(70’) Inner margin of mandible with serrations ...... ***Cricotopus*** (in part)
(*C. (C.) bicinctus*)



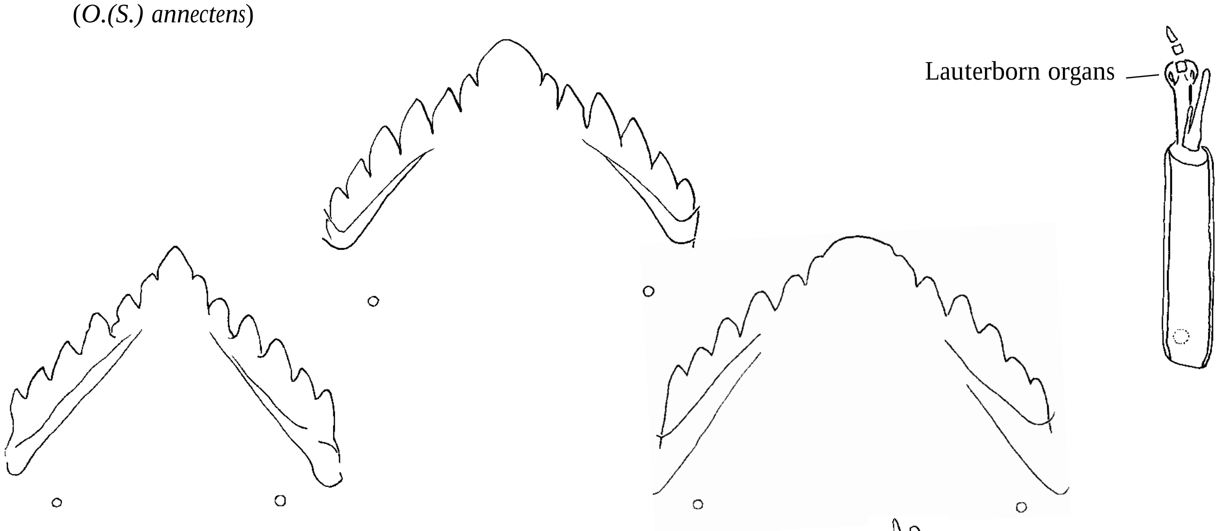
71’ Inner margin of mandible smooth 72

72(71’) Some abdominal segments with posterolateral setal tufts (may be quite small; most easily found on middle abdominal segments) 73

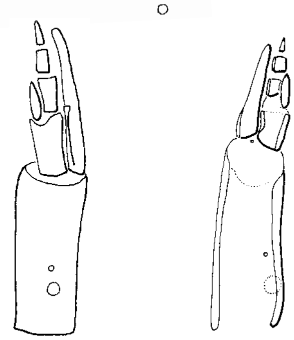


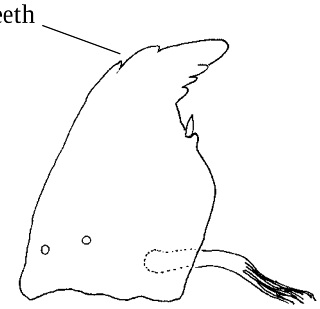
72’ Abdominal segments without tufts of setae 74

73(72) Lauterborn organs well developed, appearing as moderately large circular organs at apex of antennal segment 2; mentum with median and appressed first lateral teeth projecting strongly forward from rest of mentum; setal tufts < 100 µm long .... ***Orthocladius*** (in part)
(*O.(S.) annectens*)



73’ Lauterborn organs not developed to appear as circles at apex of second segment; mentum without first lateral teeth appressed to median tooth; setal tufts variable in length, usually > 100µm in length .... ***Cricotopus*** (in part)

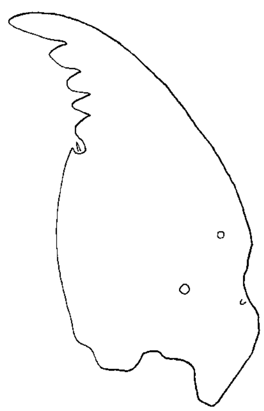


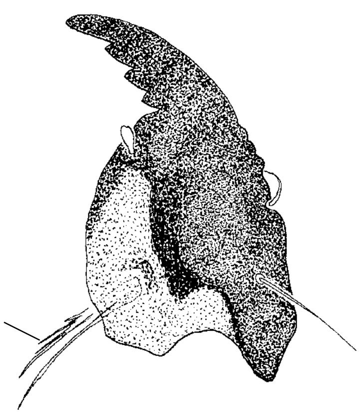


74(72') Head capsule dark brown; mandible with 2-3 dorsal teeth; restricted to colonies of blue-green alga *Nostoc* .... ***Cricotopus*** (in part)
(*C. (N.) nostocicola*)

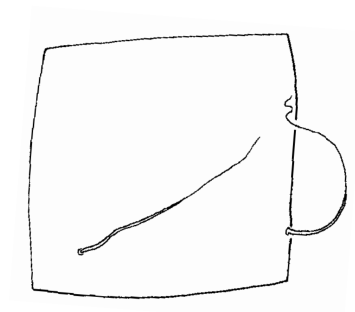
74' Head capsule yellowish to dark brown; mandible without dorsal teeth; not restricted to *Nostoc* 75

75(74') Mandible without seta interna .... ***Orthocladius*** (in part)



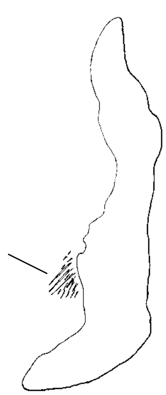


75' Mandible with seta interna 76



76(75') Some abdominal segments (usually middle segments) with long setae, at least ½ as long as the segment bearing them 77

76' Abdominal segments with setae < ½ as long as the segment bearing them 78

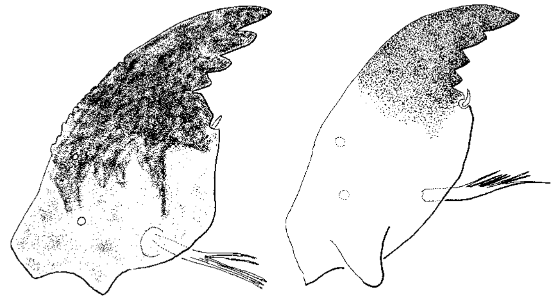


77(76') Premandible apically simple, with weak brush .... ***Cricotopus*** (in part)

77' Premandible simple or apically bifid, without brush .... ***Orthocladius*** (in part)

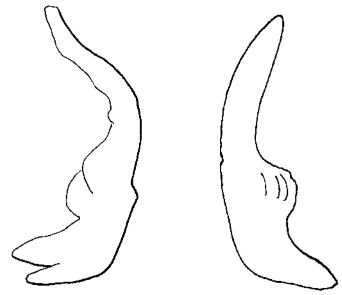
78(76’) Head capsule light brown to dark brown or dark reddish-brown; mandibles usually darkly colored to base (base may be paler than apex, but overall the mandible is dark) .. ***Orthocladius*** (in part)

78’ Head capsule yellow to light yellow-brown; mandibles with dark apex and inner teeth and light colored base, never darkly colored to base .. 79



79(78’) Premandible apically bifid .... ***Orthocladius*** (in part)
(*O.(O.) oliveri*)

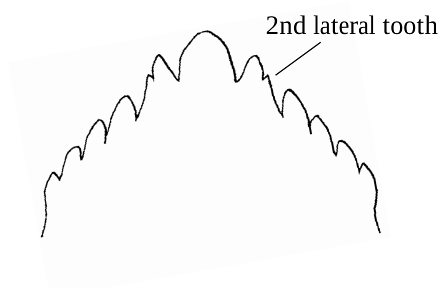
79’ Premandible simple 80



bifid simple

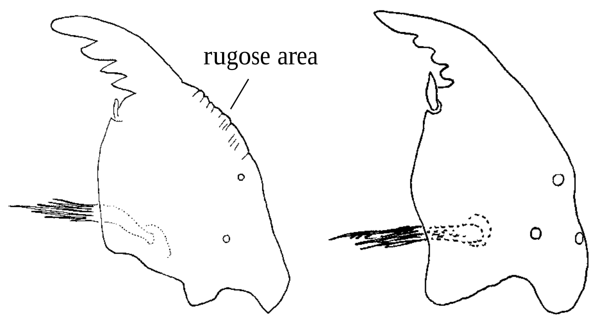
80(79’) Mentum with second lateral tooth appressed to first lateral tooth .... ***Cricotopus*** (in part)

80’ Second lateral tooth of mentum not appressed to first .. 81

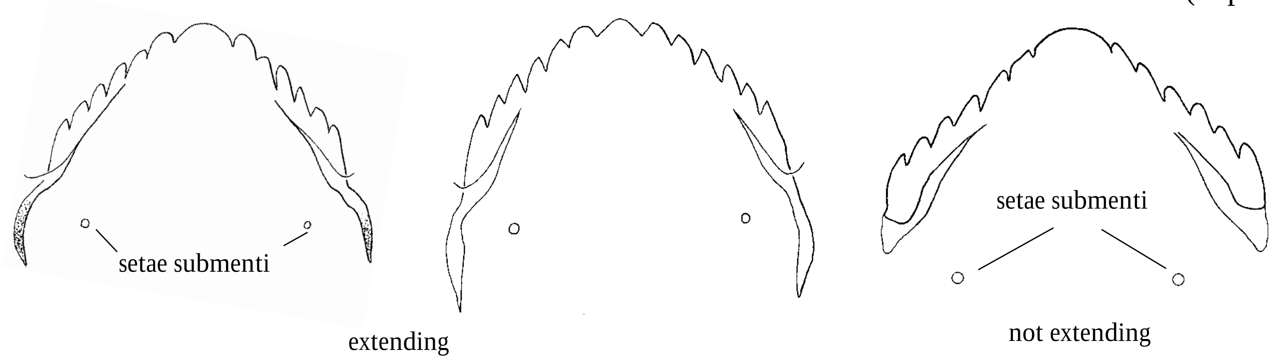


81(80’) Outer margin of mandible rugose .... ***Orthocladius*** (in part)

81’ Outer margin of mandible mostly smooth 82

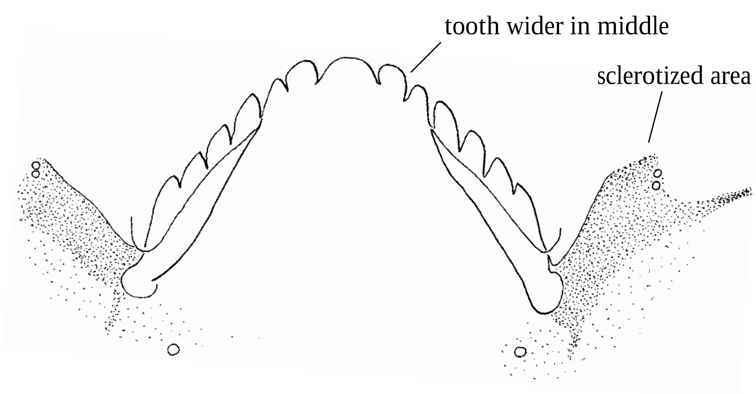


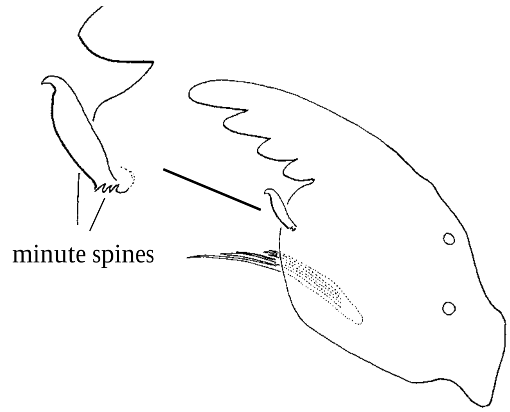
82(81’) Ventromental plates appear to extend well past a line drawn between bases of setae submenti .... ***Orthocladius*** (in part)



82’ Ventromental plates not extending as far posteriorly 83

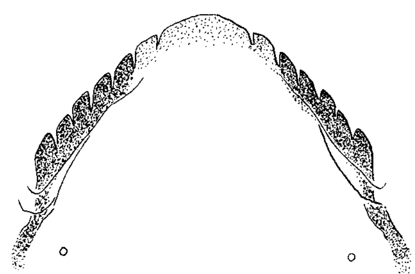
83(82’) Mentum with first lateral teeth constricted at base so that they appear wider in the middle than at bottom; minute spines present at base of seta subdentalis (often difficult to observe); head caspule with slightly more heavily sclerotized area laterad to mentum .... ***Paratrichocladius***





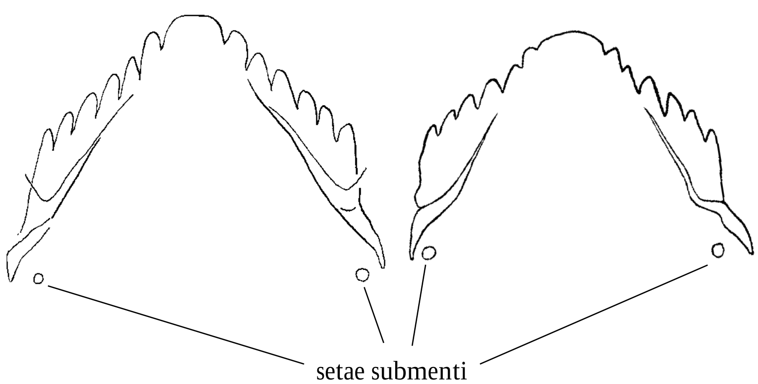
83’ First lateral tooth of mentum usually as wide or wider at bottom than at middle; small spines not present at base of seta subdentalis; sclerotized area laterad to mentum variable 84

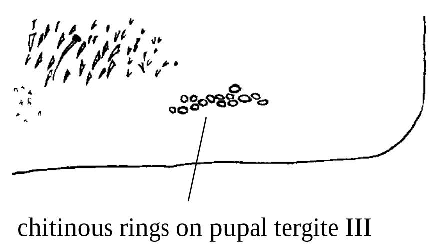
84(83’) Median and first lateral teeth of mentum paler than remaining lateral teeth .... ***Orthocladius*** (in part)



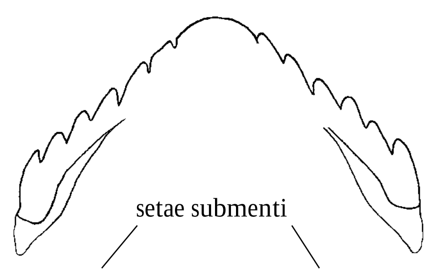
84’ Teeth of mentum unicolored 85

85(84’) Mentum triangular in outline or with median and first lateral teeth projecting above remaining lateral teeth; setae submenti located below lateral margin of mentum; pharate pupa with chitinous rings posterolaterally on at least tergites I-III .... ***Orthocladius*** (in part)

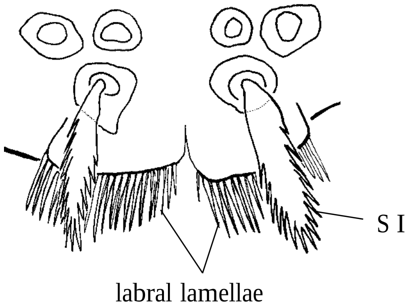


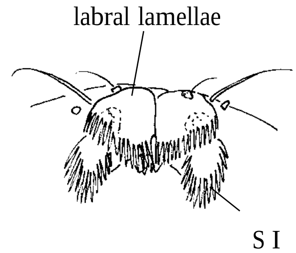


85’ Mentum convexly arched, median and first lateral teeth not projecting above remaining lateral teeth; setae submenti located more towards center line of mentum; pharate pupa without chitinous rings on tergites .... ***Cricotopus*** (in part)



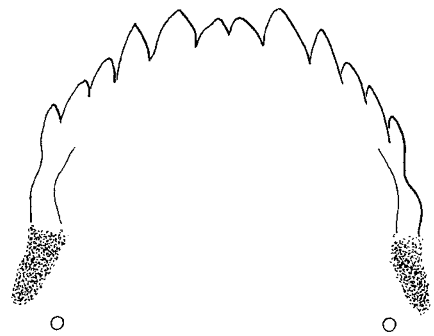
86(69’) Well developed labral lamellae present 87



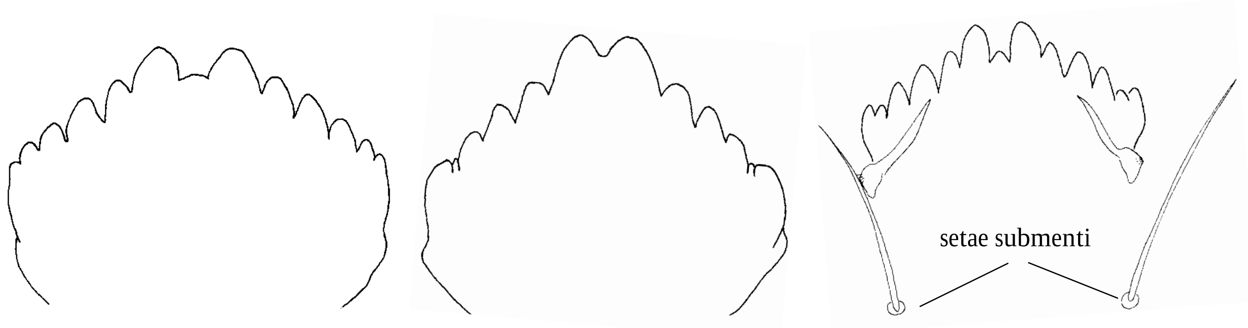


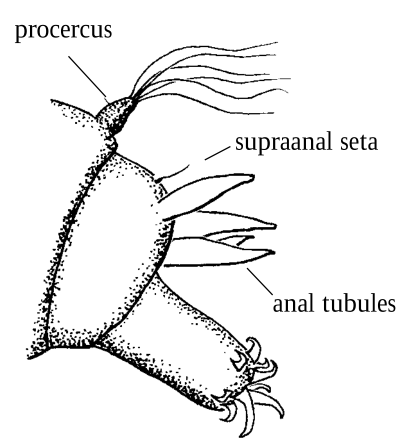
86’ Labral lamellae absent or vestigial 90

87(86) Mentum with 2-4 median teeth, none elongate; setae submenti located near base of mentum 88



87’ Mentum with 2 elongate median teeth (small central tooth sometimes present between median teeth); setae submenti displaced posteriorly, not near base of mentum 89



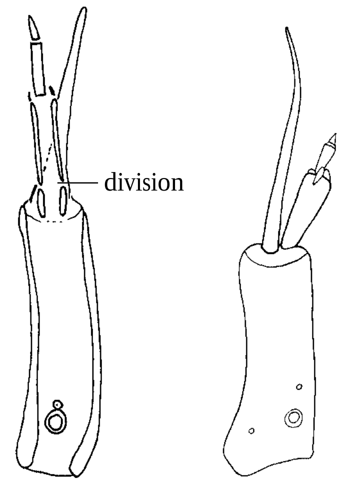


88(87) Procerci well developed, at least twice as long as wide; supranal setae shorter than anal tubules .... ***Metriocnemus*** (in part)

88’ Procerci weakly developed, about as wide as long; supraanal setae as long as or longer than anal tubules .... ***Thienemannia***

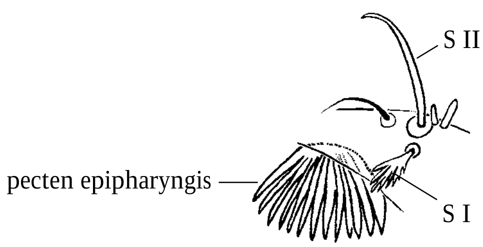
89(87’) Antennal segment 2 divided by weakly sclerotized area near base .... ***Brillia***

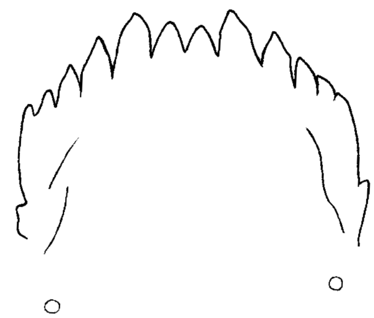
89’ Antennal segment 2 not divided .... ***Euryhapsis***



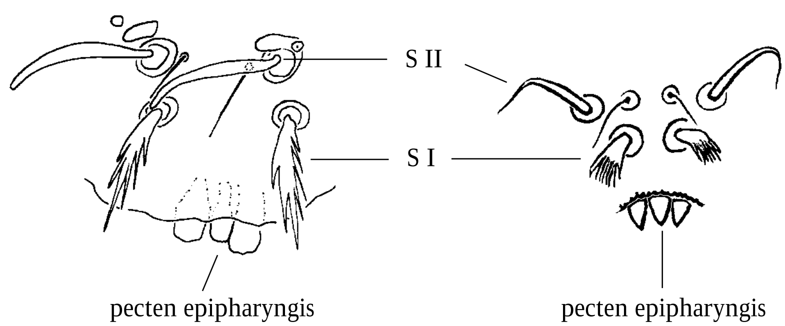
Brillia *Euryhapsis*

90(86’) Pecten epipharyngis with 15-20 long narrow teeth .... **Orthocladiinae genus E**

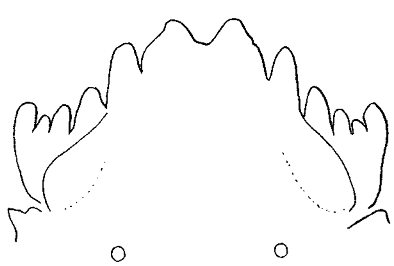


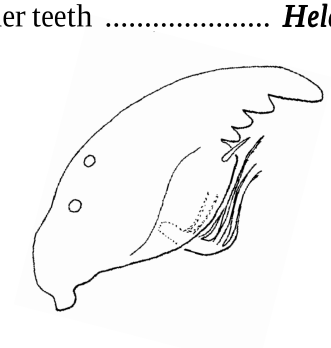


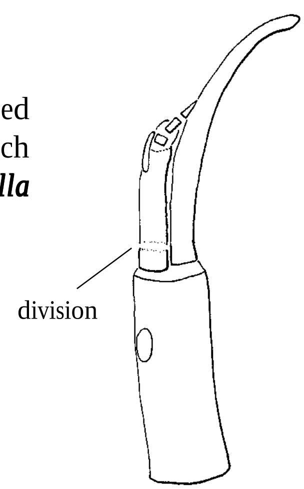
90’ Pecten epipharyngis with 3 teeth 91



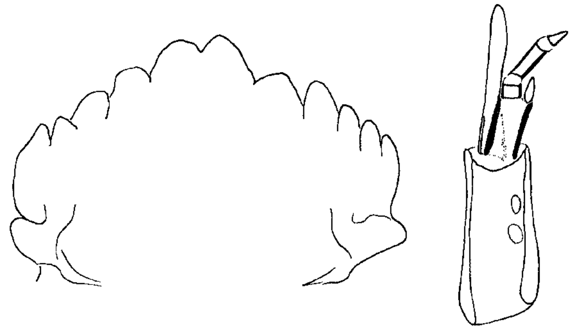
91(90’) Mentum with 2 broad median teeth divided by U-shaped or wide V-shaped gap; second antennal segment weakly divided near base; antennal blade much longer than flagellum; mandible with 3 inner teeth .... ***Heleniella***



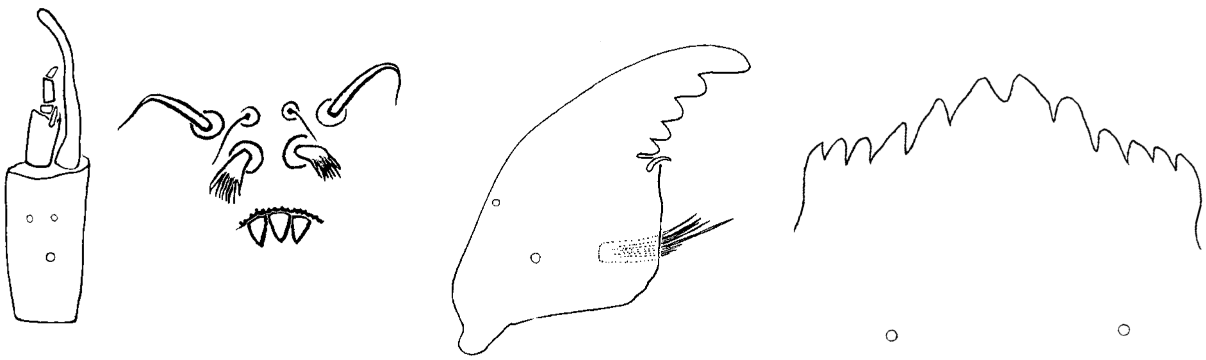




91’ Median teeth of mentum not separated by U-shaped or broad V-shaped gap; second antennal segment not weakly divided near base; if antennal blade longer than flagellum, then mandible with 4 inner teeth 92

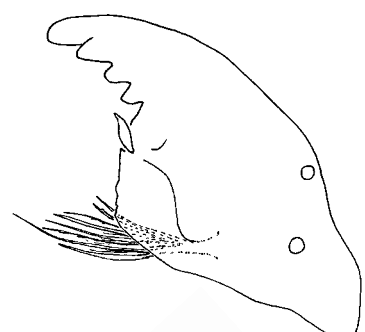


92(91’) Antennal blade longer than flagellum; S I apically pectinate/plumose; mandible with 4 inner teeth; found only in bromeliad phytotelmata in peninsular Florida ..... **Orthocladiinae genus H**

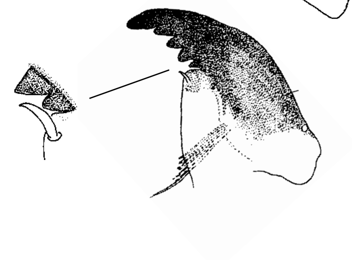


92’ Antennal blade subequal to flagellum; S I serrated; mandible with 3 or 4 inner teeth; not restricted to bromeliads in peninsular Florida 93

93(92’) Mandible with 3 inner teeth; supraanal setae about as long as anal setae .... ***Limnophyes*** (in part)



93’ Mandible with 4 inner teeth; supranal setae about 1/3 length of anal setae .... ***Compterosmittia***



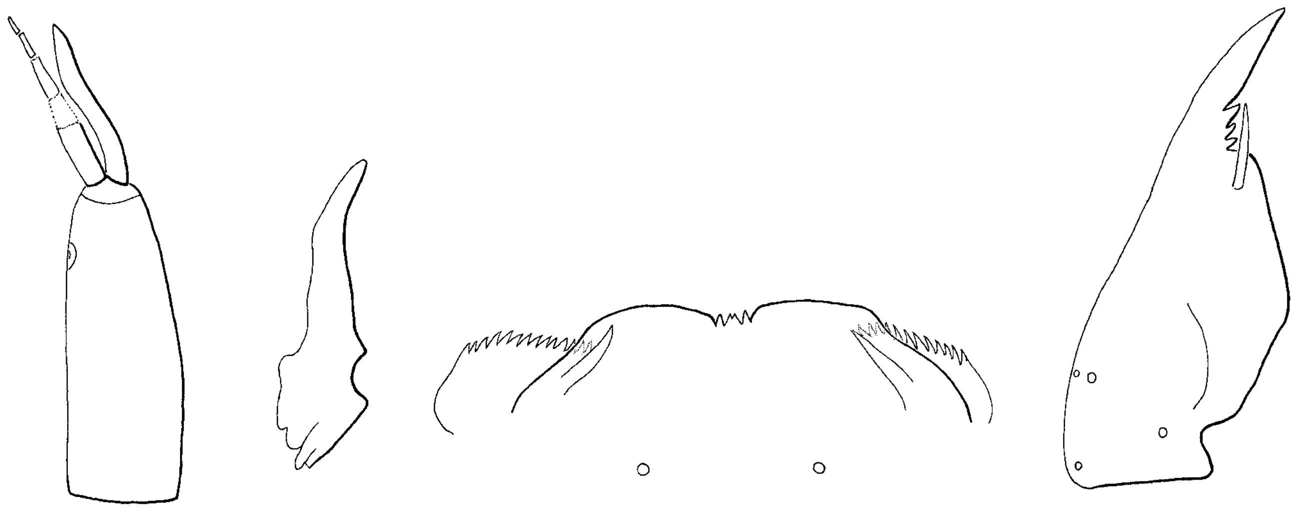
Genus *Acamptocladius*

DIAGNOSIS: This genus is diagnosed by the 5 segmented antennae, with 3rd and 4th segments difficult to distinguish; all S setae simple; ventromentum extended anteriorly to dorsomentum, with 3 central ventromental teeth (middle one may appear bifid) and with dorsomental teeth appearing to be arranged in two lateral lobes, each with about 12-18 teeth; and procerci and anal tubules present.

NOTES: This genus has not been recorded from North or South Carolina, but its presence in Canada and Florida indicates that it will eventually be found in the Carolinas. A single Nearctic species, *A. dentolatens* (Sæther) (originally described as a new genus, *Phycoidella*), has been described from larvae reared from blue-green algae (*Aphanocapsa* sp.) colonies in a lake in Canada; a Palaearctic species, *A. reissi* Cranston & Sæther, was collected from peat pools. One of the Florida *Acamptocladius* collecting sites (St. Lucie Co. in southeast central Florida) was a shallow water (0.4 m) savannah area, with gelatinous algae, *Eriocaulon*, *Nymphaea*, *Rhynchospora* and *Eleocharis* growing from a peaty bottom.

The Florida specimens do not appear to be conspecific with *A. dentolatens*. They will key to *A.* sp. (*submontanus* (Edwards)?) in Cranston & Sæther (1982), but it is very doubtful that they are that species.

ADDITIONAL REFERENCES: Cranston & Sæther 1982; Sæther 1971.



antenna premandible mentum mandible

Genus *Acricotopus*

DIAGNOSIS: Distinguished by the bifid to coarsely pectinate/palmate S I setae; mandible without a seta interna; mentum with 6 pairs of lateral teeth, with its broad median tooth notched, dividing it weakly into 4 parts; moderate ventromental plates with well developed, long beard; procerci without spurs; and anal tubules present.

NOTES: Two species are described from North America; only one, *A. nitidellus* (Malloch) is known from the northeastern US. An *Acricotopus* pupa has been collected from South Carolina; a single larva has been found in North Carolina. These specimens probably represent *A. nitidellus*; reared material is necessary to confirm their identity.

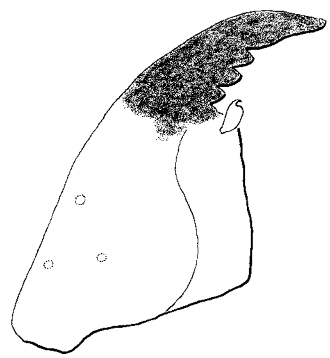
Hirvenoja (1973: fig. 38.6) and Cranston, et al. (1983: fig. 9.3D) illustrate the SI setae as bifid with serrated margins. The SI of *A. nitidellus* is more coarsely pectinate as illustrated by Johannsen (1937a: fig. 198; as *Spaniotoma senex*); the SI setae of North Carolina and Ohio specimens are similar.

Acricotopus larvae are found in small streams, temporary pools, bog pools and the littoral zone of lakes. The single North Carolina larva examined came from a stream impacted by toxic and organic wastes.

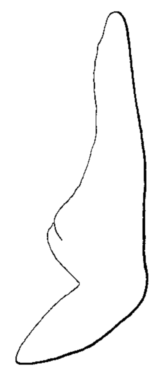
ADDITIONAL REFERENCES: Cranston & Oliver 1988a; Hirvenoja 1973; Johannsen 1937a.

SI, NC specimen

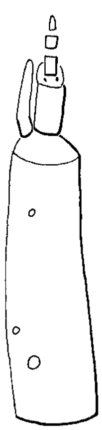
SI, OH specimen



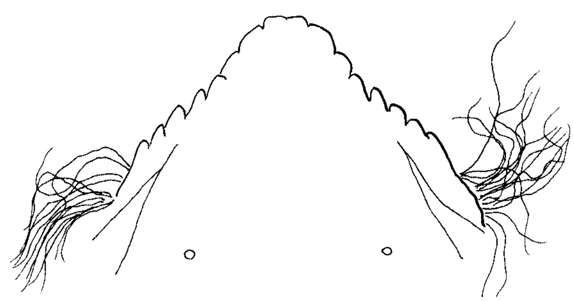
mandible



premandible



antenna



mentum

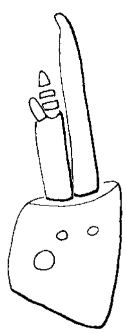
Genus ***Antillocladius***

DIAGNOSIS: The coarsely palmate SI; pecten epipharyngis appearing plate-like with numerous small rounded teeth; 5 segmented antennae with blade much longer than flagellum; apically bifid premandible; mandible with seta interna; well developed posterior parapods; and the lack of procerci and anal tubules will distinguish this genus.

NOTES: Two species of *Antillocladius* occur in the Southeast; only the immature stages of *A. pluspilalus* have been described (Sæther 1984). Larvae occur in seeps and around small streams, or are completely terrestrial; the Florida specimens figured below came from hardwood leaf litter.

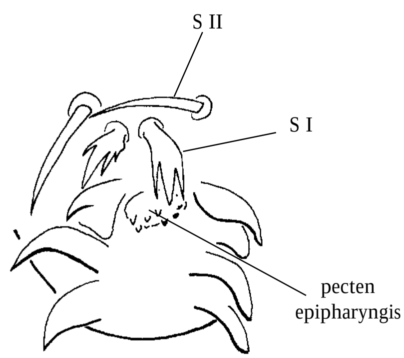
The larva of *A. pluspilalus* was described from a single exuviae; its mentum differs slightly from the unassociated Florida material figured here. Note the unusual pecten epipharyngis, which is similar to the type found in some Chironominae.

ADDITIONAL REFERENCES: Sæther 1981b, 1982, 1984.



antenna

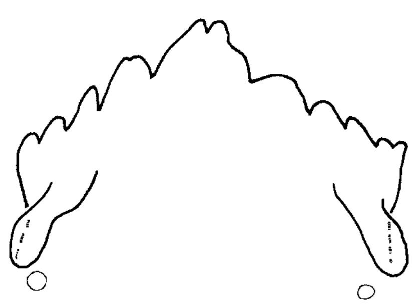
premandible



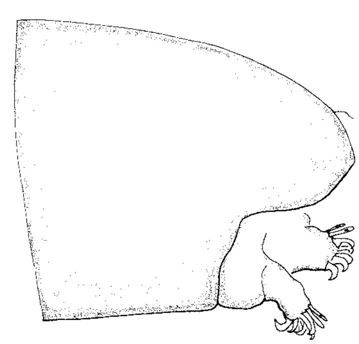
labral area

mandible

mentum, FL specimen



A. pluspilalus mentum
(adapted from Sæther 1984)



posterior end

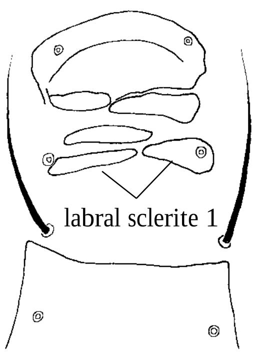
Genus ***Brillia***

DIAGNOSIS: Distinguished by the well developed pectinate labral lamellae; plumose S I; 4 segmented antenna with segment 2 divided in basal third by a weakly sclerotized area; antennal blade subequal to flagellum; distinctive mentum; posteriorly displaced setae submenti (near posterior margin of head capsule); and procerci and anal tubules present.

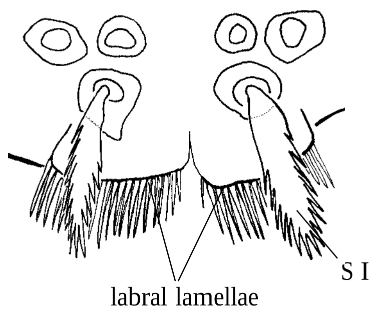
NOTES: Three species are described from eastern North America; all three occur in the Carolinas. The species formerly known as "*Brillia par*" is now placed in *Xylotopus*.

Brillia larvae are almost always associated with submerged allochthonous wood and leaves, and may be found in springs, streams, rivers and the littoral margins of lakes.

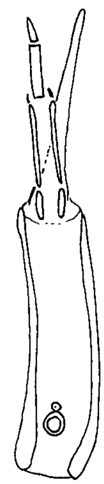
ADDITIONAL REFERENCES: Oliver & Roussel 1983.



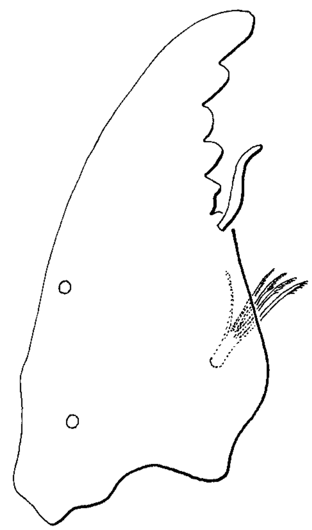
B. flavifrons
apotome and labral sclerites



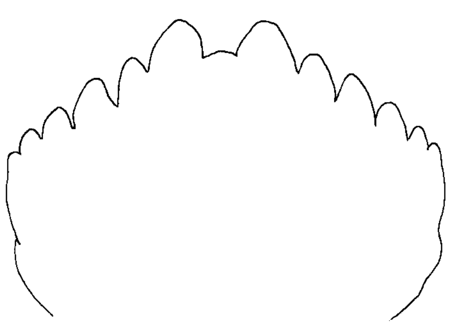
B. flavifrons
palatal surface of labrum



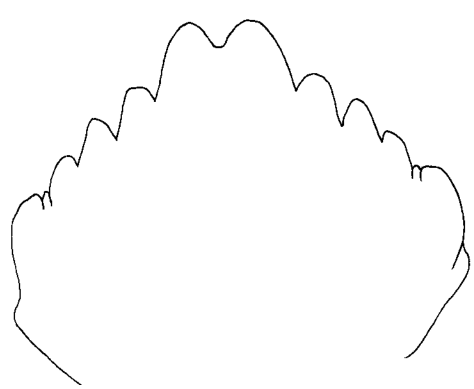
B. parva antenna



B. flavifrons mandible



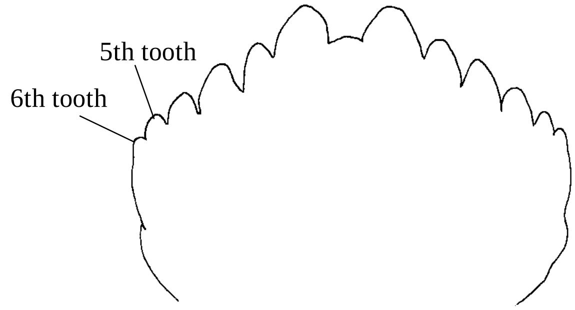
B. flavifrons mentum



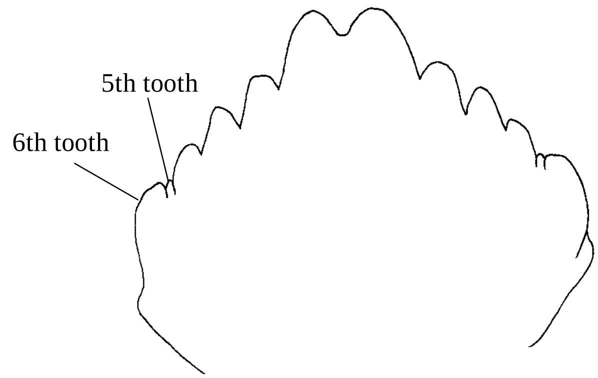
B. parva, mentum

Key to *Brillia* larvae of the southeastern United States

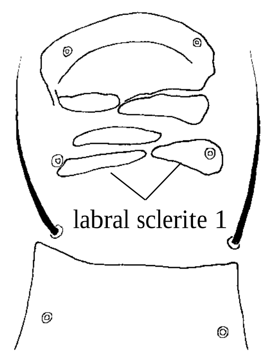
1 6th lateral tooth of mentum placed posterior to 5th lateral tooth 2



1' 6th lateral tooth of mentum even with or anterior to 5th lateral tooth .... ***B. parva***



2(1) Labral sclerite 1 entire or narrowly separated medially, separation < 8 µm ...... ***B. flavifrons***



2' Labral sclerite 1 widely separated medially, separation > 10 µm .... ***B. sera***

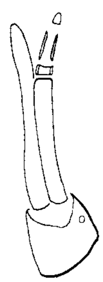
Genus ***Bryophaenocladius***

DIAGNOSIS: The five segmented antenna; simple, stout S setae; mandible without seta interna; lack of procerci and anal setae; and posterior end bent downward at a 90° angle, with posterior parapods undivided, will distinguish this genus.

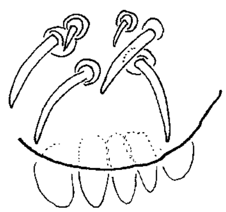
NOTES: Based on adult specimens, five species are recorded from the Carolinas; it is not possible to identify larvae to species. Larvae are very similar to those of *Gymnometriocnemus*; apparently only the divided posterior parapods of *Gymnometriocnemus* larvae will separate them from *Bryophaenocladius*, which lack the division. The larva illustrated as "*Mesosmittia* sp." in Epler (1995:6.51) is most likely a *Bryophaenocladius*.

Larvae are mostly terrestrial but several species are aquatic, inhabiting lake shorelines. Some terrestrial larvae may be pests of greenhouse plants and some crops (lettuce, potatoes and tomatoes).

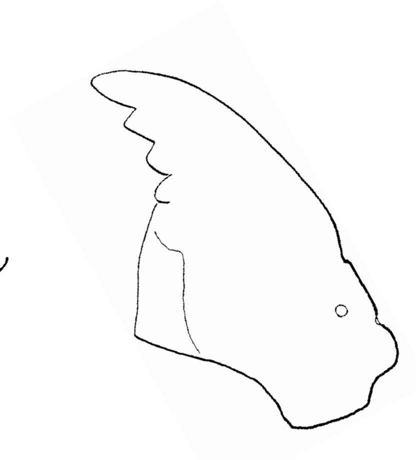
ADDITIONAL REFERENCES: Cranston 1987; Sæther 1973a; Tuiskunen & Lindeberg 1986.



antenna

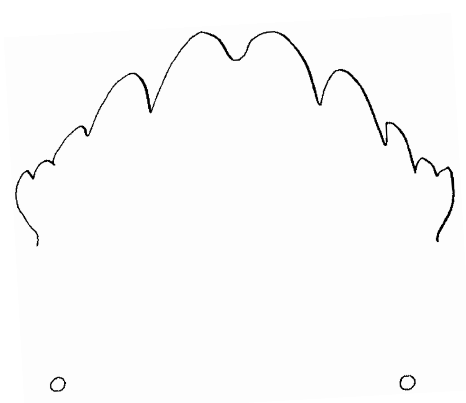


labrum

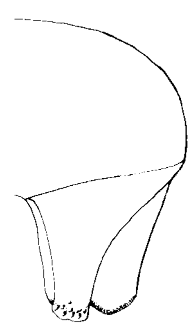


mandible

premandible



mentum



B. furcatus, posterior end
(adapted from Cranston 1987)

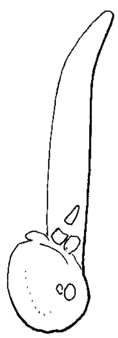
Genus *Camptocladius*

DIAGNOSIS: Distinguished by the bifid S I and S II; reduced, three segmented antennae, with 3rd segment subequal to or shorter than 2nd and blade much longer than flagellum; apically bifid premandible without brush; and the absence of procerci and posterior parapods.

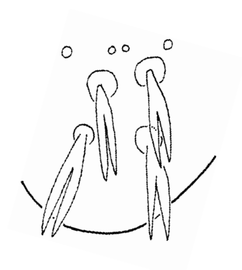
NOTES: Apparently a monotypic genus, *C. stercorarius* has not been recorded from the Carolinas. However, this species is widely distributed throughout the Holarctic and no doubt occurs in the Carolinas; I've examined unassociated specimens from north Florida (illustrated below).

Larvae are terrestrial and are usually found in cow dung and rotting vegetable matter.

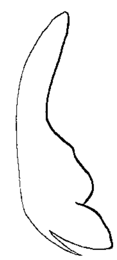
ADDITIONAL REFERENCES: Strenzke 1940, 1950a.



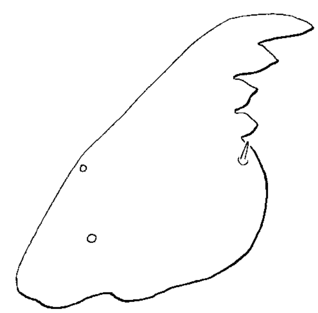
antenna



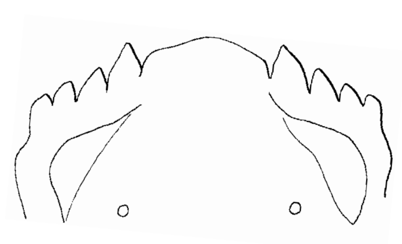
labrum



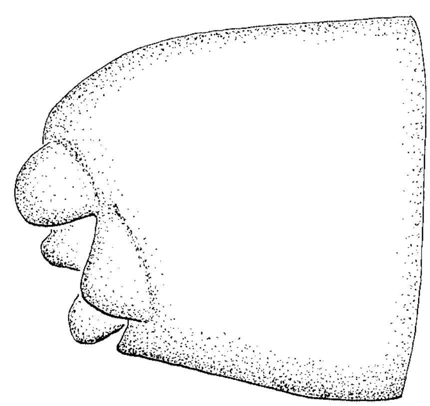
premandible



mandible



mentum



posterior end

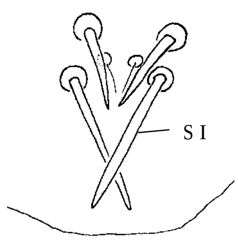
Genus ***Cardiocladius***

DIAGNOSIS: Distinguished by the brown to dark brown head capsule; simple S setae, with S I long, thick and heavily sclerotized; short basal sclerite; heavily sclerotized premandible with a broad, usually simple apex; mandible with inner serrations/spines; seta interna of mandible with long simple basal stalk that branches apically; body with short setae; and reduced procerci.

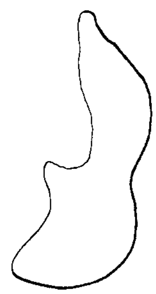
NOTES: Two species of *Cardiocladius* are recorded from the Carolinas. Both species are lotic and appear to be more common in fast flowing water; Hudson et al. (1990) stated that larvae may be "fairly tolerant of toxic pollution".

Cardiocladius larvae have been reported to be associated with or even predacious on simuliid larvae. Since many simuliid larvae prefer fast running water, as do *Cardiocladius* larvae, the association makes sense. However, there is (to my knowledge) no published evidence of *Cardiocladius* predation on simuliid larvae; all guts of *C. obscurus* larvae I've examined were filled with detritus, apparently algae. Note that *C. albiplumus* can be ectoparasitic on hydropsychid caddisfly pupae (see Notes on species)

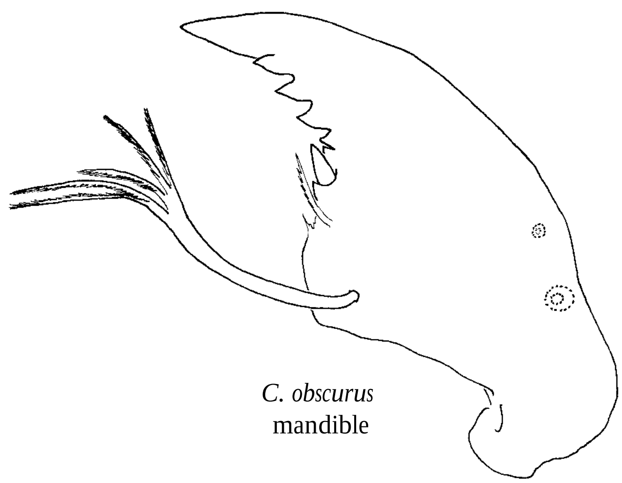
ADDITIONAL REFERENCES: Bode 1983; Oliver & Bode 1985; Parker & Voshell 1979.



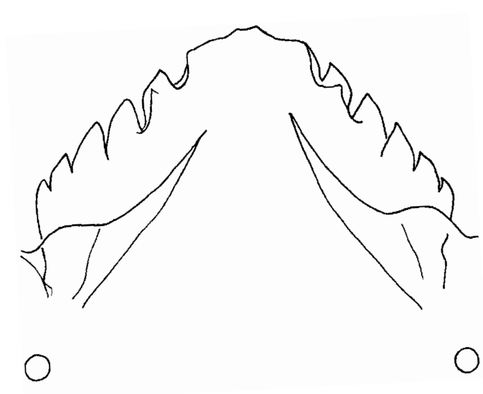
C. albiplumus
S setae



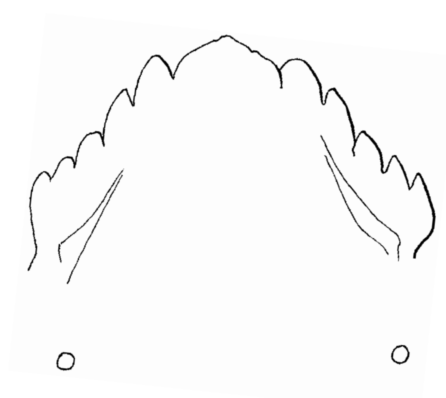
premandible



C. obscurus
mandible



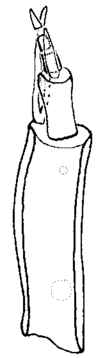
C. obscurus mentum

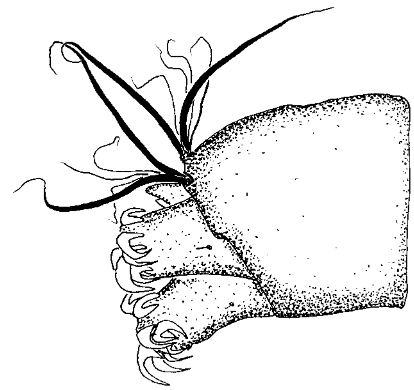


C. albiplumus mentum

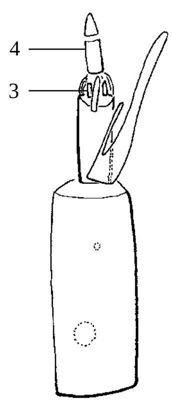
Key to *Cardiocladius* larvae of the southeastern United States

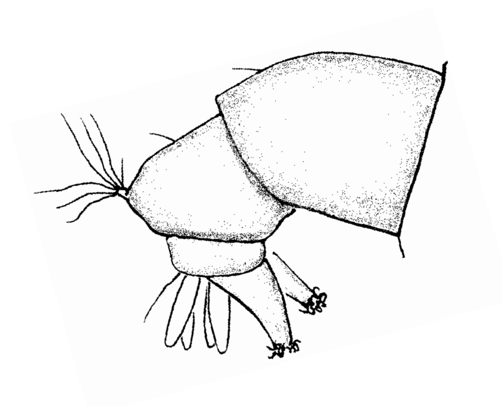
1 Antennal segments 3 and 4 subequal; each procercus with 2 setae that are thicker and longer than others; anal end not deflexed ventrally .... ***C. obscurus***





1' Antennal segment 4 about twice as long as segment 3; procerci without thicker, longer setae as above; anal end deflexed ventrally .... ***C. albiplumus***





Notes on species

C. albiplumus - Bode (1983) initially described the larva of this species as "*Eukiefferiella similis* group". Oliver & Bode (1985) associated the immature stages with the adult (previously described by Sæther (1969)) and noted that the species should be placed in *Cardiocladius,* although the immature stages appeared more closely aligned with *Eukiefferiella*. The inclusion of *C. albiplumus* in *Cardiocladius* confuses the limits of *Eukiefferiella* and related genera; on-going revisionary work will hopefully clarify the status of the species. Larvae have been reported as ectoparasites on hydropsychid caddisfly pupae (Parker & Voshell 1979); such larvae grow to a much larger size than other *C. albiplumus* larvae that have fed on algae. Note that the median tooth has a central nipple-like projection which is often worn off. *Cardiocladius albiplumus* also has supraanal setae; these setae are noted as absent in other species of *Cardiocladius* (Cranston et al. 1983). Note also that the deflexed posterior of *C. albiplumus* is similar to that of *Paraphaenocladius* and will cause it to key to *Paraphaenocladius* in Cranston et al. (1983).

C. obscurus - Larvae of this species are far more commonly encountered than those of *C. albiplumus*.

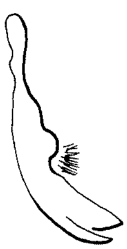
Genus *Chaetocladius*

DIAGNOSIS: In contrast to the adults and pupae, larvae of *Chaetocladius* can be difficult to diagnose due to considerable variation in some larval structures. Larvae may be diagnosed by the following: S I simple (one species, *Ch. ligni*), serrate, branched or plumose; labral lamellae present near bases of S I (sometimes absent/vestigial, as in *Ch. ligni*); antennae 5 segmented, with segment 3 shorter than or subequal to 4; premandible apically simple or bifid, with weak to moderate brush; mentum with 1 or 2 median teeth; and ventromental plates small to large, when large may extend beyond lateral margin of mentum.

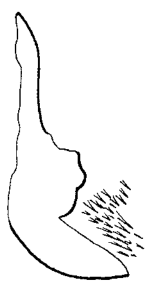
NOTES: Caldwell et al. (1997) report two species of *Chaetocladius* from the Carolinas based on adult specimens; I've seen two species from the Smoky Mountains based on pupae. There are probably several more species present in the Southeast, but with the exception of *Ch. ligni* (with its distinctive mentum and labral setae), it is not possible to identify larvae to species. *Chaetocladius stamfordi* has been shown to be a junior synonym of *Ch. piger* (Caldwell 1997); *Chaetocladius* requires revision in the Nearctic. The preanal segment of *Ch. ligni* is curved over the posterior segments, similar to *Cardiocladius albiplumus* and *Paraphaenocladius* species; I've seen larvae of *Ch. ligni* from Great Smoky Mountains National Park in North Carolina.

Chaetocladius larvae may be semi-terrestrial or aquatic, being found in wet leaves, springs, ditches, streams, ponds and permanent and temporary pools, as well as in wells and sewage treatment plants; one species, *Ch. ligni*, mines in immersed wood.

ADDITIONAL REFERENCES: Caldwell 1997; Cranston & Oliver 1988b.

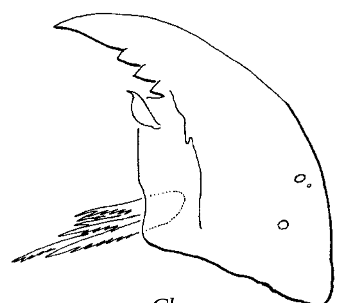


Ch. sp.
bifid premandible

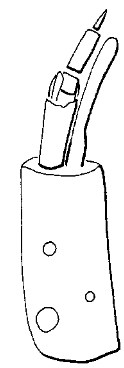


Ch. sp.
simple premandible

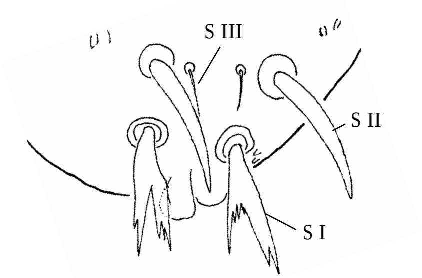
Ch. ligni premandible



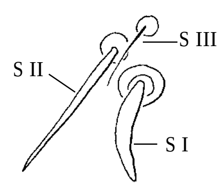
Ch. sp.
mandible



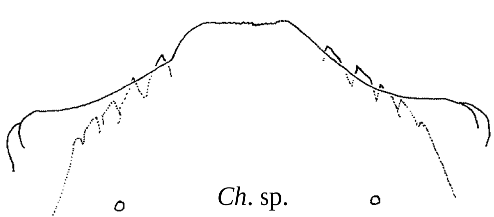
Ch. sp.
antenna



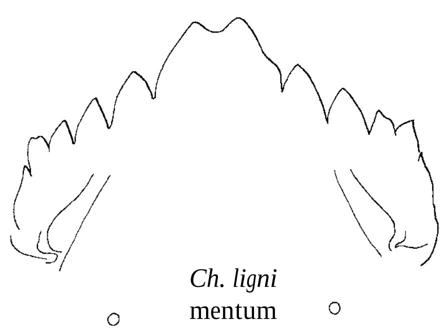
Ch. sp.
labrum



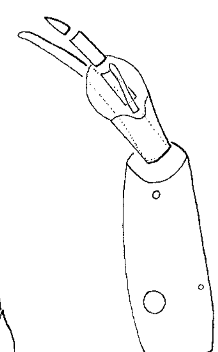
Ch. ligni
labral setae



Ch. sp.
mentum



Ch. ligni
mentum



Ch. ligni
antenna

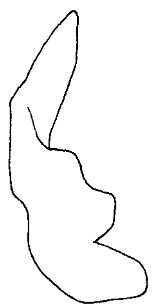
Genus ***Clunio***

DIAGNOSIS: This genus is easily identified by its plumose S I and S II; premandible with simple apex; lack of procerci and anal tubules; and its marine/brackish water habitat.

NOTES: One species, *C. marshalli*, is known from the southeastern United States. Specimens from near Wilmington, NC, are the northernmost examples I've examined.

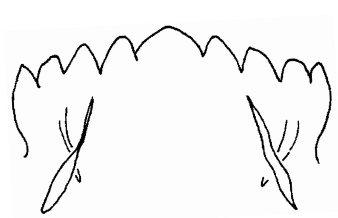
I've collected larvae and pupae from algae covered rocks in the Intracoastal Waterway in Florida, where they co-existed with *Thalassomya* larvae.

ADDITIONAL REFERENCES: Hashimoto 1976; Stone & Wirth 1947; Strenzke 1960; Wirth 1949.

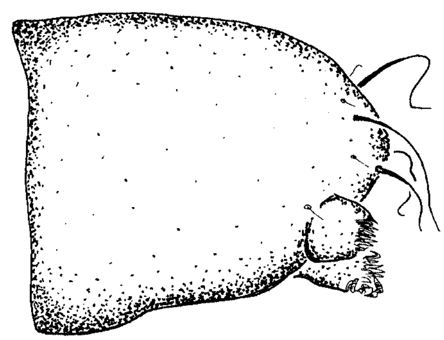


premandible

labrum



mentum



posterior end

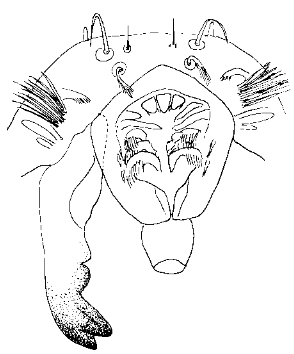
Genus *Compterosmittia*

DIAGNOSIS: Distinguished by the absence of labral lamellae; serrated S I; 5 segmented antenna, with blade shorter than to subequal to flagellum; apically bifid premandible, without brush; mentum with 2 median teeth and 5 pairs of lateral teeth; ventromental plates weak, with posterolateral portion appearing as a rounded tooth; mandible with 4 inner teeth, proximal tooth distinctly separate from mola; body setae shorter than 1/2 length of segment; and supraanal setae 1/3 length of anal setae.

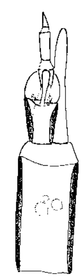
NOTES: One species, *C. nerius*, is known from the eastern United States, where it is recorded from New York and both Carolinas. The immature stages are undescribed; the diagnosis above and figures below are based on larvae from Hong Kong and Tasmania. Larvae are very similar to *Limnophyes* and *Paralimnophyes*; pupae of *Compterosmittia* are inseparable from those of *Limnophyes*.

Larvae from the Australian and Oriental regions were collected from phytotelmata (plant held waters); the habitat of immature *C. nerius* is unknown.

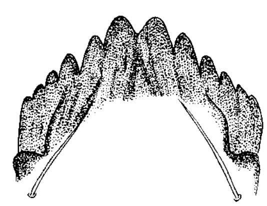
ADDITIONAL REFERENCES: Cranston & Kitching 1995; Sæther 1981b.



labrum and premandible



antenna



mentum

proximal tooth

mandible

(figures above adapted from Cranston & Kitching 1995)

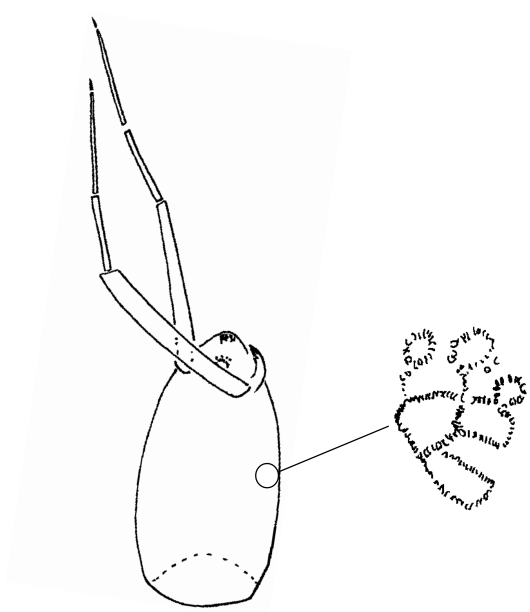
Genus *Corynoneura*

DIAGNOSIS: Distinguished by the small size (less than 4 mm) and long, 4 segmented antennae that are subequal to or longer than head capsule length.

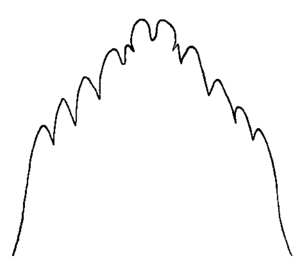
NOTES: Four named species are recorded from the Carolinas. However, it is uncertain whether these named species, three of which are Palaearctic, have been correctly identified, although I have seen pupal and adult material that is most certainly *C. lobata* (see Notes on species for *C. taris*). Seasonal variation in the number of adult antennal flagellomeres can cause confusion, perhaps leading to misidentification of adults (see Schlee (1968) and Hirvenoja & Hirvenoja (1988)). Larval keys written for European species will not work correctly in the Nearctic; matching a specimen's mentum with an illustration from the literature (mostly based on Palaearctic species) does not mean that a correct identification has been achieved. All Nearctic records of *Corynoneura* species based on larvae must be treated with extreme skepticism. Because of the difficulties in identifying *Corynoneura* species, some due to vague descriptions or misunderstandings by earlier workers who did not examine type material, it appears that the names *C. scutellata*, *C. celeripes* and *C. taris* have been grossly misused; see Schlee (1968) and Hirvenoja & Hirvenoja (1988). Note that the species keyed and illustrated as *C. scutellata* in Pinder (1978) is *C. gratias* Schlee (Hirvenoja & Hirvenoja (1988)). Needless to say, the Nearctic species of *Corynoneura* are in great need of revision!

Corynoneura are found in a wide variety of habitats, and it is not unusual to find two or more species in one sample. The key that follows must be considered preliminary; there may be other species in the Southeast whose larvae I have not seen and can not include in the key. Note especially that 4th instar larvae are necessary for correct use of much of the key; Hirvenoja & Hirvenoja (1988) found that antennae lengthened from the first to the last instars. Also note that relative lengths of antennal segments may vary within a species from instar to instar.

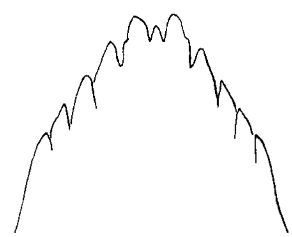
ADDITIONAL REFERENCES: Boesel & Winner 1980; Hirvenoja & Hirvenoja 1988; Schlee 1968; Sublette & Sasa 1994.



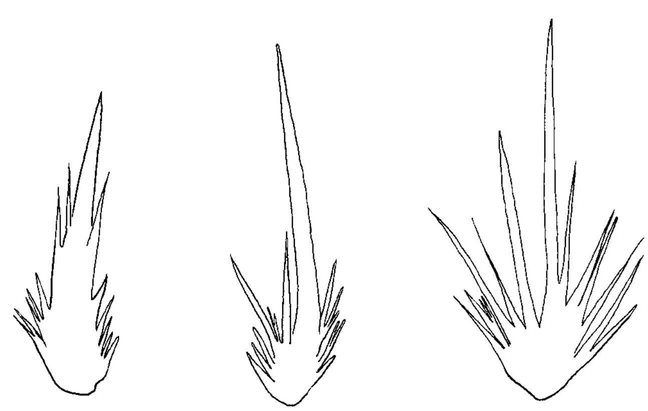
C. lobata head capsule with close-up of reticulate sculpturing



C. sp. B mentum



C. sp. G mentum



C. sp. B *C.* sp. C *C.* sp. D

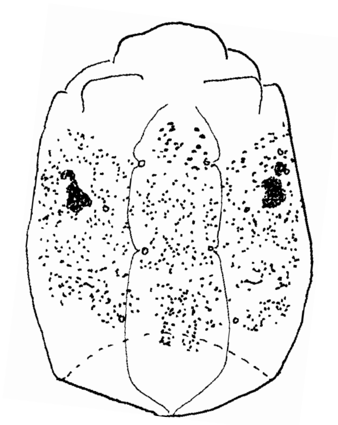
subbasal setae of posterior parapod

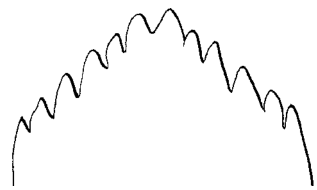
Key to *Corynoneura* larvae of the southeastern United States

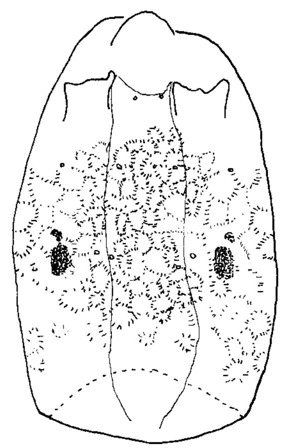
1 Head capsule integument with pustules/granules or sculpturing consisting of fine scratches, often in a reticulate pattern (sculpturing usually strongest dorsally, but may be faint in some specimens) (see figures in couplet 2) 2

1’ Head capsule integument smooth, unsculptured 5

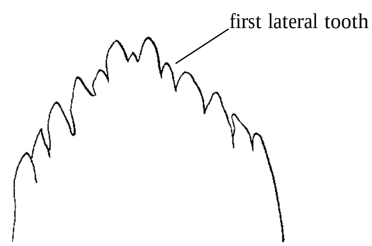
2(1) Head capsule integument pustulate/granulate; mentum with 2 median teeth; known only from southern Florida .... ***C.* sp F**



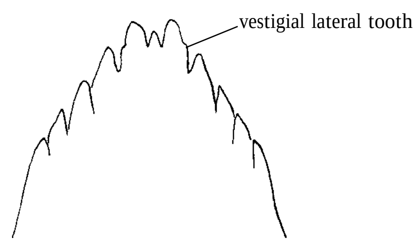




2’ Head capsule integument with sculpturing that usually forms a reticulate pattern; mentum with 3 median teeth (see couplet 3 below); widespread 3



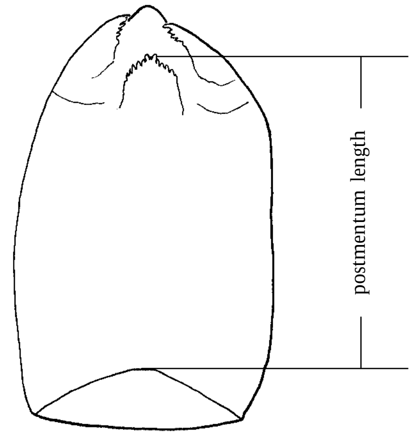
3(2’) First lateral tooth of mentum well defined, rising to about the same level as second lateral tooth, mentum with 5 well defined lateral teeth on each side .... ***C.* sp. C**



3’ First lateral tooth of mentum vestigial or appressed closely to outer median tooth so that mentum may appear to have only 4 lateral teeth per side 4

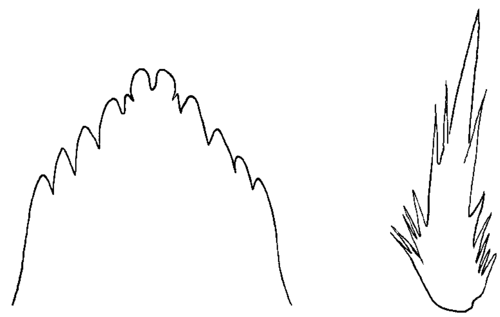
4(3') Basal antennal segment shorter, less than to slightly greater than postmentum length .... ***C. lobata***

NOTE:
4th instar larvae are necessary for accurate measurements!!

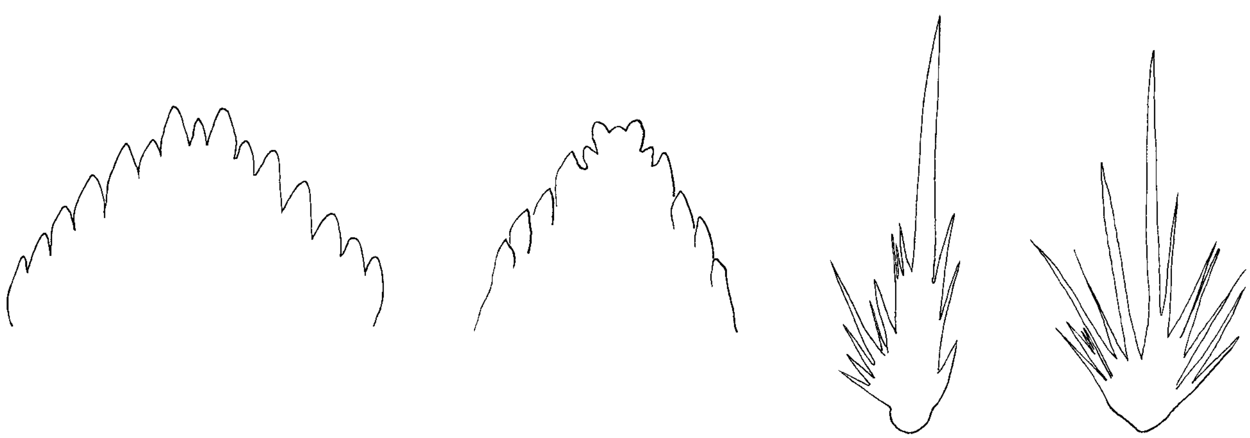


4' Basal antennal segment longer; much longer (at least 10 µm) than postmentum length .... ***C.* sp. G**

5(1') Mentum with 2 median teeth; posterior parapod subbasal setae with lateral spinules running along almost entire side of main shaft, not confined to basal half or less .... ***C.* sp. B**

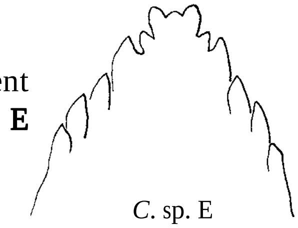


5' Mentum with 3 median teeth; posterior parapod subbasal seta with lateral spinules of main shaft confined to basal half or less 6



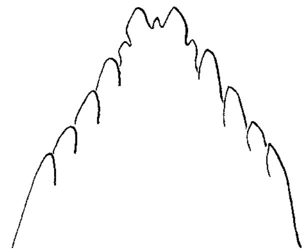
C. sp. E *C.* sp. D

6(5’) Total length of antennae subequal to head capsule length, basal segment about 80-100 µm (4th instar only!) .... ***C.* sp. E**



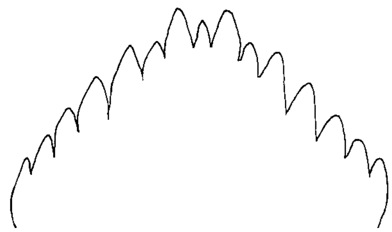
C. sp. E

6’ Total antennal length much longer than head capsule length; basal segment 190-325 µm 7



7(6’) Mentum with 5 pairs of lateral teeth; basal antennal segment 190-210 µm long (4th instar only!) .... ***C.* sp. H**

NOTE:
4th instar
larvae are necessary
for accurate
measurements!!



7’ Mentum with 6 pairs of lateral teeth; basal antennal segment 300-325 µm long (4th instar only!) .... ***C.* sp. D**

Notes on species

C. lobata - In the Nearctic this species was formerly referred to as *C. taris*. I have re-examined the holotype male of *C. taris*; contrary to Roback’s (1957) description, the gonocoxite does bear a small medial lobe and is basically identical to *C. lobata* Edwards. Both species have antennae with 10 flagellomeres; however, in adult males of Palaearctic *C. lobata* the last antennal segment is as long as the preceding 4-6 flagellomeres while in the holotype *C. taris* it is slightly shorter than the preceding 3 flagellomeres. Given the propensity for variation known in the genus *Corynoneura* (see Schlee (1968) and Hirvenoja & Hirvenoja (1988)), this difference appears insignificant. I have measured the *C. taris* holotype’s AR as 0.36; this falls within the range of ARs (0.20-0.64) for this species given by Schlee (1968). Both taxa have an S-shaped setae at the enlarged apex of the hind tibia. Associated pupae from north Florida will key to *C. lobata* in Langton (1991) and in a manuscript key to North American pupal exuviae. Under a different coverslip on the same slide as the holotype of *C. taris* is a whole mounted larva; it is not an exuviae and thus can not be directly associated as the larval exuviae of the holotype (which, according to Roback (1957), was reared.) It is this larva that Epler (1995) used as a basis for *C. taris* in his larval key. Its basal antennal segment is as long as the postmentum length (163 µm). Cranston’s (1982) key stated that the first antennal segment length of *C. lobata* was less than 200 µm but greater than 130 µm. I’ve also examined reared specimens of *C. lobata* from England and have compared them to reared Nearctic material (mostly from Florida). I can see no differences that would suggest that the two taxa are not the same entity and thus I consider the two synonymous; *lobata* is the older name and has priority. A single reared male *C. lobata* from Ohio is slightly different in that the pupa differs slightly in bearing very light tergal shagreen in contrast to the moderate to heavy shagreen of *C. lobata*.

Note that the ovoid darker area on the mid-dorsum of the head mentioned by Epler (1995) can also be observed on *C.* sp. C and *C.* sp. G. *Corynoneura* sp. G may be a variant of *C. lobata* with longer antennae; reared material is necessary to confirm whether the two taxa are different species.

C. sp. B - This is apparently the same taxon called "*C. celeripes*" by Simpson & Bode (1980); the mentum and subbasal setae of the posterior parapods are similar. However, I have reared *C*. sp. B from the Suwannee and Withlacoochee Rivers in northern Florida; this species does not appear to be *C celeripes*. Male genitalia of *C*. sp. B are somewhat similar to *C. lobata*, but differ in having a truncate transverse sternapodeme; that of *C. lobata* is sharply arched and directed anteriorly. The larva of *C. coronata* Edwards as illustrated by Cranston (1982) and Cranston et al. (1983) also has a mentum similar to *C*. sp. B, but *C*. sp. B is **not** that species either; *C. coronata* has sculpturing on the head capsule. This taxon appears to be an undescribed species and is apparently common throughout the Southeast (and perhaps the entire eastern U.S.). Hirvenoja & Hirvenoja (1988) separated some species as larvae by antennal length. Using such criteria, *C*. sp. B may consist of more than one species: in Florida and South Carolina material examined, there were two size classes based on basal antennal length/postmentum length. In specimens with basal antennal segment lengths of 150 µm or more, basal segment length was greater than postmentum length; in specimens with basal antennal lengths 125 µm or less, basal segment length was less than or subequal to postmentum length. Whether this is due to allometry, seasonal, or species differences will remain uncertain until adults of both varieties are associated with larvae (I have reared only the "short" antennal variety).

C. sp. C - Very similar to *C. lobata* and *C*. sp. G, but with a well developed first lateral tooth on the mentum. This species has long antennae; the basal segment is much longer than postmentum length. This taxon may be *C. lacustris* or *C. scutellata* but reared material is needed for confirmation.

C. sp. D - This taxon is unique in that most specimens have a mentum with 6 pairs of lateral teeth (plus three median teeth); Cranston et al. (1983) stated that *Corynoneura* has 5 pairs of lateral teeth plus 2 or 3 median teeth. The outermost 6th tooth may appear as only a notch on some specimens; the figure accompanying couplet 6' is of a considerably flattened mentum. Note also the smooth head capsule integument and the very long antennae. I have not yet seen this taxon from the Carolinas.

C. sp. E - A species with short antennae for a *Corynoneura*; total antennal length is subequal to the length of the head capsule. I have seen specimens from as far north as the Blue Ridge Parkway in North Carolina.

C. sp. F - Known only from marshes in south Florida, this species is unique among North American *Corynoneura* known to me in that the head capsule integument bears tiny pustules or granules. Its head capsule is rather squat for a *Corynoneura*; the basal antennal segment is longer than the postmentum length.

C. sp. G - I have set aside larvae with longer antennae than *C. lobata* as a separate taxon. If the basal antennal length is more than 10 µm greater than the postmentum length, I have called such larvae *C*. sp. G. There does seem to be a "natural" gap here, but, as usual, more material is needed! I have seen material of this taxon from South Carolina and northern Florida.

C. sp. H - A smooth head capsuled species with moderately long antennae, I have seen this taxon only from the Santa Fe River in northern Florida. Since much of northern Florida's chironomid fauna is found throughout the southeastern Coastal Plain, it should probably occur in that region of the Carolinas.

In addition to the described species listed by Caldwell et al. (1997), I have examined male specimens of what is probably *C. oxfordana* Boesel, described from Ohio, from the Savannah River Plant area in South Carolina and Coweeta Hydrologic Lab in North Carolina; the immature stages are undescribed.

Genus *Cricotopus*

DIAGNOSIS: A difficult genus to diagnose precisely because of variation in many key characters; many larvae are difficult or impossible to separate from *Orthocladius (Orthocladius)* and *Paratrichocladius* larvae. S I most often bifid, but sometimes simple or with one branch considerably larger than the other; pecten epipharyngis a simple scale ([*C. (Isocladius)*] or with 3 scales [*C. (Cricotopus)* and *C. (Nostococladius)*]; simple (usually) or bifid premandible; weakly developed ventromental plates; beard very weak or vestigial; mentum with an odd number of teeth; and abdominal segments with or without a pair of posterolateral setal tufts.

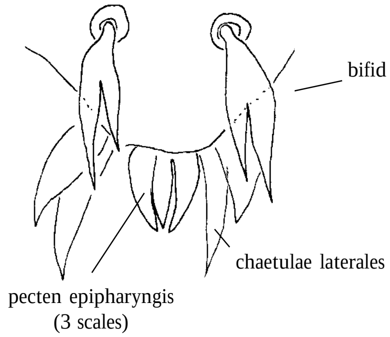
NOTES: About 16 species of *Cricotopus*, representing three subgenera (*Cricotopus*, *Isocladius* and *Nostococladius*), are recorded for the Carolinas. Many of these records are based on pupae or adults, because reliable identifications are often not possible with Nearctic *Cricotopus* larvae that have not been associated with a pupa or an adult. As noted above, some *Cricotopus* larvae are very difficult to separate from those of *O. (Orthocladius)* and *Paratrichocladius*. It may be necessary to run specimens through both the *Cricotopus* and *Orthocladius* keys; in many instances it will be necessary to have associated pupae or adults for accurate identifications. Quite often, the best you may be able to do is an identification of "*Cricotopus/Orthocladius* sp.". Hirvenoja (1973) revised *Cricotopus* for the western Palaearctic; his keys to adults, pupae and larvae have been translated and modified in Simpson et al. (1983). Note that in the Southeast there are several species that will not fit in Hirvenoja's keys or species groups, and the conspecificity of many Nearctic forms with Palaearctic species has not been conclusively demonstrated - a revision of the Nearctic species is greatly needed!

Contrary to the diagnosis in Cranston et al. (1983), most *Cricotopus* larvae do have a weak cardinal "beard" near the lateral margin of the mentum (Hirvenoja (1973) gives beard length measurements). Also note that the presence of posterolateral setal tufts on the abdominal segments will not distinguish larvae as *Cricotopus* - at least two species of *Orthocladius* (*O. annectens* and *O. lignicola*) possess setal tufts. However, note that the extremely long setal tufts of *C. sylvestris* group larvae easily identify them, visible even in alcohol. Larvae with both a simple S I and setal tufts (except for *O. lignicola*) are *Cricotopus*.

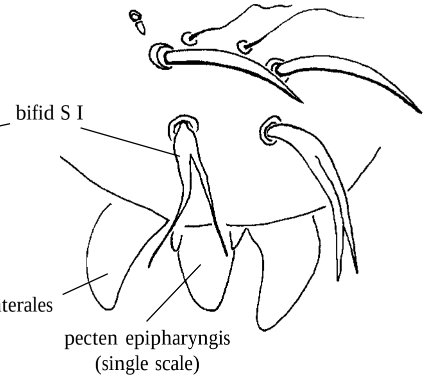
Larvae are found in a variety of aquatic habitats, where they are often associated with plants. *C. (Isocladius)* species tend to be more common in lentic conditions; *C. (Cricotopus)* species are more common in lotic situations; *C. (Nostococladius)* is associated with the blue-green alga *Nostoc*. Some *Cricotopus* larvae may be economically important as pests in rice fields (members of the *C. (I.) sylvestris* group) and as biocontrol agents for nuisance aquatic plants (*C. (I.) lebetis* for hydrilla). *Cricotopus bicinctus* and *C. infuscatus* are tolerant of many types of water pollution.

The key that follows must be used with caution; our knowledge of Nearctic *Cricotopus* larvae is still relatively poor. You should have an associated pupa or adult that indicates that your specimen is a *Cricotopus* (you may have to run your specimen through the *Orthocladius* key as well); and before applying a species-level name to a larva, it should be verified by an associated pupa or adult.

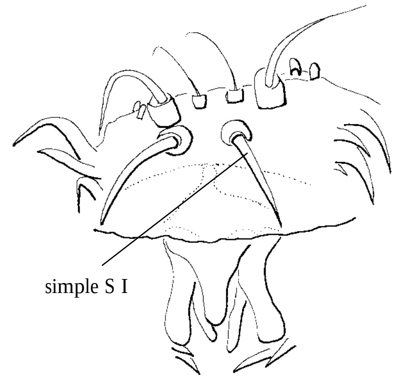
ADDITIONAL REFERENCES: Boesel 1983; Epler et al. 2000; Hirvenoja 1973; LeSage & Harrison 1980; Oliver 1977, 1984; Simpson & Bode 1980; Simpson et al. 1983 (translation of keys of Hirvenoja 1973).



C. (C.) politus
labrum

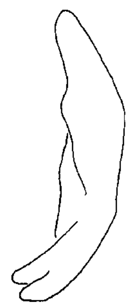


C. (I.) trifasciatus
labrum

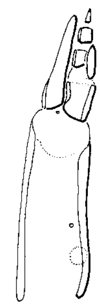


C. (I.) lebetis
labrum

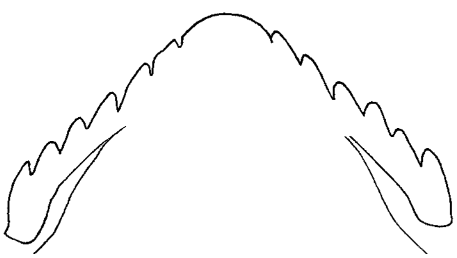
C. politus
simple premandible



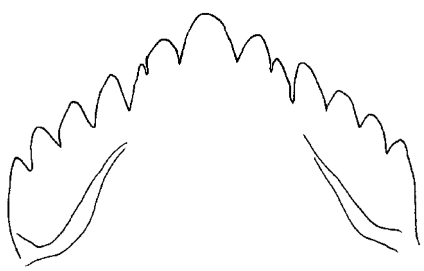
C. sylvestris apically
bifid premandible



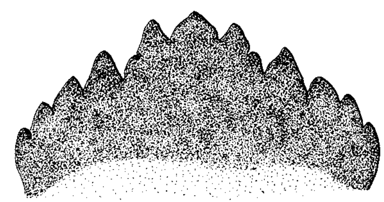
C. lebetis antenna



C. politus mentum



C. trifasciatus mentum



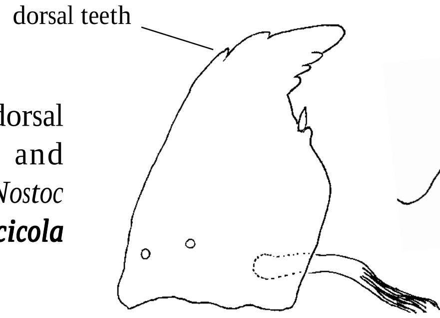
C. lebetis mentum

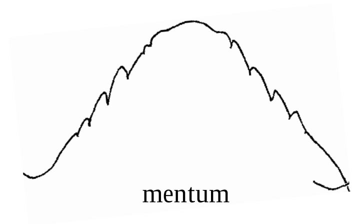
Key to *Cricotopus* larvae of the southeastern United States

(For best results you should have at least a pupal association that confirms that your specimen is indeed a *Cricotopus* before using this key. Most identifications should be considered tentative unless backed by a pupal or adult association.)

1 Head capsule dark brown to almost black 2

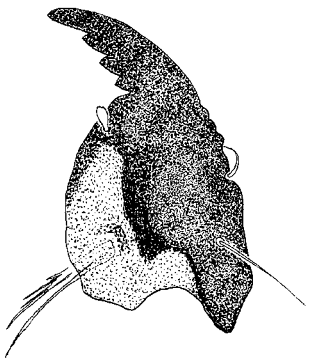
1’ Head capsule light yellow brown to light brown 3

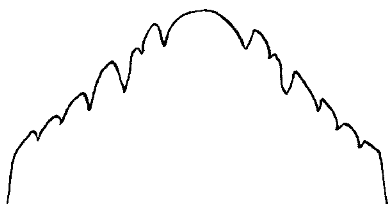


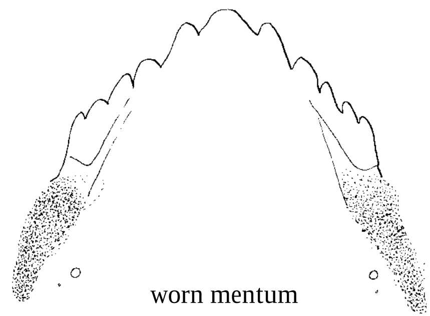


2(1) Outer margin of mandible with 2-3 dorsal teeth; mentum distinctly elongate and arched; restricted to blue-green alga *Nostoc* .... ***C. (N.) nostocicola***

2’ Outer margin of mandible without teeth; mentum as figured; not found in *Nostoc* .... ***C.(C.) fugax***

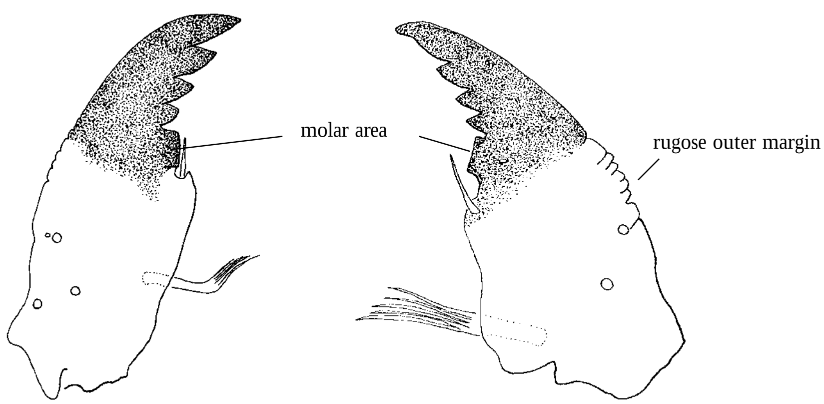






If your dark-headed specimen is not one of the above species, it probably is not a *Cricotopus*. See *Cardiocladius*, *Eukiefferiella*, *Orthocladius* and *Tokunagaia.*

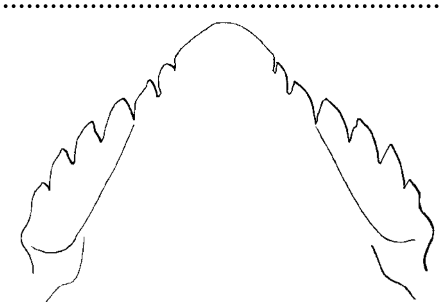
3(1’) Mandible with truncate molar area and rugose outer margin; premandible with large rounded inner tooth 4



“Santa Fe” *absurdus*

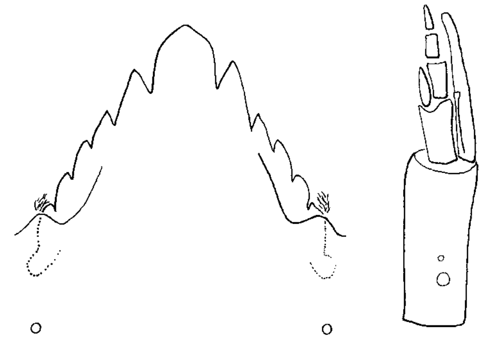
3’ Mandible without truncate molar area, outer margin smooth or rugose; premandible not as above 6

4(3) Mentum with 6 pairs of lateral teeth, first lateral tooth reduced .... ***C.(I.) absurdus***



4’ Mentum with 5 pairs of lateral teeth, first lateral tooth not reduced (figures below) 5

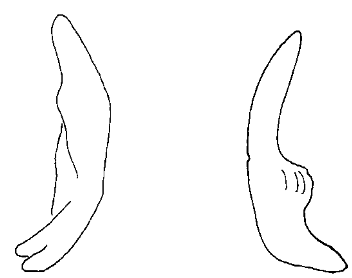
5(4’) Mentum with first pair of lateral teeth much higher than remainder of mentum .... ***C.(I.)* sp. “Santa Fe”**



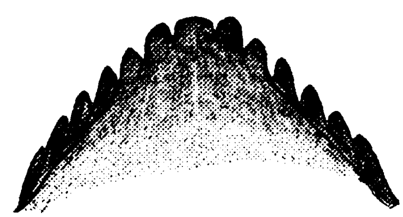
5’ Mentum with first pair of lateral teeth lower, more level with remaining lateral teeth .... ***C. (I.)* sp. “Ozarks”**

6(3’) Premandible apically bifid 7

6’ Premandible simple 12

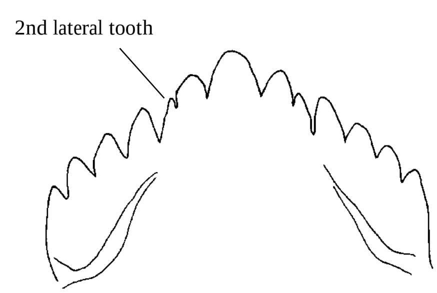


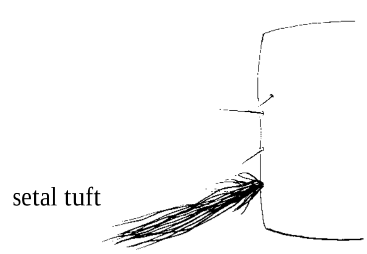
7(6) Second lateral tooth of mentum not reduced and apressed to first lateral tooth; setal tufts of abdominal segments short, at most 1/3 length of segment bearing them 8



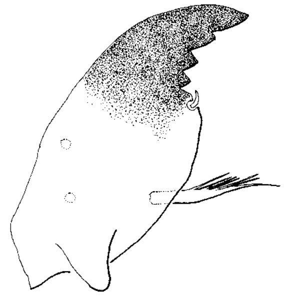
(adapted from Hirvenoja 1973)

7’ Second lateral tooth of mentum reduced and apressed to first lateral tooth abdominal setal tufts very long, as long as or longer than segment bearing them .... ***C. (I.) sylvestris* group** 9
(members of this group are very difficult to separate; your best identification may be “*Cricotopus sylvestris* group sp.”)





8(7) Mandible with light base; premandible with very weak brush .... ***C. (C.) tibialis***
(not recorded from the SE US)

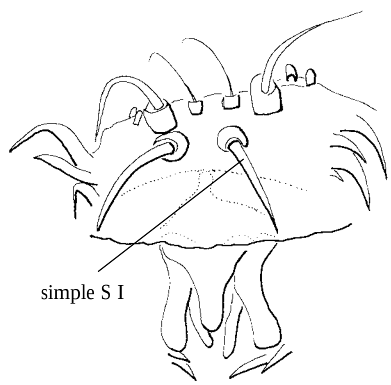


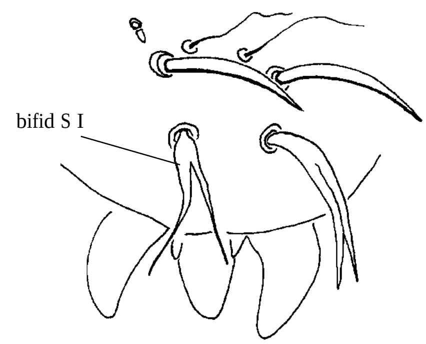
mandible with light base

C. fuscus mandible with dark base
(adapted from Hirvenoja 1973)

8’ Mandible with dark base; premandible without brush .... ***C. (C.) fuscus***

9(7’) Abdominal segments I-VII with setal tufts; S I simple; thorax with bright blue coloration in life; lives exclusively (?) within stems of the aquatic weed hydrilla .... ***C. (I.) lebetis***



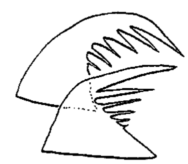


9’ Abdominal segments I-VI with setal tufts; S I bifid (although may be unevenly bifid, with one branch much larger than the other); thorax not blue in life; not restricted to hydrilla stems 10

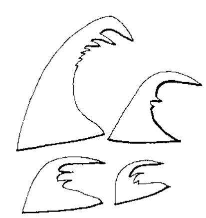
10(9’) Apical tooth of small claws of anterior parapods slightly larger than subapical teeth .... ***C. (I.) sylvestris***

Note - you will have to examine several claws; the differences can be very slight!

10’ Apical tooth of small claws of anterior parapods much larger than subapical teeth 11



longer inner spines



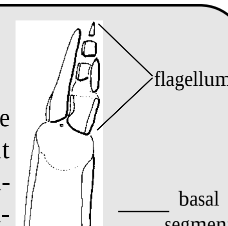
shorter inner spines

11(10’) AR of 4th instar larva 1.4-1.7 ... ***C. (I.) tricinctus***

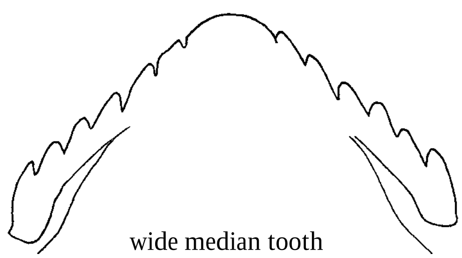
11’ AR of 4th instar larva 1.7-2.0 . ***C. (I.) trifasciatus***

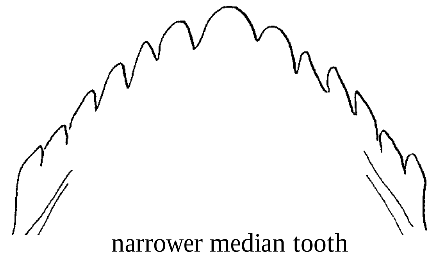
NOTE: 4th instar larvae are necessary for accurate measurements!!

AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



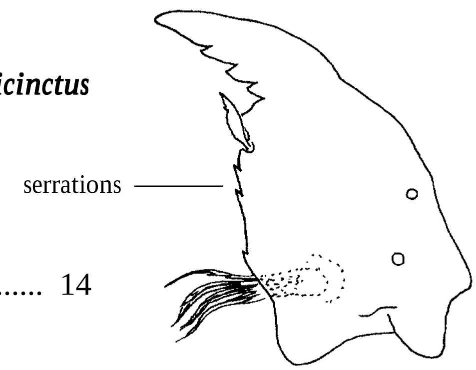
12(6’) Median tooth of mentum about 3 times (or more) as wide as first lateral tooth 13



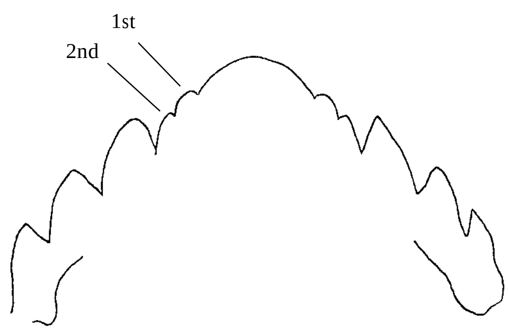


12’ Median tooth of mentum at most 2.5 times width of first lateral tooth 19

13(12) Inner margin of mandible with serrations .... ***C. (C.) bicinctus***

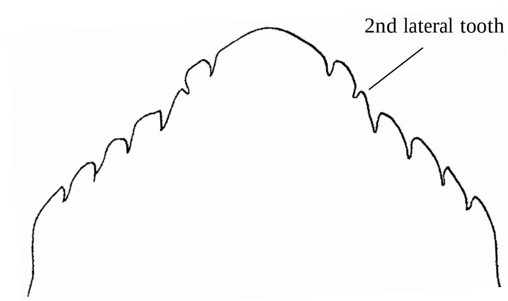


13’ Inner margin of mandible smooth 14



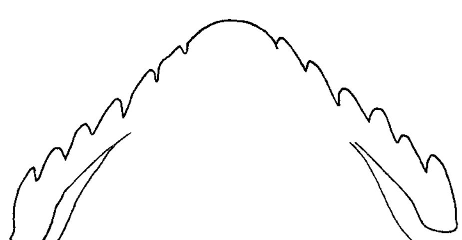
14(13’) 1st, 2nd and 6th lateral teeth of mentum reduced (6th tooth may be absent) .... ***C. (C.) trifascia***

14’ Mentum not as above; 6th lateral tooth well developed 15



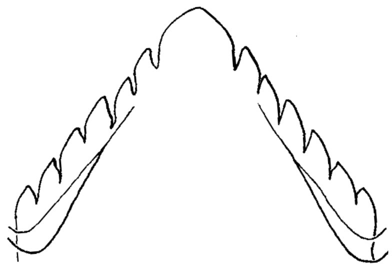
15(14’) 2nd lateral tooth of mentum reduced, setting off central 5 teeth from remainder of mentum .... ***C. (C.)* cf. *patens***

15’ 2nd lateral tooth not reduced, mentum not as above 16



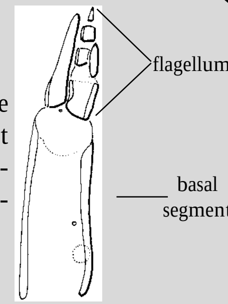
C. politus mentum

16(15') AR around 2.0-2.5; median tooth of mentum projects strongly forward .... ***C.(C.)* cf. *cylindraceus***



C. cf. *cylindraceus* mentum

AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



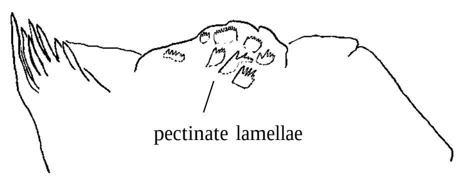
16' AR around 1.5; median tooth not projecting forward as above 17

The following 3 species are very difficult to separate as isolated larvae; associated pupae or adult males are necessary for accurate identification.

17(16') Setal tufts on abdominal segments absent or reduced, < 50 µm in length .... ***C. (C.) politus***

17' Setal tufts on abdominal segments better developed, about 80-100 µm in length 18

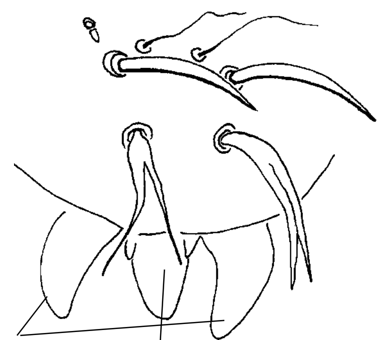
18(17') Dorsal anterior margin of galea of maxilla with numerous pectinate lamellae .. ***C. (C.) albiforceps***



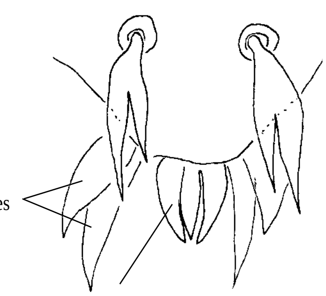
18' Dorsal anterior margin of galea without or with <2 rows of pectinate lamellae .. ***C. (C.) vierriensis***

19(12') Pecten epipharyngis a single lobe (or scale) with at most a small notch or lobe near the base of each side; mentum with 2nd lateral tooth small and partially fused to 1st lateral tooth 20

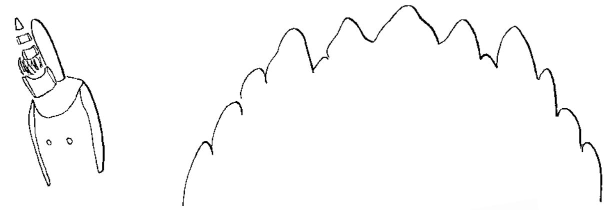
CAUTION: Do not mistake the adjacent chaetulae laterales for outer lobes of the pecten epipharyngis!



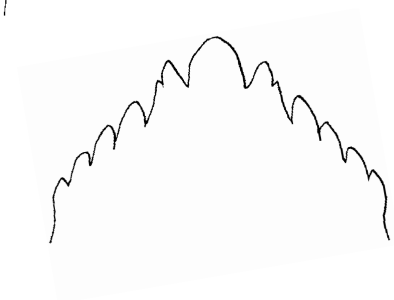
19' Pecten epipharyngis with 3 nearly equal sized lobes or scales; mentum with 2nd lateral not as small and not fused to 1st lateral tooth (except in *C. luciae* and *C. tremulus*, couplet 26) 22



20(19) Antennae short; S I simple; mentum as figured .... ***C. (I.) elegans***



20’ Antennae normal; S I bifid; mentum not as above .. 21

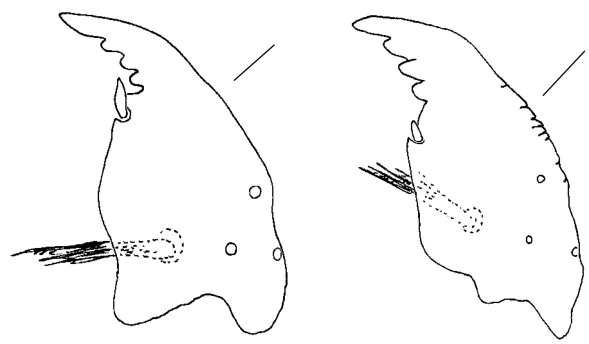


21(20) Setal tuft on abdominal segment VII with 20-50 setae .... ***C. (I.) reversus* group**

21’ Setal tuft on abdominal segment VII with < 10 setae or absent .... ***C. (I.) intersectus***

22(19’) Outer margin of mandible smooth or indistinctly rugose 23

22’ Outer margin of mandible distinctly rugose 24

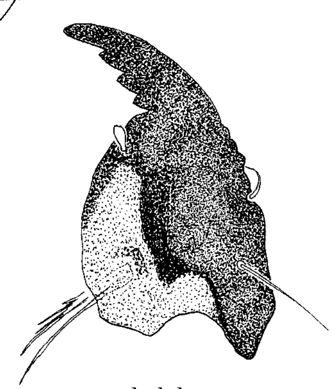


smooth outer margin rugose outer margin

23(22) Mandible with light base ... ***C. (C.) annulator complex* .... *(C. (C.) annulator*** (in part)**, *C. (C.) slossonae***, ***C. (C.) varipes)***
(these 3 species can not be distinguished as larvae; see Notes)

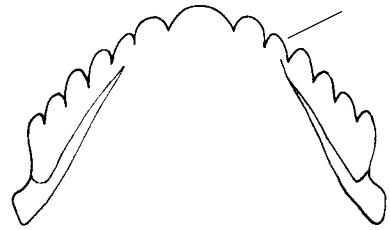
light base

23’ Mandible dark to base .... ***C. (C.) annulator*** (in part)

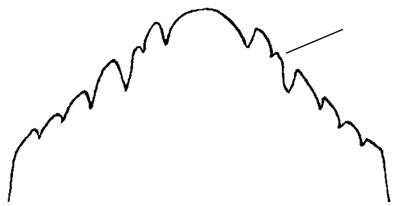


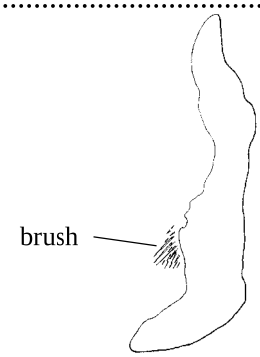
dark base

24(22') Mentum with 2nd lateral tooth about as large as other lateral teeth; premandible without brush 25



24' Mentum with 2nd lateral tooth small and appressed to 1st lateral tooth; premandible with weak brush (may require observation at 1000X) 26





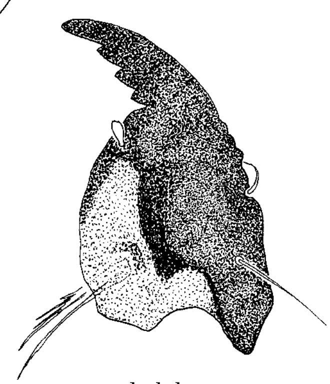
25(24) Mandible with light base .... ***C. (C.) triannulatus, C. (C.) infuscatus*** (in part) (see Notes)

25' Mandible dark to base .... ***C. (C.) infuscatus*** (in part)


light base

26(24') Mandible with light base .... ***C. (C.) luciae***

26' Mandible dark to base .... ***C. (C.) tremulus***


dark base

Notes on Species

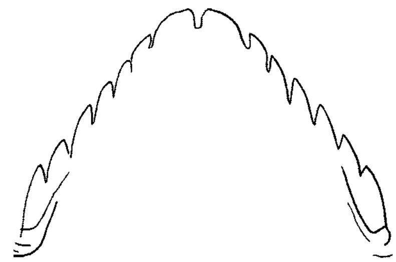
Species level (and even accurate generic level) identifications of *Cricotopus* larvae are difficult. Perceived differences in larvae are often only variants of the same species; associated pupae and/or adults are usually needed for accurate species level identification - as with *Orthocladius*, pupae usually provide the best means of species identification. Dave Lenat (NC DENR) has written a laboratory key for combined *Cricotopus* and *Orthocladius* species; the taxa were given C/O numbers, some of which were also used in Lenat (1993b). I have attempted to reconcile his system of numbers with the names listed below; his number is listed in brackets at the end of each species summary when applicable. Note that some of the numbers may apply to several species and that some species may have several numbers associated with them. Again, unless larval material is somehow associated with a pupa or adult (often through pharate pupae within very late 4th instar larvae, or pupae with attached larval exuviae – sometimes such pupae may have almost completely developed adults within, thus giving a complete larval-pupal-adult association), species level identifications can only be considered tentative!

C. (I.) absurdus - This species is not known from the Carolinas but I have seen associated material from Ohio, as well as larvae from the Ozarks (where it occurred with *C*. sp. "Ozarks"), northern Florida and Georgia. The cone-like pecten epipharyngis indicates that the species should be placed in *Isocladius*. In addition to the characters noted in the key, this species has long (80-100 µm), well developed setal tufts and a long, thin seta subdentalis.

C. (C.) albiforceps - I have seen adults from Lake Norman, NC, that closely conform to the description of this species as described by Hirvenoja (1973). The specimens differ from the description in having the first two abdominal tergites infuscate rather than white as in typical *albiforceps*. However, Hirvenoja (1973: 233) noted that some northern individuals had tergite IV or the first two tergites more or less dark. Larvae I've examined from NC identified as *C. albiforceps* do not key to that species in Hirvenoja (1973) but key to *C. vierriensis* (which they are not); and key to *C. pulchripes* in Cranston (1982), but the antennae are shorter; the larva lacks well developed setal tufts on the abdominal segments. Hirvenoja (1973) noted that the surface of the galea of the maxilla of *C. albiforceps* (a member of Hirvenoja's *festivellus* group) bears many small pectinate lamellae; that of *C. vierriensis* bears only a few such lamellae. The galea of *C. politus* bears numerous such pectinate lamellae. I have not seen genuine larval or pupal material of *C. albiforceps* from the Carolinas.

C. (C.) annulator - I've examined larvae identified as *C. annulator* from NC but they do not fit the description in Hirvenoja (1973) in that the base of the mandible is not dark. Hirvenoja's (1973) description of the larva of *C. annulator* was based on the larva of *C. bituberculatus* Goetghebuer, a species he placed as a probable junior synonym of *C. annulator*; the base of the mandible is dark in *C. bituberculatus*. Hirvenoja (1973: 203) stated that it was possible that *C. bituberculatus* was a local variation of *C. annulator*; this probable synonymy has been accepted as a synonymy by subsequent authors. I've examined the larval material Hirvenoja (1973) described, collected by Thienemann in Garmisch-Partenkirchen, Germany. This material consists of whole mounted larvae, not larval exuviae; the material is not reared and thus not directly associated with pupae or adults. There appears to be more than one species on these slides; most slides have several larvae with moderately rugose, dark-based mandibles, but one slide also has one larva with a smoothly margined, light-based mandible. Hirvenoja's (1973: 206) description of the mandible stated that the "back" of the mandible had small grooves and was almost smooth. I've also examined reared material of *C. annulator* from Scotland; in this material the larval mandibles are not dark at the base and possess mostly smooth outer margins. Schmid (1993) also described the larva of *C. annulator* without a darkened base on the mandible. *Cricotopus annulator* may occur in the SE US; it is recorded from Ontario, Canada by LeSage & Harrison (1980), who based their records on adult males and females; they were not successful in obtaining immature stages and did not include them in their keys. Sublette et al. (1998) recorded *C. annulator* from the Grand Canyon and redescribed the adult male and pupa; in assigning their specimens to *C. annulator* they recognized some variation in the pupa and adults. Most adult males of *C. slossonae* and *C. varipes* possess a minute anal point, absent in *C. annulator*. Separating *C. annulator* larvae from those of *C. slossonae* and *C. varipes* without associated adult males is not possible; larvae of all three species should be referred to as "*C. annulator* complex sp.". [C/O sp. 6]

C. (C.) bicinctus - The most common and widespread species of *Cricotopus* in the SE US, perhaps in the entire US. Larvae are usually easily identified by the serrate inner margin of the mandible, but these serrations (or thin spines) are sometimes worn off or can not be seen if the mandible is not oriented correctly; such specimens can be confused with *C. vierriensis* (q.v.) However, the abdominal setal tufts of *C. bicinctus* are very small (< 30 µm). *Cricotopus bicinctus* larvae are tolerant of organic and other forms of pollution. Note that a closely related species, *C. mackenziensis* Oliver, has been described from western Canada (Oliver 1977); it probably does not occur in the SE US. I have seen apparently aberrant *C. bicinctus* larvae from Louisiana and the Suwannee River in northern Florida that possess a narrow u-shaped notch in the middle of the median tooth. [C/O sp. 1]



aberrant mentum of *C. bicinctus* group larva from Louisiana

C. (C.) coronatus Hirvenoja - This species was recorded for the Carolinas by Hudson et al. (1990) and Caldwell et al. (1997), apparently based on a single specimen from NC. I have examined this specimen and believe it to be *C. politus*. *Cricotopus coronatus* is otherwise only known from Finland (Hirvenoja 1973) and northern Canada (Oliver et al. 1990). I have not included it on the check list for the Carolinas.

C. (C.) cf. *cylindraceus* - I've examined larvae from North Carolina that appear to be this species, but without associated pupae or adults, identification remains tentative. [C/O sp. 14]

C. (I.) elegans - A distinctive larva with reduced antennae. Hirvenoja (1973) suspected that this species was a junior synonym of the Palaearctic *C. obnixus* (Walker), but had insufficient material. [C/O sp. 42]

C. (C.) festivellus - The larva of *C. festivellus* was not described by Hirvenoja (1973); Schmid (1993) figured the larva and gave a brief diagnosis for a taxon he called "*C.* cf. *festivellus* grp.". I've seen adults that closely match *C. festivellus* from the Carolinas and Alabama; larvae remain unknown for this taxon in North America.

C. (C.) fugax - The head capsule of *C. fugax* is usually very dark; the larva lacks setal tufts and may be mistaken for *Orthocladius (Eudactylocladius) dubitatus*. The two species can be separated by the simple premandible of *C. fugax*; the premandible of *O. dubitatus* has a simple apex but also bears a broad inner tooth; and by the 3rd and 4th antennal segments: in *C. fugax* these segments are about twice as long as wide, in *O. dubitatus* they are about as long as wide. In addition, the molar area of *O. dubitatus* is usually truncate; that of *C. fugax* is usually more rounded (the mandible must be oriented correctly to observe this) but ***may*** appear truncate. See figures under *O. (Eud.) dubitatus*. Also, *C. fugax* has long (at least 1/2 length of the segment) setae on the abdominal segments; *O. dubitatus* has only short setae on the abdomen. Larvae of *C. fugax* were reared from water flowing over rock surfaces at the Coweeta Hydrologic Laboratory, North Carolina. This material was originally misdetermined as *C. luciae* and erroneously reported in Caldwell et al. (1997). Note that *C. tremulus* and *C. luciae* are also very similar to *C. fugax*, but bear a weak brush on the premandible. [C/O sp. 20]

C. (C.) fuscus - I've examined an adult from Great Smoky Mountains National Park that appears to be this species; I have not seen larvae from the SE US.

C. (C.) infuscatus - This species was collected in Ontario and the immature stages described by LeSage & Harrison (1980); they described the larva with a dark base to the mandible. However, I have examined a single reared male from Ohio in which the larval mandible is not darkened at the base. Such larvae are apparently inseparable from *C. triannulatus*; pupal or adult characters must be used to identify the species. If you're fortunate enough to have a larva with a well developed pupa within, note that the median spine patches on abdominal tergites III-VI of *C. triannulatus* are somewhat bean-shaped and about twice as wide as long; in *C. infuscatus* these patches are more transverse and about 3X as wide as long. I've seen larvae that appear to be *C. infuscatus* from NC.[some C/O sp. 5]

C. (I.) intersectus (Staeger) - I've examined reared larvae of this species from NY and have seen larvae that fit this species from Jackson and Stokes Counties in NC. It appears as C/O sp. 44 in Lenat's key;

however specimens from his collection I've examined from NC identified as C/O sp. 44 are not *C. intersectus* because they possess an apically bifid premandible and appear to be typical *C. sylvestris* group members; the premandible of *C. intersectus* is apically simple.

C. (I.) lebetis - Not recorded from the Carolinas, but known from Louisiana and Florida. In Florida, larvae have been found living within the stems of the aquatic nuisance weed hydrilla. The species had been considered a synonym of *C. tricinctus*, but recent work in which the larva and pupa were described for the first time (Epler et al. 2000) demonstrated that the taxon is a valid species. Larvae and pupae appear to only occur within the stems of hydrilla, where the larvae can cause sufficient damage to preclude further growth of the plant, thus preventing it from reaching the water surface. A major complaint against hydrilla in the South is that the plant forms large mats on the surface, impeding the passage of boats and thus making it a nuisance. This may be the first instance of a chironomid being a potential biological control agent (some African *Polypedilum* species may also be potential biocontrol agents for hydrilla). Close examination of hydrilla in other parts of the US may give a better idea of the range of *C. lebetis*.

C. (C.) luciae - *Cricotopus luciae*, originally described from Ontario, was recorded for North and South Carolina by Hudson et al. (1990) and Caldwell et al. (1997). However, my examination of North Carolina specimens identifed as *C. luciae* showed them to be *C. fugax* (q.v.). Other adult male specimens of *C. luciae* reported in Hudson et al. (1990) could not be located for verification; those records should be disregarded at this time. I have seen adult specimens and reared material from Alabama and Ohio of true *C. luciae.* Note that although LeSage & Harrison (1980) described the inferior volsella of *C. luciae* as bare, the volsellae actually have a series of 4-6 sensillae ventrally and may bear a strong seta on the "neck" or near the base. I have examined the holotype and two paratypes of *C. luciae* to confirm this. See also *C. tremulus*.

C. (N.) nostocicola - This distinctive larva is restricted to living within colonies of the blue-green alga *Nostoc*. [C/O sp. 55]

C. (C.) cf. *patens* - I've seen larvae from NC and SC that fit this species, but without associated pupae or adults the identification remains tentative. A member of Hirvenoja's *cylindraceus* group, it strongly resembles *C. (C.) flavocinctus* (Kieffer), a member of the *festivellus* group. The two can apparently only be separated as larvae by the number of rows of pectinate lamellae on the galea: three in *flavocinctus* and at most two in *patens*. Reared material is necessary to elucidate the true identity of these larvae. [C/O sp. 31]

C. (C.) politus - A relatively common but often overlooked or misidentified species, difficult to identify without an associated pupa or adult. It is easily confused with *O. carlatus* or *O. rubucundus* but is usually separable by the more medial position of the setae submenti in *C. politus*. It can also be confused with *O. nigritus;* identifications of *C. politus* larvae must be confirmed with pupae or adults! I've seen no associated material of *C. politus* from the Carolinas (only pupal exuviae from NC, adults from NC and SC). Given its distribution in northern Florida (where it is the second most common *Cricotopus* species in the Suwannee River basin), it is probably most common on the Piedmont and Coastal Plain. The abdominal setal tufts of *C. politus* may be very small (LeSage & Harrison (1980) give a 23-45 µm size range), but in associated material from northern Florida and Ohio, setal tufts are absent; in their place are single, long setae. [some C/O spp. 8, 54]

C. (I.) reversus group - Larvae that fit this group have been found in NC; accurate identification is not possible without associated pupae and/or adults. [C/O sp. 45]

C. (C.) slossonae - As a larva, not separable from *C. varipes* and some *C. annulator* (q.v.); the species may be the same, but variable as adults. See LeSage & Harrison (1980). Unassociated larvae should be referred to as "*C. annulator* complex sp." [C/O sp. 6]

C. (I.) sylvestris - Common and widespread throughout the eastern US, but difficult to separate from other members of what can be called the "*C. sylvestris* group" (*C. lebetis*, *C. sylvestris*, *C. tricinctus*, *C.*

trifasciatus); pupae may provide the best characters for species level separation. See Hirvenoja (1973), Simpson et al. (1983) and Epler et al. (2000) for pupal identification. In most cases with isolated larvae of all these species (except perhaps *C. lebetis*), an identification of "*C. sylvestris* group sp." will be the best one can do. Most *C. sylvestris* group members are found in lakes and ponds; some mine in aquatic vegetation. [C/O spp. 9, 41, 44?]

C. (C.) tibialis (Meigen) - Not recorded from the Carolinas or the SE US; included only because of its similarity to *C. fuscus*.

C. (C.) tremulus - I've examined an adult from Great Smoky Mountains National Park and several larvae from North Carolina that appear to be this species. Hirvenoja's (1973) *tremulus* group would include the following North American species: *C. annulator, C. luciae, C. infuscatus, C. slossonae, C. tremulus, C. triannulatus* and *C. varipes*. Larvae of *C. tremulus* may be most easily confused with those of *C. luciae*, but note that the larva of *C. tremulus* has a darker base to the mandible. This difference may be difficult to discern; adults must be used to confirm identity! The body setae of *C. tremulus* and *C. luciae* are long (sometimes as long as the segment bearing them) and sometimes forked. [some C/O 20]

C. (C.) triannulatus - This species is apparently more abundant in the mountains and piedmont, but has been found on the coastal plain. Listed as "*C. infuscatus* group" in Lenat (1993b), it is considered tolerant. [C/O sp. 5]

C. (I.) tricinctus - A member of the *C. sylvestris* group, not recorded from the Carolinas. See *C. sylvestris*.

C. (C.) trifascia - A species with a very distinctive mentum, apparently most common in the mountains. [C/O sp. 36]

C. (I.) trifasciatus - A member of the *C. sylvestris* group, not recorded from the Carolinas. See *C. sylvestris*.

C. (C.) varipes - As a larva, not separable from *C. slossonae* and some *C. annulator* (q.v.); the species may be the same, but variable as adults. See LeSage & Harrison (1980) for more information. Unassociated larvae should be referred to as "*C. annulator* complex sp." [C/O sp. 6]

C. (C.) vierriensis - Very similar to *C. albiforceps, C. politus* and *C. bicinctus*; see the key for characters to separate them. Adults strongly resemble *C. bicinctus*, but have a longer, thinner inferior volsella. Larvae can be confused with *C. bicinctus* if the distinctive serrations of the mandible of *C. bicinctus* are not visible. However, the abdominal setal tufts of *C. vierriensis* are very long (about 80-100 µm) compared to the very short ones of *C. bicinctus* (< 30 µm). I have seen samples from the Suwannee River in northern Florida in which larvae and pupae of *C. bicinctus*, *C. politus* and *C. vierriensis* were all present on one Hester-Dendy sampler. [C/O sp. 46]

C. (I.) sp. "Ozarks" - I first saw material of this taxon from the Ozarks, hence the name. I have since examined more material from the Kentucky River in Kentucky; this taxon has not yet been found in the Carolinas, but might be expected to occur there. It shares the characteristic premandible and mandible with *C. absurdus* and *C*. sp. "Santa Fe", and has long (125-160 µm) setal tufts. Two prepupae of *C*. sp. "Ozarks", one from the Ozarks, the other from Kentucky, were also examined. Unusual for *Cricotopus*, the pupa has two long, thick, spine-like macrosetae on each anal lobe. The pupal thoracic horn is similar to some other *Isocladius* species: long, club-like and smooth; it resembles a baseball bat. I have examined larvae from Ohio that have a mentum that is intermediate between *C*. sp. "Ozarks" and *C*. sp. "Santa Fe". In the Ohio specimens the median tooth and first three pairs of lateral teeth are similar to those of *C*. sp. "Santa Fe", but the 4th and 5th pairs of lateral teeth are low and rounded. This might indicate that three species are present or that *C*. sp. "Ozarks" and *C*. sp. "Santa Fe" represent the extreme ends of a single variable species.

C. (I.) sp. "Santa Fe" - This taxon is based upon several unassociated larvae from the Santa Fe River in north Florida; I have not seen material from the Carolinas. This larva has a premandible and mandible similar to those of *C*. sp. "Flint" and *C*. sp. "Ozarks", and also has long (up to 200 µm) setal tufts. A similar premandible is found in the European species *C. (I.) brevipalpis* Kieffer.

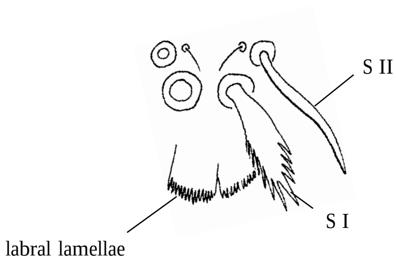
Genus *Diplocladius*

DIAGNOSIS: Distinguished by the plumose SI; apically pectinate labral lamellae; apically bifid premandible; 5 segmented antennae; well developed ventromental beard; and mandible with 4 inner teeth.

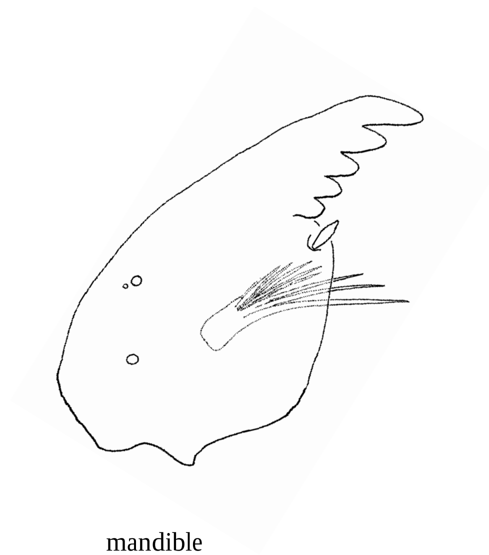
NOTES: One Holarctic species, *D. cultriger*, is known from the eastern United States. Cranston et al. (1983) noted that there is variation in Nearctic larvae that may indicate that more than one species is present, but to date no such variation or new species have been described.

Diplocladius larvae are usually found in springs and cool streams; in North Carolina they are found mainly in winter.

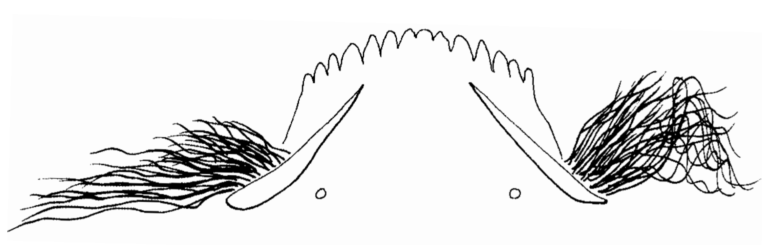
ADDITIONAL REFERENCES: Johannsen 1937a; Schmid 1993.



labrum



mandible



mentum

Genus *Doithrix*

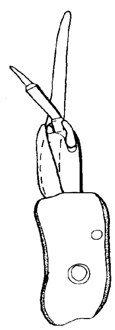
DIAGNOSIS: Distinguished by the SI with weak lateral serrations; apically bifid premandible; mandible with seta interna and 3 inner teeth; vestigial procerci,; long anal tubules with several constrictions; and normal sized anal setae.

NOTES: Three species are recorded from the mountain and piedmont areas of the Carolinas (Caldwell et al. 1997). The presence of a third species in the Carolinas renders the key to *Doithrix* larvae in Sæther & Sublette (1983) obsolete. In that key, *D. parcivillosa* has a distinctly bifid median tooth on the mentum, postmentum length of 90-94 µm and supranal/anal seta ratio of about 0.43; *D. villosa* has indistinctly bifid median tooth, postmentum length of 105-113 µm and supranal/anal seta ratio of about 0.30. The larva of the third species, *D. dilloni*, is undescribed. Larvae can not realistically be identified to species without associated pupae or adults.

The mandible may appear to have 4 inner teeth.

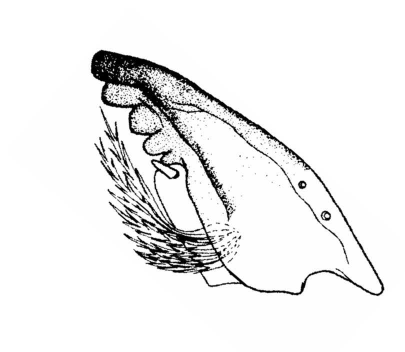
Larvae may be considered semi-terrestrial; the larvae described by Sæther & Sublette (1983) were reared from the vicinity of small streams and seeps.

ADDITIONAL REFERENCES: Cranston & Oliver 1998a; Sæther & Sublette 1983.

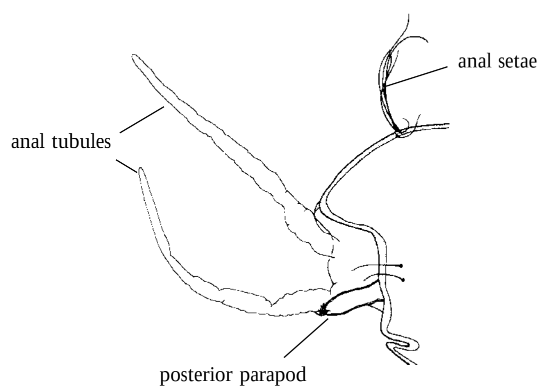


D. villosa antenna

D. villosa mentum



D. villosa mandible



D. parcivillosa
posterior portion of body
(all figs. adapted from Sæther & Sublette 1983)

Genus *Epoicocladius*

DIAGNOSIS: The distinctive mentum and mandible; long, thick body setae; single pair of anal tubules and symphoretic or parasitic life style will identify this genus.

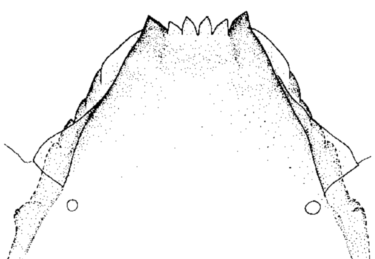
NOTES: Only one named species, *E. flavens*, is recorded from the Southeast. Jacobsen (1992) described the larvae of three other species from the eastern US. At least one of them, *E.* sp. #3, occurs in the Carolinas. His *E.* sp. #4 is *E. flavens*, which is also found in the Carolinas.

Contrary to the diagnosis in Cranston et al. (1983), the S I setae may be simple or coarsely plumose and the S II may be simple. Note that the S II setae are mounted on tubercles.

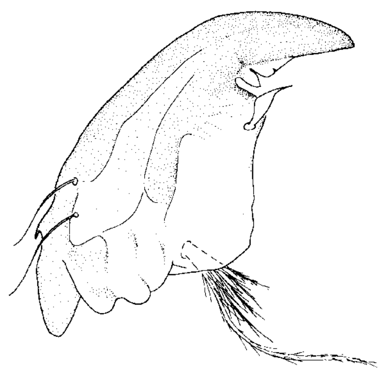
Epoicocladius larvae live commensally or as parasites on larvae of the mayfly family Ephemeridae.

The key and the excellent figures below are adapted from Jacobsen (1992)

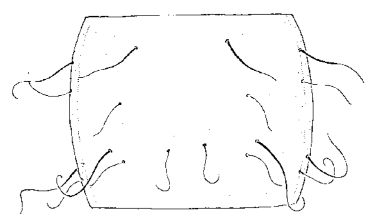
ADDITIONAL REFERENCES: Jacobsen 1992.



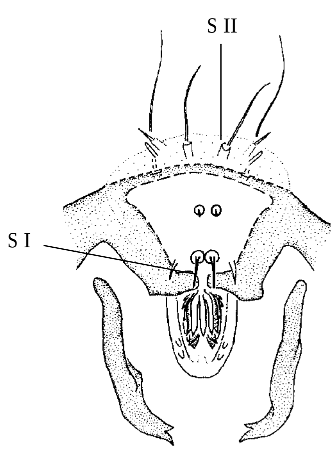
E. sp. #3 mentum



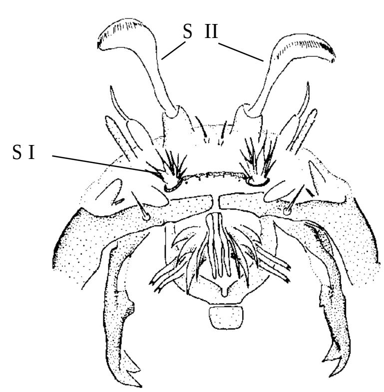
E. sp. #3 mandible



E. flavens middle abdominal segment



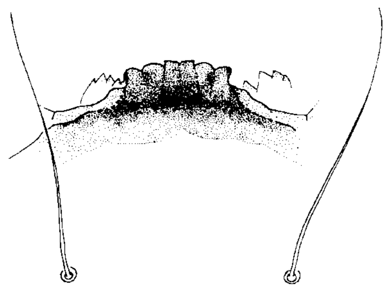
E. sp. #1 labrum

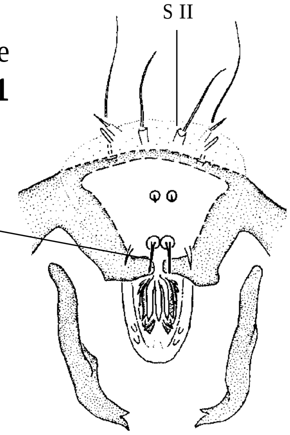


E. sp. #3 labrum

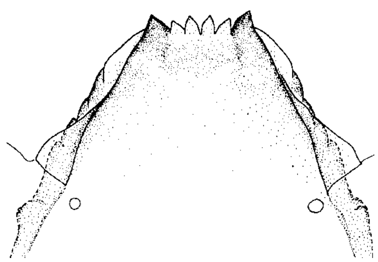
Key to *Epoicocladius* larvae of the eastern United States

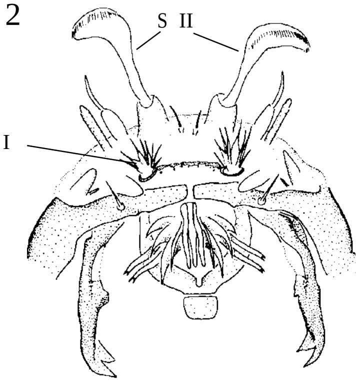
1 Mentum reduced, with median group of teeth dark; S I and S II setae of labrum simple .... ***E.* sp. #1**



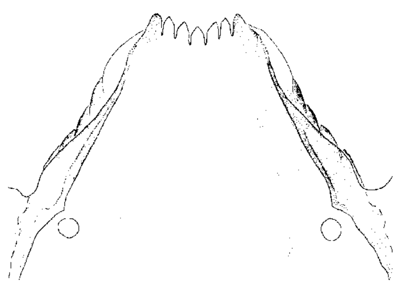


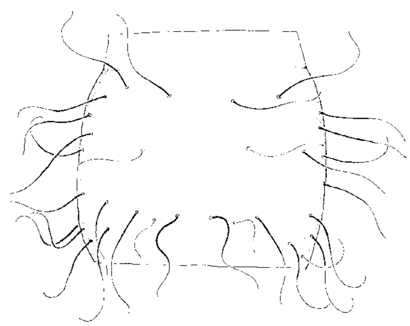
1' Mentum normal, with median teeth paler than lateral teeth; S I coarsely plumose; S II spatulate, apically pectinate 2



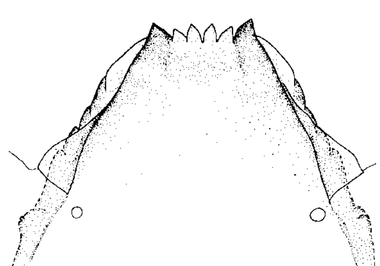


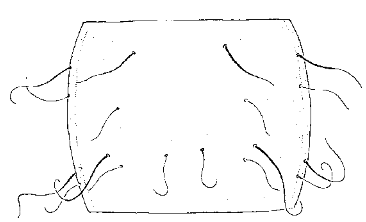
2(1') Mentum with 7-8 median teeth, middle 5-6 pale; middle abdominal segments each with about 40-45 setae .... ***E.* sp. #2**



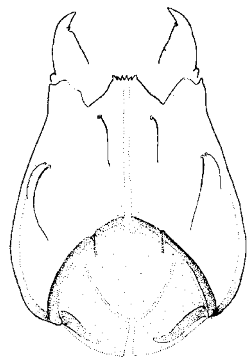


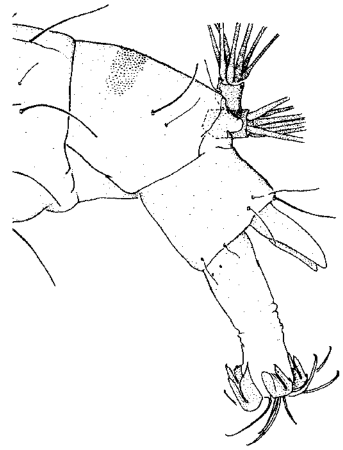
2' Mentum with 6 median teeth, middle 4 pale or light brown; middle abdominal segments each with < 30 setae 3



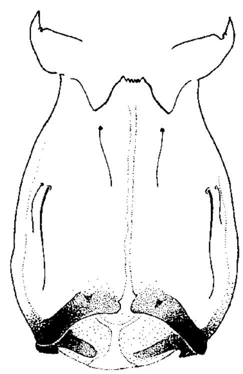


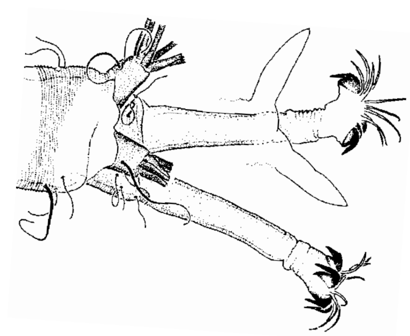
3(2') Posteroventral margin of head capsule strongly arched; posterior parapods < 300 µm long, with stout claws amber colored .... ***E.* sp. #3**





3' Posteroventral margin of head capsule not strongly arched; posterior parapods > 300 µm long, with stout claws dark .... ***E. flavens***





Notes on species

E. flavens - Larvae of this species live among the gills of the ephemerid mayfly *Hexagenia* where they apparently graze on fine particulates. Known from the Carolinas; Jacobsen (1992) referred to this taxon as *E*. sp. #4. Note that Sæther's (1969) synonymy of this species with *E. ephemerae* (Kieffer) is incorrect; both are distinct species (Jacobsen 1992). The mentum of *E. flavens* is similar to that of *E*. sp.#3, but the 4 median teeth are paler; this color difference is sometimes difficult to discern; rely on the shape of the posteroventral margin of the head capsule.

E. sp. #1 Jacobsen - Recorded from Pennsylvania and West Virginia, where larvae are parasitic on larvae of *Ephemera guttulata* Pictet.

E. sp. #2 Jacobsen - Recorded from Massachusetts, Pennsylvania and Vermont, where larvae are commensal on larvae of *Litobrancha recurvata* (Morgen).

E. sp. #3 Jacobsen - Recorded from Maryland, Pennsylvania and West Virginia. Jacobsen (1992) found larvae living symphoretically on larvae of *Ephemera guttulata*, *E. simulans* Walker and *E. varia* Eaton. I've also examined larvae from Great Smoky Mountains National Park and other areas in North Carolina.

Genus *Eukiefferiella*

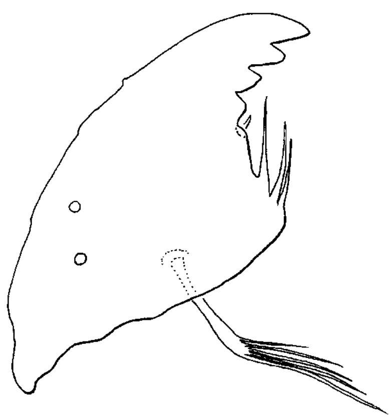
DIAGNOSIS: The simple, thin S I; distinctly serrate labral chaetae; weak/vestigial ventromental plates; seta interna of mandible divided almost to base (except in *E. devonica* group); inner margin of mandible with spines/serrations; 4 or 5 segmented antennae; well developed procerci; and body with simple setae that are usually < 1/2 the length of the body segment bearing them (exception: *E. devonica* group sp. B) will distinguish this genus.

NOTES: The taxonomy of *Eukiefferiella* in North America remains unclear. Because relationships between Nearctic and Palaearctic taxa are uncertain, Bode (1983) used species groups for larval taxa; these species groups are used in the key that follows. Some of these groups may consist of several species. Note that these species group names are based on European species; some of these taxa maybe the same as their Palaearctic counterparts, but until a revision is completed for the Nearctic, with all larval forms associated with pupae and adults and compared with European taxa, most identifications of *Eukiefferiella* larvae will have to remain at the species group level.

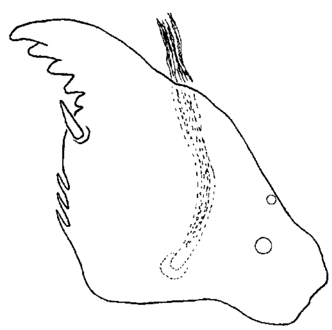
Some earlier records of *Eukiefferiella* may pertain to *Cardiocladius, Tvetenia* or *Tokunagaia*.

Eukiefferiella larvae are usually found in running water, where they are often encountered in moss and algae; some taxa are pollution tolerant. Preserved larvae may be green, blue or red.

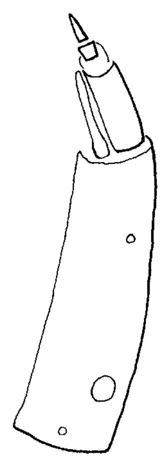
ADDITIONAL REFERENCES: Bode 1983; Lehmann 1972; Sæther & Halvorsen 1981; Sublette et al. 1998.



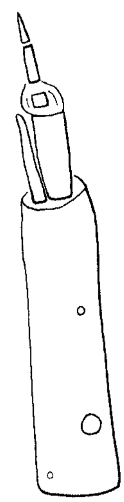
E. devonica group mandible



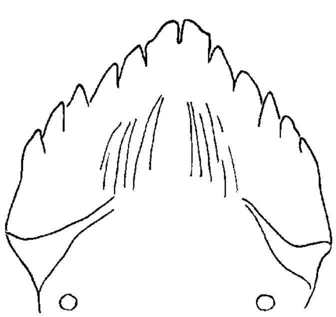
E. claripennis group mandible



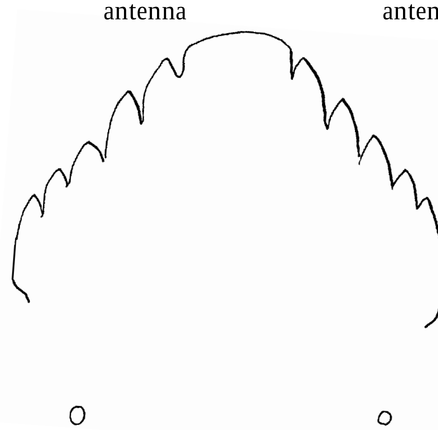
E. brevicalcar group sp. A antenna



E. brevicalcar group sp. B antenna



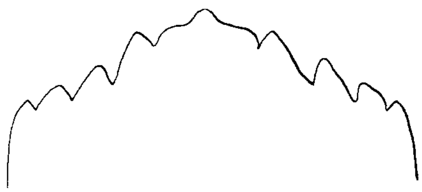
E. claripennis group mentum

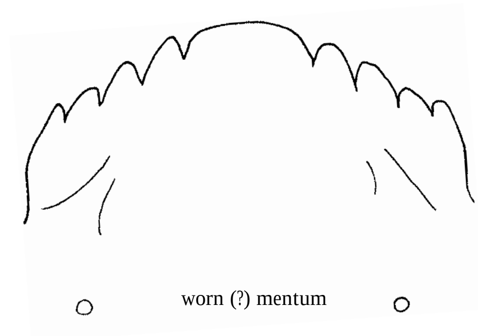


E. gracei group mentum

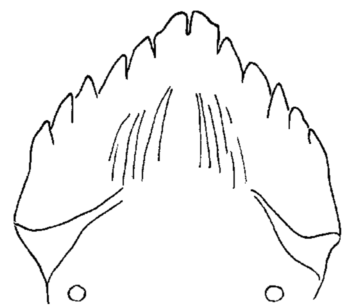
Key to *Eukiefferiella* larvae of the southeastern United States

1 Mentum with 4 pairs of lateral teeth .... ***E. devonica* group** 2





1’ Mentum with 5 pairs of lateral teeth 3

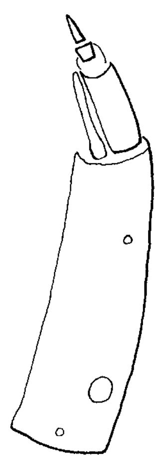


2(1) Head capsule yellow-brown to light brown; middle body segments with setae less than half as long as segment length .... ***E. devonica* group sp. A**

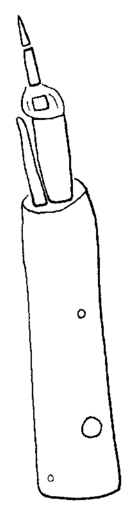
2’ Head capsule dark brown to reddish brown; middle body segments with setae more than half as long as segment length .... ***E. devonica* group sp. B**

3(1’) Antenna with 4 segments 4

3’ Antenna with 5 segments 7

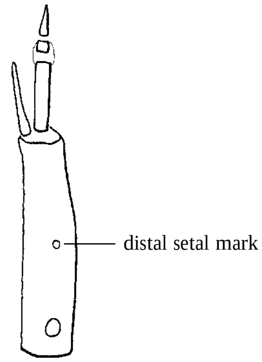


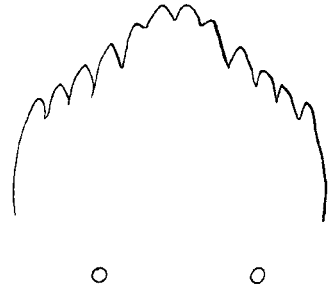
4 segments



5 segments

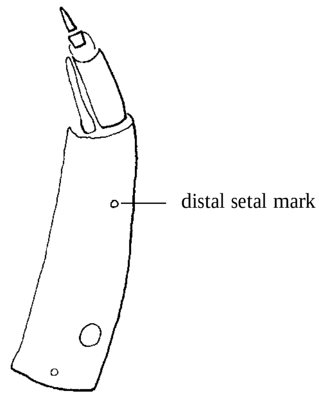
4(3) Distal setal mark of basal antennal segment located at mid point or closer to base; mentum as figured .... ***E. coerulescens* group**



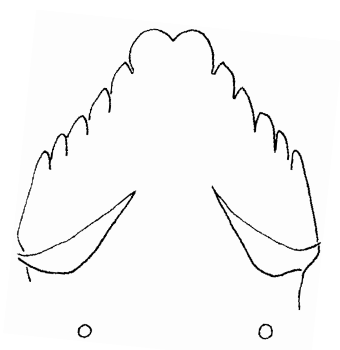


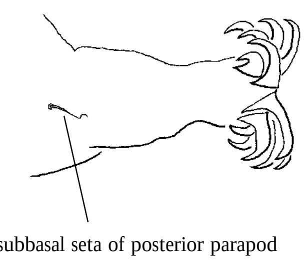
E. coerulescens group

4’ Distal setal mark of basal antennal segment located distal to mid point 5

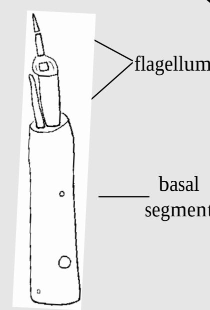


5(4’) Median teeth of mentum large, barely divided medially; subbasal seta of posterior parapod weak, < 25 µm long; AR 1.40-1.80; ventromental plates relatively large .... ***E. pseudomontana* group**

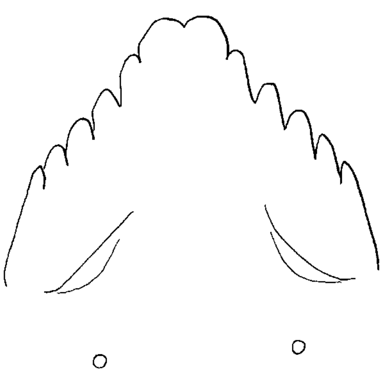


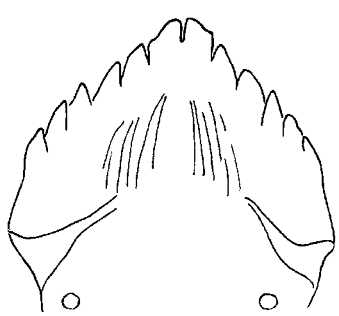


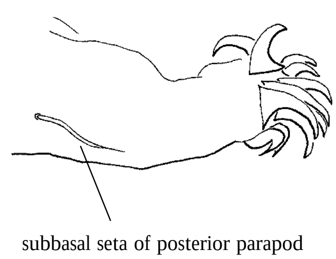
AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



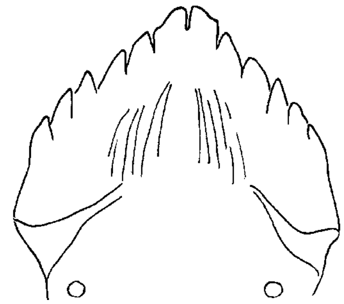
5’ Median teeth not as wide (if wide then ventromental plates small); subbasal seta usually > 40 µm long; AR usually > 1.80; ventromental plates smaller (if larger then median teeth well divided) 6



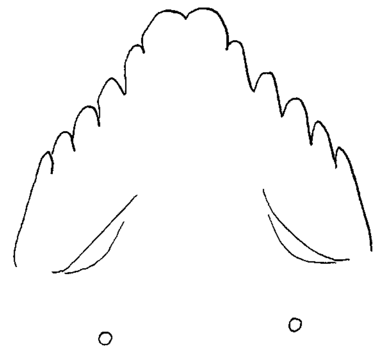




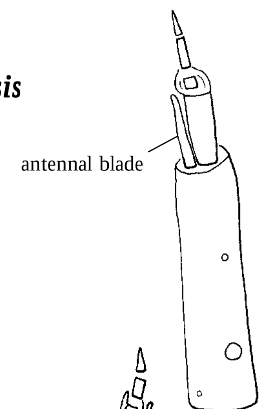
6(5') 1st lateral tooth of mentum subequal in width to either of median teeth .... ***E. claripennis* group**

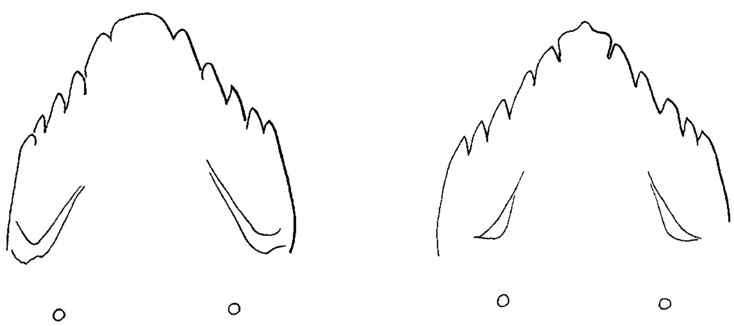


6' 1st lateral tooth about 1/2 as wide as either median tooth .... ***E. brevicalcar* group sp. A**



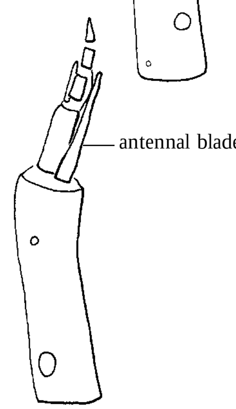
7(3') Antennal blade subequal to segment 2 .... ***E. tirolensis***





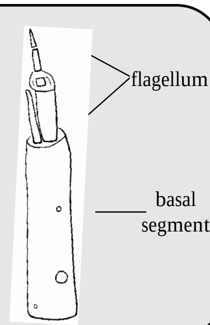
E. tirolensis menta

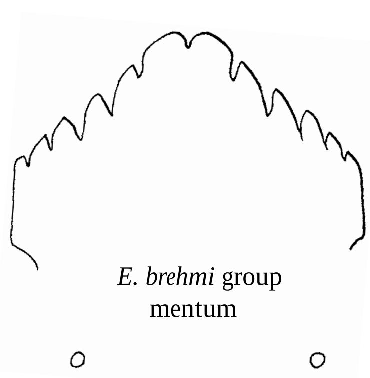
7' Antennal blade extends past segment 2 to segment 4 or beyond 8



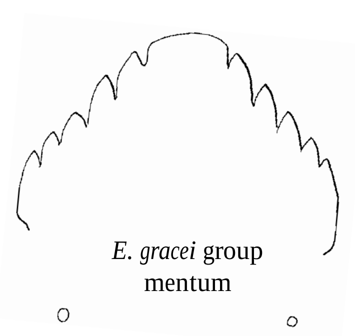
8(7') Mentum with 2 median teeth; AR 1.14-1.50 .... ***E. brehmi* group**

AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)





E. brehmi group mentum



E. gracei group mentum

8' Mentum with single median tooth; AR 1.50 or higher .... ***E. gracei* group**

Notes on species

E. brehmi group - Note the long body setae of this taxon, approaching 1/2 the length of the segment bearing them. The mentum has angulate "shoulders" posterolaterally. In specimens with a worn mentum (so that the bifid median tooth is not apparent), the lower AR of this taxon will separate it from *E. gracei* group specimens.

E. brevicalcar group - There are at least two species in this group in the Carolinas; *E. brevicalcar* group sp. A has four segmented antennae and two median teeth. Also see *E. tirolensis* below.

E. claripennis group - Members of this group appear to be the most commonly encountered species of the genus in the Southeast. Bode (1983) noted that this group includes the most tolerant *Eukiefferiella* in North America.

E. coerulescens group - I have not seen larval material of this group from the Southeast, but it is recorded from SC by Caldwell et al. (1997). I've also seen a male from Pen Branch in the Savannah River Plant area in SC that apparently belongs in this group; it has pubescent eyes but has 2 setae on the squama. It is very difficult to separate larvae from the similar *E. brevicalcar* group sp. A. Although illustrated by Bode (1983) and Schmid (1993) with two median teeth, Cranston et al. (1983) figure a mentum with a single median tooth.

E. devonica group - There are apparently at least two species in this group in the Carolinas. In Europe, the group consists of *E. devonica* and *E. ilkleyensis*; both species have been recorded as adults or pupae from the Carolinas, but larvae have not yet been associated for them. Note the longer inner "spines" of the mandible in members of this group, and that the seta interna is not deeply divided, thus resembling that of *Cardiocladius*. Also note that *E. devonica* group sp. B has the longest body setae of the genus in the Southeast, with some equaling the length of the segment which bears them. This may cause them to be keyed as *Tvetenia* in some keys, but note that the S I of *Tvetenia* is weakly branched to plumose, not simple as in *Eukiefferiella*.

E. gracei group - Like the *E. brehmi* group, the mentum is angulate posteriorly and body setae are relatively long. ARs are higher, >1.50, than in the *brehmi* group (AR 1.14-1.50); use caution because *E. brehmi* group specimens with a worn mentum can be easily confused with *E. gracei* group larvae.

E. pseudomontana group - Larvae resemble the European species *E. clypeata*, but associated pupae from NY indicate that this species is *E. pseudomontana* or an undescribed species closely related to it. This species group appears to be uncommon in the Southeast.

E. tirolensis - A member of the *brevicalcar* group. Identification of this species is based on reared material, in particular the distinctive pupa, from a creek in SC. The single adult male examined differs slightly from Lehmann's (1972) description in having an AR of 0.51 (0.30-0.40 in Lehmann) and wing length of 1.35 µm (about 1.50 in Lehmann). The larvae has five segmented antennae and a single median tooth. This may be the same taxon recorded as *E. lobifera*, another European species, from SC by Caldwell et al. (1997).

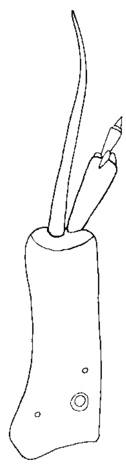
Genus *Euryhapsis*

DIAGNOSIS: The broad, pectinate labral lamellae; plumose S I; 4 segmented antennae (with 2nd segment entire) with antennal blade longer than flagellum; very short ventromental beard; posteriorly displaced setae submenti; and well developed procerci and anal tubules will distinguish this genus.

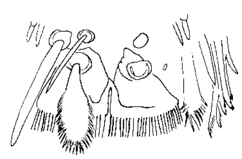
NOTES: Three species of *Euryhapsis* are described from western North America; only the immature stages of one species, *E. cilium* Oliver, are described. The larval diagnosis above is based on this species; additional material of other species may alter the diagnosis. I have examined adult males of an apparently undescribed species from the Great Smoky Mountains National Park; I have not seen any immature *Euryhapsis* material from the Southeast. Larvae are very similar to those of *Brillia*, except the second antennal segment is entire, not subdivided as in *Brillia*, and a minute beard is present in *Euryhapsis*.

Little is known of the ecology of the immature stages except that they inhabit medium sized bodies of flowing water.

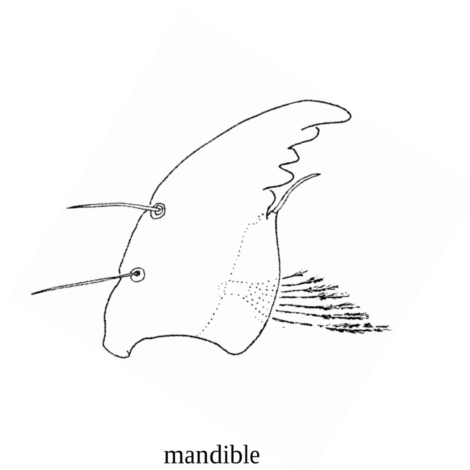
ADDITIONAL REFERENCES: Oliver 1981c.



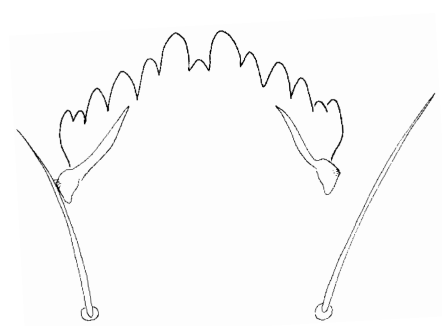
antenna



labrum



mandible



mentum

larval structures of *E. cilium*
(adapted from Oliver 1981c)

Genus *Georthocladius*

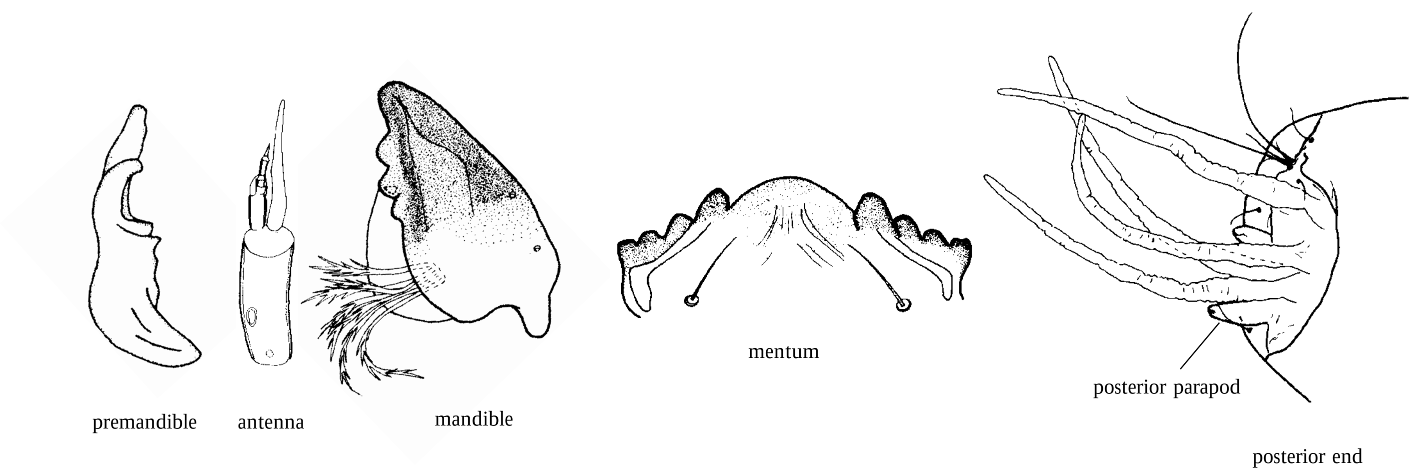
DIAGNOSIS: The weakly serrate S I (may appear simple); mandible with seta interna; procerci absent or vestigial; and long anal tubules with numerous constrictions identify this genus. The mentum may have 1 or 2 median teeth, the mandible 2 or 3 inner teeth.

NOTES: Sæther (1982) established a new subgenus, *G. (Atelopodella)*, which is distinguished in the larval stage from the nominate subgenus by its double median tooth; 3 inner mandibular teeth; normal seta subdentalis; lack of posterior parapods and the presence of 2 small dorsal plates (which are probably vestigial procerci) bearing small setae. In *G. (Georthocladius)* the mentum has a single median tooth, there are only 2 inner teeth on the mandible, the seta subdentalis is broad, small posterior parapods with small or vestigial claws are present and at least 1 large anal seta is present (there are no procerci).

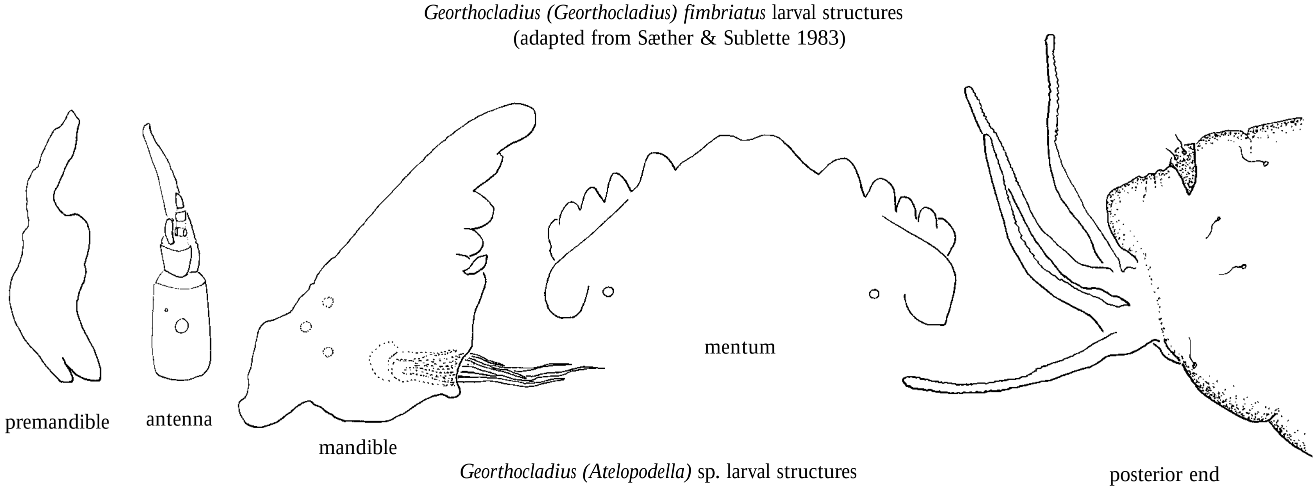
I've examined specimens referable to *G. (Atelopodella)* from the Carolinas and Tennessee (figured below) that have an apically bifid premandible, not mentioned in the description of the only known larva of the subgenus, *G. (A.) curticornus*. I have also examined a Florida larva that apparently fits the subgenus *Atelopodella* except that its mentum bears a single median tooth. None of these larvae were associated with pupae or adults and their identity remains tentative; they do not appear to be *G. (A.) curticornus.*

Larvae are recorded from bogs, seeps and lotic habitats.

ADDITIONAL REFERENCES: Sæther 1982; Sæther & Sublette 1983.



Georthocladius (Georthocladius) fimbriatus larval structures
(adapted from Sæther & Sublette 1983)



Georthocladius (Atelopodella) sp. larval structures

Genus *Gymnometriocnemus*

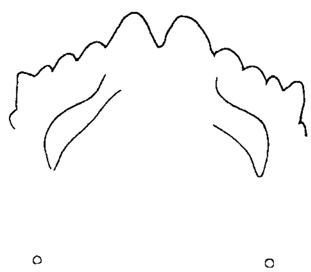
DIAGNOSIS: Distinguished by the simple S I; mandible without seta interna; posterior parapods at right angle to body axis and divided, with claws on the anterior portion; and lack of procerci.

NOTES: Both of the described species known from North America (*G. (G.) subnudus* and *G. (Raphidocladius) brumalis*) occur in the Carolinas. However, no larvae have been positively associated with adults; larvae are thus not identifiable to species. I've also seen adults of an apparently undescribed species from the North Carolina portion of Great Smoky Mountains National Park.

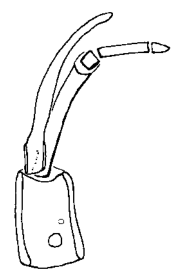
Gymnometriocnemus larvae are difficult to separate from those of *Bryophaenocladius*, differing only in the weakly divided posterior parapods of *Gymnometriocnemus*; those of *Bryophaenocladius* are undivided.

Pupae and adults of the subgenus *G. (Raphidocladius)* have been collected from seeps and springs; larvae may be aquatic or semi-aquatic. Larvae of *G. (Gymnometriocnemus)* may be exclusively terrestrial.

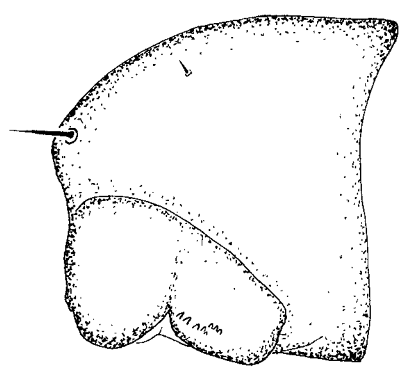
ADDITIONAL REFERENCES: Sæther 1983d.



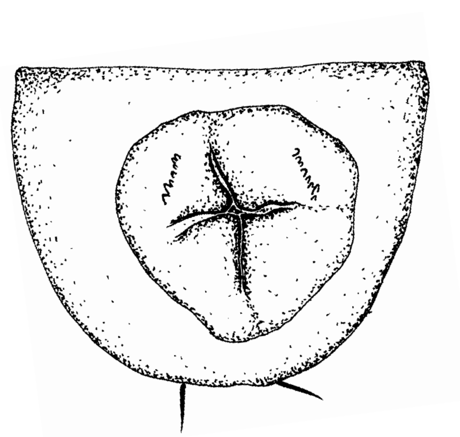
mentum



antenna



anal end, lateral



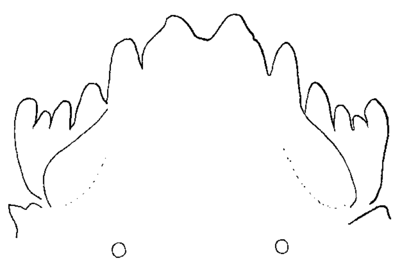
anal end, ventral

Genus *Heleniella*

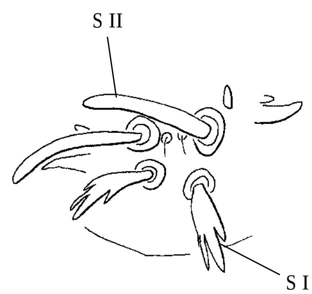
DIAGNOSIS: Distinguished by the coarsely serrate S I; stout S II; apically bifid premandible; 5 segmented antennae with the second segment divided near its base and third segment very small; long antennal blade; mentum with 2 broad median teeth separated by a U-shaped or broad V-shaped gap and with a distinct tooth or notch near the base of the mentum.

NOTES: Two species of *Heleniella* occur in the Carolinas, where they are found mainly in mountain streams. Larvae have not been associated with adults and can not be identified to species.

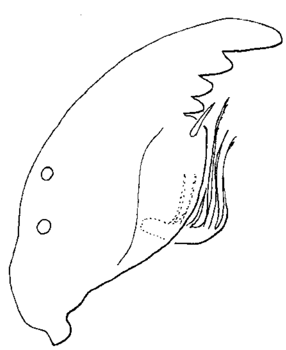
ADDITIONAL REFERENCES: Sæther 1969, 1985g.



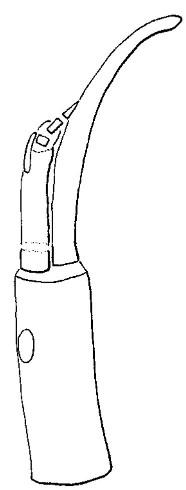
mentum



labrum



mandible



antenna

Genus *Heterotrissocladius*

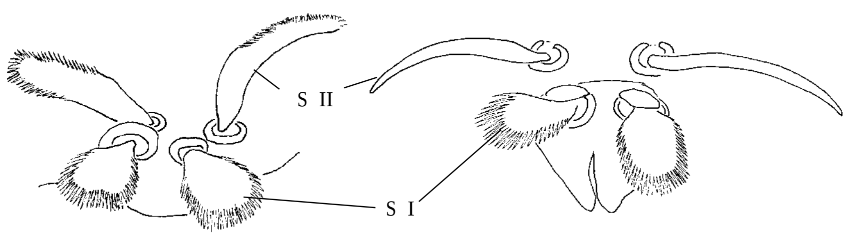
DIAGNOSIS: Larvae are distinguished by the plumose S I; pecten epipharyngis of 3 serrated spines; 7 segmented antenna with the 3rd segment 1/3 or less the length of the 4th and with the 7th segment hairlike; and well developed ventromental plates that extend beyond the lateral margin of the mentum.

NOTES: Two described species are known from the Southeast, although one, *H*. sp. C Sæther, known only as a larva, does not have a formal name. At least one additional undescribed species has been found in Georgia.

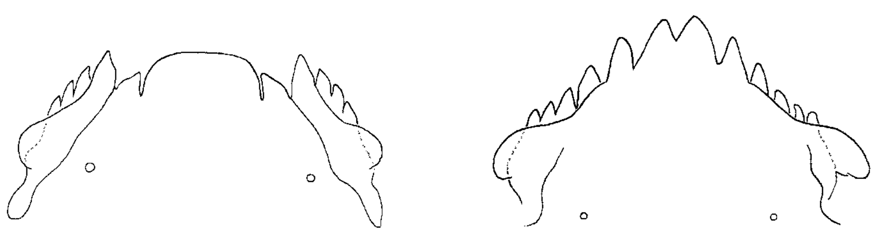
The following key includes an Ohio species, *H. boltoni*, that may eventually be found in the Carolinas. At least two other species (*H. changi* and *H*. sp. E Sæther) are known from the northeastern and north central United States; see Sæther (1975a).

In the Southeast, most larvae are found in rivers, streams, seeps and pools. The majority of other northern species are found most often in lakes.

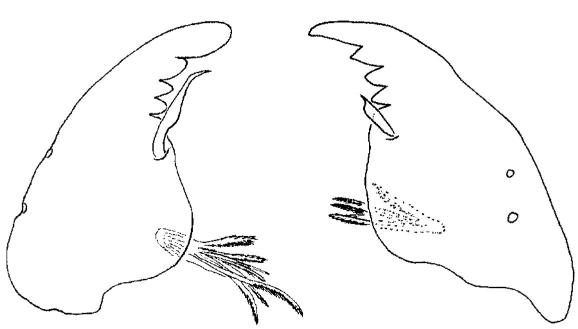
ADDITIONAL REFERENCES: Sæther 1975a, 1992b.



H. sp. C labrum   *H. marcidus* labrum

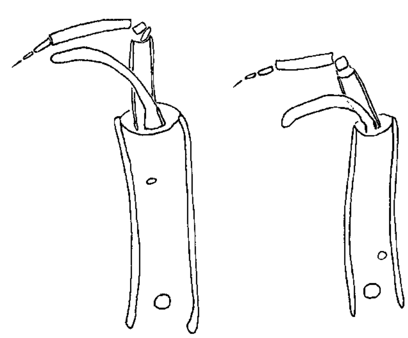


H. sp. C mentum   *H. marcidus* mentum



H. sp. C   *H. marcidus*

mandibles

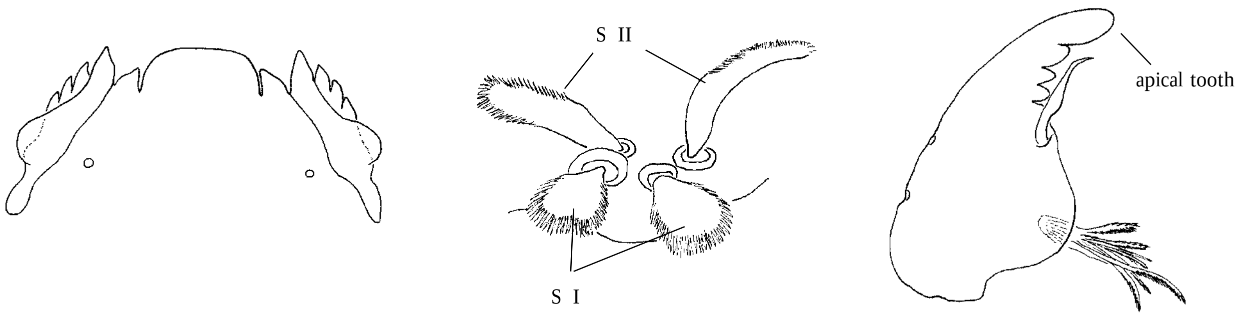


H. sp. C   *H. marcidus*

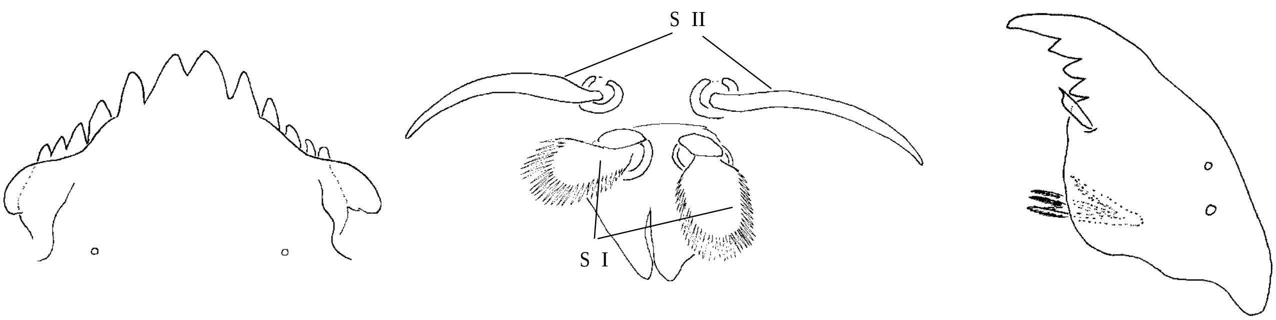
antennae

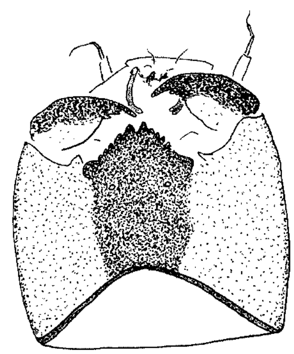
Key to *Heterotrissocladius* larvae of the southeastern United States

1 Mentum with single median tooth; S II broad, plumose; apical tooth of mandible broad .... ***H.* sp. C**



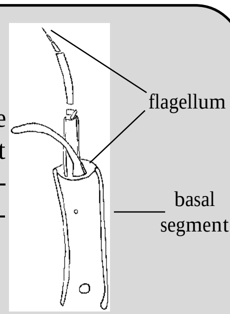
1’ Mentum with 2 median teeth; S II thinner, simple; mandible with smaller apical tooth 2





2(1’) Postmentum darker than remainder of head capsule; 1st antennal segment 75-95 µm long; AR 1.05-1.14 .... ***H. marcidus***

AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



NOTE: 4th instar larvae are necessary for accurate measurements!!

2’ Postmentum as most slightly darker than remainder of head capsule; 1st antennal segment 43-58 µm long; AR 0.80-1.00 .... ***H.* sp. “Caldwell”** and ***H. boltoni***

Notes on species

H. boltoni - Not known from the Carolinas, *H. boltoni* was recently (Sæther 1992b) described from vernal pools and streams in Ohio. To date it has been found only in Ohio, but could possibly occur elsewhere in the eastern US. The larva is indistinguishable from *H.* sp. “Caldwell” (see below); adult males are needed for identification of both species.

H. marcidus - The only named species of *Heterotrissocladius* found in the Southeast and the most commonly encountered. Generally recognized by its darkened postmentum and longer basal antennal segment. Newly molted individuals may not have the darkened postmentum.

H. sp. C Sæther - The larva’s distinctive mentum, broad apical tooth of the mandible, long seta subdentalis (the figure in Epler (1995) was of a mandible with a broken seta subdentalis), broad plumose S II, and a premandibular brush, make *H.* sp. C unusual for a *Heterotrissocladius*; this taxon may deserve a separate genus but until the larva is associated with an adult it is best kept in *Heterotrissocladius*. Known from North Carolina and Florida.

H. sp. “Caldwell” - This undescribed taxon has been reared from Georgia by B.A. Caldwell; it is not known from the Carolinas. I have been unable to find characters to separate the larva of this species from *H. boltoni*. The larvae of both species have a lightly pigmented postmental area, different from the normally darkly pigmented postmentum of *H. marcidus*. The adult male of *H.* sp. “Caldwell” is unlike that of any other described Holarctic *Heterotrissocladius*; the gonostylus is broadly triangular.

I have also seen a single larva from North Carolina with a pale postmentum that is similar to *H.* sp. “Caldwell” and *H. boltoni*, but appears to have a pecten epipharyngis composed of flattened, smooth scales instead of the finely serrated scales of other southeastern *Heterotrissocladius* species. However, it is not possible to accurately observe the pecten epipharyngis of this specimen; the apparent pecten epipharyngis may be displaced chaetulae laterales.

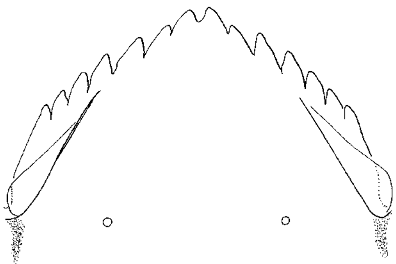
Genus *Hydrobaenus*

DIAGNOSIS: Distinguished by the smooth outer margins of the chaetulae laterales; mentum with single or double median tooth; well developed ventromental plates; absence of a beard; apically bifid premandible, without brush; maxilla with well developed pecten galearis; and 6 segmented antenna, with 6th segment vestigial, threadlike.

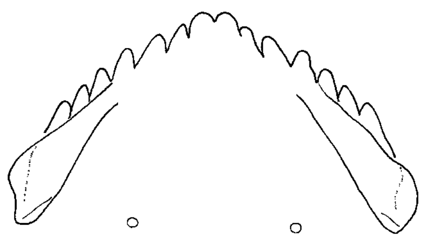
NOTES: At least five species of *Hydrobaenus* occur in the Southeast; two described species, *H. johannseni* and *H. pilipes*, are recorded from the Carolinas. An undescribed species (*H*. sp. "Georgia") is known from several streams in Georgia and *H. pilipodex* is recorded from Alabama; either two may eventually be found in the Carolinas. A more unusual undescribed species, *H*. sp. O, is known from streams of the mountains and Piedmont of North Carolina and from Ohio; this species is unusual in having a single median tooth instead of the normal double median tooth of *Hydrobaenus*. *Hydrobaenus* sp. O was referred to as "*Oliveridia*" in Caldwell et al. (1997). It appears that *H. pilipes* may be the most common species in the Southeast. Although Sæther (1976) offered a key to larvae, in reality it is impossible to separate most larvae to species without an associated pupa or adult; there is considerable variation and overlap in characters. Note that *H*. sp. "Georgia" will key to *H. johannseni* or *H. pilipes* in Sæther's (1976) key.

Hydrobaenus larvae are most common in streams in the Southeast, occurring most often in the winter or early spring.

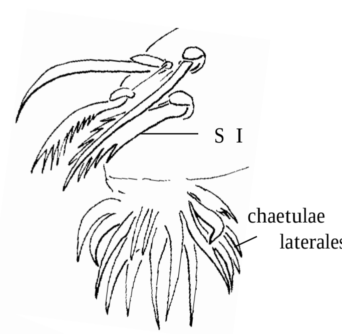
ADDITIONAL REFERENCES: Sæther 1976, 1989b; Tuiskunen & Lindeberg 1986.



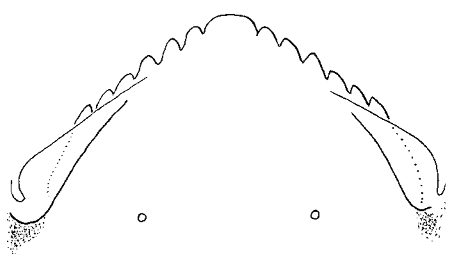
H. sp. "Georgia" mentum



H. pilipes ? mentum

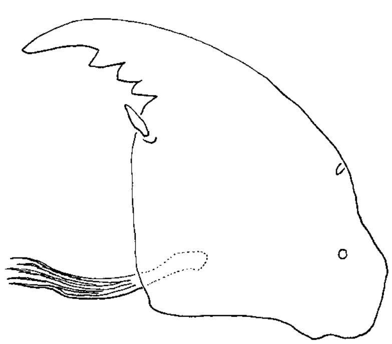


H. sp. O labrum

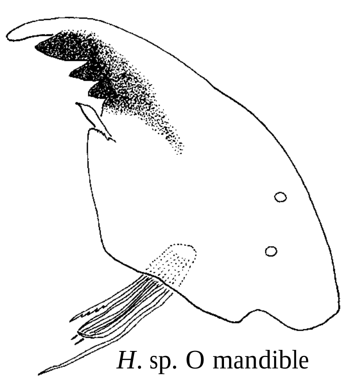


H. sp. O mentum

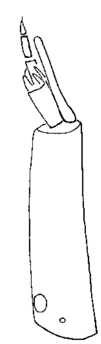
H. sp. O premandible



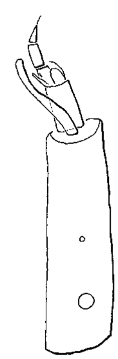
H. sp. "Georgia" mandible



H. sp. O mandible



H. sp. "Georgia" antenna



H. sp. O antenna

Genus *Krenosmittia*

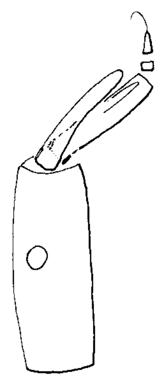
DIAGNOSIS: The small size (body < 3.5 mm); apically bifid premandible; distinctive mentum; elongate maxillary palp; and the very elongate anal setae will distinguish this genus.

NOTES: No named species are known from the Southeast; although Hudson et al. (1990) and Caldwell et al. (1997) list two “undescribed species”, I have seen larval material of only one apparent taxon. *Krenosmittia* is know to occur at least as far south as northwestern Florida.

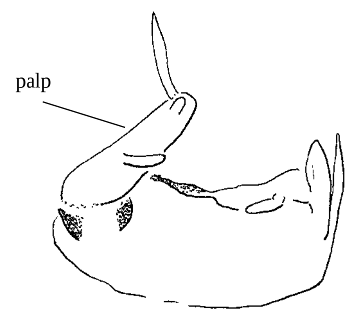
Cranston et al. (1983) stated that the antenna of *Krenosmittia* was 4 segmented. However, material from the Southeast appears to be 5 segmented, with the apical segment a thread-like extension. In addition the second antennal segment appears to be weakly divided near the base, somewhat similar to the antennae of *Brillia* and *Heleniella*. *Krenosmittia* antennae are difficult to observe clearly because of their small size and they usually have detritus stuck to them.

Larvae are found in sandy substrata of springs and streams; they are apparently hyporheic.

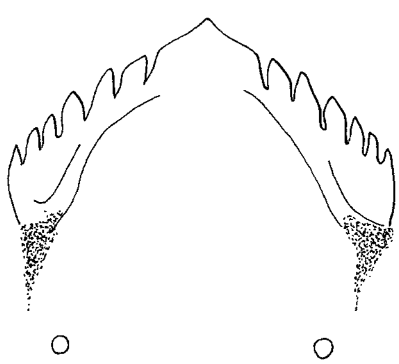
ADDITIONAL REFERENCES: Ferrington 1984; Sæther 1969; Tuiskunen & Lindeberg 1986.



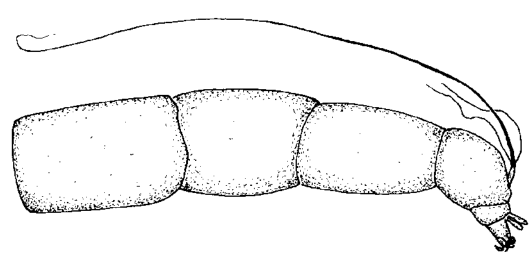
antenna



maxilla



mentum



posterior body segments

Genus *Limnophyes*

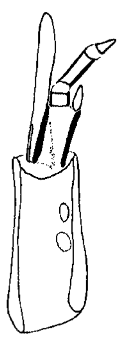
DIAGNOSIS: Larvae are distinguished by the absence of labral lamellae; serrate SI (but serrations sometimes reduced); 5 segmented antennae with antennal blade as long as or slightly longer than the flagellum; mentum with 2 median teeth and 5 lateral teeth; ventromental plates weak, with posterolateral portion appearing as a rounded basal tooth; mandible with 3 inner teeth, with mola not tooth-like; body setae shorter than 1/2 length of segment, simple (occasionally bifid); and supraanal setae about as long as anal setae.

NOTES: Based on adult males, nine species of *Limnophyes* are known from the Carolinas. Although Sæther (1990) offered a key to some larvae, only a few are associated with adults; it is not realistically possible to identify *Limnophyes* larvae to species without associated adult males.

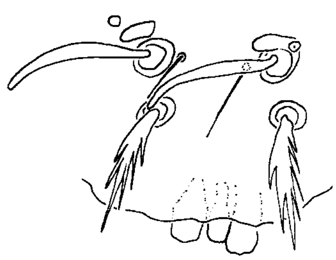
The only described larvae of the genus *Compterosmittia*, described from Hong Kong and Tasmanian larvae (see Cranston & Kitching (1995)), are very similar to those of *Limnophyes*, differing only in the tooth-like mola and the shorter supraanal setae of *Compterosmittia* (and perhaps the shorter antennal blade of *Compterosmittia*). Note that *C. nerius* occurs in the Carolinas and that its larva is undescribed; it may very well be masquerading as a *Limnophyes* in some samples.

Limnophyes larvae are found in rivers, streams, springs, seeps, in moss on rock surfaces, stream margins and other semi-aquatic habitats, as well as in terrestrial habitats.

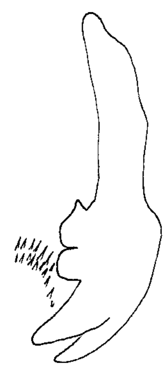
ADDITIONAL REFERENCES: Cranston & Oliver 1988a; Sæther 1975d, 1990; Sublette & Sasa 1994.



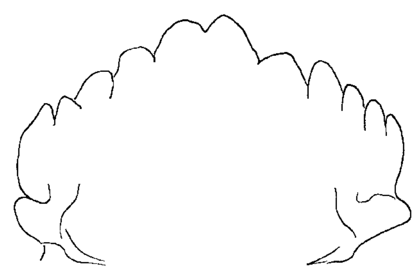
antenna



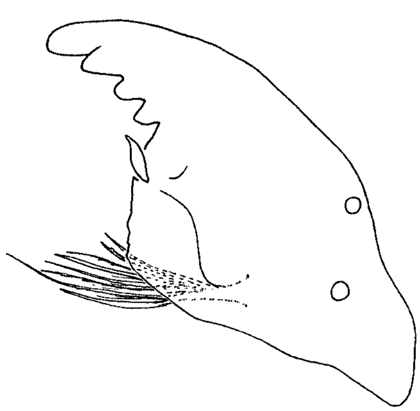
labrum



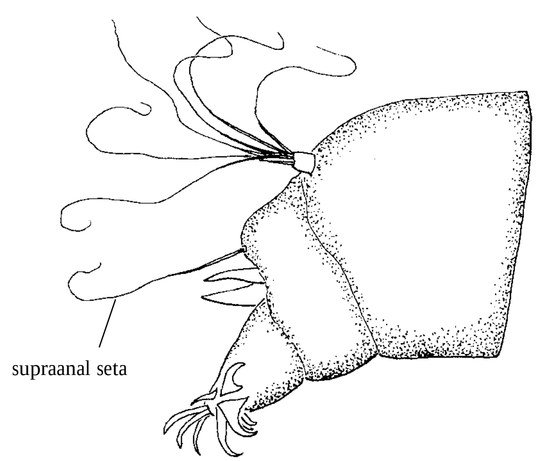
premandible



mentum



mandible



posterior body segments

Genus ***Lopescladius***

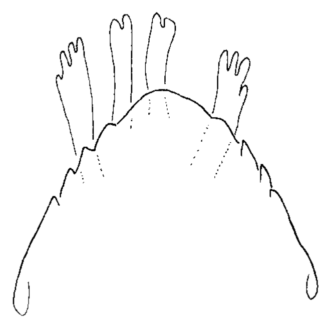
DIAGNOSIS: The small size (< 4 mm long); simple, apically pointed premandible; antennae longer than head capsule; 2nd antennal segment with median weakly sclerotized area and minute Lauterborn organs at apex; and last antennal segment (4th) long and whip-like will distinguish this genus.

NOTES: One described, named species, *L. hyporheicus*, is recorded from South Carolina by Hudson et al. (1990) and Caldwell et al. (1997); I have not seen material of this taxon from the Southeast. *Lopescladius* sp. 1, another species, described but unnamed by Coffman & Roback (1984), is known from South Carolina. All larvae I've examined from the Southeast appear to be *L*. sp. 1; I've also examined Roback's *L*. sp. 1 material from the Savannah River Plant area in South Carolina. It is possible that *L*. sp. 1 is based on smaller specimens of *L. hyporheicus* with an unworn mentum, but until *L*. sp. 1 is associated with an adult male it is best to retain the two as separate taxa. Two additional species, based on adults, are known from Kansas and Illinois (Sæther 1983b).

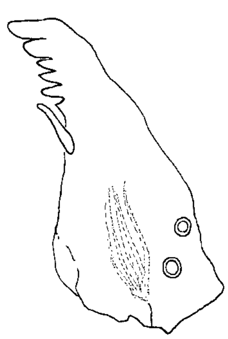
Lopescladius larvae are found in sandy substrata of streams and rivers.

ADDITIONAL REFERENCES: Coffman & Roback 1984; Sæther 1983b.

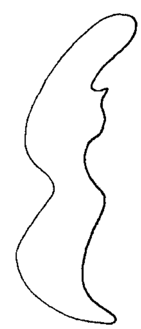
L. hyporheicus mentum



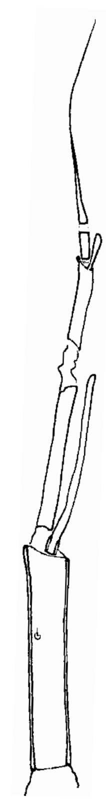
L. sp 1 mentum with hypopharyngeal scales



L. sp. 1 mandible



L. sp. 1 premandible



L. sp. 1 antenna

Genus *Mesocricotopus*

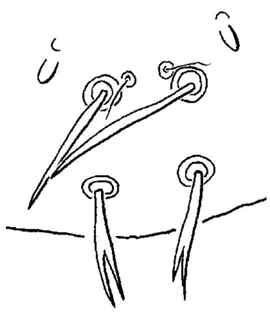
DIAGNOSIS: Distinguished by the bifid S I; antennal blade longer than the flagellum; absence of labral lamellae; two median teeth of the mentum; maxilla with pecten galearis; and mandible with 4 inner teeth (proximal 4th tooth sometimes difficult to observe).

NOTES: One described Nearctic species, *M. loticus*, is known from Georgia and Ohio (Caldwell 1996). I have also seen an adult male of an undescribed species from Great Smoky Mountains National Park in North Carolina.

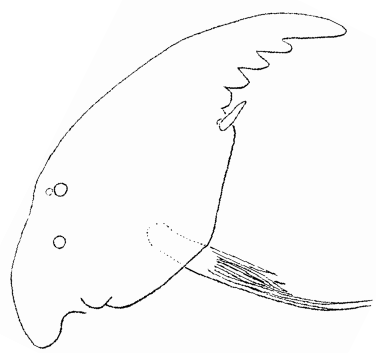
Larvae of *M. loticus* were found in 2nd and 3rd order streams. The undescribed male from North Carolina was collected at a light trap near a mountain stream. This contrasts with the littoral to profundal lake zones known as habitats for the Holarctic species *M. thienemanni*.

Although Cranston et al. (1983) described the S setae of the labrum as "normal", their illustration (Fig. 9.40E) shows the S III as large and displaced laterad to S I. In *M. loticus*, the S III are small and located between the S I setae.

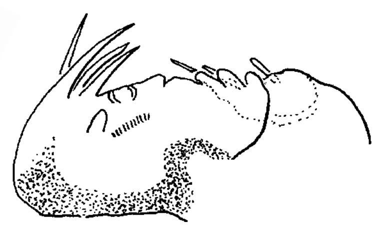
ADDITIONAL REFERENCES: Caldwell 1996.



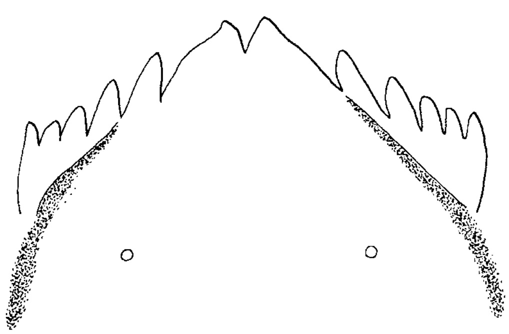
labrum



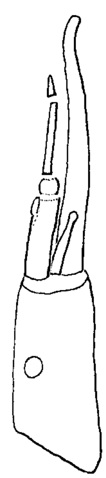
mandible



maxilla, dorsal



mentum



antenna

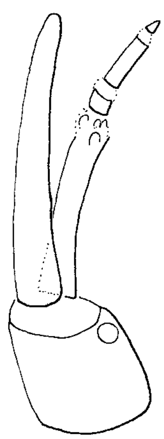
Genus *Mesosmittia*

DIAGNOSIS: The simple labral setae; lack of seta interna on the mandible, distinctive mentum; and lack of procerci, anal setae and anal tubules will distinguish this genus.

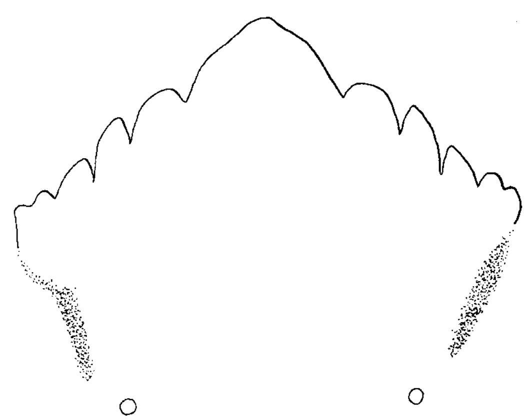
NOTES: Earlier texts (e.g., Cranston et al. (1983)) referred to Nearctic *Mesosmittia* as *M. flexuella*. However, Sæther (1985c) showed that *M. flexuella* is apparently not present in the Nearctic and described several new Nearctic species, three of which are recorded from the Southeast (Caldwell et al. 1997). Judging by adult specimens I've seen, *M. patrihortae* appears to be the most common species in the Southeast.

Mesosmittia larvae appear to be mostly terrestrial, although they may be found in aquatic habitats. The larvae illustrated by Epler (1995: 6.51) as "*Mesosmittia* sp." is probably a *Bryophaenocladius* (or *Gymnometriocnemus*); its identity will remain a mystery until it is reared and adults are examined.

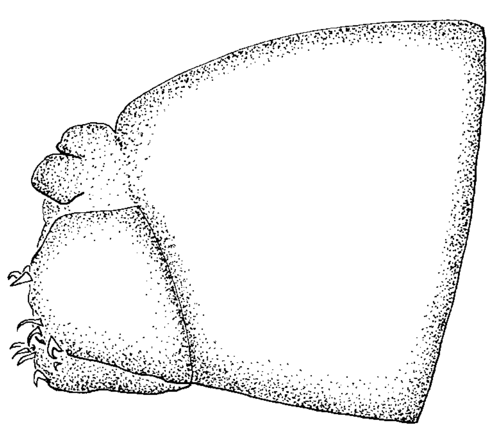
ADDITIONAL REFERENCES: Sæther 1985c; Strenzke 1950b.



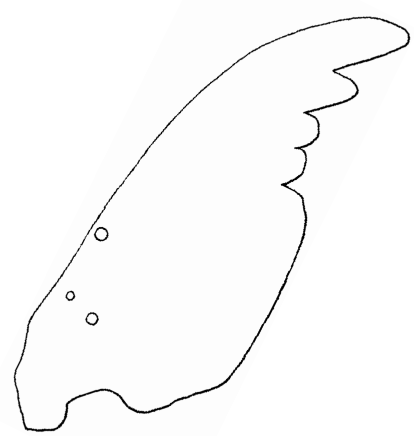
antenna



mentum



posterior body segments



mandible

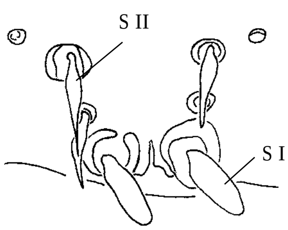
Genus *Metriocnemus*

DIAGNOSIS: Distinguished by the usually plumose S I (simple in *M. fuscipes*); well developed labral lamellae (reduced in *M. fuscipes*); lack of ventromental beard; well developed procerci; and short anal and supraanal setae.

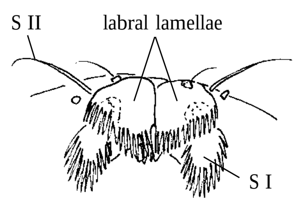
NOTES: Three species are known from the Carolinas, all identifiable to species as larvae. The larvae identified by Epler (1995: 6.52-6.54) as *M*. sp. B do not belong with *Metriocnemus.* Newly reared material indicates that they probably represent a new genus, Orthocladiinae genus H Epler, perhaps closely related to *Compterosmittia*.

Larvae are known from a variety of aquatic habitats, including water held by the pitcher plant *Sarracenia*, marine intertidal pools, sewage treatment beds, moss, tree holes, in damp soil, madicolous habitats (water flowing in a thin film), and in seeps, springs, streams, rivers and lakes.

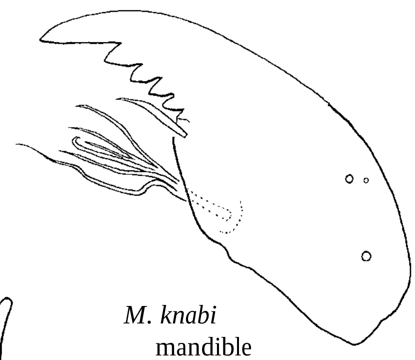
ADDITIONAL REFERENCES: Cranston & Judd 1987; Oliver & Sinclair 1989; Sæther 1989a.



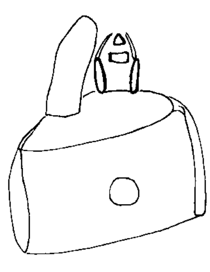
M. fuscipes labrum



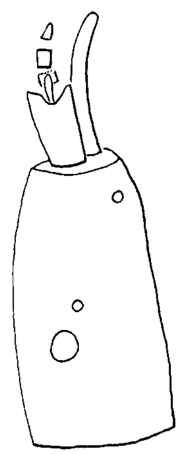
M. knabi labrum



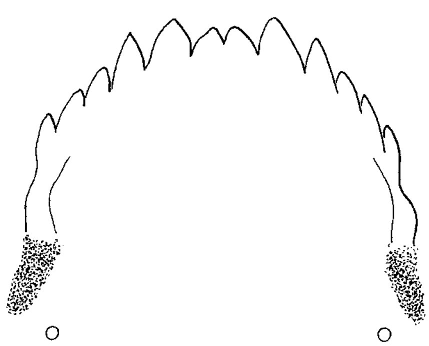
M. knabi mandible



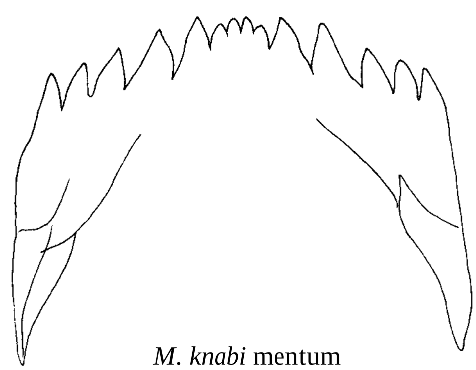
M. fuscipes antenna



M. eurynotus antenna



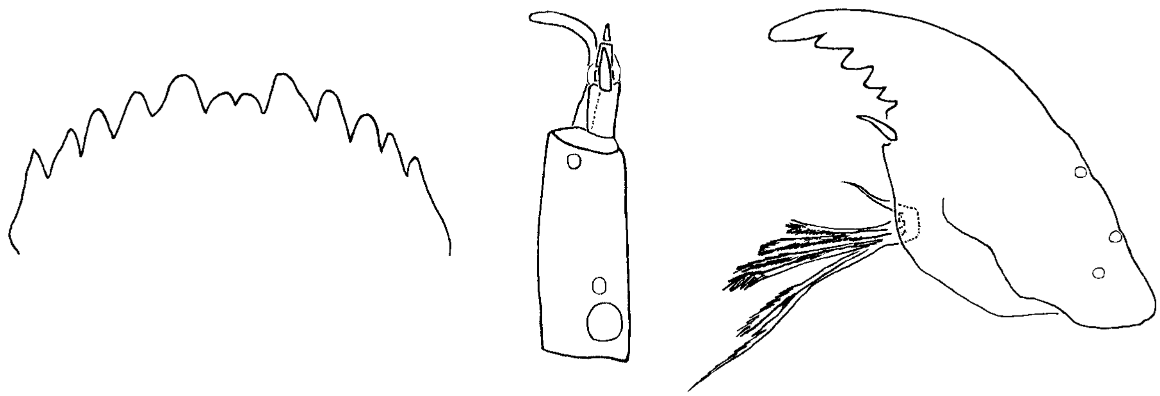
M. eurynotus mentum



M. knabi mentum

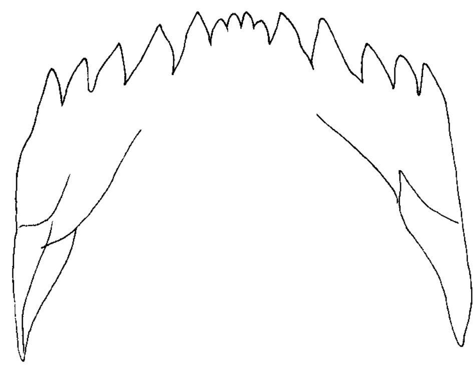
Key to *Metriocnemus* larvae of the southeastern United States

1 Abdominal segments with long setae (at least 1/2 as long as segment bearing them); known only from bromeliads in southern Florida .... ***M.* sp. A**



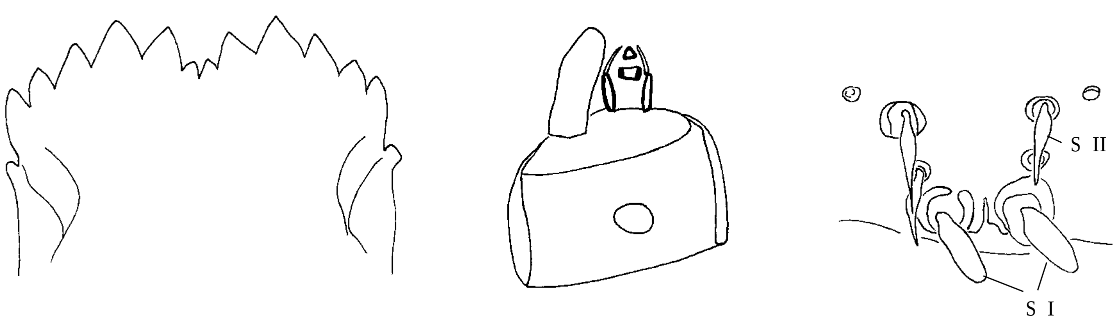
1’ Abdominal segments with short setae; widespread 2

2(1’) Mentum with 4 median teeth; restricted to water held by pitcher plant *Sarracenia* .... ***M. knabi***

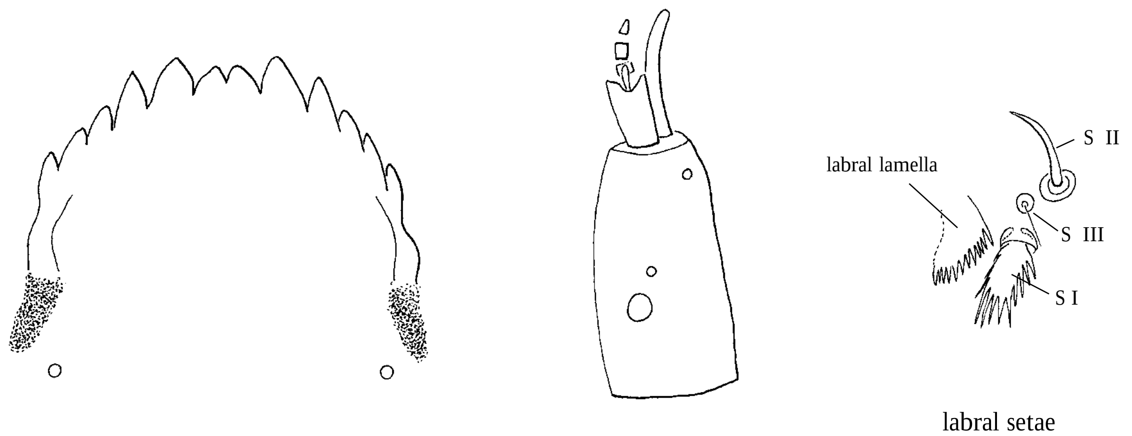


2’ Mentum with 2 median teeth; not restricted to *Sarracenia* phytotelmata 3

3(2’) Median teeth of mentum deeply sunken; antenna squat; S I simple .... ***M. fuscipes***



3' Median teeth of mentum slightly lower than first lateral teeth; antenna normal; S I plumose .... ***M. eurynotus***



Notes on species

M. eurynotus - Formerly known as *M. hygropetricus* and *M. obscuripes*. The two median teeth of the mentum may be worn down to appear as one rounded tooth or as a semicircular depression. Larvae are usually found in madicolous habitats, such as water flowing in thin sheets over rocks. They may occur in organically enriched habitats, especially sewage treatment beds.

M. fuscipes - According to Sæther (1989a) the second most common and widespread species of *Metriocnemus*, following *M. eurynotus*. Most of the larva's body segments are banded with purple; Bill Beck used to call this larva "Bungarus" (a genus of banded snakes, the kraits). Larvae occur in springs, seeps and streams; de la Rosa and Nastase (1987) reported a "small larva of *Metriocnemus* cf. *fuscipes*" found among larvae of *M. knabi* in the pitcher plant *Sarracenia purpurea* L.

M. knabi - Larvae are restricted to the water held by the pitcher plant *Sarracenia*, most often (exclusively?) *S. purpurea*. Note that the larval procerci are huge, as large as the posterior parapods.

M. sp. A - This species is known only from bromeliad phytotelmata (water held by plants) in south-central Florida; it is not expected to occur in the Carolinas. The procerci are more than twice as long as wide. An unusual larva for a *Metriocnemus* (if indeed it belongs here), for it has long abdominal setae. These setae should easily separate this species from *M. eurynotus*, which has a similar mentum, S I and labral lamellae. All characters other than the long body setae seem to place it in *Metriocnemus*; until pupae and adults are discovered, I am keeping it in *Metriocnemus*. Another phytotelmatic species placed as *Metriocnemus* sp. B in Epler (1995) has been moved to Orthocladiinae genus H (q.v.).

Metriocnemus abdominoflavatus Picado has been reported from North Carolina and Florida by Caldwell et al. (1997). It is very doubtful that this poorly described Costa Rican species (see Picado (1913)) occurs in the United States; these records may refer to *M. fuscipes*.

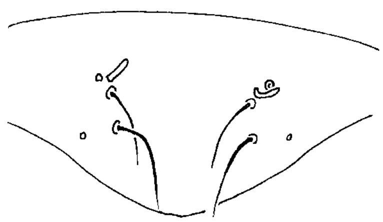
Genus *Nanocladius*

DIAGNOSIS: The simple labral setae (a single Japanese species with apically pectinate S II); large ventromental plates which extend past the lateral margin of the mentum; lack of cardinal beard; and distinctive mentum with wide median area, usually with two small central teeth, distinguish the genus in our area.

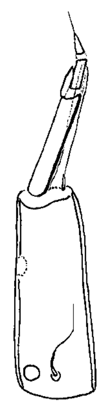
NOTES: A common and widespread genus, *Nanocladius* is divided into two subgenera: *Nanocladius (Plecopteracoluthus)* is phoretic or parasitic on aquatic insects; *Nanocladius (Nanocladius)* species are free-living. Larvae are found in lakes, rivers and streams; at least one species, *N. distinctus*, is tolerant of high levels of organic nutrients.

Identification of some *Nanocladius* species is difficult; many determinations based on larvae alone are suspect. A pupal association is often necessary for accurate identification. I have seen numerous misidentifications, especially of early instar larvae, in which the ventromental plates are not developed as in the 4th instar; this is especially true for larvae identifed as species of *N. (Plecopteracoluthus)*. Sæther (1977a) provided keys for larvae, pupae and adults, but the keys and descriptions are ambiguous and contain numerous errors; some species descriptions include measurements, etc., from more than one species. There are several undescribed species in the eastern United States.

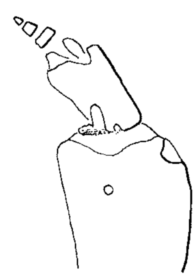
ADDITIONAL REFERENCES: Dendy 1973; Dendy & Sublette 1959; Dosdall & Mason 1981; Fittkau & Lehman 1970; Epler 1986; Sæther 1977a; Simpson & Bode 1980; Steffan 1965.



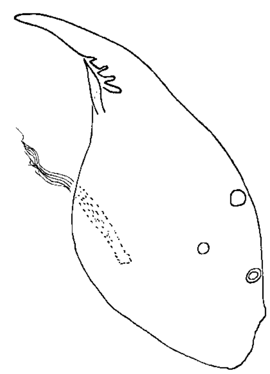
N. crassicornus labrum



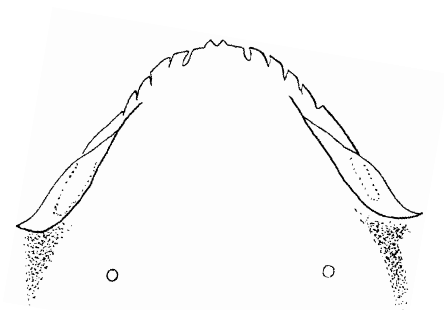
N. crassicornus antenna



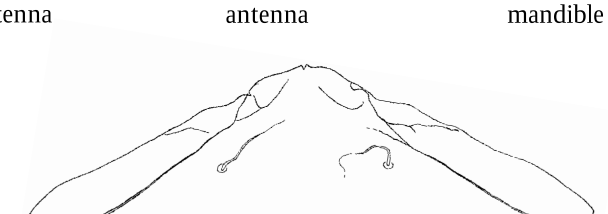
N. sp. 1 antenna



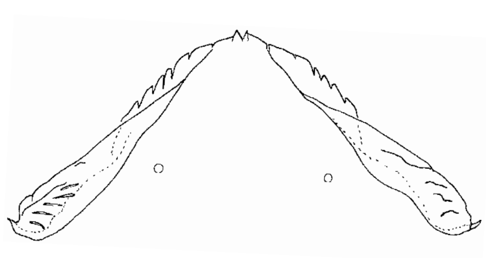
N. crassicornus mandible



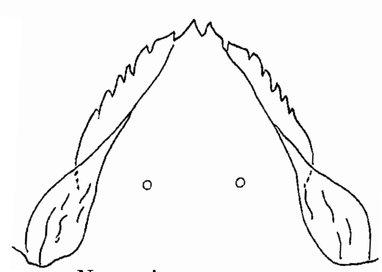
N. branchicolus mentum



N. balticus mentum



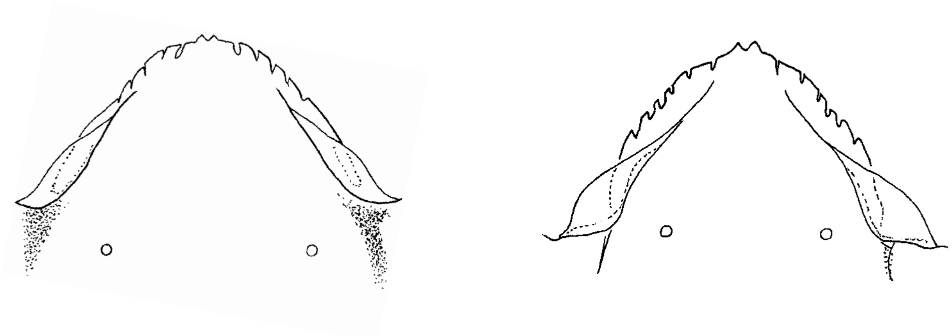
N. distinctus mentum



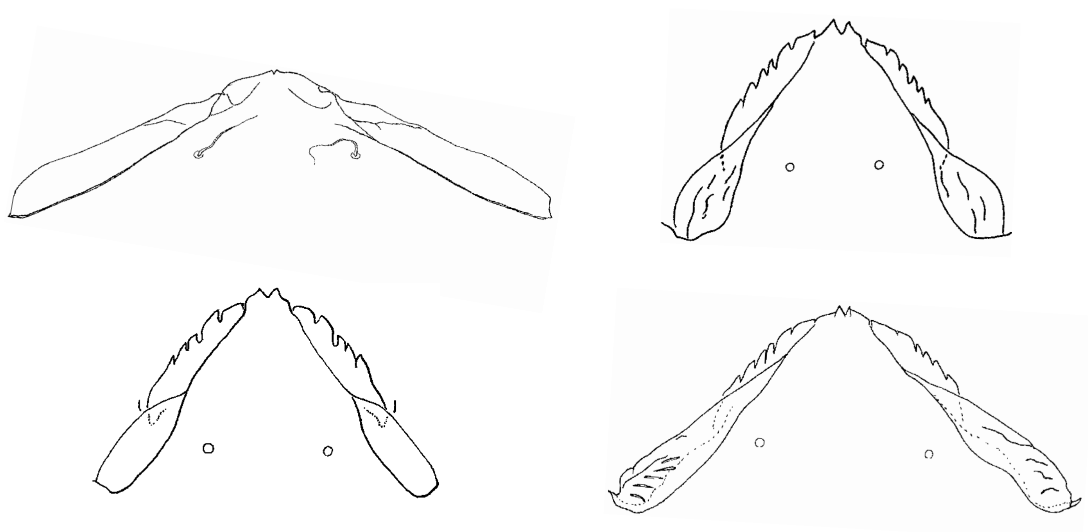
N. crassicornus mentum

Key to *Nanocladius* larvae of the southeastern United States

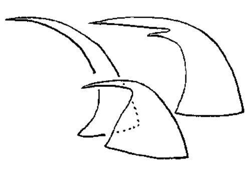
1 Ventromental plates short, scarcely extending past the posterolateral margin of the mentum .. 2



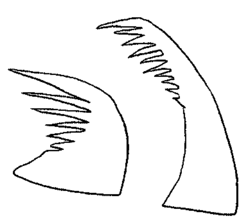
1' Ventromental plates long, extending at least more than 1/2 their length beyond the posterolateral margin of the mentum 7



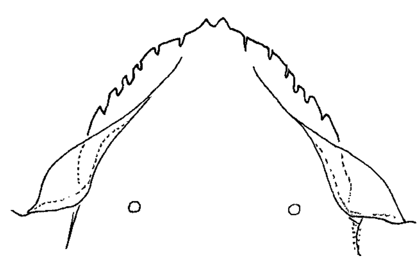
2(1) Anterior parapods with most claws smooth, although some present with internal teeth; free-living, usually on aquatic macrophytes, usually in lentic habitats .... ***N. (N.) alternantherae***



anterior parapod claws of *N. alternantherae*



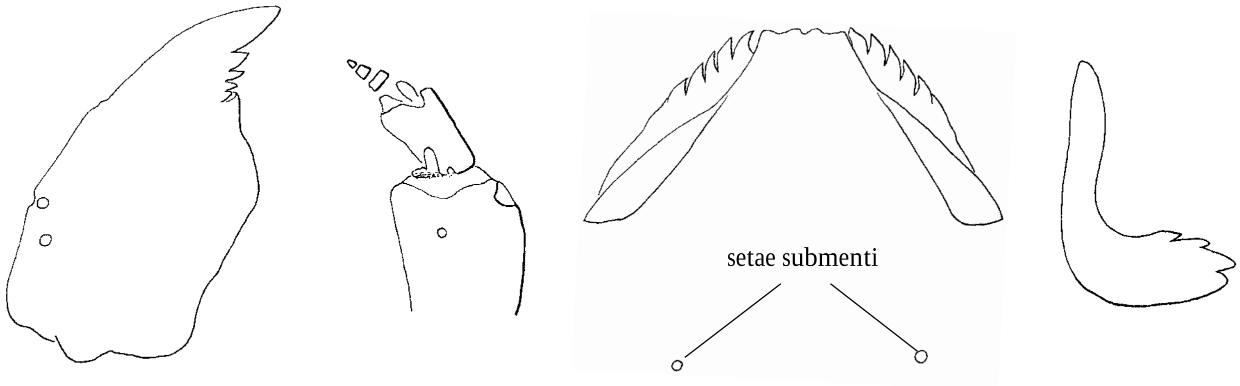
strongly pectinate claws



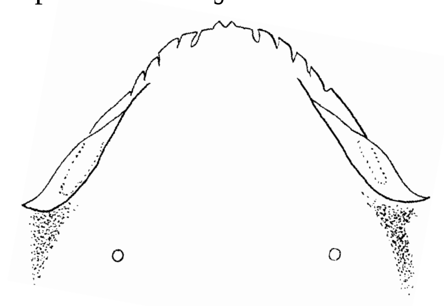
mentum of *N. alternantherae*

2' Anterior parapods with most medium-sized claws strongly pectinate/serrated; phoretic or parasitic on aquatic macroinvertebrates, usually in lotic habitats 3

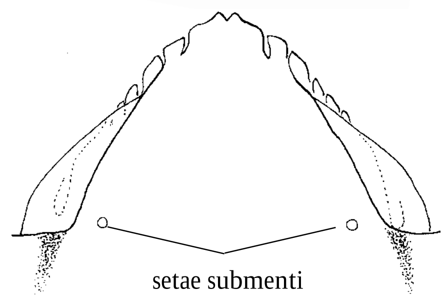
3(2') Apical tooth of mandible stout; antennae reduced; premandible with 4-5 apical teeth; setae submenti displaced posteriad; obligate parasite on *Ephemera guttulata* .... ***N. (P.)* sp. # 1**



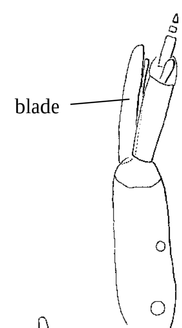
3' Apical tooth of mandible longer, thinner; antennae not as reduced; premandible simple or at most weakly bifid; setae submenti not displaced as far posteriad; not parasitic on *E. guttulata* 4



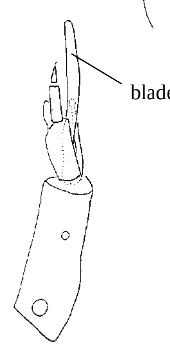
4(3') Setae submenti just posterior to ventromental plates .. 5



4' Setae submenti even with ventromental plates 6

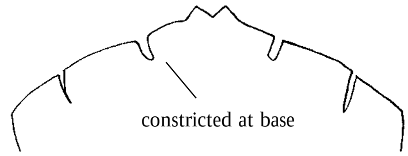


5(4) Antennal blade shorter than flagellum; central cusps of mentum sharp, distinct .... ***N. (P.) branchicolus***



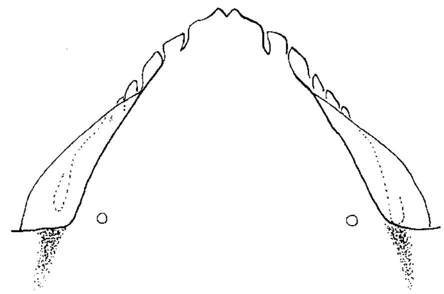
5' Antennal blade longer than flagellum; central cusps of mentum weaker, lower .... ***N. (P.)* sp. #3**

6(4') Median tooth of mentum constricted at base; postmentum usually dark near posterior margin of head capsule .... ***N. (P.) downesi***

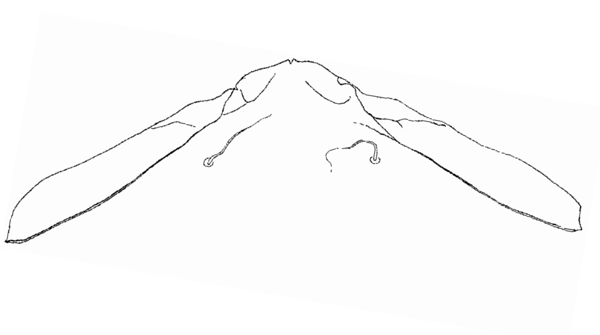


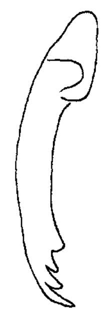
central teeth of *N. downesi* mentum

6' Median tooth of mentum not constricted basally; postmentum not darkened .... ***N. (P.)* sp. # 5**

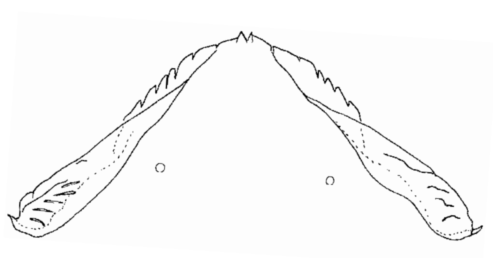


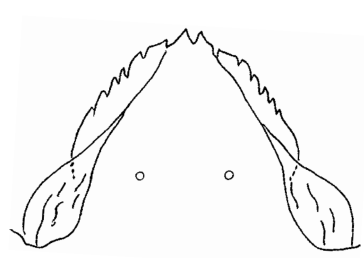
7(1') Ventromental plates extremely wide; teeth of mentum not distinct; premandible with 3-5 apical teeth 8

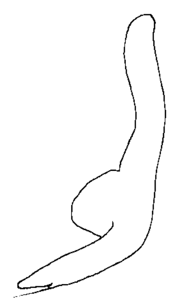




7' Ventromental plates not as wide; lateral teeth of mentum usually distinct; premandible simple or apically bifid 10

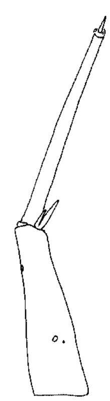




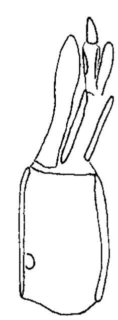


8(7) Antennae elongate, with 2nd segment longer than basal segment .... ***N. (N.)* sp. D**

8' Antennae reduced, with 2nd segment at most subequal to basal segment 9

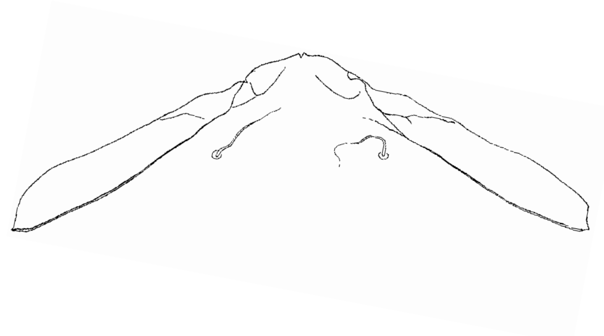


N. sp. D



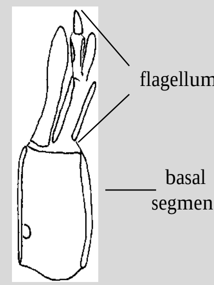
N. balticus

9(8’) AR ≤ 1.00; postmentum length > 130 µm; ventromental plates with horizontal ridges near anterior margin; some anterior parapod claws pectinate .... ***N. (N.) balticus***



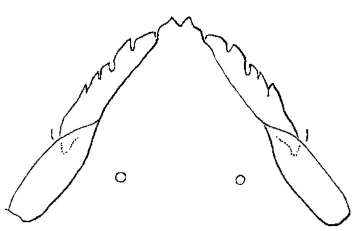
NOTE:
4th instar
larvae are necessary
for accurate
measurements!!

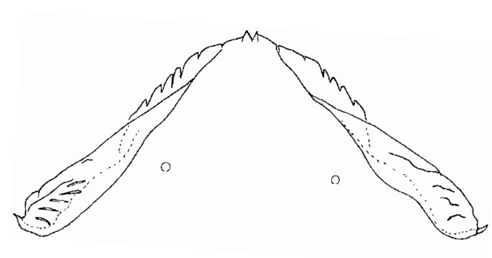
AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



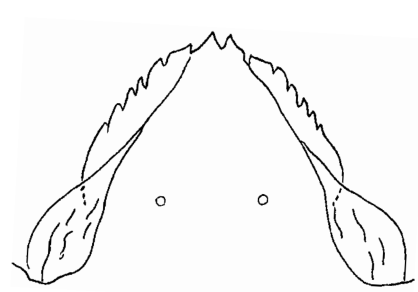
9’ AR 1.00-1.12; postmentum length < 120 µm; ventromental plates apparently smooth; most anterior parapod claws smooth .... ***N. (N.) incomptus***

10(7’) Ventromental plates elongate, without ridges or with horizontal ridges 11

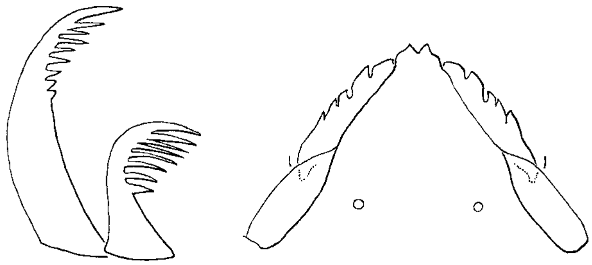




10’ Ventromental plates tear-drop shaped, with vertical ridges ...... ***N. (N.) crassicornus*, *N. (N.)* cf. *rectinervis*** 13



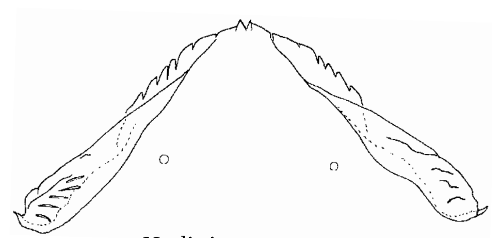
11(10) Anterior parapod claws strongly pectinate; AR 1.2-1.5; ventromental plates smooth .... ***N. (N.) spiniplenus***



AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

NOTE: 4th instar larvae are necessary for accurate measurements!!

11' Anterior parapod claws smooth; AR ≥ 1.5; ventromental plates with horizontal ridges 12

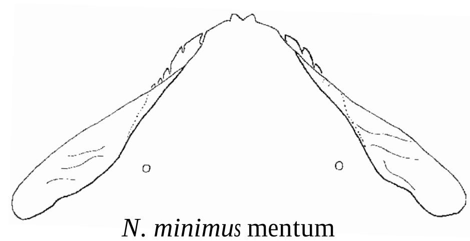


N. distinctus mentum

12(11') Ventromental plates with strong, distinct horizontal ridges; AR 1.7-2.0; basal antennal segment length 53-60 µm .... ***N. (N.) distinctus***

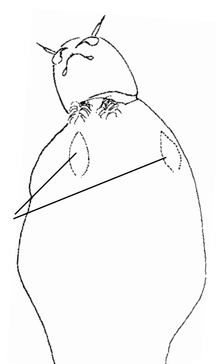
12' Ventromental plates with weak horizontal ridges; AR 1.5-1.8; basal antennal segment length 40-53 µm .... ***N. (N.) minimus***

NOTE: 4th instar larvae are necessary for accurate measurements!!



N. minimus mentum

The larvae of the following two species are inseparable. However, if you have a late 4th instar larva, the developing pupal thoracic horns may be visible. If they are, the larvae may be identified to species by the following:



developing thoracic horns in late 4th instar larva

13(10') Pupal thoracic horn ovoid .... ***N. (N.) crassicornus***

13' Pupal thoracic horn elongate ..... ***N. (N.)* cf. *rectinervis***

N. crassicornus

N. cf. *rectinervis*

Notes on species

Larvae of many *Nanocladius* are difficult to identify to species; pupae often provide the best characters for species separation. Larvae of the subgenus *Plecopteracoluthus* have been the most misidentified members of the genus; this has led to numerous papers with misinformation concerning macroinvertebrate hosts of *Nanocladius*. Note that *N.* (*Plecopteracoluthus)* species may be phoretic or parasitic. Much of the information in this manual concerning *N. (Plecopteracoluthus)* species has been graciously provided by Dr. Rick Jacobsen.

N. (N.) alternantherae - A common species usually associated with plants in lentic conditions. The short ventromental plates easily confuse this taxon with members of the subgenus *Plecopteracoluthus*. However, *N. alternantherae* is free-living; all known members of *Plecopteracoluthus* are phoretic or parasitic on aquatic macroinvertebrates, and most of the claws of the anterior parapods of *N. alternantherae* are simple; those of *Plecopteracoluthus* species are strongly pectinate. Note that some of the parapod claws of *N. alternantherae* will have inner teeth, but the majority of the medium-sized claws will be smooth. This species can be easily confused with *N.* cf. *rectinervis* (as used in this manual); *N. alternantherae* is usually found associated with plants in lentic conditions; *N.* cf. *rectinervis* is usually lotic. Pupae of *alternantherae* strongly resemble those of *N.* cf. *rectinervis* but differ in having one of the dorsal antepronotal setae much thinner and shorter than the other; these setae are subequal in *N.* cf. *rectinervis*. Note that the original description (Dendy & Sublette 1959) of *N. alternantherae* is in error; the pupal thoracic horn does have small spines.

N. (N.) balticus - I have examined a reared specimen from Florida that appears to be this species. It occurs in both the Carolinas and has been found as far south as the Orlando, Florida, area. This species is difficult to separate from *N. incomptus*; unless 4th instar larvae are present and can provide accurate measurements, larvae should be identified as "*N. balticus* group sp.".

N. (P.) branchicolus - A parasitic species found on the perlid stoneflies *Acroneuria* spp., *Paragnetina media* (Walker) and *P. immarginata* (Say). *Nanocladius branchicolus* and *N. downesi* have been frequently misidentified and confused in the literature. Jacobsen (pers. comm.) notes that *N. branchicolus* is not found on the coenagrionid damselfly *Argia* as reported by Dosdall & Parker (1998); these specimens were *N. downesi*. Known from Michigan, New York, North Carolina (Great Smoky Mountains National Park), Pennsylvania, Wisconsin, Wyoming, Ontario and Saskatchewan.

N. (N.) crassicornus - A common species in northern Florida, where I have been able to confirm its identity with associated pupae. At this time, characters have not been found that will separate larvae of *N. crassicornus* from those of *N.* cf. *rectinervis* . Although Simpson & Bode (1980) used antennal characters to separate the two species, these characters do not hold up when a larger range of material is examined.

N. (N.) distinctus - A species with large ventromental plates bearing distinct horizontal ridges, *N. distinctus* often occurs in water with high organic loading, such as below pulp mill discharges. It can be confused with *N. minimus*, which usually has weaker ridges on the ventromental plates and is smaller.

N. (P.) downsei - A phoretic (not parasitic) species found on a wide variety of aquatic macroinvertebrates: Plecoptera: Perlidae; Megaloptera: Corydalidae: *Corydalus*, *Chauliodes*, *Nigronia*; Hemiptera: Belostomatidae: *Belostoma*; Odonata: Coenagrionidae: *Argia*. It has been found in Georgia, Maryland, Michigan, Missouri, New Hampshire, North Carolina, Pennsylvania, Tennessee, Vermont, Wisconsin and Quebec. Although recorded from the Carolinas by Hudson et al. (1990) and Caldwell et al. (1997), with the exception of one specimen from North Carolina, their specimens have not been reexamined for positive identification. Almost without exception, all records of this species and *N. branchicolus* in the "gray literature" must be viewed with considerable skepticism.

N. (N.) incomptus - A member of the *balticus* group; in general, only 4th instar larvae are identifiable because of the similarity between this species and *N. balticus*.

N. (N.) minimus - As a larva and adult male, very difficult to identify; according to Sæther (1977a) only the female and pupa are easily identified. This species may be a variant of *N. anderseni* (Sæther 1977a). Records of this species from throughout the Southeast, such as those in Hudson et al. (1990) and Caldwell et al. (1997), must be viewed with skepticism. Originally described from South Carolina.

N. (N.) cf. *rectinervis* - Note that what has been called *N. rectinervis* in North America may not be that species, originally described from the Palaearctic. See figures of *N. rectinervis* in Cranston et al. (1983: fig. 9.44B); the ventromental plates are apparently much longer than those of specimens identified as *N. rectinervis* from the Nearctic. The material described by Sæther (1977a) as *N. rectinervis* and *N. alternantherae* was mixed (Sæther, in ms.). I have not examined any associated material of this taxon from the Palaearctic. For the time being, it would be best to call this taxon *N.* cf. *rectinervis* until its identity can be settled through examination of reared material from both sides of the Atlantic. This species is apparently inseparable from *N. crassicornus* as a larva. Although Simpson & Bode (1980) suggested that lengths of the first antennal segment might separate the two species, these measurements overlap and are unusable. Epler (1995) confused *N. rectinervis* with *N. alternantherae*; most of what he called *rectinervis* was actually *alternantherae* (also see *alternantherae* above). Records of *N. rectinervis* as a phoretic organism on North American macro-invertebrates are in error and in most cases refer to species, some undescribed, of *N. (Plecopteracoluthus)* (R. Jacobsen, pers. comm.). These include the record of *N. rectinervis* on *Nigronia serricornis* (Say) in Gotceitas & Mackay (1980) (referable to *N. (P.)* sp. # 5) and probably those of Dosdall et al. (1986) on the stonefly *Pteronarcys dorsata*.

N. (N.) spiniplenus - Records of this species by Dosdall et al. (1986) as a phoretic organism on the stonefly *Pteronarcys dorsata* are probably in error. Fourth instar larvae and pupae are necessary for accurate identification.

N. (N.) sp. D - Epler (1992, 1995) called this taxon "Orthocladiinae genus D" and suggested that it was a *Nanocladius*. Several colleagues (Caldwell, Cranston, Sæther, all pers. comm.) agree that it is best placed in *Nanocladius*. It is not known to me from the Carolinas; it is known from Georgia (Caldwell et al. 1997) and western Florida.

N. (P.) sp. #1 Jacobsen - This distinctive species is an obligate parasite on the mayfly *Ephemera guttulata* Pictet. No other species of *N. (Plecopteracoluthus)* has such short antennae, a stout apical tooth of the mandible and the short, stout, apically dissected body setae. This *Nanocladius* has not been found in the Carolinas but its host has been recorded from North and South Carolina (Pescador et al. 1999), leading one to believe that it will probably be found in the Carolinas. Known from Kentucky, Maryland, Pennsylvania, Virginia and West Virginia.

N. (P.) sp. #3 Jacobsen - Larvae are parasitic on the stoneflies *Pteronarcys biloba* Newman, *Pt. proteus* Newman and *Pt. scotti* Ricker. B. A. Caldwell has collected *N. (P.)* sp. #3 from *Pt. scotti* in Georgia. It is the species reported from *Pt. biloba* as "*Nanocladius (Plecopteracoluthus)* undescribed sp., nr. *branchicolus*" in Giberson et al. (1996). It is also probably the species referred to as *N. branchicolus* on *Pt. dorsata* (Say) by Dosdall et al (1986), but no material exists (R. Jacobsen, pers. comm.). Distributed from New Brunswick to Georgia, but not yet recorded from the Carolinas.

N. (P.) sp. #5 Jacobsen - Larvae are phoretic on *Nigronia serricornis* (Say) and the damselfly *Argia*. Larvae of *N. (P.)* sp #5 were referred to as *N. rectinervis* in Gotceitas & Mackay (1986); some of Hilsenhoff's (1968) *N. downesi* on *Nigronia serricornis* were also this species, and it is the *N. (P.)* sp. of Pennuto (1997, 1998). Known from Connecticut, Maine, Maryland, North Carolina, Pennsylvania and Wisconsin.

Genus *Orthocladius*

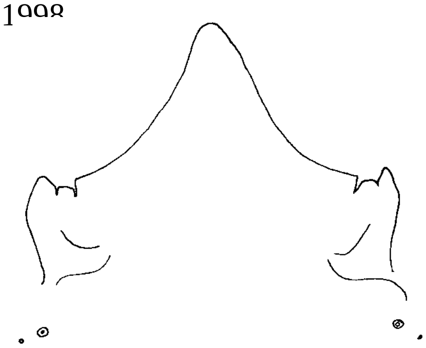
DIAGNOSIS: Difficult to diagnose because of the wide range of character variation; some larvae are difficult to distinguish from *Cricotopus (Cricotopus)* and *Paratrichocladius* larvae. Most *Orthocladius* possess a bifid SI (secondarily split in one undescribed species) or, less commonly, the SI is simple; pecten epipharyngis always of three scales; premandible simple or apically bifid; weak to moderately developed ventromental plates; weak or vestigial beard; mentum with odd number of teeth (ranging from 5 to 21); and body usually without setal tufts (but tufts present in at least 3 species in the United States).

NOTES: Four of the five subgenera of *Orthocladius* occur in the Carolinas: *Eudactylocladius, Euorthocladius, Orthocladius* and *Symposiocladius*. Although the various subgenera have recently been revised, it is still very difficult to identify larvae, making associations with pupae or adult males imperative for accurate species level identification; pupae are often the best stage for species identification. The discovery of setal tufts on *O. annectens* (Fagnani & Soponis 1988) negates the use of that character in separating some *Orthocladius* larvae from those of *Cricotopus* that also bear setal tufts.

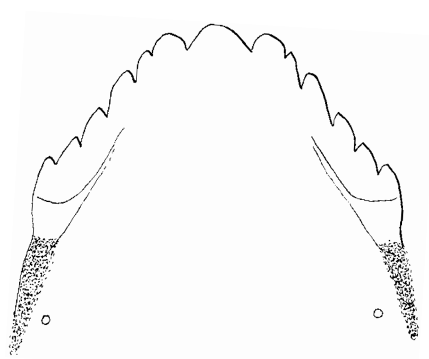
The distinction between some *O. (Orthocladius)* species (*frigidus*, *vaillanti* and sp. “Jacobsen”) and *O. (Euorthocladius)* is unclear; much more work is necessary. A worldwide revision of *Orthocladius* (including all its subgenera) and *Cricotopus* are needed. Note that several Nearctic *Orthocladius* species are probably synonyms of Palaearctic taxa (See Notes on species)

Orthocladius larvae inhabit a wide variety of habitats, although most are usually found in running water. It is not unusual to find more than one species at a single site. *Orthocladius (S.) lignicola* larvae mine in submerged soft or decomposing hardwoods. The larvae and pupae of many (all?) *O. (Euorthocladius)* live in gelatinous tubes.

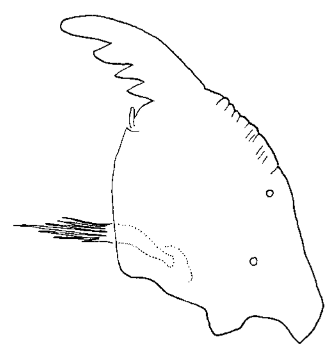
ADDITIONAL REFERENCES: Caldwell 1999; Cranston 1999; Cranston & Oliver 1988b; Fagnani & Soponis 1988; Langton & Cranston 1991; Sæther 1969; Soponis 1977, 1987, 1990; Sublette et al. 1998



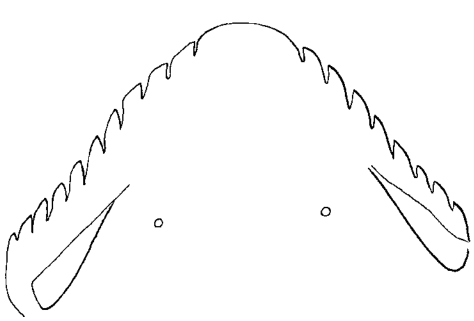
O. (S.) lignicola mentum



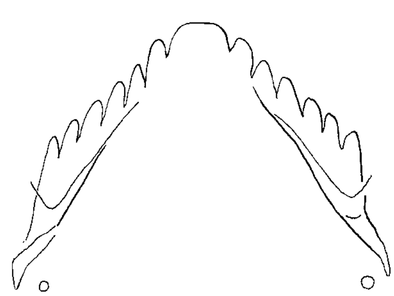
O. (Eud.) dubitatus mentum



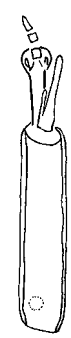
O. (O.) dorenus mandible



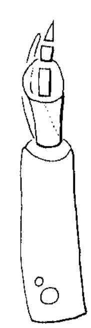
O. (Euo.) rivulorum mentum



O. (O.) rubicundus mentum



O. (S.) annectens antenna

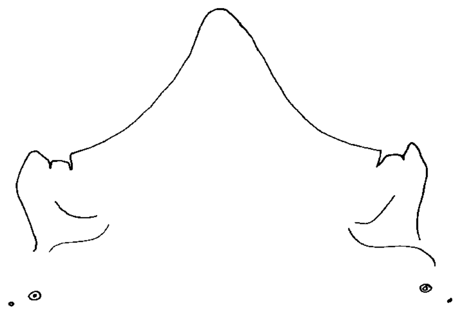


O. (O.) nigritus antenna

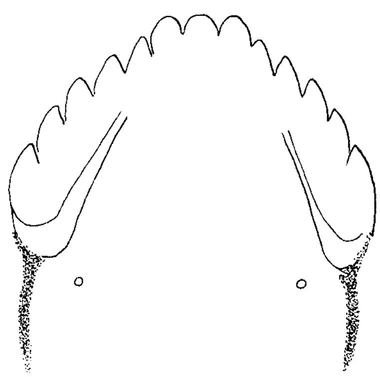
Key to *Orthocladius* larvae of the southeastern United States

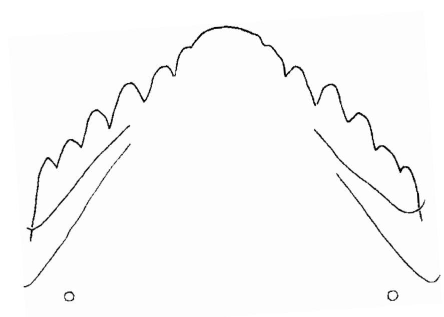
(You should have a pupal association that confirms that your specimen is an *Orthocladius* before attempting this key. Most identifications should be considered tentative unless backed by a pupal or adult association)

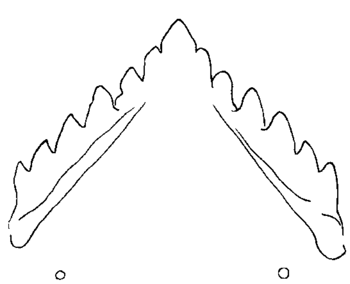
1 Mentum with huge median tooth and < 11 lateral teeth (caution – a worn mentum may have less than the usual number of teeth visible!); abdominal segments with posterolateral setal tufts .... ***O. (S.) lignicola***

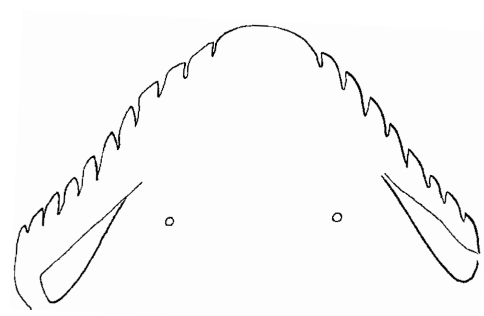


1' Mentum with more normal median tooth and 11 or more lateral teeth; abdominal segments usually without posterolateral setal tufts (present in one species, couplet 12) ………..…………. 2

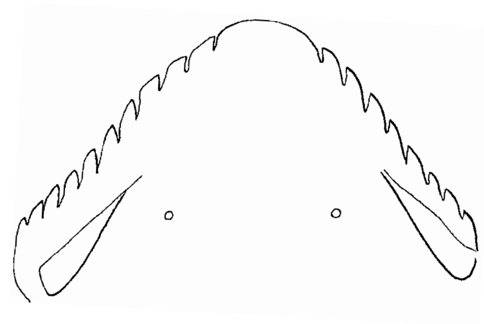




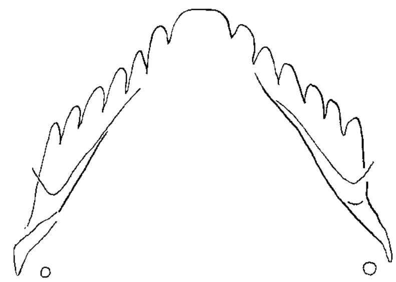




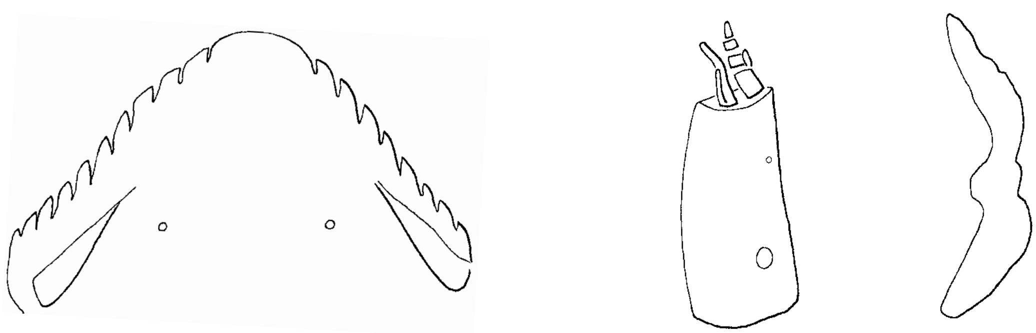
2(1') Mentum with more than 13 teeth …….……….. 3



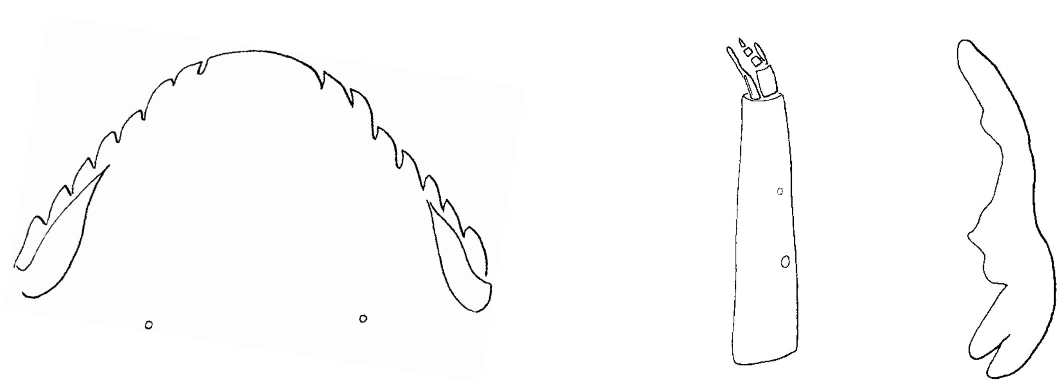
2' Mentum with 13 teeth …………...……………. 4



3(2) Mentum with 17-21 teeth; basal segment of antenna short; premandible simple .... ***O. (Euo.) rivulorum***

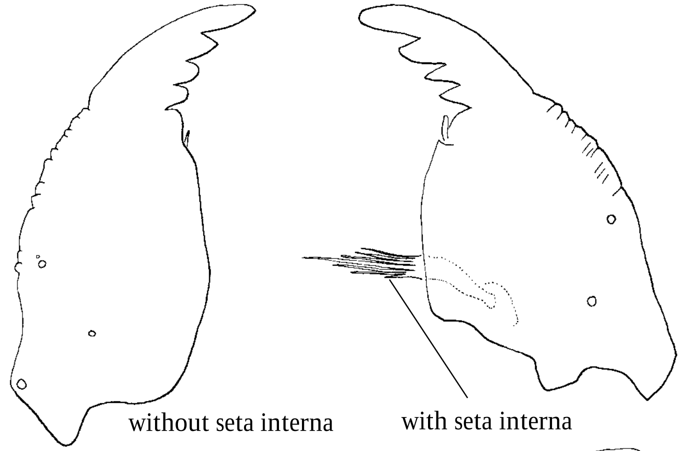


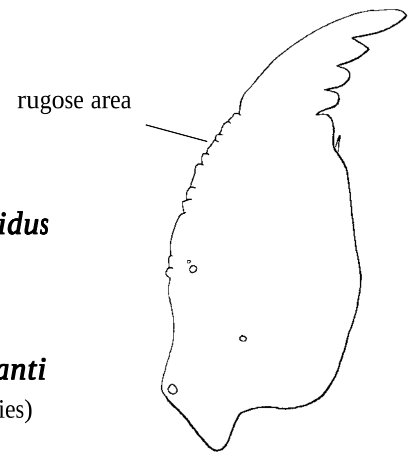
3' Mentum with 15 teeth; basal segment of antenna long; premandible apically bifid .... ***O. (O.)* sp. "Jacobsen"**



4(2') Mandible without seta interna 5

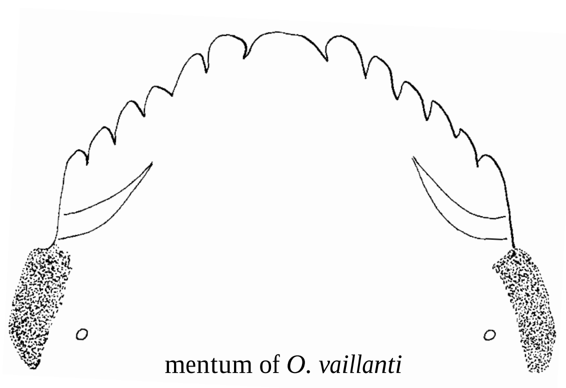
4' Mandible with seta interna …....….. 6

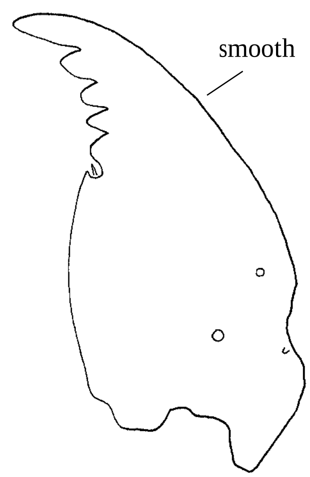




5(4) Outer margin of mandible rugose .... ***O. (O.) frigidus***

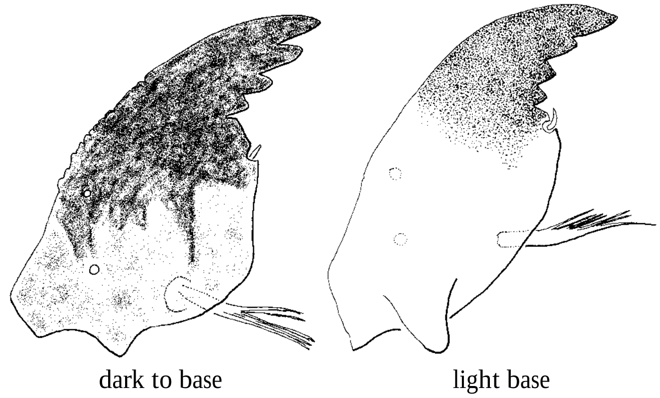
5' Outer margin of mandible mostly smooth .. ***O. (O.) vaillanti***
(see Notes; if premandible bifid represents a different, undescribed, species)



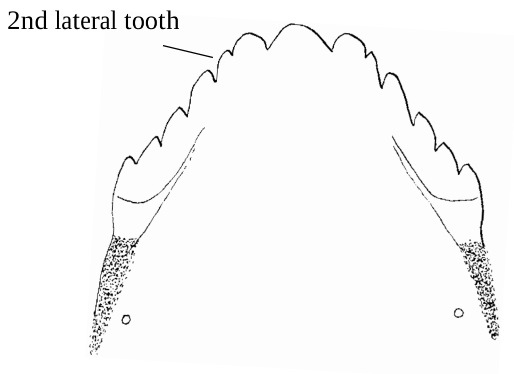


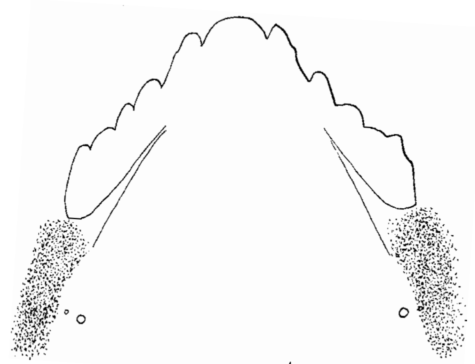
6(4') Head capsule light brown to dark brown or dark reddish-brown; mandibles usually darkly colored to base (base may be paler than apex, but overall the mandible is dark) …................ 7

6' Head capsule yellow to light yellow-brown; mandibles with dark apex and teeth and light colored base, never darkly colored to base …..…… 11



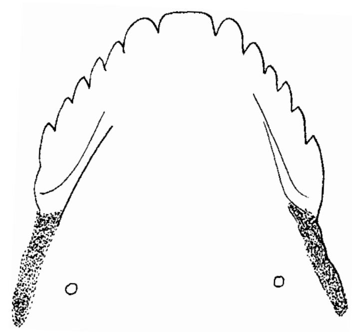
7(6) 2nd lateral tooth of mentum reduced and partially fused to 1st lateral tooth .. ***O. (Eud.) dubitatus***





worn mentum

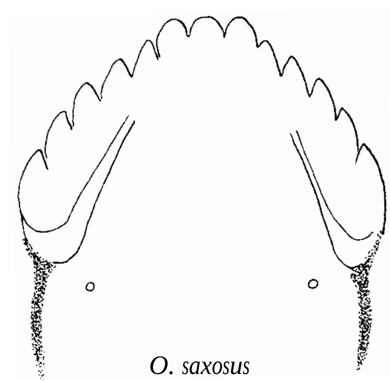
7’ 2nd lateral tooth not reduced or fused to 1st lateral tooth ….. 8



O. thienemanni

8(7’) Mentum with median tooth > 1.5X width of 1st lateral tooth 9

8’ Mentum with median tooth < 1.5X width of 1st lateral tooth 10



O. saxosus

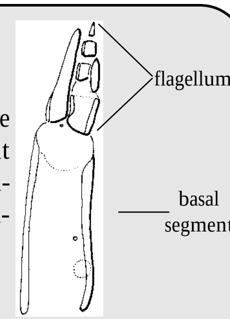
9(8) AR > 1.85 .... ***O. (Euo.) thienemanni***

9’ AR < 1.85 .... ***O. (Euo.) luteipes***

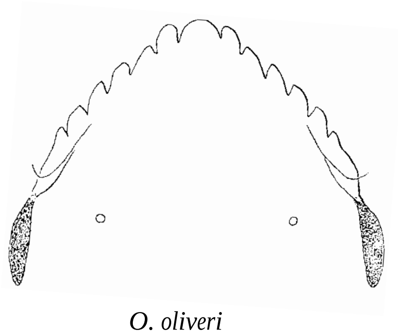
10(8’) AR < 1.80 …......................... ***O. (Euo.) rivicola***

10’ AR > 1.80 …......................... ***O. (Euo.) saxosus***

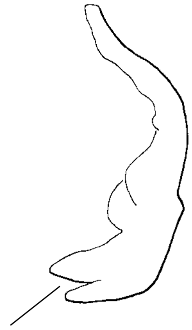
AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



11(6') Premandible apically bifid .... ***O. (O.) oliveri***

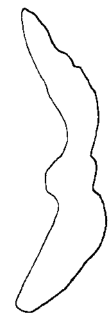


O. oliveri

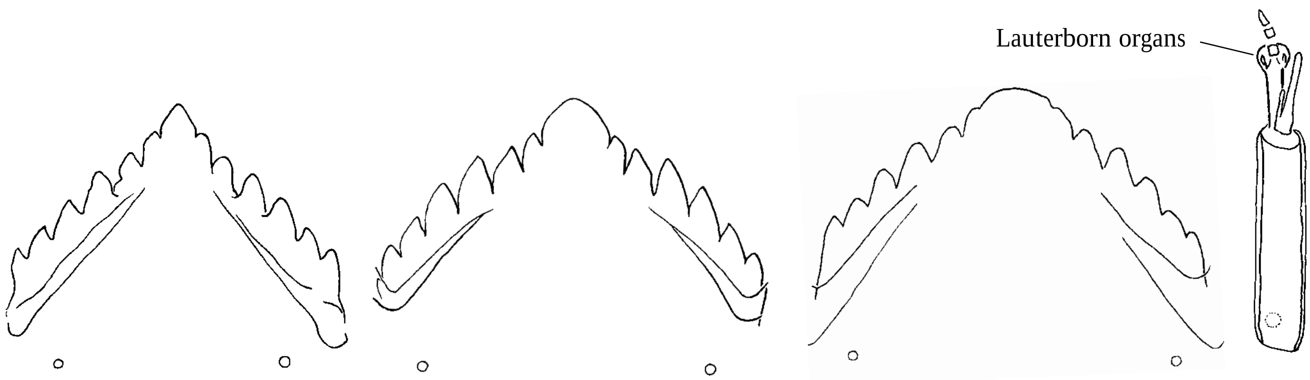


apically bifid premandible

11' Premandible apically simple (may be slightly notched apically) .. 12



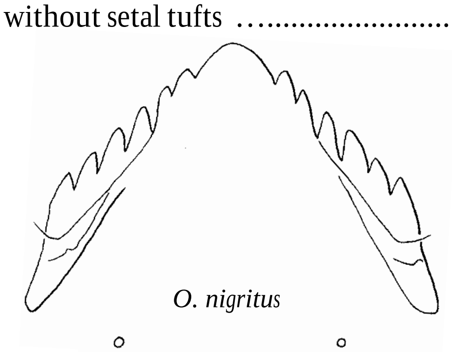
12(11') Mentum with 1st lateral teeth small and partially fused to median tooth, median tooth and 1st lateral teeth projecting far beyond remaining mental teeth; Lauterborn organs large, appearing circular; abdominal segments with posterolateral setal tufts .... ***O. (S.) annectens***



variation in menta due to wear

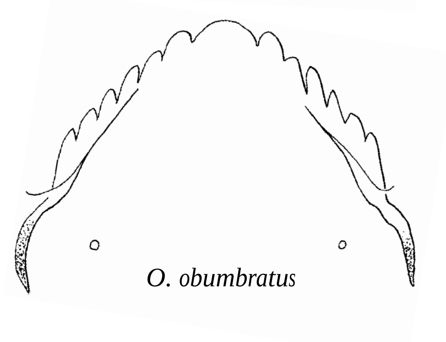
12' 1st lateral teeth of mentum not small and partially fused to median tooth; Lauterborn organs not as above (may be large but rarely appear circular); abdomen without setal tufts 13

13(12') Mentum more triangular in outline; median tooth, 1st and 2nd lateral teeth often project above remaining lateral teeth 14



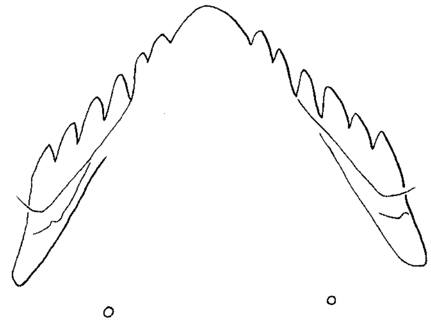
O. nigritus

13' Mentum more convex in outline, without teeth projecting far beyond their neighbors 17

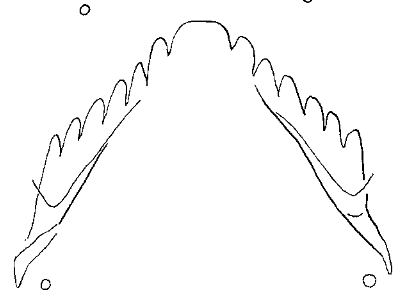


O. obumbratus

14(13) Median tooth of mentum about 3X width of 1st lateral tooth 15



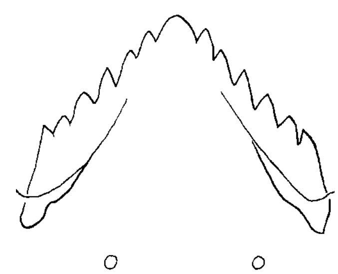
14’ Median tooth of mentum at most about 2x width of 1st lateral tooth 16



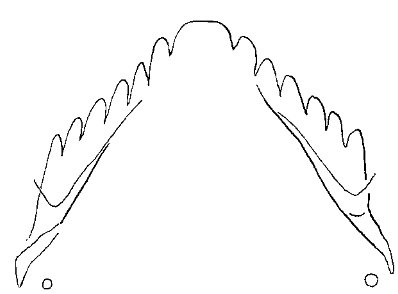
15(14) Mandible moderately rugose on outer margin .... ***O. (O.) nigritus***

15’ Mandible smooth on outer margin ….. ***O.(O.) carlatus***
(and perhaps some *O. (O.) rubicundus*)

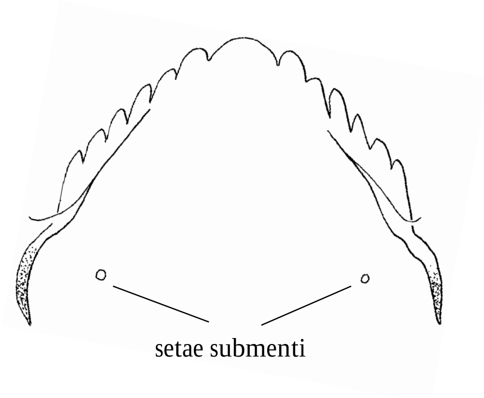
16(14’) Mandible with outer margin rugose (see 15 above); mentum as figured .... ***O.(O.) dentifer***

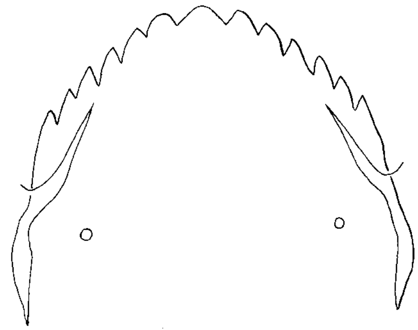


16’ Mandible with outer margin smooth (see 15’ above); mentum as figured .... ***O. (O.) rubicundus***

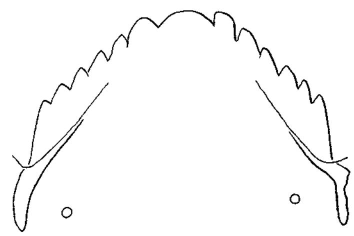


17(13') Ventromental plates apparently extended posteriorly, far exceeding line drawn through setae submenti 18

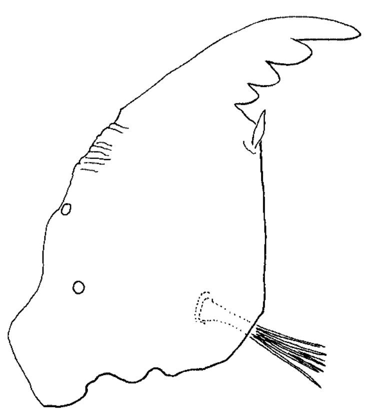


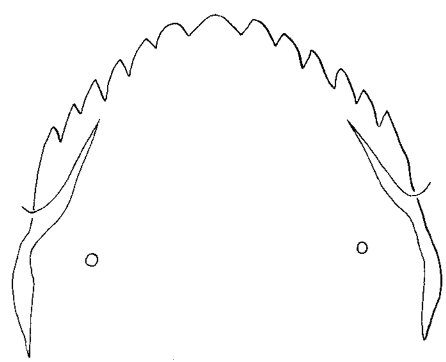


17' Ventromental plates not extended as far posteriorly, barely exceeding line drawn through setae submenti 20

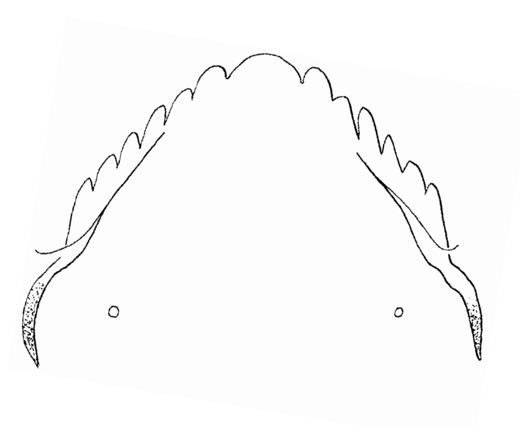


18(17) Mandible rugose on outer margin; median tooth of mentum <1.5 X width of 1st lateral tooth .. .. ***O. (O.) mallochi***

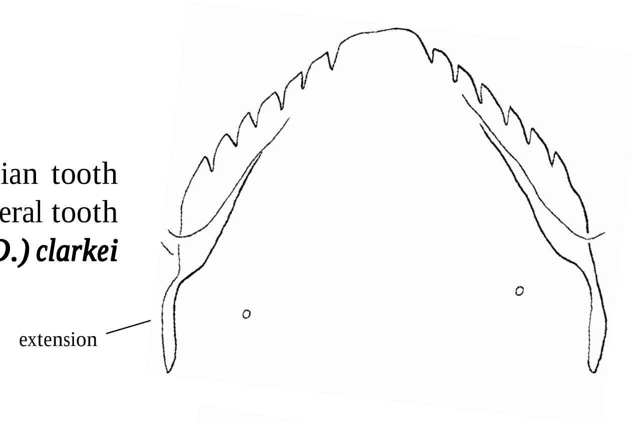




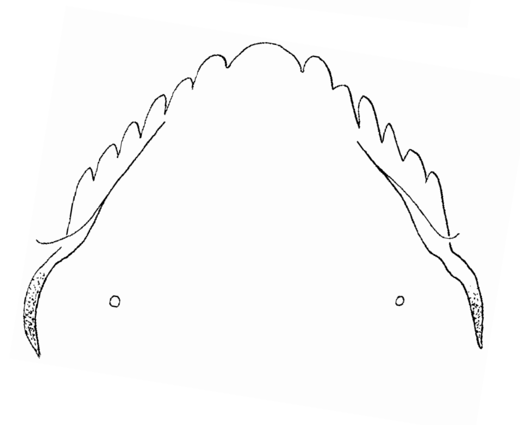
18' Mandible smooth to slightly rugose on outer margin; median tooth of mentum about 2-3X width of 1st lateral tooth 19



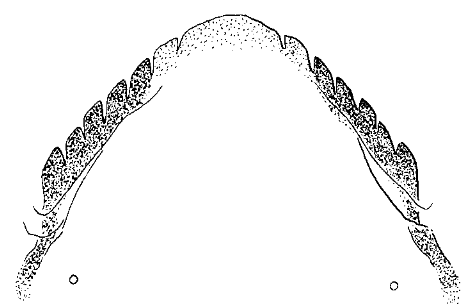
19(18’) Ventromental “plate” extension longer; median tooth of mentum more than 3.3X as wide as 1st lateral tooth …... ***O. (O.) clarkei***



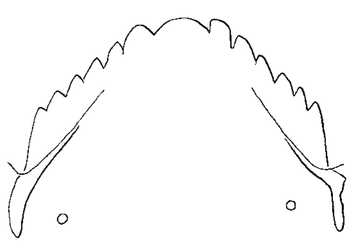
19’ Ventromental “plate” extension shorter; median tooth of mentum about 2.5-3.3X as wide as 1st lateral tooth ….. ***O. (O.) obumbratus***

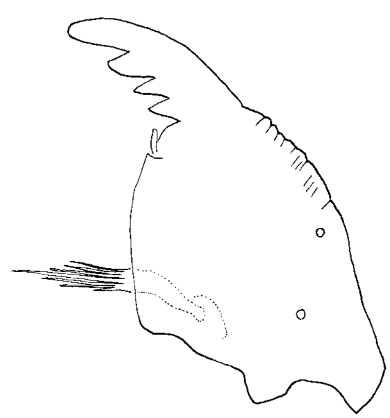


20(17’) Median tooth and 1st lateral tooth of mentum lighter in color than remaining lateral teeth; outer margin of mandible smooth to weakly rugose .. ***O. (O.) robacki*** (and perhaps some ***O. (O.) obumbratus*****)**



20’ Median tooth similar in color to lateral teeth; outer margin of mandible strongly rugose .... ***O. (O.) dorenus***





Notes on Species

Species level (and even accurate generic level) identifications of *Orthocladius* larvae are difficult. Perceived differences in larvae are often only variants of the same species; associated pupae and/or adults are usually needed for accurate species level identification - as with *Cricotopus*, pupae usually provide the best means of species identification. Dave Lenat (NC DENR) has written a laboratory key for combined *Cricotopus* and *Orthocladius* species; the taxa were given C/O numbers, some of which were also used in Lenat (1993b). I have attempted to reconcile his system of numbers with the names listed below; his number is listed in brackets at the end of each species summary when applicable. Note that some of the numbers may apply to several species and that some species may have several numbers associated with them.

Many *Orthocladius* larvae have sclerotized extensions at the posterior corner of the mentum, which appear as elongated, posteriorly directed ventromental plates. However, these extensions appear to be more heavily sclerotized areas of the cuticle that are extensions of the mentum and not true ventromental plates. They may prove to be useful in separating some species, but more reared material is needed to realistically assess their utility. Note that the ability to observe the rugosity (or amount of wrinkles) on the outer margin of the mandible is dependent upon the orientation of the mandible. If the outer edge is not lined up correctly, rugosity may only appear as a series of thin lines on the surface of the mandible. And to further confuse matters, it appears that mandibular rugosity may vary within a species - some specimens may be smooth when most other specimens of that species ordinarily have rugose mandibles.

Again, unless larval material is somehow associated with a pupa or adult (often through pharate pupae within very late 4th instar larvae, or pupae with attached larval exuviae – sometimes such pupae may have almost completely developed adults within, thus giving a complete larval-pupal-adult association), species level identifications can only be considered tentative! If you are serious about species-level identification of *Orthocladius* larvae, you ***must*** use the keys and descriptions found in Soponis (1977, 1987, 1990), Langton & Cranston (1991), Cranston (1999) and Caldwell (1999) to identify associated pupae and/or adults.

O. (S.) annectens - A common species of the coastal plain; mature larvae are most abundant during late Winter/early Spring. The distinctive mentum, with the median tooth projecting forward and small first lateral tooth placed well forward of the second lateral tooth, well developed Lauterborn organs that usually appear as circles at the apex of the second antennal segment, and the abdominal setal tufts distinguish this taxon. The median teeth of the mentum are often worn down; rely on the circular appearance of the Lauterborn organs and the setal tufts to identify such specimens. Recently transferred from *O. (Orthocladius)* to *O. (Symposiocladius)*. [C/O sp. 52]

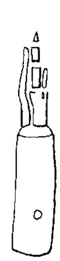
O. (O.) carlatus - The smooth outer edge of the mandible and perhaps smaller size (Soponis (1977) gives a mentum width of less than 125 µm for *carlatus*; note that this is for 4th instar larvae) separate this species from *O. nigritus*. However, some uncertainty exists about the characters of the larva of *O. carlatus*. In Roback's material at the Academy of Natural Sciences of Philadelphia are two slides from 1953 (from the time period and area when the type material of *O. carlatus* was collected); each has apparently associated pupal and larval exuviae of *O. carlatus*. On one, the mandible is smooth; on the other it is rugose. Also, Roback's original description (1957: 77) stated that the Lauterborn organs were weak; Soponis' (1977: 32) redescription stated the same. However, below her description she wrote "Roback (1957a) described and figured (fig. 161) the Lauterborn organs of the larva of *carlatus* as weak. However, I find them to be robust (Fig. 110a)." On the two above mentioned Roback specimens, one has antennae with weak Lauterborn organs; the other is missing the apical segments of the antennae. Larvae with pharate pupae from North Carolina that appear to be *O. carlatus* have smooth mandibles and moderately developed Lauterborn organs. Associated material is needed for more positive identification; the pupa is the only stage that will definitely confirm the identify of this species. [some C/O sp. 8?, many C/O sp. 54]

O. (O.) clarkei Soponis - Not definitely known from the Southeast. I have seen some larvae from NC that may fit this species. However it is more likely that they are *O.(O.) obumbratus,* whose ventromental plates may also appear to be extended posteriorly. Associated material is needed before *O. clarkei* can be said to occur in the southeastern US. [some C/O sp. 54?]

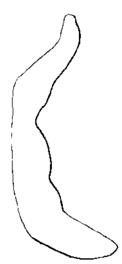
O. (O.) dentifer - In the Southeast, recorded from SC; I've also examined material from the NC portion of Great Smoky Mountains National Park. There is also a reared specimen from extreme western FL in the collection at Florida A&M University. Larvae of this species (especially those with a worn mentum) may resemble *O. annectens* but lack the large Lauterborn organs and abdominal setal tufts of that species.

O. (O.) dorenus - Possibly the same species as the Palaearctic *O. (O.) pedestris* Kieffer. [C/O sp. 7]

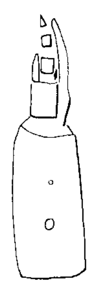
O. (Eud.) dubitatus - Head capsule color of this relatively common species is variable, running from medium to dark brown to dark reddish-brown. Cranston (1999) noted that *O. dubitatus* was one of the most variable species in the subgenus *Eudactylocladius,* in all life stages. This species is easily confused with *Cricotopus fugax*. The two species can be separated by the simple premandible of *C. fugax*; the premandible of *O. dubitatus* has a simple apex but also bears a broad inner tooth; by the 3rd and 4th antennal segments: in *C. fugax* these segments are about twice as long as wide, in *O. dubitatus* they are about as long as wide; the molar area of *O. dubitatus* is usually truncate, that of *C. fugax* is usually more rounded (the mandible must be oriented correctly to observe this); and the abdominal setae of *O. dubitatus* are short; those of *C. fugax* are long (at least 1/2 length of the segment). I have seen specimens of *O. dubitatus* from North Carolina misidentified as *O. carlatus* and *O. wiensi* and from South Carolina misidentified as *O. nigritus*. [C/O spp. 3, 29, 40]



C. fugax antenna

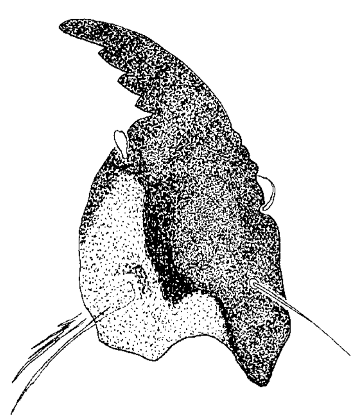


C. fugax premandible

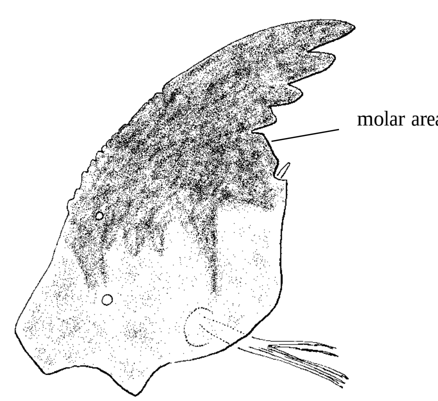


O. dubitatus antenna

O. dubitatus premandible



C. fugax mandible



O. dubitatus mandible

O. (O.) frigidus - This species and *O. vaillanti* are the only *Orthocladius* species in the SE US that lack a seta interna on the mandible. *Orthocladius (Eou.) roussellae* Soponis, known only from Alaska, Wyoming, the Yukon and Northwest Territories, also lacks a seta interna; *O. roussellae* has 15 teeth on the mentum. *Orthocladius frigidus* had been placed in the subgenus *Euorthocladius*, but Soponis (1987) redescribed the species and placed it in *O. (Orthocladius)*. *Orthocladius frigidus* larvae are difficult to separate from those of *O. vaillanti*; it appears the only separating character is the rugose outer margin of the mandible of *frigidus* (which is smooth in *vaillanti*). Soponis (1990: fig. 13) shows the S I of *frigidus* as being unevenly bifid; Schmid (1993: fig. 87D) illustrates them as evenly bifid. The S I of *vaillanti* are evenly bifid. Both species have a similar mentum, although that of *frigidus* may be more convex; more material is needed. As with so many species of *Orthocladius*, associated pupae are needed for accurate identification. [C/O sp. 2, some C/O sp. 60]

O. (O.) hellanthali - I've seen a single adult male of this species from the Tennessee portion of Great Smoky Mountains National Park; the immature stages are unknown.

O. (S.) lignicola - The distinctive mentum of this wood-mining species distinguishes it from all other *Orthocladius*. This species was referred to as *O. tryoni* in Soponis (1977); she did not have associated larvae available. *Orthocladius lignicola* was later (Cranston 1982) elevated to generic status as *Symposiocladius*, but *Symposiocladius* was eventually relegated to subgeneric status under *Orthocladius*. [C/O 48]

O. (Euo.) luteipes - Difficult to distinguish from *O. thienemanni* as a larva; only the AR will separate most specimens. Both species have very large Lauterborn organs. These two species have been confused often in the literature (see Soponis 1990); pupae are needed for accurate identification. [some C/O sp. 13]

O. (O.) mallochi - The larva of this species is usually easily recognized by the posteriorly extended ventromental plates and relatively narrow median tooth of the mentum. It is recorded for SC by Caldwell et al. (1990) but I have not seen material of this species from the SE US. Note that *O. (O.) wiensi* Soponis, known from Minnesota and Manitoba, will also key to this species in the key above; see Soponis (1977).

O. (O.) nigritus - Somewhat similar to *O. carlatus*, but *O. nigritus* has a rugose outer edge to its mandible (but see the notes under *O. carlatus*). Also similar to *O. dorenus*, but the median tooth of the mentum of *nigritus* extends farther ahead of the lateral teeth than that of *dorenus*. [C/O sp. 8]

O. (O.) obumbratus - A common, widespread but variable species, best identified in the pupal or adult stage. The color of the mentum is apparently variable, as is the width of the median tooth and the amount of rugosity on the outer edge of the mandible. Note that contrary to Soponis (1977), the ventromental plates appear to be extended posteriorly, but not as far or as well developed, as in *O. clarkei*, *O. mallochi* and *O. oliveri*. Most *O. obumbratus* larvae have a pair of single, simple setae that are about 70 µm long, located caudolaterally on the abdominal segments; note that this may not be a specific character because I have been unable to examine associated larvae of many other *Orthocladius* species. Some *O. obumbratus* larvae can be easily mistaken for *Paratrichocladius*. [C/O spp. 10, some 54; some C/O sp. 10 larvae are *Paratrichocladius*]

O. (O.) oliveri - The only *O. (Orthocladius)* in the Southeast with an apically bifid premandible except for the distinctive *O.* sp. "Jacobsen", an undescribed species with a 15-toothed mentum (q.v.; see also *O. vaillanti*). Note that some *O. (Euorthocladius)* may have a bifid premandible, and that many *Orthocladius* may have premandibles that are apically notched. The outer margin of the mandible of *O. oliveri* is weakly to moderately rugose. Note also the posteriorly directed, narrow sclerotized area posterior to the ventromental plates, similar to that of *O. clarkei* and *O. mallochi* (but not as well developed), and to a lesser extent, that of *O. obumbratus*. [C/O sp. 35]

O. (Euo.) rivicola - Soponis (1990: 28, 30) noted considerable variation in larval material of *O. (Euo.) rivicola*, which can easily be confused with *O. (Euo.) saxosus*. Associated pupae are needed for accurate identification. [C/O sp. 13, 13A]

O. (Euo.) rivulorum - The distinctive mentum, which may bear from 17-21 teeth, simple premandibles and the short basal segment of the antenna will identify this species. Note that the mentum is not always symmetrical; sometimes there are more teeth on one side of the mentum than the other. A rare species of clean mountain streams and rivers; also recorded from the sandhills region. [C/O sp. 37, 61]

O. (O.) robacki - This may be the same as the Palaearctic species *O.(O.) oblidens* (Walker). Soponis (1977) could not find characters to separate the larvae of *O. robacki* from *O. obumbratus*. However, on material I've examined, the ventromental plates of *obumbratus* appear to extend farther posteriorly than those of *robacki*. It is possible that both species may have the median tooth of the mentum lighter in color than the lateral teeth, so caution must be used (although I have not seen any associated *obumbratus* larvae with a lighter median tooth). Larval material should be associated with a pupa or an adult male for accurate identification! [C/O sp. 12]

O. (O.) rubicundus - Formerly known as *O. curtiseta* in North America; known from as far south as northern FL. [some C/O sp. 54?]

O. (Euo.) saxosus - This species is apparently rare in the mountain and piedmont regions. Note the narrower median tooth of the mentum, the large Lauterborn organs, higher AR (>1.85) and perhaps the long body setae (greater than ½ length of segment on the more posterior body segments). However, Soponis (1990) described *O. rivicola*, *O. saxosus*, and *O. thienemanni* all with some long body setae. Soponis (1990: 28, 30) noted considerable variation in larval material of *O. (Euo.) rivicola*, some of which may key to this species. She also noted (1990: 38) that in *O. saxosus* larvae may have 4 or 5 inner teeth on the mandible and that the usually simple premandible may be bifid. [some C/O sp. 60]

O. (O.) subletti - Recorded from SC by Caldwell et al. (1990); I have not seen material of this species from the Carolinas. The record might be considered doubtful considering that *O. subletti* was described from the western US. However, *O. hellanthali* was also described from the western Nearctic (Alaska, California, Northwest Territories) but has been found in the Smoky Mountains. The immature stages of both species are undescribed.

O. (Euo.) thienemanni - As a larva, difficult to separate from *O. luteipes* (q.v.) or sometimes *O. saxosus*, due to variation in the width of the median tooth of the mentum (see Soponis 1990: 42); pupae provide the best means of identification. [C/O sp. 51?]

O. (O.) vaillanti - Caldwell (1999) recently described the larva and adult male of this species, known previously only from the Palaearctic as a pupa (Langton & Cranston 1991). Very similar to *O. frigidus*, but apparently separable by the more rugose outer margin of the mandible of *O. frigidus* (smooth in *vaillanti*). See also *O. frigidus* above. I have also examined associations of an undescribed *Orthocladius* species from Ohio that will run to *O. vallainti* in the key above; however, this larva has bifid premandibles and the pupa has a "normal" *Orthocladius* thoracic horn, not the type seen in *O. vaillanti* or *O. frigidus*. Refer to this undescribed species as *O.* sp. "Ohio". [C/O sp. 64]

O. (O.) sp. "Jacobsen" - Larvae of this undescribed species resemble *O. (Euo.) rivulorum* because of the 7 pairs of lateral teeth on the mentum; *O. rivulorum* usually has at least 8 pairs of lateral teeth. However, this taxon has been reared and is being described by Rick Jacobsen; the pupa and adult are typical *O. (Orthocladius)* (my examination of Ohio material and Jacobsen, pers. comm.) Note that this new species has bifid S I setae that are secondarily split, the premandibles are apically bifid and the basal antennal segment is much longer than that of *O. rivulorum*. I've seen associated material from Ohio and larvae from Indiana and North Carolina.

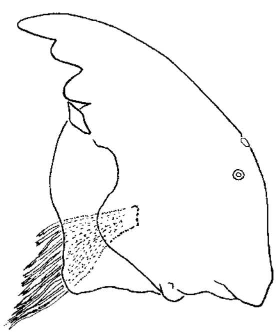
Genus ***Parachaetocladius***

DIAGNOSIS: Larvae are distinguished by the distinctive mentum, with broad median tooth (sometimes weakly divided or notched medially); simple premandible without brush; mandible with 1-2 inner teeth; and each procercus with one very long seta, at least 1/4 as long as the body length.

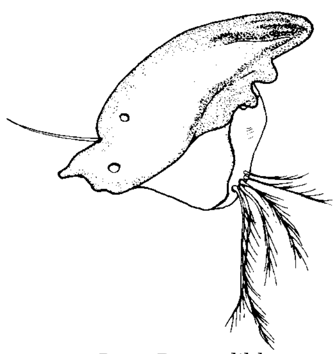
NOTES: One named species, *P. abnobaeus*, is known from the Southeast; it occurs as far south as northern Florida. In addition, Sæther & Sublette (1983) illustrated the larva of an apparently different taxon, *P.* sp. B. This taxon differs in having only one inner tooth on the mandible (figure below). This "species" is only known from one stream, Howard Creek, in Oconee County, South Carolina; it may be an aberrant or deformed *P. abnobaeus*. Note: do not mistake the darkened molar area (proximal to the inner teeth) of the mandible of *Parachaetocladius* species for an additional inner tooth.

Parachaetocladius larvae are found in lotic conditions and are often associated with spring-fed streams.

ADDITIONAL REFERENCES: Cranston & Oliver 1988a; Sæther & Sublette 1983.

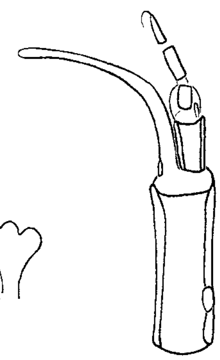


P. abnobaeus mandible

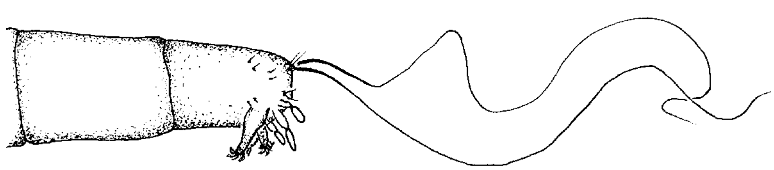


P. sp. B mandible
(adapted from Sæther & Sublette 1983)

P. abnobaeus mentum



P. abnobaeus antenna



posterior segments

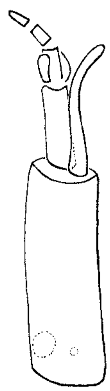
Genus *Paracricotopus*

DIAGNOSIS: Distinguished by the S I with weak apical serrations or S I appears to be simple; smooth inner margin of the mandible (proximal to inner teeth); reduced ventromental plates, without a beard; long (at least 1/2 as long as segment), simple abdominal setae; and well developed procerci with spurs.

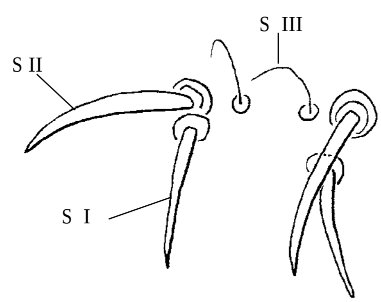
NOTES: Three species are recorded from the Southeast; all but *P. mozleyi* (known only from Georgia) have been found in the Carolinas. It is probable that *P. mozleyi* is a junior synonym of *P. glaber*, but *P. millrockensis* appears to be a distinct species. Because of the paucity of associated material and uncertain variation in larval characters, it is not possible to reliably separate *Paracricotopus* larvae to species.

Larvae are denizens of mosses, liverworts and algae in seeps, bogs, springs and low order streams.

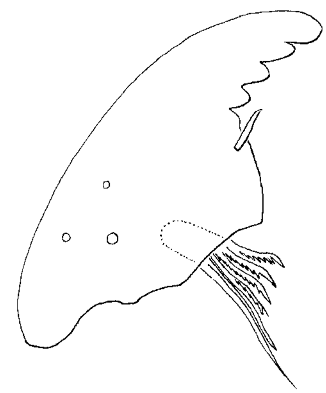
ADDITIONAL REFERENCES: Caldwell 1985; Sæther 1980b; Steiner 1983.



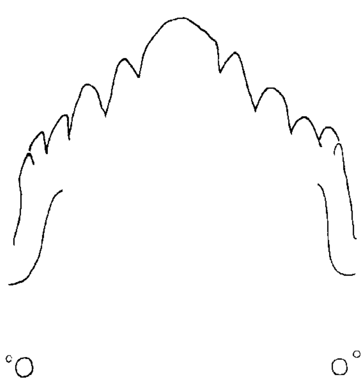
P. sp. antenna



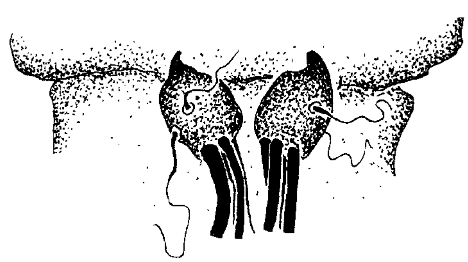
P. sp. labrum



P. sp. mandible



P. millrockensis mentum



P. millrockensis procerci
(anal setae abbreviated)

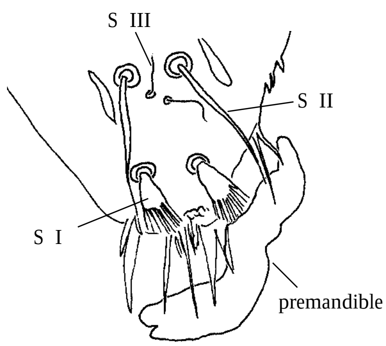
Genus ***Parakiefferiella***

DIAGNOSIS: Larvae may be distinguished by the 6 (7 in some?) segmented antennae, with the last segment hairlike; S I most often pectinate-plumose, but may be bifid (simple to bifid in one species tentatively assigned to the genus); premandible simple, apically notched or weakly bifid; mentum with an odd number of teeth in known southeastern US taxa; ventromental plates usually well developed and may extend beyond lateral margin of the mentum, usually without a beard (but a weak beard present in one species tentatively assigned to this genus)

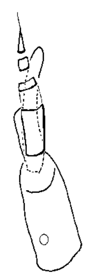
NOTES: Based on larvae, at least five species, perhaps seven, of *Parakiefferiella* are found in the Southeast. A problem is that most of the larvae have not been associated with adults; thus no names can be placed on them, with the exception of *P. coronata*. I have tentatively assigned two enigmatic taxa to *Parakiefferiella*: *P.* sp. D and *P.* sp. F; see Notes on species. The genus requires revision in North America; the paper by Tuiskunen (1986b) is the best source available, but does not cover larvae.

Parakiefferiella larvae are commonly encountered in lentic and lotic habitats.

ADDITIONAL REFERENCES: Sæther 1969; Sublette et al. 1998; Tuiskunen 1986b; Walker et al. 1992.

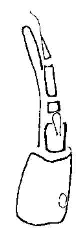


P. sp. A labrum

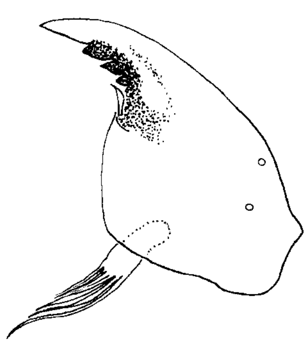


P. sp. A antenna

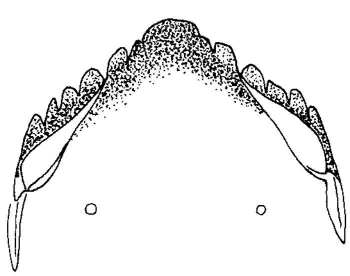
P. sp. B antenna



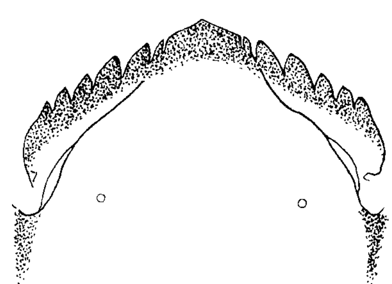
P. coronata antenna



P. sp. E mandible



P. sp. B mentum



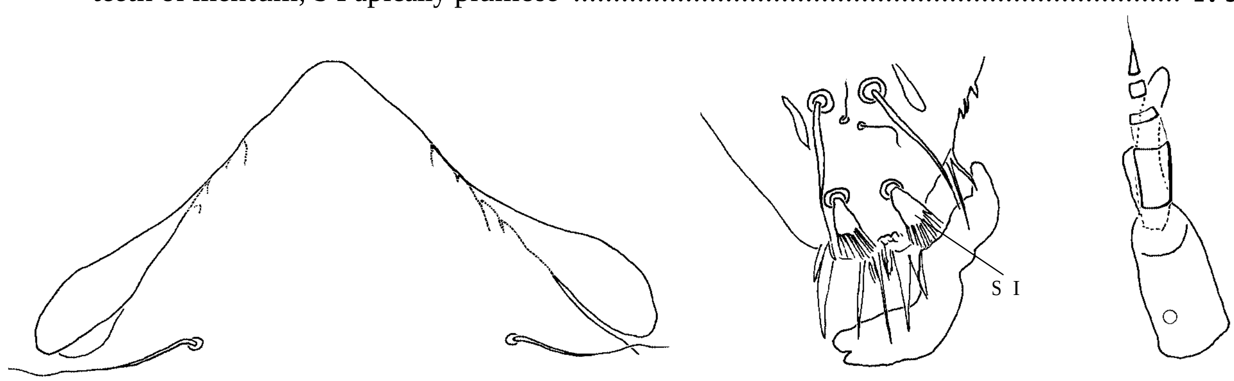
P. coronata mentum

Key to *Parakiefferiella* larvae of the southeastern United States

1 A weak beard present near ventromental plates; S I bifid .... ***P.* sp. F**

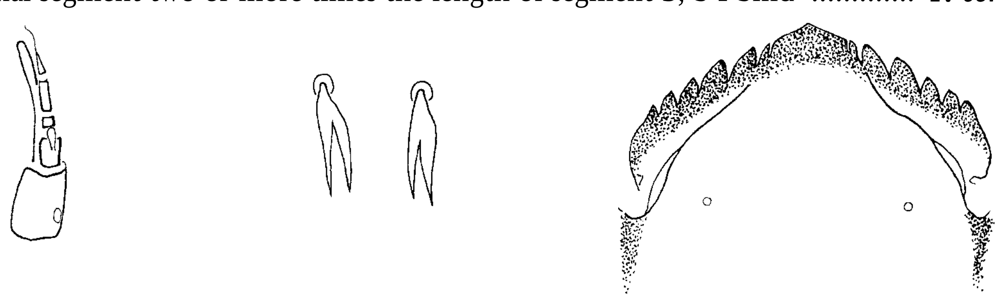
1’ Beard not present near ventromental plates; S I bifid, simple or pectinate/plumose 2

2(1) Mentum with large, pale dome-shaped median tooth; ventromental plates cover most of lateral teeth of mentum; S I apically plumose .... ***P.* sp. A**



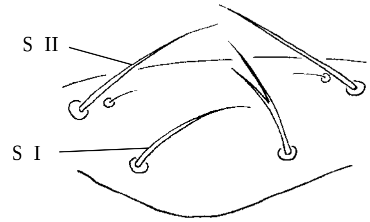
2’ Median tooth of mentum dark, if pale then not as large and not dome-shaped; ventromental plates usually smaller, not covering all of lateral teeth; S I variable 3

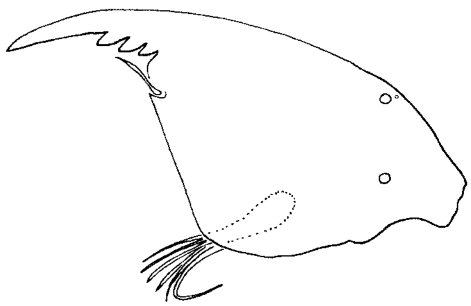
3(2’) 4th antennal segment two or more times the length of segment 3; S I bifid .... ***P. coronata***

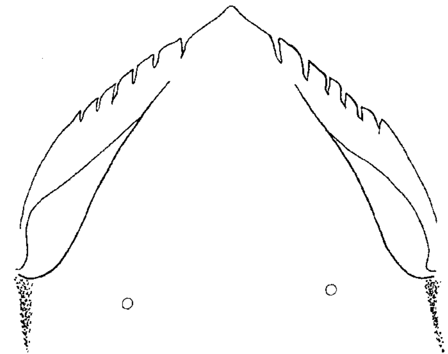


3’ 4th antennal segment subequal to 3rd; if S I bifid, then thinner, longer 4

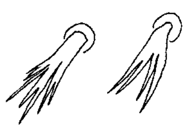
4(3') S I simple or bifid; 2nd antennal segment shorter than to slightly longer than 3rd; apical tooth of mandible very long; procerci darkly sclerotized .... ***P. sp.* D**



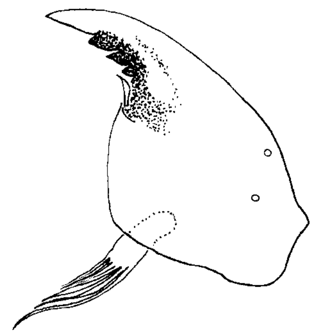




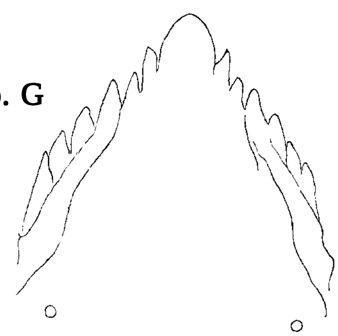
4' S I pectinate; 2nd antennal segment 2 or more times longer than 3rd; apical tooth of mandible not as long and thin; procerci not darkly scelrotized 5



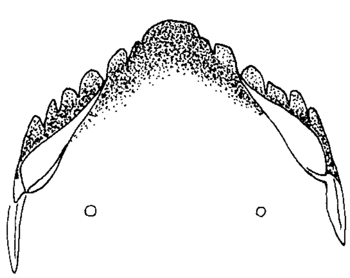
pectinate S I

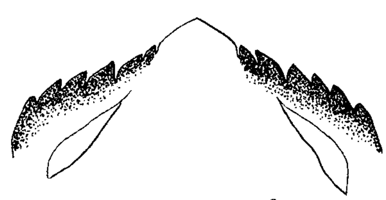


5(4') Median tooth of mentum projects far anterior to lateral teeth .. ***P.* sp. G**

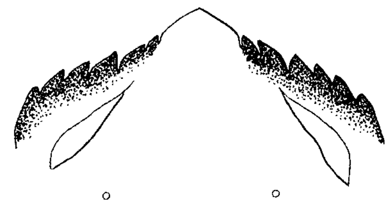


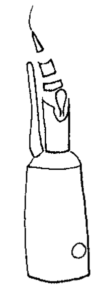
5' Median tooth not projecting as far 6





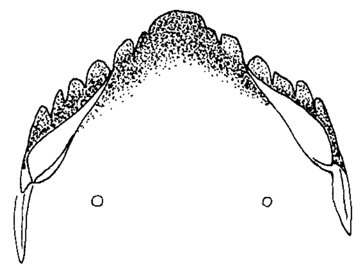
6(5') Median tooth of mentum paler than first lateral tooth .... ***P.* sp. E**





6' Median tooth of mentum approximately same color as first lateral tooth .... ***P.* sp. B**

central teeth of unworn mentum



Notes on species

P. coronata - This species' identity is confirmed with associated pupae and adults. It occurs as far south as the northern Everglades in Florida. This taxon was called "*Parakiefferiella* sp. C" in Epler (1995). The S I's are bifid.

P. sp. A - This species has a distinctive mentum with large ventromental plates. I've seen material from Florida and the Carolinas. This taxon is very similar to *P. triquetra* (Pankratova). Note that Chernovskij's (1949) "description" of this taxon as "Orthocladiinae gen. ? *triquetra*" was not valid; Pankratova (1970) validated the name.

P. sp. B - A common species in the Southeast; this is probably *P. bathophila*, but there is insufficient reared material available to be certain. It is possible that *P. subaterrima* is the same species as *P. bathophila*; again, there is insufficient reared material available; *bathophila* would have priority over *subaterrima*.

P. sp. D - I've examined larvae of this taxon with developing pupae within them; the anal lobes indicate it can be placed in *Parakiefferiella* although there are some peculiarities in the spine patch on tergite II. The S I's are long and simple, although two specimens examined, one from Florida, the other from North Carolina, had one S I that was bifid (see figure in key). In addition, the procerci are darkly sclerotized. This is the taxon called "genus nr. *Nanocladius* B" by Mozley (1980) and Caldwell et al. (1997).

P. sp. E - The pale median tooth is distinctive for this species. Also, in ***most*** larvae the apical tooth of the mandible is lighter than the inner teeth; this may help separate some larvae from the similar *P.* sp. B, in which the entire apex of the mandible is usually darkened. I've seen material from North and South Carolina. This is apparently the larva called "*Parakiefferiella* sp." in Simpson & Bode (1980).

P. sp. F - This taxon may not belong in *Parakiefferiella* because it has a cardinal beard; however, Cranston et al. (1983) note that some unreared larvae tentatively assigned to *Parakiefferiella* have a beard. This is the taxon called "*Stilocladius* ? sp." in Epler (1995). The S I is bifid. I've seen material from northern Florida; it probably also occurs on at least the Coastal Plain in the Carolinas.

P. sp. G - This taxon was figured by Dr. S.C. Mozley in an unpublished, undated manuscript; the figure in the key is adapted from his illustration. I have not seen material of this species, recorded by Mozley from Wake County, NC. The S I is pectinate.

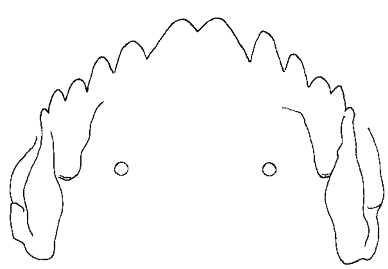
Genus *Parametriocnemus*

DIAGNOSIS: Distinguished by the plumose S I; antenna 5 or 6 segmented (if 6, last segment vestigial, hairlike); antennal blade shorter than flagellum; AR more than 1.25; mentum with double median tooth; ventromental plates extending beyond lateral margin of mentum; setae submenti located high on mentum, about 1/2 distance of length of ventromental plates; maxilla with or without pecten galearis; and procerci well sclerotized, with long anal setae (> 300 µm).

NOTES: Based on adult males, 3 described species are known from the Carolinas. At least one tentatively new species is known from Florida and North Carolina, and I have reared another undescribed species from northern Georgia. At present it is not possible to construct a larval key for species identification; larvae should be identified as "*Parametriocnemus* sp.". The larva of *P*. sp. F is unique in the Nearctic fauna for its vestigial 6th antennal segment and presence of pecten galearis (see Notes on species); note that Schmid (1993) described and figured the larvae of the Palaearctic species *P. boreoalpinus* (Gowin & Thienemann) and *P. stylatus* (Kieffer) with a pecten galearis on the maxilla, contrary to the diagnosis in Cranston et al. (1983).

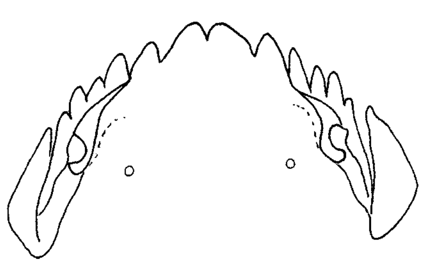
Parametriocnemus larvae are often misidentified as *Paraphaenocladius*, but note the longer basal antennal segment (and corresponding higher AR of more than 1.25) and anal setae of *Parametriocnemus*. *Parametriocnemus* larvae are found in springs and lotic habitats.

ADDITIONAL REFERENCES: Sæther 1969.



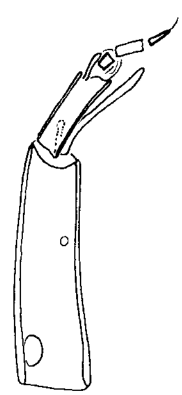
P. sp. mentum

P. sp. antenna

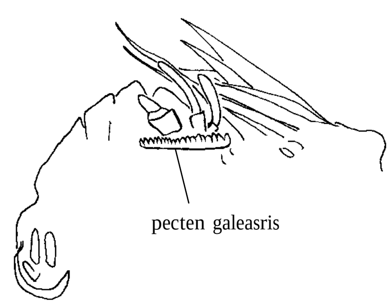


P. sp. F mentum

P. sp. F S I



P. sp. F antenna



P. sp. F maxilla

Notes on species

P. eoclivus - B.A. Caldwell (pers. comm.) has identified an adult of this species, originally described from Quebec, from the Tennessee portion of Great Smoky Mountains National Park; it probably also occurs in North Carolina. Sæther (1969) described the larva, but not in enough detail to allow consistent separation from other species.

P. hamatus - I've seen adults from the North Carolina portion of Great Smoky Mountains National Park; the immature stages are unknown.

P. lundbeckii - Based on adult male specimens, the most common and ubiquitous member of the genus in the eastern US. However, larvae of other *Parametriocnemus* species are insufficiently known to allow identification of any species as a larva without an associated pupa or male. Unassociated larvae should be identified as "*Parametriocnemus* sp. ".

P. cf. *vespertinus* - Recorded from North Carolina by Caldwell et al. (1997); the immature stages are unknown.

P. sp. F - An unusual species in that the larva has a 6 segmented antenna and a pecten galearis on the maxilla. However, I have associated material from Costa Rica of two undescribed *Parametriocnemus* species that have larvae with similar 6 segmented antennae. One of these species, *P*. sp. CR-1 Epler, has adult male genitalia very similar to *P. lundbeckii* but the adult male has a low AR (0.72-0.78); the AR of *P. lundbeckii* is usually above 1.00. It is probable that *P*. sp. F is the larva of my adult species *P.* sp. 1 that I have identified from Great Smoky Mountains National Park; this species has genitalia similar to those of *P. lundbeckii* but has an AR of about 0.40.

Genus *Paraphaenocladius*

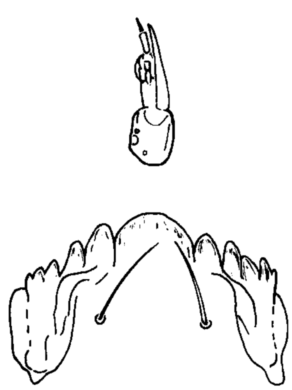
DIAGNOSIS: Distinguished by the plumose S I; 5 segmented antennae; antennal blade usually subequal to or longer than flagellum; AR 0.5-1.0; mentum with single or weakly divided median tooth; ventromental plates large and extending beyond lateral margin of mentum; setae submenti located high on mentum, about 1/2 distance of length of ventromental plates; maxilla without pecten galearis; and weakly sclerotized procerci with short anal setae (< 200 µm).

NOTES: Sæther & Wang (1995) recently revised the genus and recorded 5 species from the Carolinas; the key below is adapted from that work. NOTE that larvae ***must*** be 4th instar to key correctly and you should confirm your identifications with associated pupae or adults (see Sæther & Wang (1995) for pupal and adult keys). Because of considerable variation, Sæther and Wang (1995) established subspecies for several species. Southeastern US subspecies are: *P. exagitans exagitans*, *P. irritus longiocostatus* and *P. pseudirritus nearcticus*.

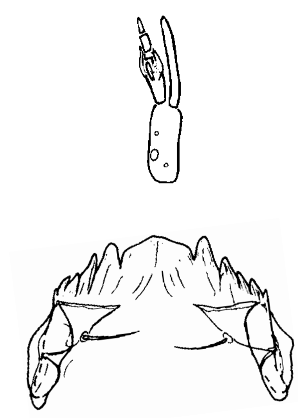
Many larvae that I've examined from the Southeast identified as *Paraphaenocladius* have been *Parametriocnemus* or *Chaetocladius*. Much of the problem with identifying *Paraphaenocladius* larvae has probably been the body characters used in keys such as Cranston et al. (1983) - the preanal segment being extended over the anal segment so that the anal setae are directed posteriorly. Unfortunately, when slide mounted many larvae are distorted enough that almost any specimen will fit such a diagnosis. In addition, several other taxa also fit this diagnosis (some *Cardiocladius* and *Chaetocladius*). All known *Paraphaenocladius* larvae have a short basal antennal segment, resulting in a low AR of < 1.0; the antennae of *Parametriocnemus* have longer basal segments and higher ARs, > 1.25. *Paraphaenocladius* larvae have weakly sclerotized procerci bearing short anal setae (< 200 µm); those of *Parametriocnemus* are more sclerotized and have long anal setae (> 300 µm) (4th instar measurements!). The setae submenti of *Chaetocladius* are near the posterior margin of the ventromental plates, not about half way down along the mentum as in *Paraphaenocladius* and *Parametriocnemus*.

Larvae occur in semi-terrestrial or semiaquatic habitats (moss lined banks of springs and streams, moist soil in seeps, periphyton at the margin of water bodies) or in true aquatic habitats such as springs, streams and standing water bodies.

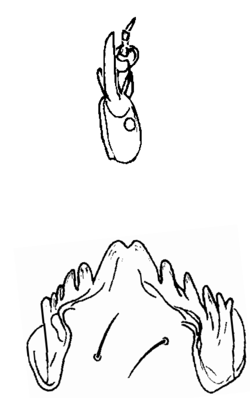
ADDITIONAL REFERENCES: Sæther & Wang 1995.



P. exagitans mentum and antenna



P. pseudirritus mentum and antenna



P. pusillus mentum and antenna

(all figures adapted from Sæther & Wang 1995)

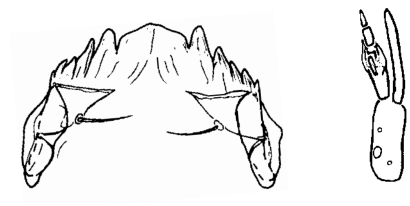
Key to *Paraphaenocladius* larvae of the southeastern United States

(the larva of *P. irritus* is unknown)

NOTE: 4th instar larvae are necessary for accurate measurements!!

NOTE: 4th instar larvae are necessary for accurate measurements!!

1 Median tooth of mentum single; procercus 19-32 µm long, 15-17 µm wide; basal antennal segment 26-31 µm long .... ***P. pseudirritus***



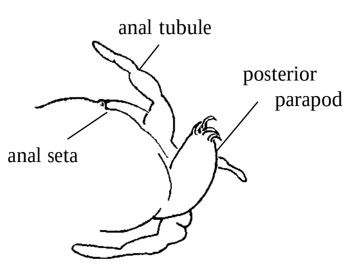
1’ Median tooth of mentum double (may be worn to appear as single tooth); procercus 9-15 µm long, 8-11 µm wide; basal antennal segment 12-20 µm long 2

2(1’) Postmentum (distance from mentum to posterior margin of head capsule) and mandible about 79 µm long .... ***P. pusillus***

2’ Postmentum 86-124 µm long; mandible 86-109 µm long 3

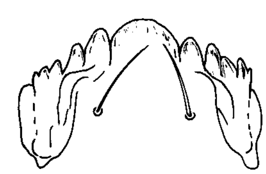
P. pusillus mentum

3(2’) Longer anal tubules much longer than posterior parapods; median teeth of mentum weakly divided, often appearing single when worn; postmentum 86-111 µm long .... ***P. exagitans***



posterior end

P. exagitans mentum with “fresh” median teeth



P. exagitans mentum with worn median tooth

3’ Longer anal tubules at most slightly longer than posterior parapods; median teeth of mentum always appear divided; postmentum > 113 µm long .... ***P. innasus***

(all figures adapted from Sæther & Wang 1995)

Genus *Parasmittia*

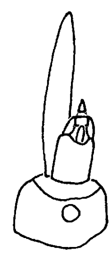
DIAGNOSIS: The multilobed S I; pecten epipharyngis of 3 small scales; short, 4 segmented antennae with blade much longer than the flagellum; lack of procerci and posterior parpaods; and the terrestrial habitat distinguish this genus.

NOTES: The genus appears to be monotypic, with the species *P. carinata* having a Holarctic distribution. I've seen adults from Great Smoky Mountains National Park that appear to be this species, previously known only from Nova Scotia in North America.

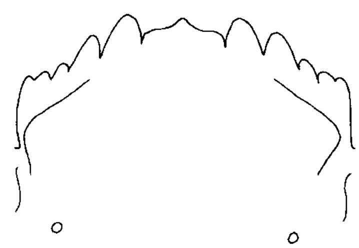
Larvae are terrestrial.

ADDITIONAL REFERENCES: Strenzke 1950a.

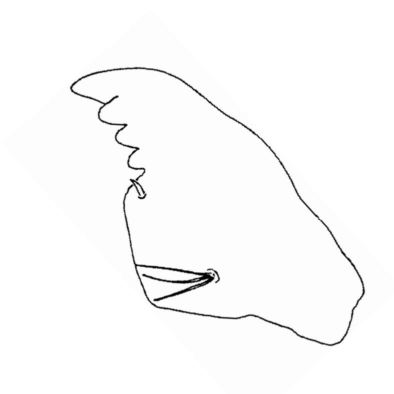
labrum and premandibles



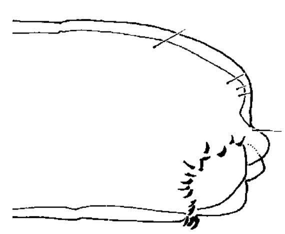
antenna



mentum



mandible



posterior end

(all figures adapted from Cranston et al. 1983)

Genus *Paratrichocladius*

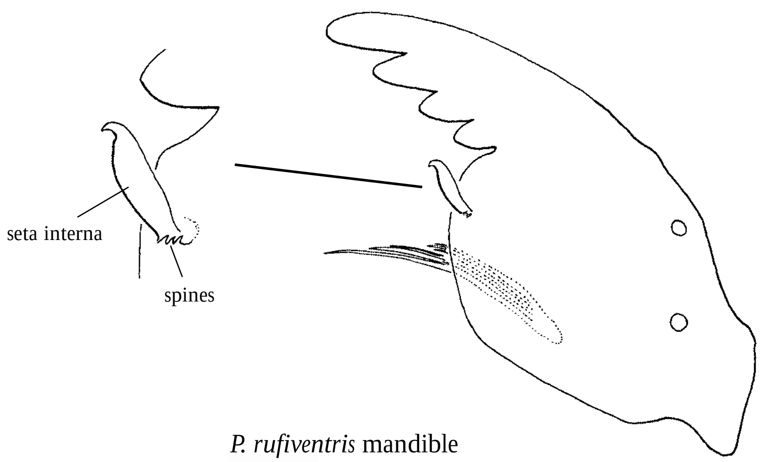
DIAGNOSIS: Difficult to distinguish from some *Cricotopus* and *Orthocladius*, but larvae can usually be identified by the bifid S I; pecten epipharyngis of 3 subequal scales; premandible simple or apically bifid, without brush; 1st lateral teeth of mentum constricted at base so that broader in the middle than at the bottom; lack of cardinal beard; small rounded posterolateral margin of the mentum; mostly smooth outer margin of the mandible; seta interna with minute spines at base (sometimes very difficult to observe); and simple, moderately short (< 1/2 length of segment) abdominal setae.

NOTES: One species, *P. rufiventris*, is known from the Southeast (North and South Carolina); other species may occur also. Oliver et al. (1990) recorded 3 species for North America; *P. nitidus* (Malloch), known from Manitoba, Illinois, Iowa, New York and Utah, may the same species as *P. skirwithensis* (Edwards), recorded from New Brunswick, Nova Scotia. However, the larva of *P. nitidus* is undescribed. The larva of *P. skirwithensis* has dark brown to black mentum, mandible and hind margin of the head capsule, compared to the light to medium brown color of those structures in *P. rufiventris,* and its setae submenti are not displaced posteriad.

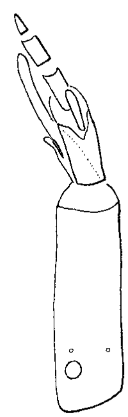
This genus can be very difficult to identify - it may appear very similar to some *Cricotopus* and *Orthocladius* species, especially *C. triannulatus* and *O. obumbratus*. Larvae of *P. rufiventris* can usually be "easily" identified by the setae submenti that are displaced posteriad to the ventromental plates; however, note that several *Cricotopus* species have setae submenti that are displaced posteriad. Note also the small rounded posterolateral margin of the mentum and an area of slightly more heavily sclerotized cuticle that runs along the anterior margin of the head capsule lateral to the mentum (see figure below).

Larvae are recorded from many aquatic habitats, including brackish water.

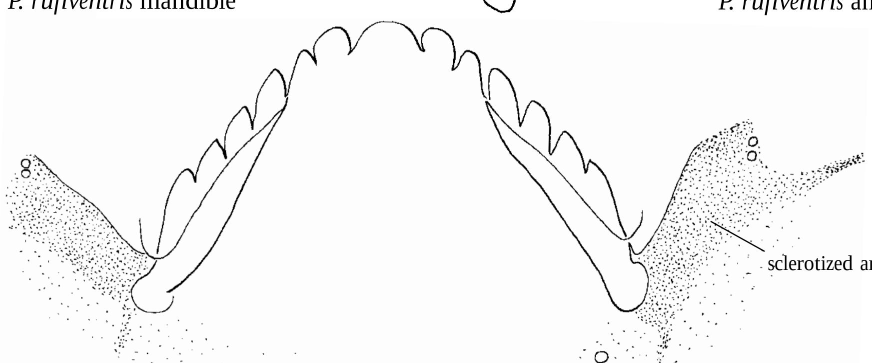
ADDITIONAL REFERENCES: Rossaro 1979, 1990.



P. rufiventris mandible



P. rufiventris antenna



P. rufiventris mentum

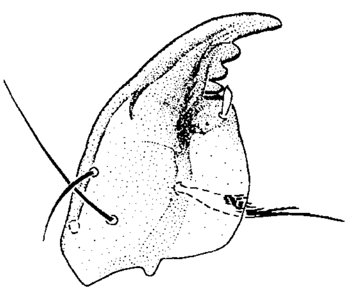
Genus *Platysmittia*

DIAGNOSIS: Distinguished by the bifid-serrated S I; pecten epipharyngis of 3 slender scales; 6 segmented antennae, with 6th segment hairlike and blade longer than flagellum; maxilla with pecten galearis; mentum with 2 median teeth and 5 pairs of lateral teeth, 4th smaller than 5th; and setae submenti located just posterior to a line drawn between the bases of the ventromental plates.

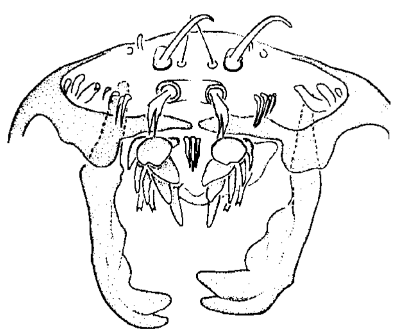
NOTES: Two species are known from the Nearctic; one, *P. fimbriata*, is recorded from the Southeast (Tennessee and North Carolina). The second species, P. *bilyji*, is known from Pennsylvania and Maryland in addition to Manitoba; it may eventually be found in the Carolinas. Larvae of the two species can be separated by the longer 4th antennal segment of *P. bilyji*.

Platysmittia larvae have been collected from small intermittent streams.

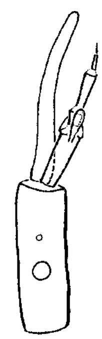
ADDITIONAL REFERENCES: Jacobsen 1998; Sæther 1982, 1985j.



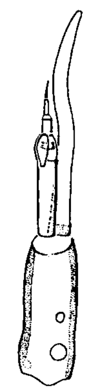
P. bilyji mandible



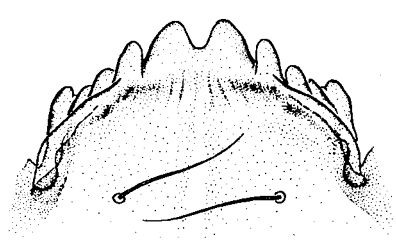
P. bilyji labrum



P. bilyji antenna



P. fimbriata antenna



P. fimbriata mentum

(figures adapted from Jacobsen 1998)

Genus *Psectrocladius*

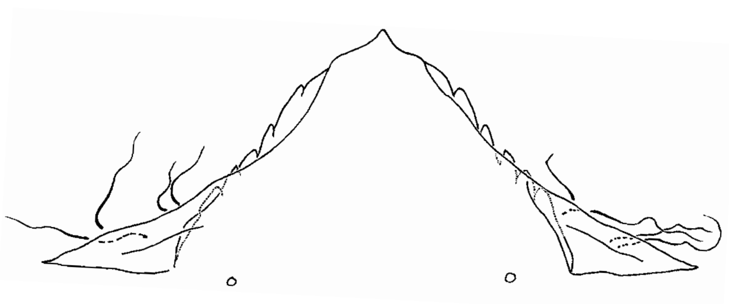
DIAGNOSIS: The bifid/trifid (uncommon) to palmate (typical) S I; apically simple premandible without a brush; well developed ventromental plates and cardinal beard; and procercus with 1 to several spurs, which may vary from minute to large, will distinguish the genus.

NOTES: *Psectrocladius* is divided into four subgenera, all of which have been recorded from the Southeast. Caldwell et al. (1997) record *Ps. (Mesopsectrocladius)* from Georgia, but I have not seen any material of this subgenus and none are included in the key below. The taxonomy of the genus in the Nearctic is confused and is in need of revision on a Holarctic basis; several Nearctic species are probably synonyms of Palaearctic species.

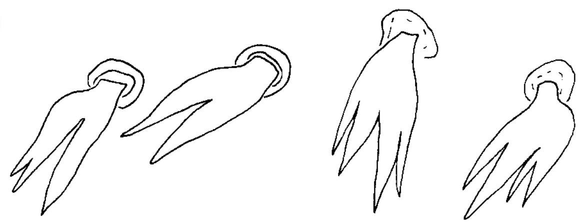
The S I is usually large and palmate in most *Psectrocladius* species, but differs from that in at least three taxa in the Southeast; most different is a *Ps. (Monopsectrocladius)* species commonly found in the Southeast in which the S I is trifid or occasionally bifid.

Larvae are found in lentic and lotic habitats and seem to prefer acidic conditions.

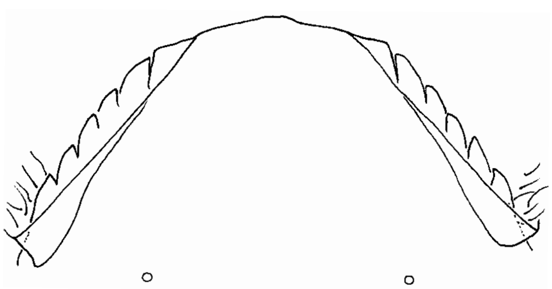
ADDITIONAL REFERENCES: Cranston 1982; Langton 1980, 1985; Sæther 1969; Sublette 1967.



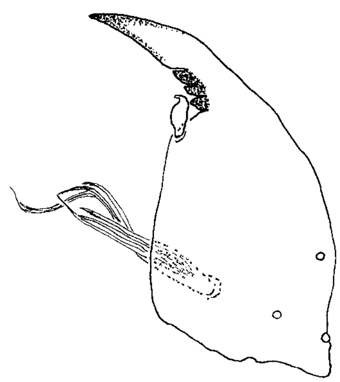
Ps. (Monopsectrocladius) sp. mentum



Ps. (Monopsectrocladius) sp. S I's of two specimens

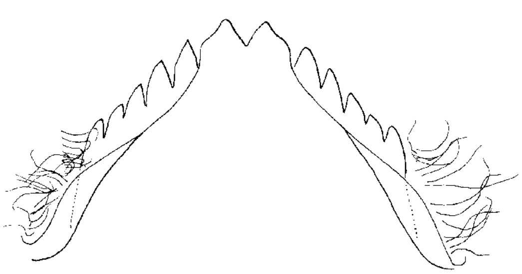


Ps. elatus mentum

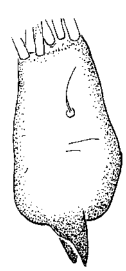


Ps. elatus mandible

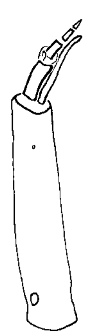
Ps. elatus S I



Ps. sordidellus grp. sp. mentum



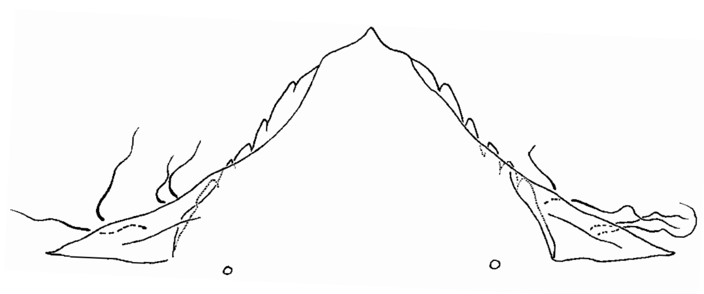
Ps. flavus procercus

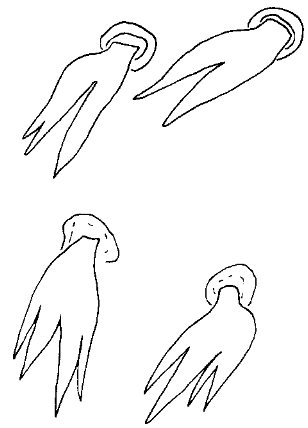


Ps. psilopterus grp. antenna

Key to *Psectrocladius* larvae of the southeastern United States

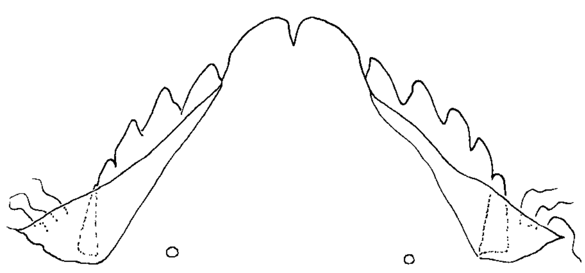
1 Mentum with single nipple-like median tooth; S I with ≤ 5 teeth, may be deeply bifid or trifid .... ***Ps. (Monopsectrocladius)* sp.**

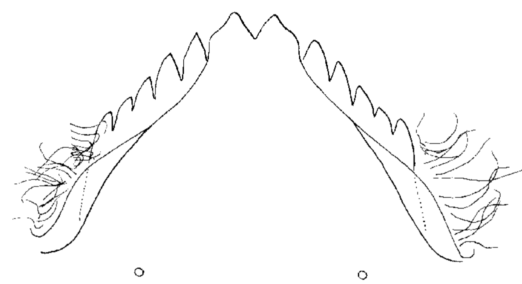




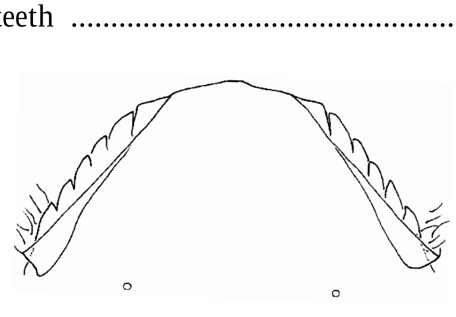
1’ Mentum with single broad tooth or 2 median teeth (see all figures below); S I variable, with 3 or more teeth 2

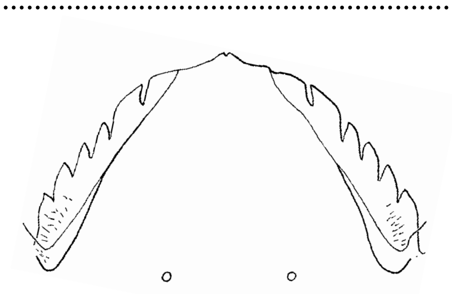
2(1’) Mentum with 2 median teeth, each at least as wide as lateral teeth 3

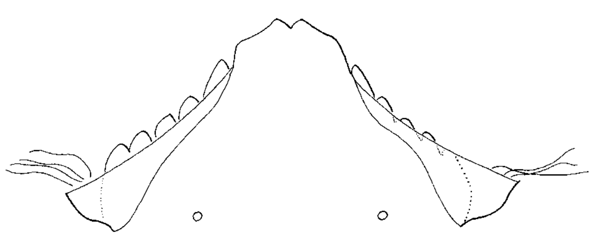


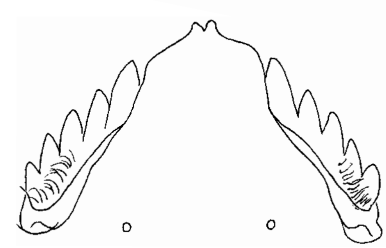


2’ Mentum with single broad tooth or 2 nipple-like median teeth that are smaller than the first lateral teeth 4

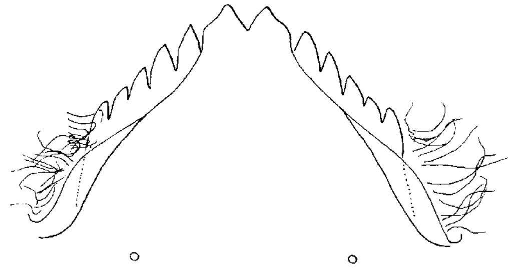




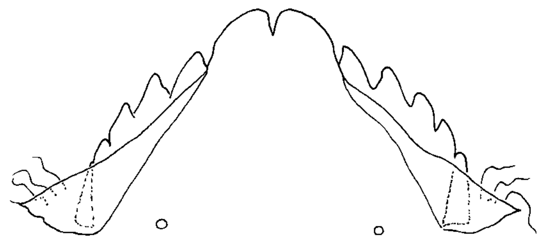




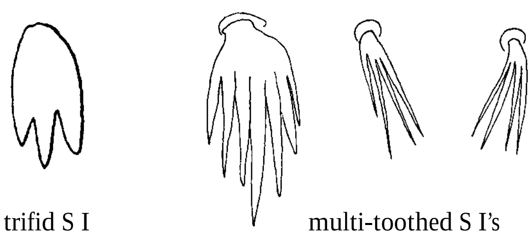
3(2) Median teeth apically pointed; mandible almost completely dark brown-black .. ***Ps. (Ps.) sordidellus*** **grp sp.**

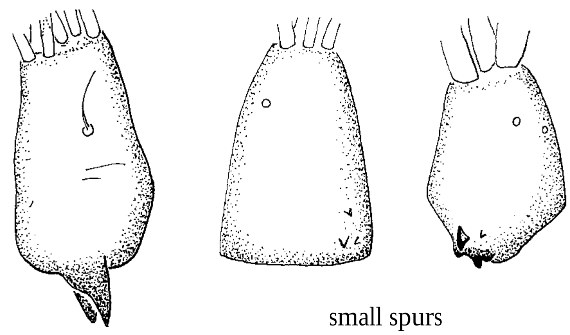


3' Median teeth rounded; mandible with only apical and 3 inner teeth darkened .... ***Ps. (Ps.) vernalis***



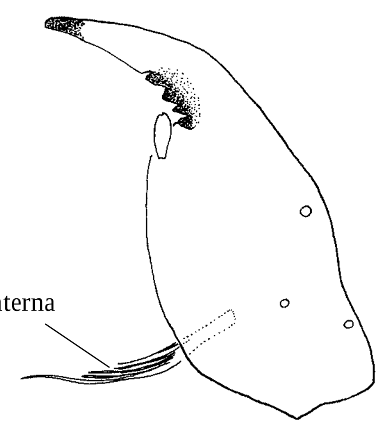
4(2') Procercus with large bifid or double spurs; S I broadly trifid 5



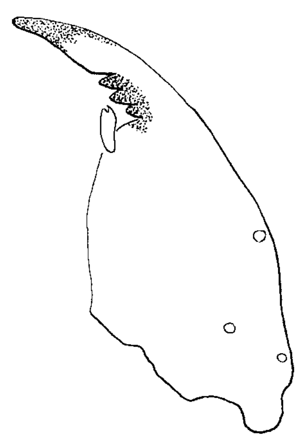


4' Procercus with 1 to several small spurs; S I with 4 or more teeth or rays 6

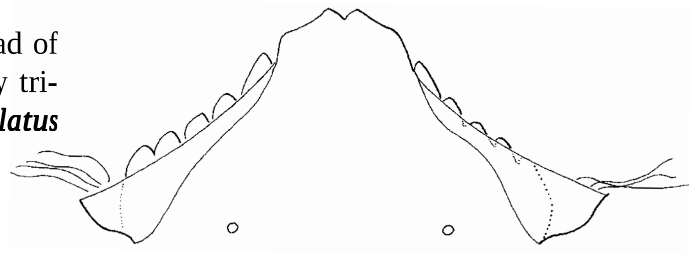
5(4) Mandible with seta interna ...... ***Ps. (Allopsectrocladius) pilosus***



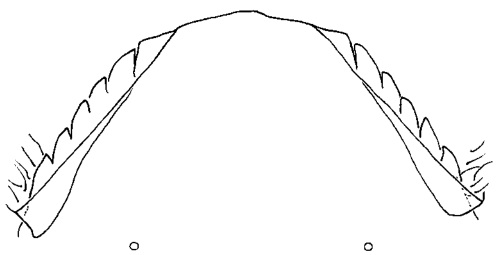
5' Mandible without seta interna .. ***Ps. (Allops.) flavus***

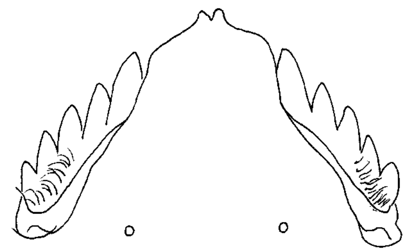


6(4’) Median tooth/teeth project strongly ahead of lateral teeth; ventromental plates broadly triangular .... ***Ps. (Ps.)* cf. *octomaculatus***



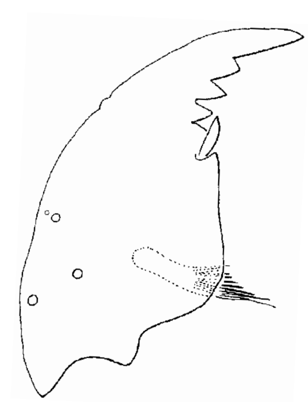
6’ Median tooth/teeth do not project as strongly forward; ventromental plates smaller, generally more rounded .... ***Ps. (Ps.) psilopterus* group** 7



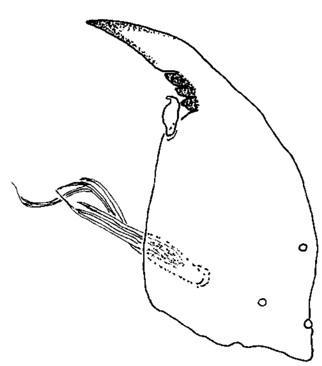


Ps. psilopterus grp. sp. 3

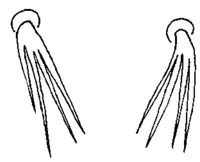
7(6’) Apical tooth of mandible approximately as long as width of 3 median teeth; mentum as figured above .... ***Ps. (Ps.) psilopterus* group sp. 3**

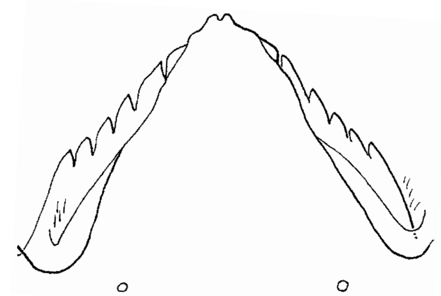


7’ Apical tooth of mandible longer than width of 3 inner teeth 8



8(7') S I with 4 narrow teeth or rays .... ***Ps. (Ps.) psilopterus*** **grp. sp. 2**

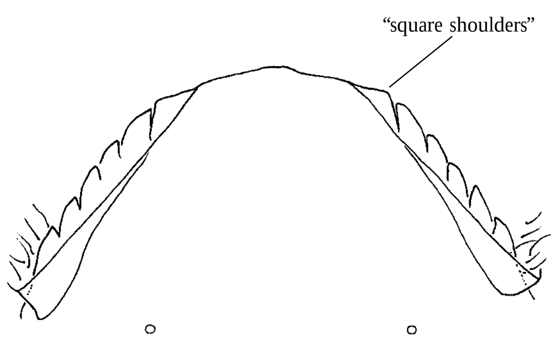


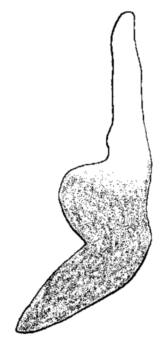


Ps. (Ps.) psilopterus grp. sp. 2 mentum

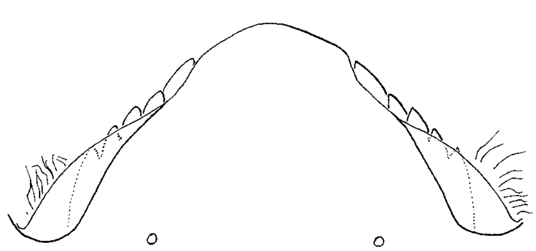
8' S I with 5 or more stouter teeth/rays 9

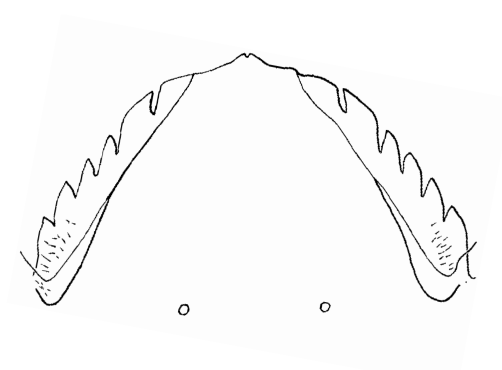
9(8') Median tooth of mentum broad, with relatively straight anterior margin and usually "square-shouldered" outer margin; premandible apically wider and darker .... ***Ps. (Ps.) elatus***



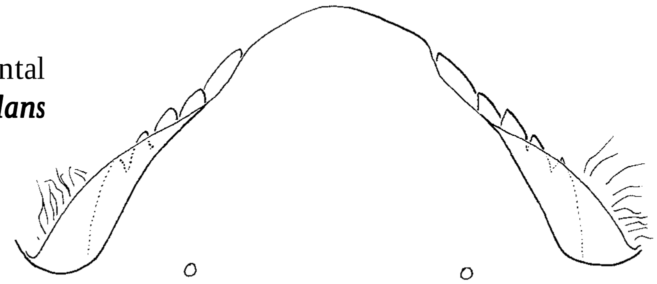


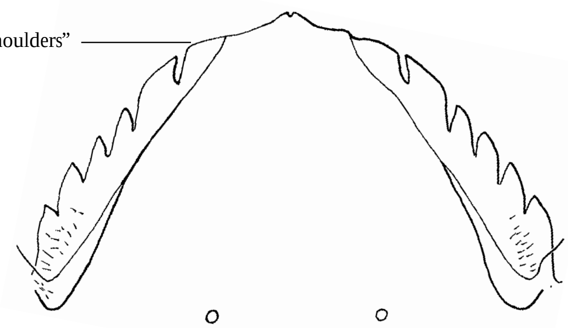
9' Median tooth of mentum rounded or if laterally angulate then with nipple-like central teeth; premandible apically narrow and not as darkened 10





10(9‘) Median tooth of mentum rounded; ventromental plates wider .... ***Ps. (Ps.) simulans***





10’ Median tooth of mentum with “square shoulders”; ventromental plates narrower .... ***Ps. (Ps.) psilopterus* grp. sp. 1**

Notes on species

Note that the mentum can often be worn in many specimens; median teeth may be worn almost smooth and the normally angulate lateral margin of the median tooth of some species may be rounded.

Ps. (Ps.) elatus - Found throughout the Southeast; very similar to *Ps. simulans*. Roback (1957) described *Ps. elatus* as a new species and stated that it was very similar to *Ps. simulans*. In some larval specimens of *Ps. elatus*, including material in the Academy of Natural Sciences of Philadelphia collection identified by Roback, the outer margins of the median tooth are rounded, not squared off as originally described and figured by Roback. In such instances the broader and darker premandible will usually identify such larvae. Roback (1957) also examined type material of *Ps. simulans* and apparently used that material to find characters to separate his *Ps. elatus* from *Ps. simulans*. Pupae are separated by having more spines on the medial patch on T IV: 25 in *Ps. simulans*, 6-12 in *Ps. elatus*, although Sæther (1969: 85) noted that because of considerable variation in the genus this character might not work to separate the two taxa. Adult males are separated by the more quadrate inferior volsella and the more angulate terminus of the gonostylus of *Ps. simulans* (also see fig. 42 in Sæther (1969) for an illustration of the male genitalia of what Sæther called *Ps. simulans*). Note that although the mentum of *Ps. elatus* resembles that illustrated for *Ps. (Mesopsectrocladius)* in Cranston et al. (1983: fig. 61B), pupae indicate that *Ps. elatus* is a member of the nominate subgenus and should be placed in the *psilopterus* group.

Ps. (Allopsectrocladius) flavus - Not recorded from the Southeast, but I have examined pupal exuviae of putative *Ps. flavus* from northern Georgia. Some aspects of this species’ identity are unclear. The larva is similar to *Ps. simulans* (and the Palaearctic *Ps. platypus*) except that it lacks a seta interna on the mandible. It is very similar to, and may be inseparable from, the larvae of *Ps. nigrus* and *Ps. obvius* (Walker). However, *Ps. obvius* and *Ps. nigrus* are darker as adults and are probably distinct species; these two species are probably synonymous; *obvius* is the older name and would have priority. Johannsen's (1937: 66) description of *Ps. flavus* with four inner mandibular teeth is probably in error (the darkened molar area was probably mistaken for a tooth), but Johannsen's associated larval material of *Ps. flavus* could not be located in the Cornell University collection. Roback (1957) used Johannsen's 4 inner toothed mandible character in his key and also stated that the S I setae ("labral bristle") of *Ps. flavus* were not "compound", which I interpret as not palmate (similar to what Roback stated about the S I of another Johannsen species, *Ps. simulans*). However, a larval-prepupal association of an apparent *Ps. flavus* from New York, identified by pupal and adult (color) characters, has three inner mandibular teeth and a trifid S I, similar to that of *Ps. pilosus*. I have also examined pupal exuviae of apparent *Ps. flavus* from northern Georgia; these exuviae have thoracic horns longer than 0.5 mm and over 120 taeniae on the anal lobes. It is obvious that all of Johannsen's type material of *Psectrocladius* species must be re-examined, if it can be located in the Cornell University collection.

Ps. (Allopsectrocladius) nigrus - Originally described from Pennsylvania, this species has not been recorded from the Carolinas. It is not included in the key but would key to *Ps. flavus*. Although I've examined some of the type material of *Ps. nigrus* (the holotype male is in alcohol and lacks its hypopygium, not yet found on a separate slide), type material of *Ps. flavus* was not available, making an accurate distinction between the two species in the larval stage impossible (Johannsen's description of the larva of *Ps. flavus* with 4 inner teeth on the mandible is probably in error). Roback (1957) separated the adults of *Ps. flavus* and *Ps. nigrus* by the dark color of *Ps. nigrus*; the pupa were separated by the higher count of anal fin taeniae in *Ps. flavus* (125+ in *flavus*; 90+ in *nigrus*) and the larger thoracic horn of *flavus* (0.6 mm in *flavus*; 0.35 in *nigrus*). Is coloration a valid means of separating the two taxa and are the pupal measurements significant to separate the two species? An in depth study of all type material, if it can be located, is necessary. These two species may both be junior synonyms of *Ps. obvius* (Walker), a species originally described from the Palaearctic. See *Ps. flavus* above.

Ps. (Ps.) cf. *octomaculatus* - I've examined a larva from Georgia and a pupal exuviae from North Carolina that probably represent *Ps. octomaculatus*, but without reared material from both sides of the Atlantic the determination remains uncertain. This species is a member of the *Ps. (Ps.) limbatellus* group; this group and *Ps.* cf. *octomaculatus* were recorded for North Carolina by Caldwell et al. (1997).

Ps. (Allopsectrocladius) pilosus - Reared material from Florida, Georgia and Maine fits the description of this species except there are two spurs (one considerably smaller than the other) on the mid tibiae of the adults; *Ps. pilosus* was described with only one spur on the mid tibiae (although Roback (1957: 89) apparently misstated it as "tarsi with one spur"). Sublette (1967: 531) used the character of one tibial spur for *Ps. pilosus* in his key to *Psectrocladius* adults. However, I have examined the holotype female of *Ps. pilosus*; there are two spurs on the mid and hind tibiae, although one is considerably smaller than the other (the smaller is about 1/4 the length of the larger). The holotype is in alcohol; also in the microvial with the type is a partially decomposed female pupa. This pupa does not belong with the holotype because it is a separate, different animal. It appears the holtype's pupal and larval exuviae are each mounted on separate slides; I matched them following Roback's collection numbers and have labeled them accordingly. The associated exuviae from Georgia compare well with these exuviae and other material determined by Roback; I've also seen unassociated larvae from North Carolina. This species may the same as the Palaearctic *Ps. platypus* (Edwards), except that *Ps. platypus* was described as being almost wholly black (Edwards 1929: 333); *Ps. pilosus* was described as being brown and yellow (Roback 1957). The immature stages of the two taxa are morphologically similar and appear to be inseparable.

Ps. (Ps.) psilopterus group - At least five species in this group are present in the eastern United States; this includes *Ps. elatus*, *Ps. simulans* and the three taxa discussed here. Similar material from the Southeast, including larvae from South Carolina and reared material from northwestern Florida and southern Georgia, I've placed as *Ps. psilopterus* group sp. 1. It is unclear whether *Ps. psilopterus* group sp. 1 represents the same taxon as the Palaearctic *Ps. psilopterus*, but it strongly resembles it. *Psectrocladius psilopterus* grp. sp. 2 is represented by an unusual species based on one reared male and a larva from Georgia and adults from the Savannah River Site in South Carolina. The larva of this species has very finely dissected semi-palmate S I setae (with only 4 rays) and very fine, short beard setae. The mentum resembles that of *Ps. psilopterus* grp. sp. 1; the larva also has a narrow premandible apex and the apical tooth of the mandible is longer than the width of the three inner teeth, similar to that of *Ps. psilopterus* grp. sp. 1 and *Ps. simulans*. The pupa does not fit well into any defined species group; it may be an aberrant member of the *psilopterus* group. The adult resembles other members of the *Ps. psilopterus* group; it has microtrichia on the anal point, apparently lacking in other members of this group. I've reared an additional species from peat bogs in Maine that I'm calling *Ps. psilopterus* group sp. 3; this taxon may be *Ps. semicirculatus* Sæther. Some of these specimens were reared from larvae collected in the jelly of an amphibian egg mass. It is included in the key because it may eventually be found in boggy areas of the Carolinas.

Ps. (Ps.) simulans - Very similar to *Ps. elatus* (see above). Roback (1957: 87) stated in his key that the larva of *Ps. simulans*, based on examination of type material, lacked "compound labral bristles", referring to the S I setae. I was unsuccessful in obtaining any material of *Ps. simulans* from the Cornell University collection to confirm this. Sæther (1969) described a reared *Ps. simulans* with the "seta anteriores [S I] 5-rayed". I have seen one larva from North Carolina (with the normal *Psectrocladius* palmate S I) and larvae and a single male from the Savannah River Site in South Carolina that appear to be *Ps. simulans*.

Ps. (Ps.) sordidellus group - I've examined a larva that is probably true *Ps. sordidellus* that was collected in North Carolina; this larva resembles a *Rheocricotopus* and might be mistaken for that genus (but note the palmate S I).

Ps. (Ps.) vernalis - A distinctive species in the larval and adult stage, found throughout the eastern US and west to the Rocky Mountain states.

Ps. (Monopsectrocladius) sp. - There may be two species of the subgenus *Monopsectrocladius* present in the Southeast. I've examined a male from Alabama that is almost certainly the Palaearctic *Ps. (M.) calcaratus* (Edwards). Two reared males from Georgia appear to represent a different species, with a more rounded inferior volsella and more inflated gonostylus. More reared material from the Nearctic and Palaearctic is necessary to resolve the identity of these taxa; larvae should be identified as "*Ps. (Monopsectrocladius)* sp.". Note that in larvae from the southeastern U.S. the S I setae are usually bifid or trifid, in contrast to the palmate S I setae usually found in most *Psectrocladius* larvae. Also note that this larva resembles *Rheocricotopus tuberculatus* but lacks the ventral tubercles on the head capsule of that species in addition to other characters.

Ps. (Ps.) sp. 1 Epler - An undescribed species, known only from an adult male from Pen Branch at the Savannah River Site in South Carolina.

Genus *Pseudorthocladius*

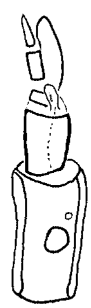
DIAGNOSIS: Distinguished by the mentum with well to weakly divided paired median teeth and 4 pairs of lateral teeth; mandible with 3 inner teeth; simple premandible; and 2-3 very long anal setae.

NOTES: *Pseudorthocladius* is a species-rich genus, with at least 11 species recorded from the Carolinas. However, larvae can not be identified to species.

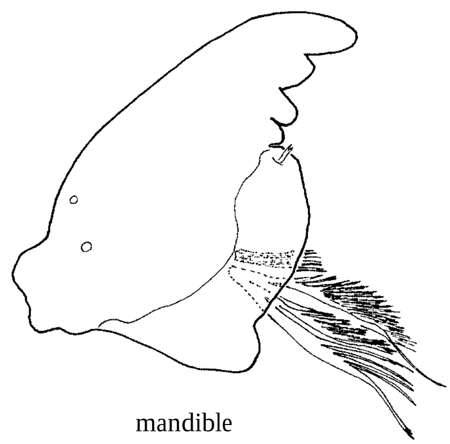
Larvae are similar to *Parachaetocladius*; that genus has only 2 inner teeth on the mandible and one anal seta per procercus. Although Cranston et al. (1983) stated that *Pseudorthocladius* has 2-3 anal setae, I have seen apparent *Pseudorthocladius* larvae with only one seta and 3 inner teeth on the mandible. Given the number of species in the genus and the paucity of known larvae, there may be more variation in *Pseudorthocladius* larvae than is recorded in the literature.

Larvae are found in mosses, bogs, springs and streams

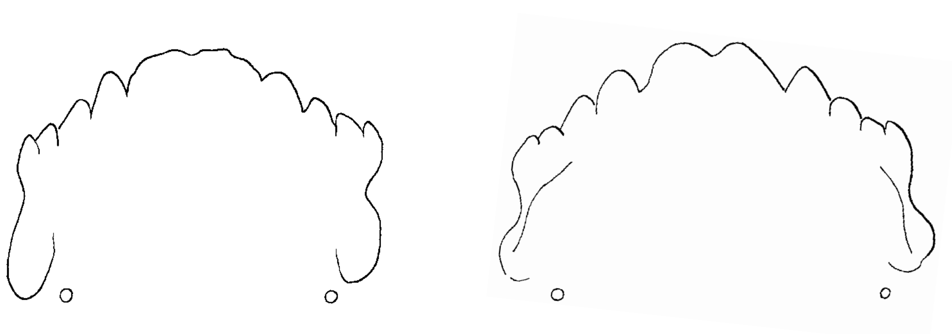
ADDITIONAL REFERENCES: Cranston & Oliver 1988a; Sæther & Sublette 1983; Schnell 1991; Soponis 1980b.



antenna



mandible



menta

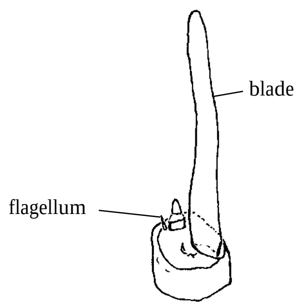
Genus *Pseudosmittia*

DIAGNOSIS: Identified by the bifid S I and S II; premandible with brush; antennae 3 or 4 segmented, with antennal blade greatly exceeding the flagellum and with ultimate segment longer than penultimate; lack of procerci, but 1-3 weak anal setae prersent; and posterior parapods weakly developed and with claws, or posterior parapods vestigial and anal claws absent.

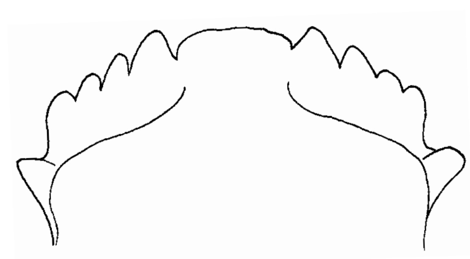
NOTES: *Pseudosmittia* is currently being revised on a world wide basis by Drs. L.C. Ferrington, Jr. and O.A. Sæther. Several species occur in the Southeast; it is not possible to identify the larvae to species.

Larvae are found in terrestrial or semi-terrestrial habitats, but are also sometimes encountered in vegetated marshy areas, pond and stream borders, and in streams and rivers.

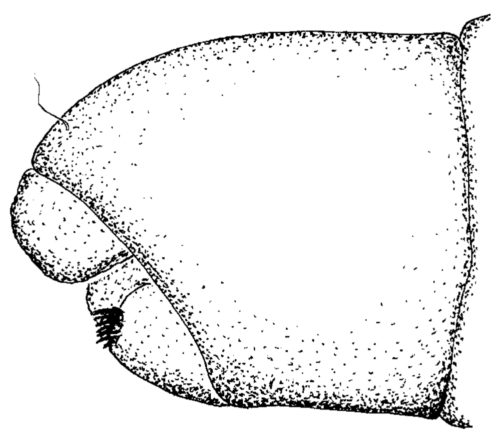
ADDITIONAL REFERENCES: Cranston & Oliver 1988a.



antenna



mentum



posterior end

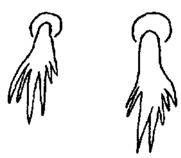
Genus *Psilometriocnemus*

DIAGNOSIS: Distinguished by the apically dissected S I; 6 segmented antennae with 6th segment hairlike, vestigial; antennal blade subequal to flagellum; pecten epipharyngis of 3 slender scales; apically bifid premandible; maxilla with pecten galearis; mentum with 2 median teeth and 5 pairs of lateral teeth, 4th and 5th teeth subequal; and setae submenti well posterior to a line drawn between the bases of the ventromental plates.

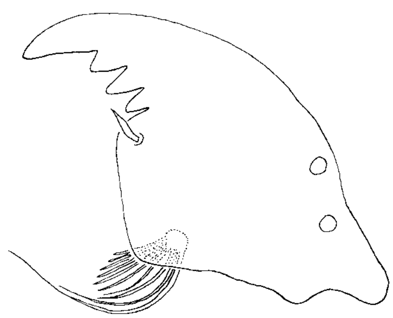
NOTES: One species, *Ps. triannulatus*, is known from the Carolinas, Georgia, Kansas, New Hampshire, Tennessee, New Brunswick, Nova Scotia, Ontario and Quebec. Larvae may be confused with *Platysmittia*, but that genus has the setae submenti placed more anteriorly and the antennal blade is markedly longer than the flagellum.

Larvae are found in damp soil, seeps, springs and small streams.

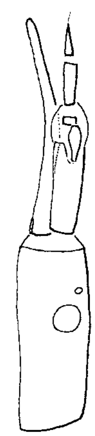
ADDITIONAL REFERENCES: Cranston & Oliver 1988a; Sæther 1969, 1982.



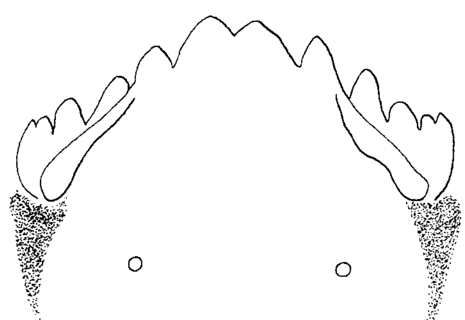
S I from 2 different specimens



mandible



antenna



mentum

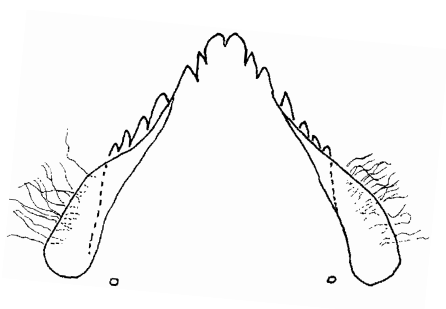
Genus *Rheocricotopus*

DIAGNOSIS: Larvae are distinguished by the bifid or apically multi-toothed S I; premandible apically simple, without brush; mandible with relatively short apical tooth; mentum with median tooth simple, medially notched or bifid (or with two teeth), with well developed ventromental plates and cardinal beard; and procerci usually with a distinct spur.

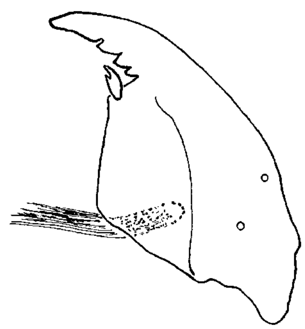
NOTES: Nine species are known from the Carolinas; the immature stages are undescribed for two of the species, and an additional larval type is known from Virginia.

Rheocricotopus robacki is the most common and widespread member of the genus in the eastern United States, often abundant in many lotic systems.

ADDITIONAL REFERENCES: Caldwell 1984; Sæther 1985b; Sæther & Schnell 1988.



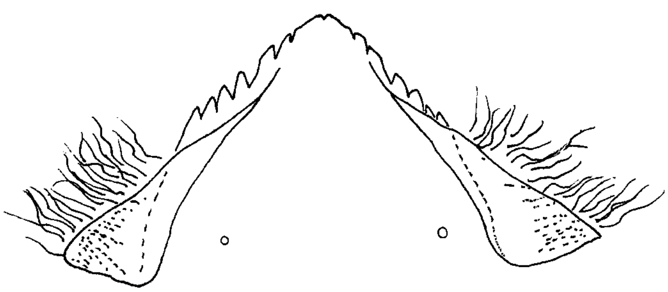
mentum



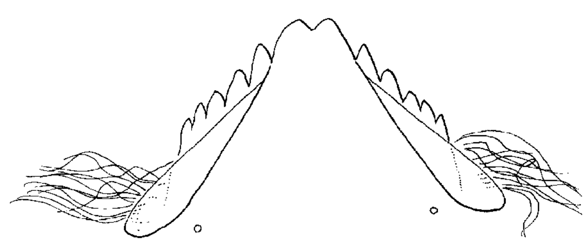
mandible

antenna

Rh. robacki



Rh. tuberculatus mentum

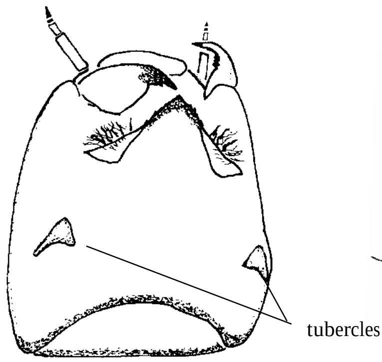


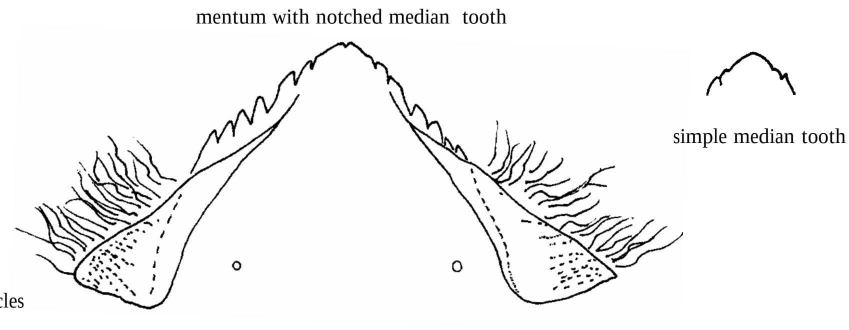
Rh. eminellobus mentum

Key to *Rheocricotopus* larvae of the southeastern United States

(larvae of *Rh. amplicristatus* and *Rh. conflusirus* are unknown)

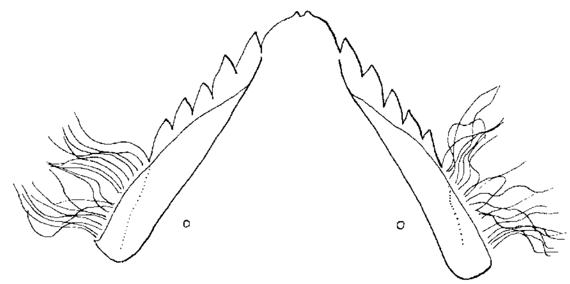
1 Head capsule with a pair of ventrolateral tubercles; ventromental plates large and triangular .... ***Rh. tuberculatus***





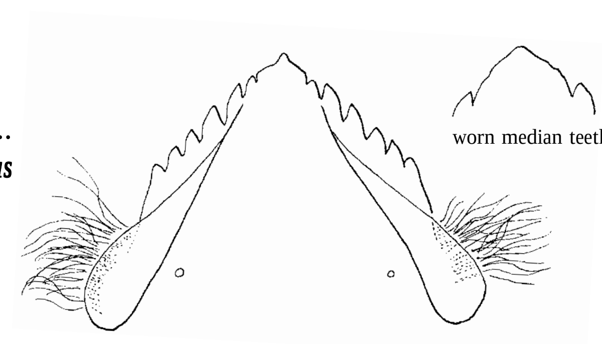
1’ Head capsule without tubercles; ventromental plates not as broad, usually posteriorly rounded (see figures below) 2

2(1’) Median tooth dome-like, with 2 small central teeth .... ***Rh.* sp. VA**

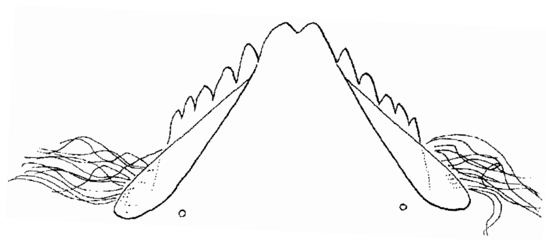


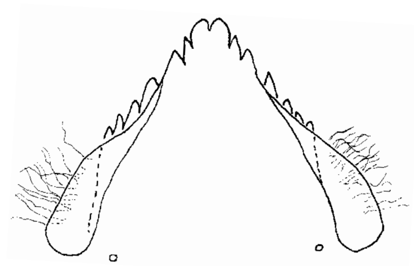
2’ Median tooth simple or bifid (see below) .. 3

3(2’) Mentum with single median tooth .... ***Rh. unidentatus***

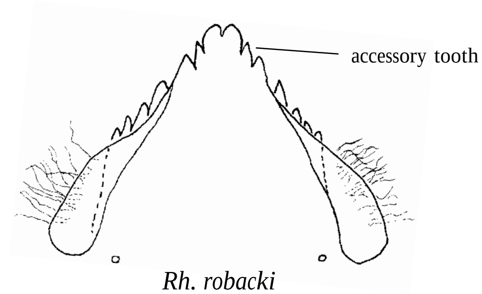


3’ Mentum with bifid median tooth (or 2 median teeth) 4



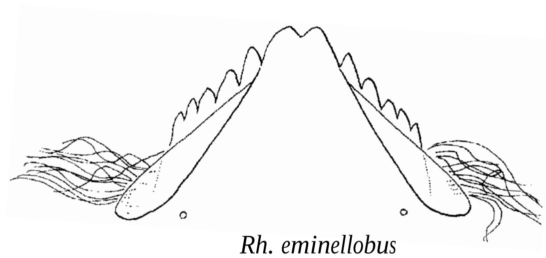


4(3') Each median tooth with a small lateral accessory tooth 5



Rh. robacki

4' Median teeth simple 6

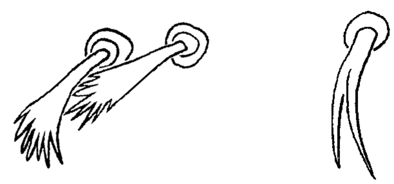

Rh. eminellobus

5(4) Longest body setae > 100 µm long and relatively stout; last antennal segment 6-8 µm long; very common .... ***Rh. robacki***

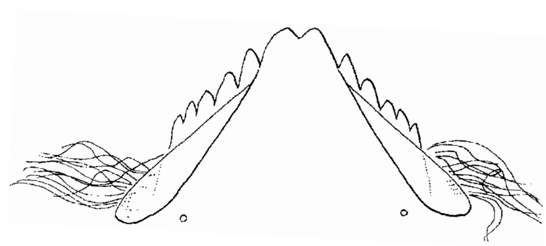
5' Longest body setae <100 µm long and thin, hairlike; last antennal segment 10 µm long; uncommon .... ***Rh. pauciseta***

6(4') S I apically split into 4 or more teeth .... ***Rh. glabricollis***

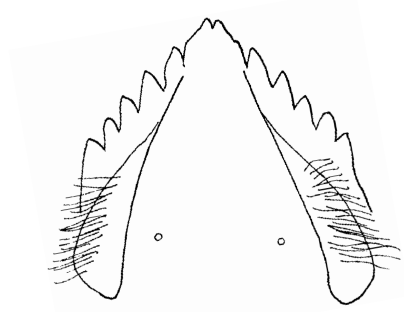
6' S I bifid 7


Rh. glabricollis bifid S I of *Rh. effusus*

7(6') Beard beneath ventromental plate with 10-15 setae .... ***Rh. eminellobus***



7' Beard beneath ventromental plate with 25-31 setae .... ***Rh. effusus***


(mentum excessively flattened)

Notes on species

Rh. amplicristatus - The immature stages are undescribed; this species is known from adult males collected at the Savannah River Site in South Carolina and a record from Georgia in Caldwell et al. (1997).

Rh. conflusiris - The immature stages are undescribed; known only from the holotype, an adult male collected at the Jocassee Reservoir in South Carolina.

Rh. effusus - This Holarctic species is distinguishable from the similar *Rh. eminellobus* (q.v.) by the greater number of cardinal beard setae (25-31) and the higher AR (1.5-1.8). Another similar species is *Rh. effusoides*, described from South Dakota (Sæther 1985b: 98) and not recorded from the Southeast. It has 32-33 beard setae and an AR of 1.8-2.1. Note that Sæther (1985b: 71, couplet 7) keys the pupa of *Rh. effusus* with 4 taeniae (as "lamelliform setae") on T V-VI, but in his description for the pupa, he stated 3-4 taeniae for those tergites; pupal exuviae associated with reared North Carolina larvae bear only 3 taeniae on T V-VI. See also *Rh. pauciseta* below.

Rh. eminellobus - Similar to *Rh. effusus* but separable by the lower number of beard setae (fewer than 15) and lower AR (1.1-1.3). Both species are recorded from North and South Carolina.

Rh. glabricollis - In the highly stylized original figure of the larval mentum in Gouin (1936: fig. 18; as *Trichocladius Gouini* Goetghebuer, a junior synonym), the median teeth of the mentum were illustrated as being lighter in color than the lateral teeth; Cranston (1982) used this character in his key to *Rheocricotopus*. However, Sæther (1985b: 92) noted that the majority of the larvae he examined had dark median teeth. Sæther (1985b) described the S I as being split into 6-7 apical teeth but illustrated them (fig. 14B) with only four apical divisions. I have not seen associated larval material of this species but have seen a single larva from Virginia; its placement in the key is based on Saether's (1985b) description.

Rh. pauciseta - An apparently rare species; the larval description of this species is apparently from two larval exuviae described in Sæther (1969). I have not seen larval material of this species. Some reared larvae of *Rh. effusus* from North Carolina that I've examined might be mistakenly identified as *Rh. pauciseta* because there is a slight "shelf" on the outer margin of the median teeth that could be taken for a worn accessory tooth; this *Rh. effusus* material is apparently some of the same material Sæther (1985b) used in his description of the larva of *Rh. effusus*.

Rh. robacki - The most common and widespread member of the genus in the Southeast, usually easily identified by the accessory lateral tooth on the median teeth and the longer (at least 100 µm in fourth instar larvae), thicker body setae. These larger setae are usually more easily found on the more posterior body segments.

Rh. tuberculatus - An unmistakable species, easily identified by the ventral tubercles on the head capsule and the large, triangular ventromental plates. Caldwell (1984) described the larva with a single median tooth, but the majority of larvae I've assigned to this taxon have the median tooth slightly notched in the center of the anterior margin. Epler (1995) also noted that pupae associated with larvae with a notched median tooth had 4 taeniae on T VII, while type material he examined had only 3 taeniae on T VI. While this could certainly fall within a range of variation (e.g., see *Rh. effusus* above), a small possibility exists that a cryptic species may be involved.

Rh. unidentatus - Originally described from Ohio (Sæther and Schnell 1988), I've seen larvae from two sites in North Carolina. The small lateral notches on the median tooth may be worn down; I've seen material from one site in which larvae were present with such worn and unworn menta.

Rh. sp. VA Epler - This larva is known only from a single specimen from Virginia. It is not known whether it represents one of the two Southeastern *Rheocricotopus* species with undescribed immature stages, a new taxon or an aberrant specimen.

Genus *Rheosmittia*

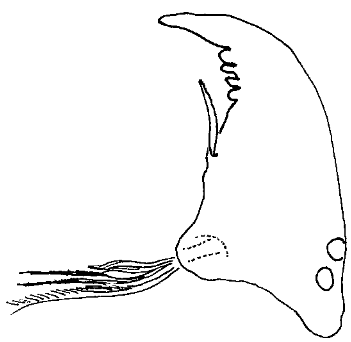
DIAGNOSIS: Distinguished by the distinctive antennae, which are at least ½ the length of head capsule, and have the second segment (and sometimes the first segment) unevenly sclerotized; and the strongly arched mentum, with 2 large hypopharyngeal scales dorsal to it.

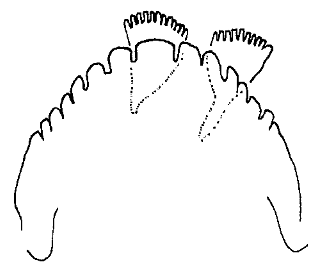
NOTES: It appears that at least two species of *Rheosmittia* occur in the Southeast; only *Rh. arcuata* is described. The majority of unassociated larvae I've examined from the Southeast appear to be *Rh. arcuata* or a species very similar to it; I have only seen *Rheosmittia* sp. A from northern Florida. The two taxa can be separated by the longer apical mandible tooth of *Rh*. sp. A and the higher number of apical teeth on its hypopharyngeal scales: more than 10 in *Rh*. sp A; 5-8 in *Rh. arcuata* (Caldwell (1996) described the larva of *Rh. arcuata* with 5-6 teeth on the hypopharyngeal scales). Caldwell (1996) and Cranston & Sæther (1986) noted that the Lauterborn organs of antennal segment 2 are absent and suggested that structures reported as Lauterborn organs were probably extruded intersegmental membranes or the style.

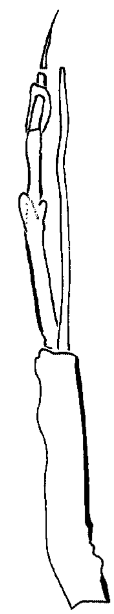
Larvae inhabit shifting sand substrata of streams and rivers.

ADDITIONAL REFERENCES: Caldwell 1996; Cranston & Sæther 1986.


premandible

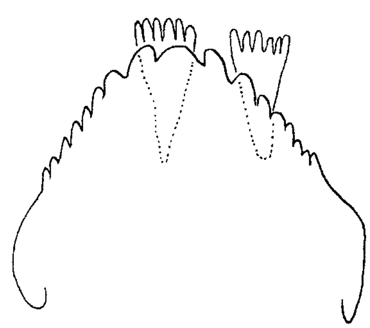

mandible


mentum and hypopharyngeal scales


antenna

Rh. sp. A


mandible


mentum and hypopharyngeal scales

Rh. arcuata paratype

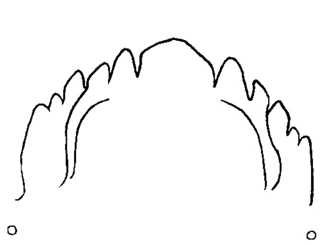
Genus *Smittia*

DIAGNOSIS: Distinguished by the plumose S I; apically bifid premandible; antenna with 4 (possibly 5?) segments, with antennal blade less than or equal to flagellum; mandible with 3 inner teeth; and lack of procerci and anal setae.

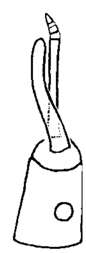
NOTES: At least four species of *Smittia* are known from the Southeast; one described species and two undescribed species (based on adult males) are known from the Carolinas. The genus requires revision in the Nearctic. It is not possible to identify larvae to the species level.

Smittia larvae are generally considered terrestrial, but larvae are often found in water. Webb (1982) found *S. lasiops* larvae in soil in corn fields. I have illustrated two types of *Smittia* larvae below; both have been found in terrestrial leaf litter in hardwood forests and in streams. *Smittia* sp. B is unusual for the genus because of its trifid median tooth (or 3 median teeth). Note that *S*. sp. A is not a "worn mentum version" of *S*. sp. B.

ADDITIONAL REFERENCES: Webb 1982.

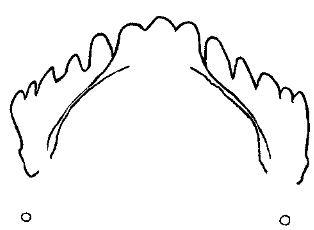


Smittia sp. A mentum



Smittia sp. A antenna

Smittia sp. A premandible



Smittia sp. B mentum

Genus *Stilocladius*

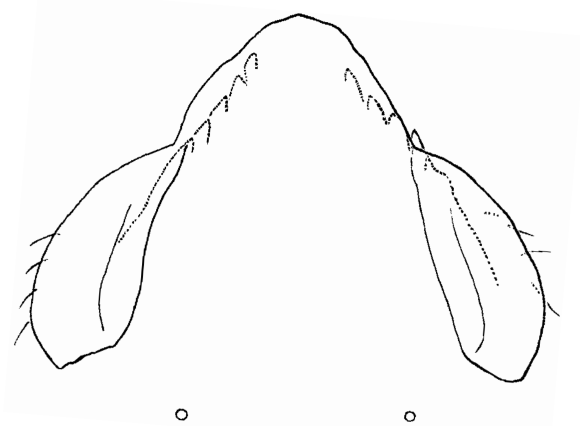
DIAGNOSIS: Distinguished by the simple or apically toothed S I; elongate ventromental plates with sparse beard beneath them; and 6 segmented antennae, with the last segment hairlike.

NOTES: One species, *S. clinopecten*, is known from the Southeast; an additional undescribed species is known from streams in Maryland and Pennsylvania. Material of the undescribed species, *S.* sp. A, was collected by Dr. Rick Jacobsen and will be described in a future publication; it can be distinguished from *S. clinopecten* by the right-angled outer margin of the first lateral tooth of the mentum and higher antennal ratio (1.3-1.6 for *S.* sp. A; 0.8-0.9 for *S. clinopecten*). *Stilocladius* sp. A appears similar to but is apparently not *S. montanus* of Rossaro (1984). The larva included as "*Stilocladius* ? sp." by Epler (1995) is placed in *Parakiefferiella* in this manual.

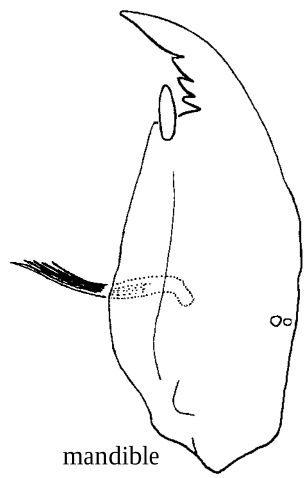
Note that the ventromentum of *Stilocladius* often covers the mental teeth, especially in specimens that have not been firmly pressed with the cover slip.

Stilocladius larvae are found most often in small streams.

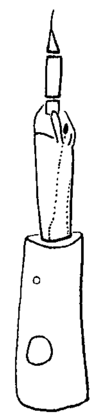
ADDITIONAL REFERENCES: Rossaro 1984; Sæther 1982.



mentum



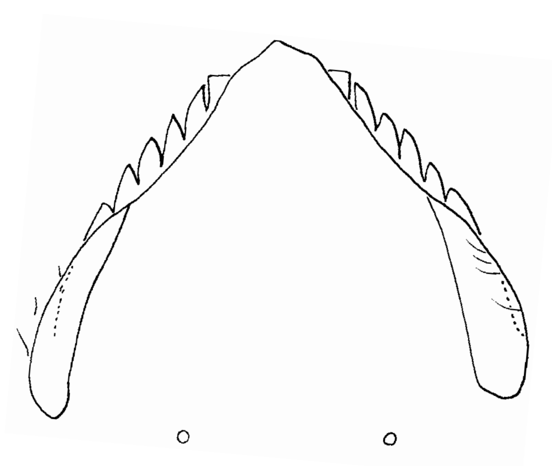
mandible



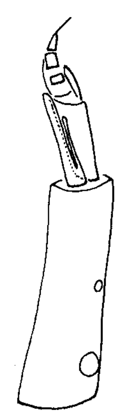
antenna

S. clinopecten

S I



mentum



antenna

S. sp. A

Genus *Symbiocladius*

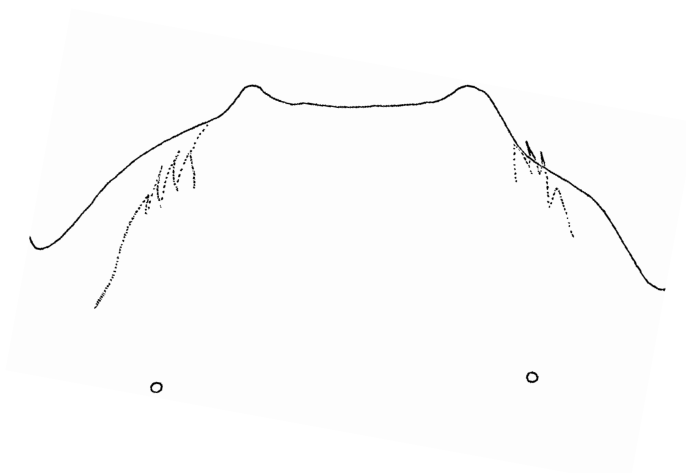
DIAGNOSIS: The distinctive mentum, without median teeth and sharply pointed, almost spinelike lateral teeth; reduced antennae; vestigial procerci; and ectoparasitic habit will distinguish this genus.

NOTES: Two species are recorded from the Southeast; *S. chattahoocheensis* is known only from Georgia, *S. equitans* is recorded from North Carolina. Species level records of *Symbiocladius* based only on immature stages must be viewed with skepticism; immature stages of the two species known from eastern North America can not be distinguished at the species level.

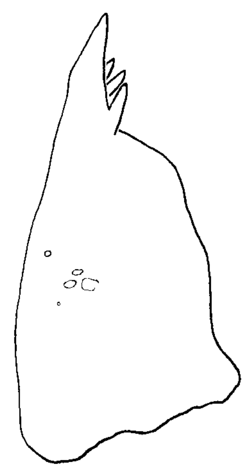
Symbiocladius larvae are obligate parasites on mayfly nymphs; *S. chattahoocheensis* was described from specimens collected from the heptageniid *Epeorus* nr. *vitreus* (Walker); Roback (1966b) reported *Epeorus* sp. as a host from North Carolina.

ADDITIONAL REFERENCES: Caldwell 1984.

antenna



mentum



mandible

S. chattahoocheensis

Genus *Synorthocladius*

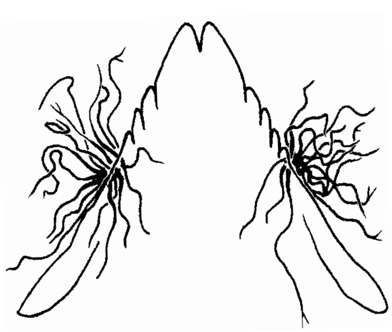
DIAGNOSIS: Distinguished by the simple S I; distinctive mentum with well developed ventromental beard with apically branched filaments; mandible without seta interna but bearing a large spine on the inner margin; large seta subdentalis; and abdominal segments with alternating simple and plumose setae.

NOTES: One described species, *S. semivirens*, is recorded from the Southeast. However, based on adult males, at least one additional species is known from North Carolina (Great Smoky Mountains National Park) and South Carolina (Savannah River Plant area). The larvae of the undescribed species is unknown; unassociated larvae from the Southeast should be identified as "*Synorthocladius* sp. ". *Synorthocladius* larvae were misidentified as *Parorthocladius* by Beck (1976, 1979).

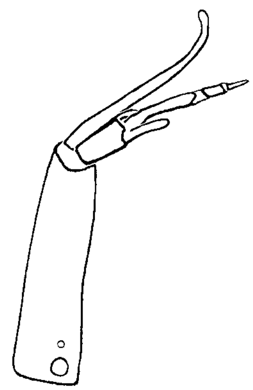
The extent of sclerotization of the third antennal segment is variable; antennae may appear to be four or five segmented. Larvae are usually blue-green in life and before slide mounting; this coloration is often carried through to the adult stage.

Larvae are most often found in running water, but may also occur in springs and other lentic situations.

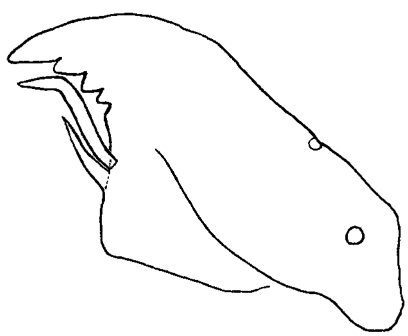
ADDITIONAL REFERENCES: None.



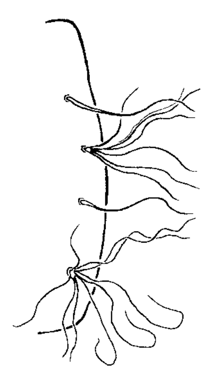
mentum



antenna



mandible



abdominal segment

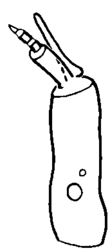
Genus *Thienemannia*

DIAGNOSIS: The plumose S I; pair of serrated labral lamellae (in one Palaearctic species); 5 segmented antenna; premandible apically bifid, with brush; mentum with 2 median teeth; narrow ventromental plates; maxilla without pecten galearis; short, weakly sclerotized procerci; and the long supraanal setae distinguish this genus.

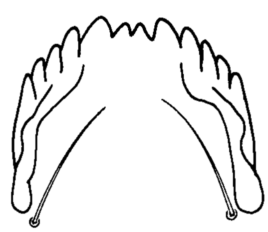
NOTES: One species, *Th. pilinucha*, is known from the eastern US. It was described from eastern Tennessee; it has not been reported from the Carolinas but can be expected in the mountainous western portions. The immature stages of *Th. pilinucha* are unknown; figures below are of a Palaearctic species, *Th. gracilis*. Larvae are similar to *Metriocnemus* and *Limnophyes*; note that figures 9.76B, D, G, H and J in Cranston et al. (1983) and figures 9, 11, 14, 16 and 17 in Sæther (1985h) are not *Thienemannia*, but *Limnophyes* (Sæther 1990). Note that although the key in Cranston et al. (1983) and Sæther et al. (2000) stated "labral lamellae apparently absent", a pair of apically serrated labral lamellae are illustrated for *Th. gracilis* in Cranston et al. (1983:fig. 9.76F) and Sæther (1985h:fig. 13).

Larvae have been found in springs and are considered hygropetric in streams.

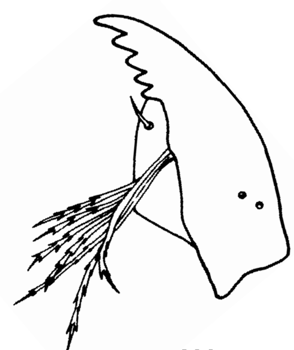
ADDITIONAL REFERENCES: Sæther 1985h.



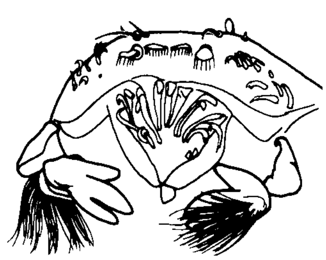
antenna



mentum



mandible



labrum

maxilla

(figs. adapted from Sæther 1985h)

Genus *Thienemanniella*

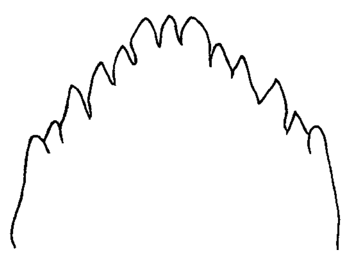
DIAGNOSIS: Larvae are distinguished by their small size (< 4 mm); long (> half the length of the head capsule), well sclerotized 5 segmented antennae; and simple subbasal setae of the posterior parapods.

NOTES: Seven species of *Thienemanniella* are known from the Southeast, five of which have been recorded from the Carolinas. The genus was recently reviewed by Hestenes & Sæther (2000); three new species were described, all of which have since been found in the Carolinas. *Thienemanniella xena* is by far the most commonly encountered species, but many older records of *Th. xena* must be viewed with skepticism because of previous inadequacies in identification materials.

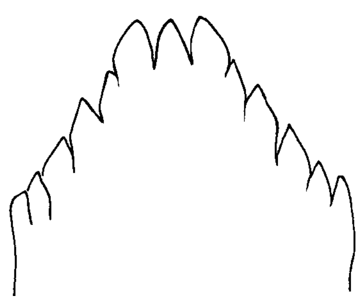
Larvae which have lost their antennae may be confused with *Corynoneura*; most *Corynoneura* have subbasal setae on the posterior parapods with spinose bases or sides; some *Corynoneura* species have sculptured head capsules. All *Thienemanniella* larvae known to me from the Southeast have thick, simple subbasal setae and none have head sculpturing.

Larvae occur in running and standing water, but are usually found in streams and rivers, and can be encountered in clean or enriched habitats. It is not unusual for several species to be found within one sample. Larvae are eaten by a variety of aquatic macroinvertebrates, and are often found in the guts of many tanypod species; I've also seen them in the gut of the naidid worm *Chaetogaster diaphanus* (Gruithusen).

ADDITIONAL REFERENCES: Boesel & Winner 1980; Hestenes & Sæther 2000; Schlee 1968.

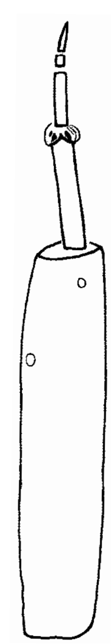


Th. xena mentum



Th. similis mentum

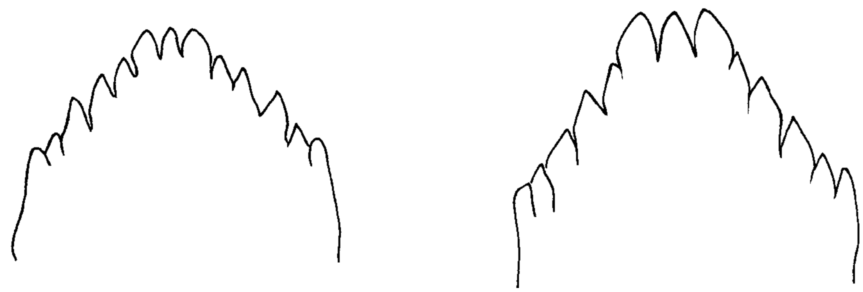
Th. xena antenna



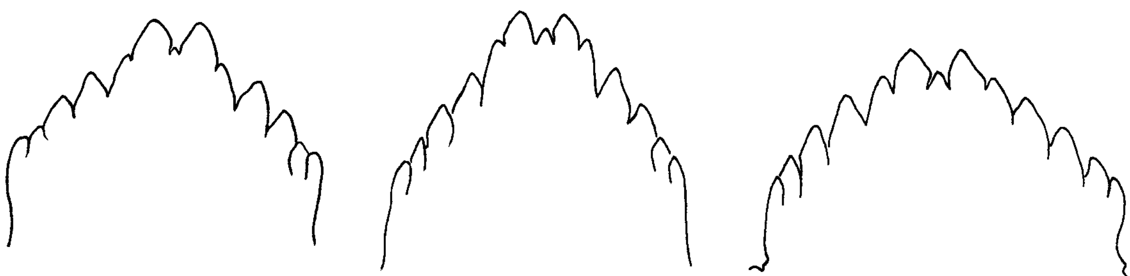
Th. similis antenna

Key to *Thienemanniella* larvae of the southeastern United States

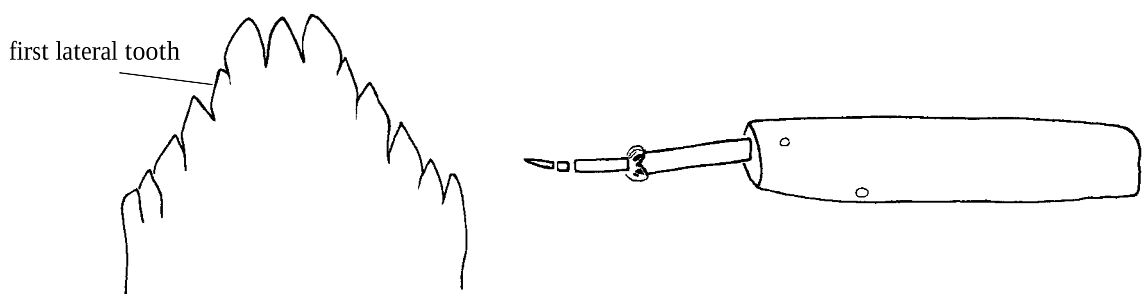
1 Mentum with 3 large median teeth, the central tooth at least 2/3 length of the outer median teeth 2



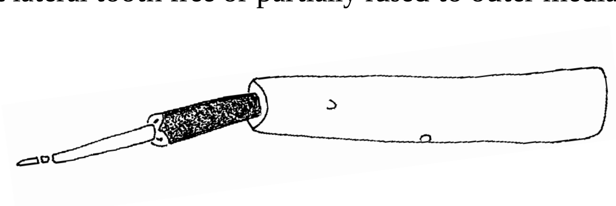
1' Mentum with 2 large median teeth, if central tooth is present it is vestigial or at most 1/2 length of outer median teeth 4



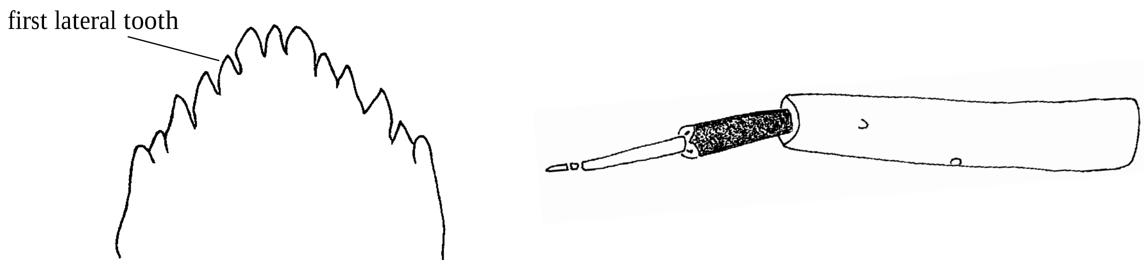
2(1) Antennal segment 3 0.5-0.7 as long as segment 2, segment 2 pale; mentum with first lateral tooth partially fused to outer median tooth .... ***Th. similis***



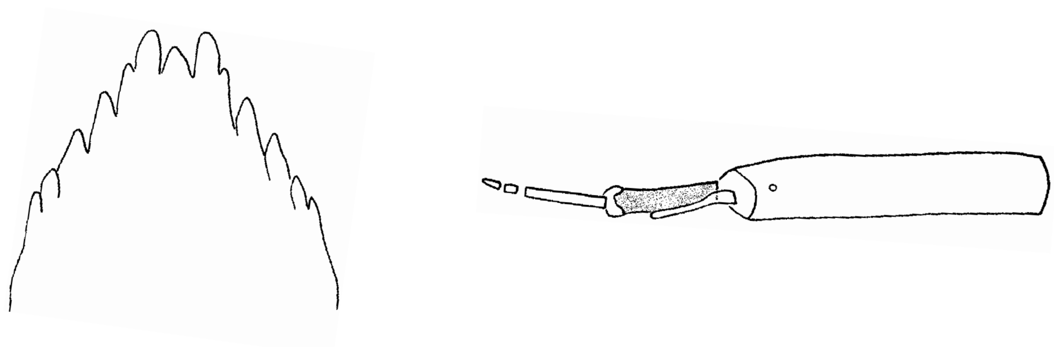
2' Antennal segment 3 equal to or slightly shorter than segment 2, segment 2 light to dark brown; mentum with first lateral tooth free or partially fused to outer median tooth 3



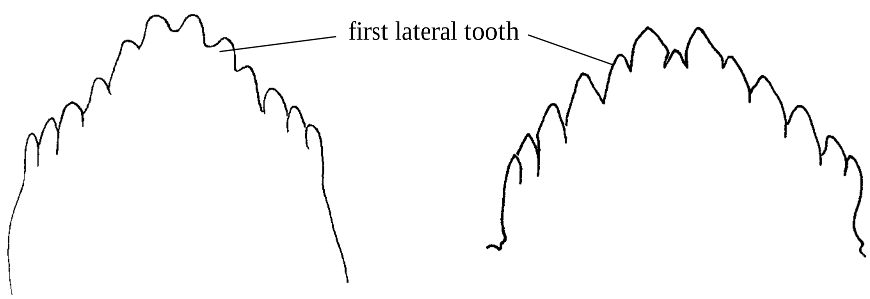
3(2') Mentum with central tooth equal to or slightly shorter than outer median teeth; first lateral tooth not partially fused to outer median tooth; antennal segment 2 dark brown .... ***Th. xena***



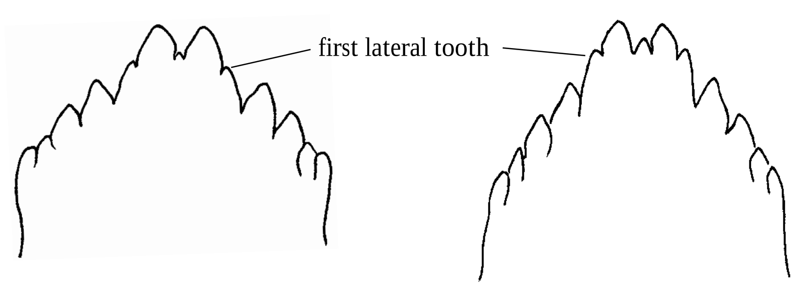
3' Mentum with central tooth clearly shorter than outer median teeth; first lateral tooth partially fused to outer median tooth; antennal segment 2 pale brown .... ***Th. taurocapita***



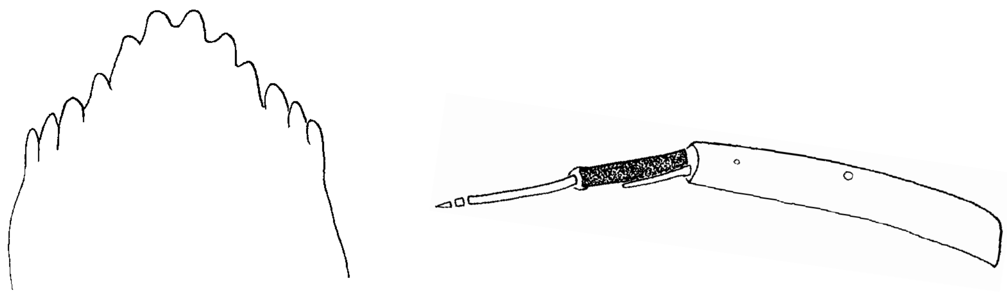
4(1') Mentum with first lateral tooth free, not partially fused to median tooth 5



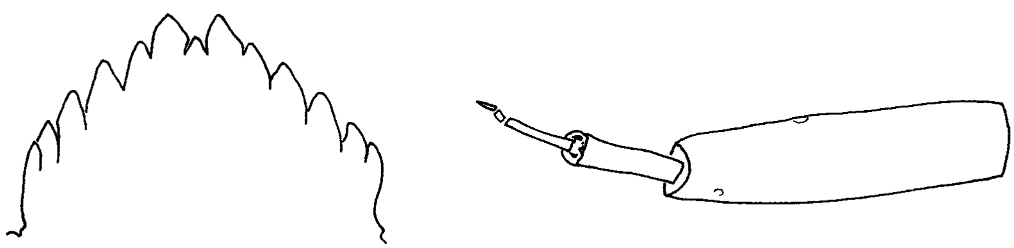
4' Mentum with first lateral tooth partially fused to median tooth 6



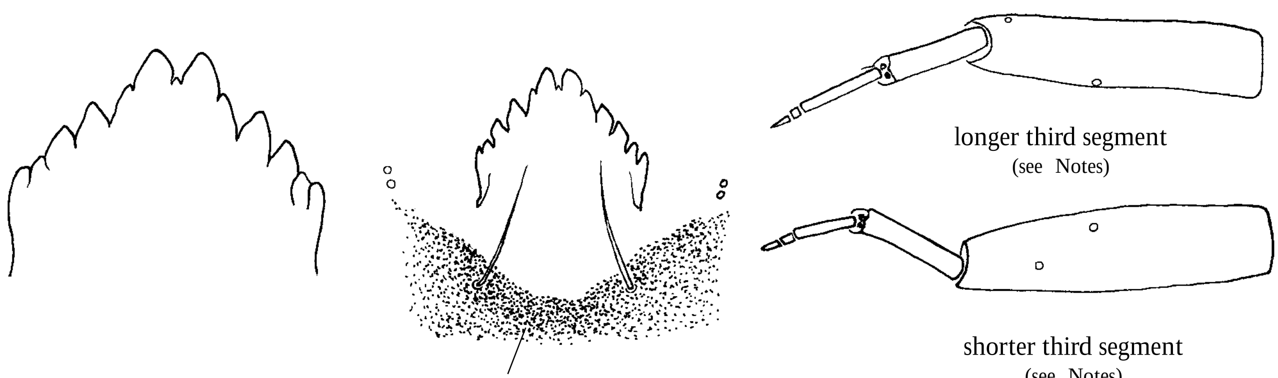
5(4) Mentum without a central tooth; second antennal segment brown; third antennal segment about as long as segment 2 .... ***Th. boltoni***



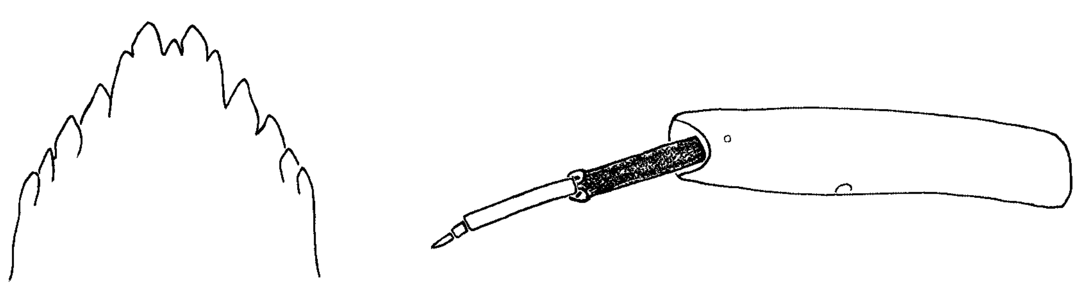
5’ Mentum with a small central tooth; second antennal segment pale; third antennal segment about 0.8 as long as segment 2 .... ***Th.* sp. C**



6(4’) Central median tooth of mentum absent (worn away) or minute; third antennal segment 0.5-0.9 length of second; second antennal segment pale; venter of head capsule usually with granular appearance ending anteriorly in a semicircle .... ***Th. lobapodema***



6’ Central median tooth small but distinctive; third antennal segment equal to second; second antennal segment light brown; venter of head capsule without granular appearance .... ***Th.* sp. B**



Notes on species

Th. boltoni - Described from and previously known only from Ohio. In addition to the holotype and two paratypes, I've examined a male and larvae from North Carolina. The species is apparently restricted to springs and small spring fed streams.

Th. lobapodema - This taxon is apparently the same as those called "*Thienemanniella* sp. A" and "*Th*. sp. D" in Epler (1995); it is also the same taxon as "*Thienemanniella* nr. *fusca* (Kieffer)" of Simpson & Bode (1980); note that *Th. fusca* is a junior synonym of *Th. acuticornis* (Kieffer) and is an entirely different species from *Th. lobapodema* – the mentum is different (with three equal median teeth) and the third antennal segment is very short, similar to that of *Th*. sp. A of Hestenes & Sæther (2000). Epler (1995) noted that two species might have been present in his *Th*. sp. A due to the range in third antennal segment lengths. Hestenes & Sæther (2000) gave lengths of antennal segment 3 being 0.5 - 0.7 the length of segment 2. I examined four paratypes of *Th. lobapodema*, all collected in Ohio at the same place and date (note that Hestenes & Sæther (2000: 117) list only the reared female from this series as a paratype, although all four specimens are marked as paratypes). Only one of the paratype larvae had an easily discernable semi-circular postmental mark; this specimen had an antennal segment 3/2 ratio of 0.7 and longest body setae of 130 µm. The other three specimens had ratios of 0.5-0.6 and longest body setae of 86-106 µm. In other, unreared, material I've examined, third antennal segment lengths run a continuum from 0.5 to 0.9 of the length of the second segment; usually those specimens with longer antennae have longer body setae. The semi-circular clear area (not granulose like the remainder of the head capsule) posterior of the mentum is usually distinctive in most fourth instar specimens mounted in CMC; it can be difficult to discern in very old material (hence the *Th*. sp. D of Epler (1995)) and in some larvae and larval exuviae mounted in other media. It appears that most larvae with a clearly defined semi-circle on the mentum also sport longer antennae and body setae (up to 180+ µm), but there are exceptions. Do these specimens represent another species? However, none of the longer antennal variety have been reared and it may be wise to set aside those specimens with long (more than 0.75 the length of segment 2) third antennal segments and longer (over 125 µm) body setae; such specimens may prove to be a different species. If so, this would mean that the type series is mixed; I have not seen the holotype (a mature male pupa). In the Southeast, *Th. lobapodema* is known from Alabama, Florida, Georgia, North and South Carolina, where it can be common in streams and rivers, and often occurs with other members of the genus.

Th. similis - A relatively common species throughout the Southeast, usually not as common as *Th. xena*, often occurring with it and *Th. lobapodema*. Epler (1995) called this taxon "*Th*. cf. *similis*". I've also seen some earlier instar (probably third) larvae from South Carolina that appear to be *Th. similis* but have shorter third antennal segments. Since these are not fourth instar larvae, it might be possible that the antennal segments do not attain their full respective lengths until the fourth instar. It is also possible they may represent an undescribed species, but until fourth instar larvae are found and associated with pupae and adults, their status remains unclear.

Th. taurocapita - Previously known only from type material from Ohio. It has been collected from headwater streams to rivers, but is most common in streams. I've examined a male captured at a light trap near a creek in Great Smoky Mountains National Park in North Carolina.

Th. xena - The most common and abundant species of the genus in the Southeast, usually easily recognized by the three median teeth that are subequal in length, first lateral teeth not partially fused to the outer median tooth, dark brown second antennal segment and long third antennal segment (subequal to second). I've seen what may be a variant from the Savannah River Plant area in South Carolina in which the median tooth is narrower than the outers and the second antennal segment is not as dark brown. I've examined the type series, originally described from Pennsylvania.

Th. sp. B - This species has a very long third antennal segment, as long as the brown second antennal segment, and an almost always distinguishable central median tooth, at most about 1/3 the height of the outer median teeth. Known from northern Florida and northern Georgia. This taxon may be a variant of *Th. taurocapita* but I have not seen any *Th*. sp. B larvae with a central median tooth as long as those of *Th. taurocapita* specimens I've examined; its true identity will remain unknown until it is reared. In north Florida it often occurs with *Th. lobapodema*, *Th. similis* and *Th. xena*.

Th. sp. C - This taxon is known only from southern Florida.

Thienemanniella obscura Brundin and *Th. partita* Schlee are recorded from South Carolina by Hudson et al. (1990) and Caldwell et al. (1997). I have no idea where their records are from and have not seen any material that could be remotely associated with those taxa; these records should be considered dubious.

Genus *Tokunagaia*

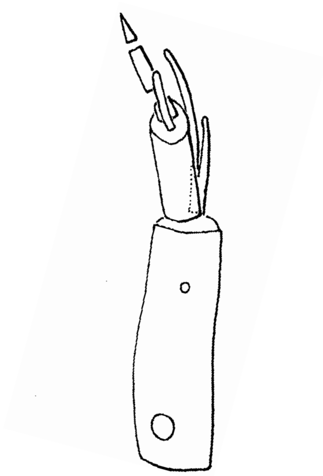
DIAGNOSIS: Distinguished by the dark brown to blackish head capsule; simple, thick S I; simple or weakly serrate labral chaetae and chaetulae laterales; simple, blunt premandible; elongate, well sclerotized basal sclerite; 5 segmented antenna with 4th segment about twice as long as third, with antennal blade extending at least to or past 4th segment; mentum with 5 pairs of lateral teeth and a pair of median teeth; inner margin of mandible with long spines (or spines reduced to points); seta interna of mandible with branches split to near base; procerci not reduced; and supraanal setae shorter than anal tubules.

NOTES: Halvorsen & Sæther (1987) expanded *Tokunagaia* by the inclusion of the *Eukiefferiella rectangularis* group, thus the larval diagnosis in Cranston et al. (1983) is incomplete. The taxonomy of *Tokunagaia*, *Cardiocladius* and *Eukiefferiella* remains unclear.

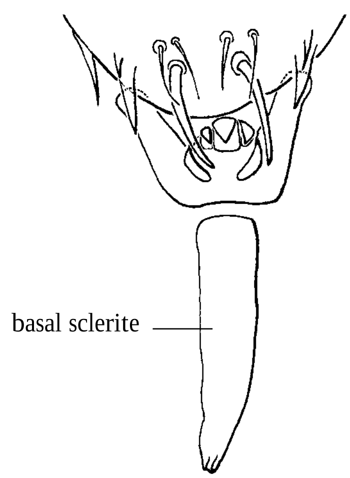
At least one unnamed species is known from mountainous western North Carolina. A pupal exuviae collected from a pool at Coweeta Hydrologic Lab is similar to that figured as "*Adactylocladius* sp." by Sæther (1969:fig. 28A). Other North Carolina material includes a larva with developing pupal characters that match it with the Coweeta pupal exuviae, and several unassociated larvae. I've also seen a larva from Oconee Co., SC, that appears to be a *Tokunagaia*, but the mentum is badly worn. I've also examined additional specimens of what might be two additional undescribed species from Ohio.

Tokunagaia larvae are found in moss or algal mats on stones in streams and can also be hygropetric. The central portion of the mentum is often badly worn or broken.

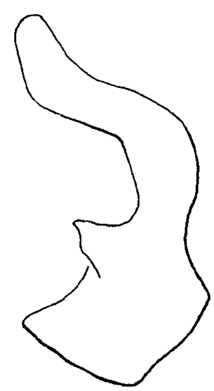
ADDITIONAL REFERENCES: Bode 1983; Halvorsen & Sæther 1973; Sæther 1969.



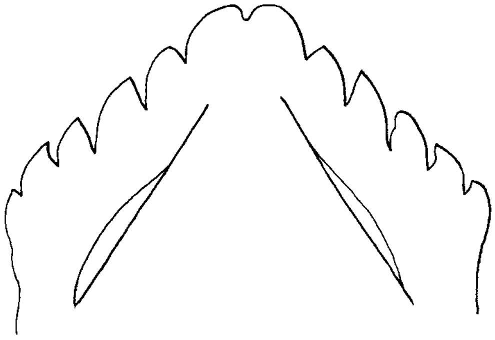
antenna



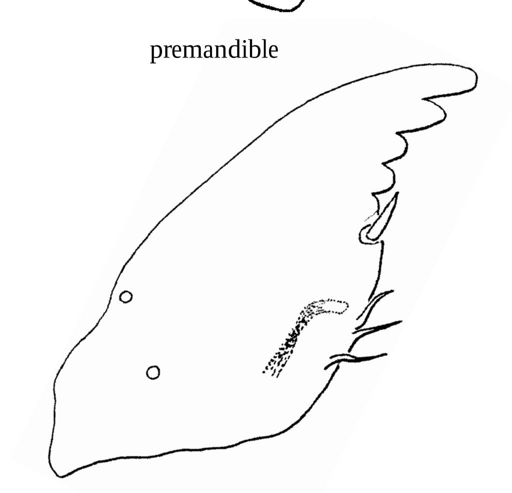
labrum and basal sclerite



premandible



mentum



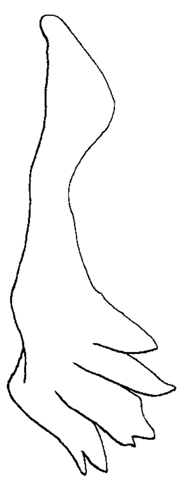
mandible

Genus *Trichochilus*

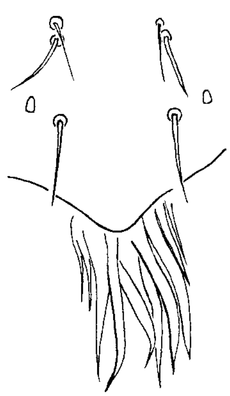
DIAGNOSIS: Distinguished by the simple S I; reduced antennae, apparently 3 segmented; premandible with multiple large apically serrated branches; ventromentum without teeth and extending below lateral plates of dorsomental teeth; mandible with long apical tooth and only a slight indication of inner teeth (a series of low serrations is apparent on most specimens), without seta subdentalis and seta interna; procerci developed, with anal setae; large, ovoid anal tubules that are larger than the posterior parapods; and by the apparently parasitic habit of the larvae within unionid mussels.

NOTES: The genus *Trichochilus* was established by Sæther (1985i) for a peculiar female originally described as *Trichocladius lacteipennis* Johannsen. Recent associated material from Pennsylvania (R. Jacobsen, pers. comm.) shows that the immature stages of *Trichochilus* live within unionid molluscs. In the collection at Florida A & M university, I found pupal specimens with associated larval exuviae misidentified as *Baeoctenus* (another taxon whose larvae live within unionid clams) that are identical to the Pennsylvania material. Unfortunately, these specimens bear only the data "27 March 1965, found ass'td with *E. buckleyi*" on their labels; it is unknown where the specimens were collected. *Trichochilus* larvae are similar to the specimens from Louisiana unionids briefly described by Roback (1979b) as "genus nr. *Phycoidella*", but lack the "comblike row of preapical setae" on the mandible. Roback noted that the Louisiana specimens were the same as larvae from New Brunswick mentioned in a paper by Gordon et al. (1978) and earlier by Sæther (1977b). Roback's specimens were presumed to be instar 1 larvae; it is possible that the row of setae on the mandible might not be present in later instars. Specimens from the locality Roback (1979b) cited could not be located in the collection at the Philadelphia Academy of Natural Sciences; however a single early instar larva from another site in Louisiana, collected from "between the demibranchs of *Lampsilis hydriana*", was found in the collection and examined. It has a mandible similar to that illustrated by Roback, but the specimen is not in good enough condition to determine if it is *Trichochilus*. The existence of *Trichochilus* in the Carolinas is a definite possibility.

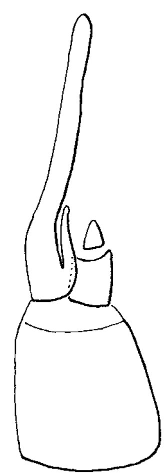
ADDITIONAL REFERENCES: Roback 1979b; Sæther 1985i.



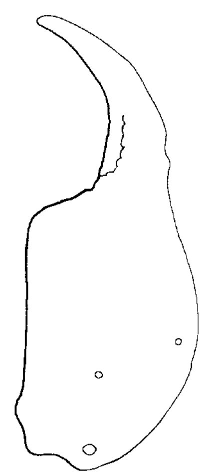
premandible



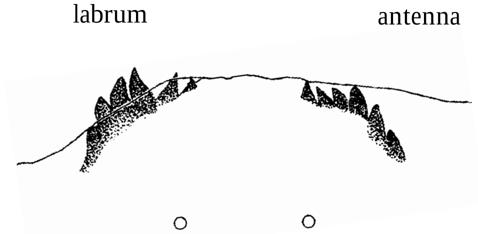
labrum



antenna



mandible



mentum

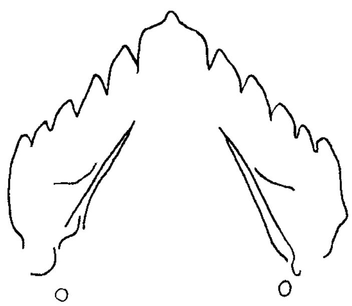
Genus *Tvetenia*

DIAGNOSIS: The coarsely toothed to plumose SI; mandible with 1-3 inner spines or serrations; seta interna divided to near base; narrow ventromental plates; lack of beard; and the long, strong body setae that are at least 1/2 the length of body segment that bears them will distinguish this genus.

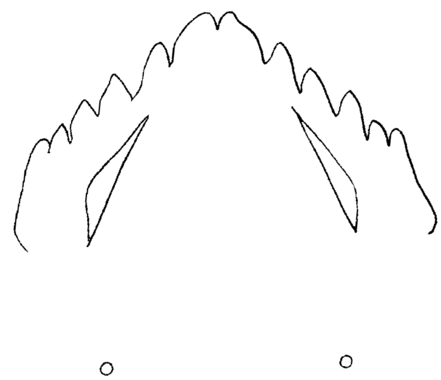
NOTES: At least four species are known from the Southeast; there may be as many as six. Species in the genus were formerly placed in *Eukiefferiella*; Sæther & Halvorsen (1981) transferred these species to *Tvetenia*. Note that some *Eukiefferiella* species may have long body setae and can be confused with *Tvetenia*; their simple S I setae and, in some cases dark brown head capsules, will separate them Many previous records of various *Tvetenia* species in the eastern US should be treated with skepticism.

Tvetenia larvae are found in running water; *T. vitracies* can be tolerant of high organic nutrient levels.

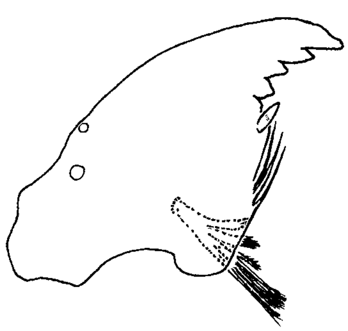
ADDITIONAL REFERENCES: Bode 1983; Mason 1985c; Sæther 1969; Sæther & Halvorsen 1981.



T. vitracies mentum



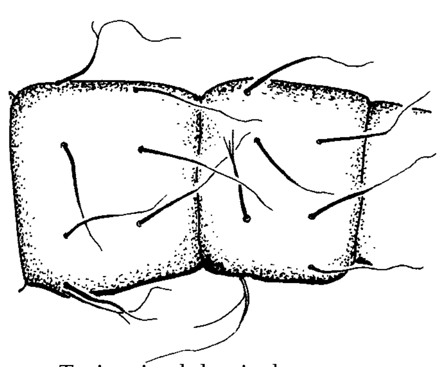
T. paucunca mentum



T. vitracies mandible

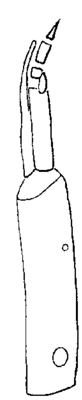
T. vitracies S I

T. sp. GA S I



T. vitracies abdominal segments

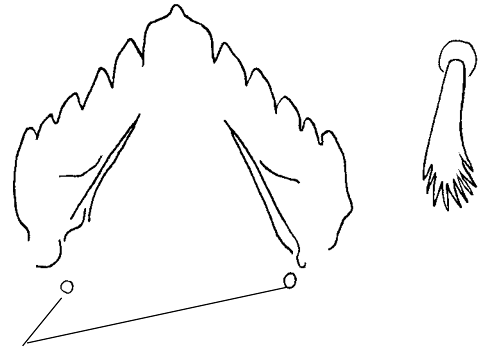
T. vitracies antenna



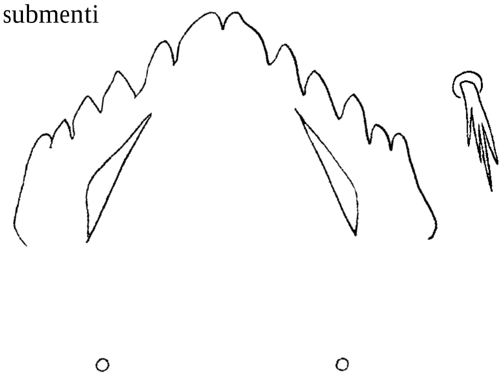
T. paucunca antenna

Key to *Tvetenia* larvae of the southeastern United States

1 Mentum with single median tooth; setae submenti placed close to mentum; S I plumose ...... ***T. vitracies***

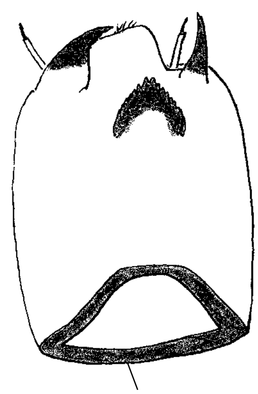


1’ Mentum with bifid median tooth; setae submenti placed more posteriorly; S I coarsely branched 2



2(1’) Postoccipital margin pale, about same color as rest of head capsule; basal segment of antenna 45-60 µm long 3

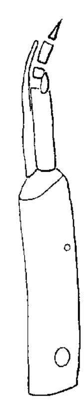
2’ Postoccipital margin much darker than rest of head capsule; basal segment of antenna > 65 µm 4



NOTE: 4th instar larvae are necessary for accurate measurements!!

3(2) 4th antennal segment about 2X as long as 3rd .... ***T. paucunca***

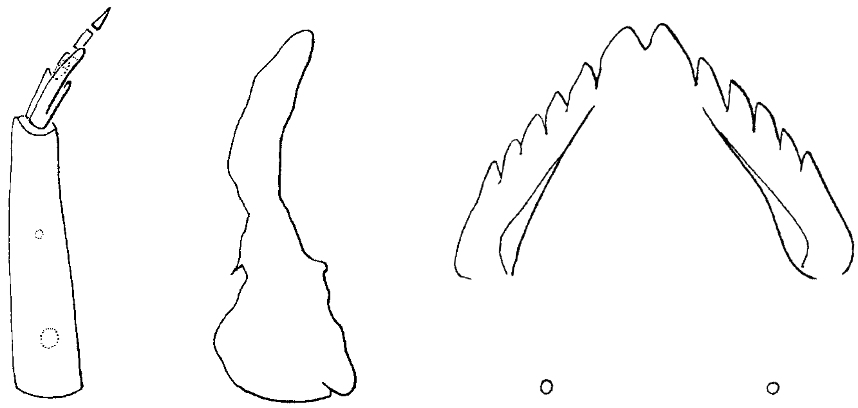
3’ 4th antennal segment about 4-6X as long as 3rd .... ***T. bavarica***
(see Notes on species)



T. paucunca antenna

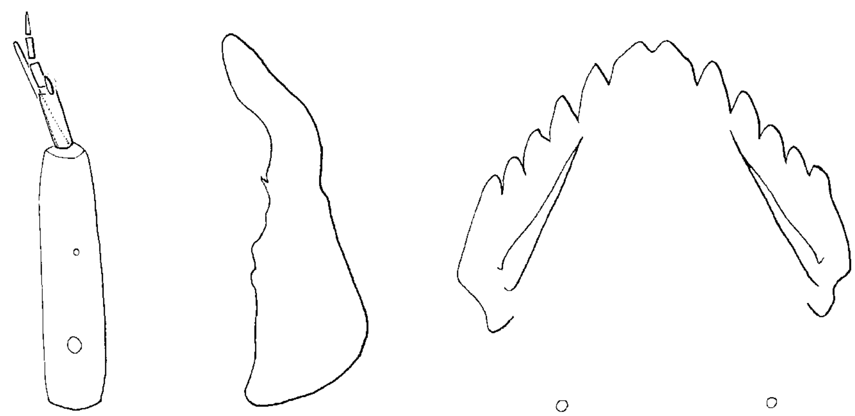
4(2') Basal antennal segment about 66-78 µm long; premandible apically notched; longest abdominal seta 200-225 µm long .... ***T.* sp. GA**

NOTE: 4th instar larvae are necessary for accurate measurements!!



4' Basal antennal segment about 83-96 µm long; premandible without apical notch; longest abdominal seta 260-340 µm long .... ***T.* sp. NC**

NOTE: 4th instar larvae are necessary for accurate measurements!!



Notes on species

T. bavarica - Recorded from the Carolinas by Hudson et al. (1990) and Caldwell et al. (1997), but I have not seen material of *T. bavarica* from the Southeast. All larvae I've examined that were previously identified as *T. bavarica* were assignable to *T. paucunca*. Following Schmid (1993), the 4th antennal segment of *T. bavarica* is 4-6X longer than the 3rd; in all material I examined the 4th antennal segment was about 2X as long as the 3rd. The pupa of *T. bavarica* is distinctive, bearing a band of tiny spines around the apex of the wing sheath rather than the more usual single row found in other members of the genus.

T. calvescens - Recorded for Georgia by Hudson et al. (1990) and Caldwell et al. (1997); all material I've seen identified as this taxon I've referred to *T. paucunca*; see below.

T. paucunca - Relatively common in the Carolinas; more common in the mountains and coastal plain regions. This species may be the same as the Palaearctic species *T. calvescens*; however, until more work is done I feel it is best to retain the name *paucunca* for this taxon. It is also possible that both are valid species and both may occur in the Nearctic; if so, all associated material (especially the pupal stage) I've examined would still be referable to *T. paucunca*. The reared material I examined was from Georgia and North Carolina and produced measurements lower than those given by Sæther (1969) for *T. paucunca* (as a *Eukiefferiella*); the first antennal segment of southeastern specimens ranged from 45-50 µm, mean 47, while Sæther's material was 54-60, mean 57; AR's of southeastern material ranged from 1.36-1.48, mean 1.43, while those of Sæther's material were 1.54-1.75, mean 1.64. Note that the median teeth can be worn to appear as a single broad tooth; the 3-4 branched S I setae, more posteriorly placed setae submenti and pale postocciput will help separate this species from *T. vitracies*, which has a more plumose S I and darkened postocciput. *Tvetenia paucunca* would belong with the "*T. bavarica* group" of Bode (1983) and is probably the species illustrated in his work.

T. *verralli* - I have not seen material of this species, recorded for North Carolina by Hudson et al. (1990) and Caldwell et al. (1997). It is not included in the key, but if it did occur here it would key to *T*. sp. GA (which it definitely is not) or *T*. sp. NC.

T. *vitracies* - This is the species referred to as "*T*. *discoloripes* group" by Bode (1983). It is common and widespread throughout the Southeast, occurring as far south as Florida. In the Carolinas, this species appears to be more common on the Coastal Plain than in the mountains, where *T. paucunca* is more common.

T. sp. GA - An undescribed species similar to the Palaearctic *T. duodenaria* Kieffer. Pupae are similar in that they lack the recurved hooklets on the posterior margins of the abdominal tergites; adult males are similar except they lack the seta-bearing "plate" on tergum IX. I've examined associated material from the northern portion of the Coastal Plain in southern Georgia (Crisp County).

T. sp. NC - A large species I've seen only as unassociated larvae from North Carolina. It may be undescribed or perhaps *T. discoloripes* or *T. verralli*, but associated material would be necessary for accurate identification.

Genus *Unniella*

DIAGNOSIS: Distinguished by the plumose S I; apically bifid premandible; 5 segmented antennae; mentum with median tooth lower than second lateral teeth, with first lateral tooth reduced and fused to the second; well developed ventromental plates which extend beyond the lateral margin of the mentum; and mandible with 4 inner teeth.

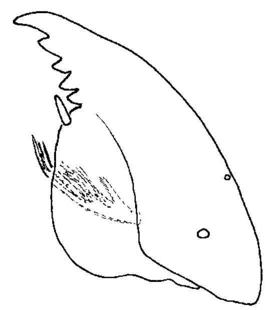
NOTES: One species, *U. multivirga*, is found in the southeastern United States. Larvae were called "*Trissocladius*" in Beck (1976, 1979). The antennae are apparently 5 segmented, but in many specimens it is difficult to distinguish the 4th and 5th segments; thus the antennae may appear 4 segmented.

Larvae occur in streams and rivers; *U. multivirga* can be abundant in streams from northern Florida to South Carolina in late Winter to early Spring.

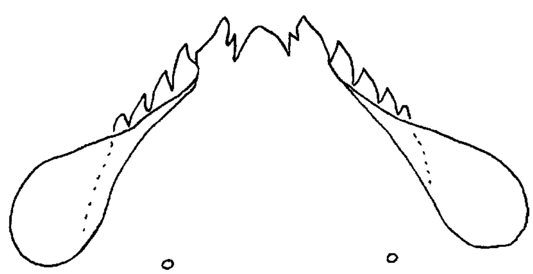
ADDITIONAL REFERENCES: Caldwell 1986.

antenna

premandible



mandible



mentum

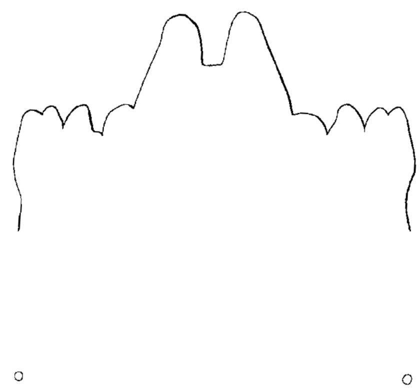
Genus *Xylotopus*

DIAGNOSIS: Distinguished by the heavily sclerotized, dark head capsule; distinctive mentum with 2 large, elongate median teeth; and the lateral fringe of setal tufts on the abdominal segments.

NOTES: One species, *X. par*, is known from North America. The species was formerly placed in *Brillia*.

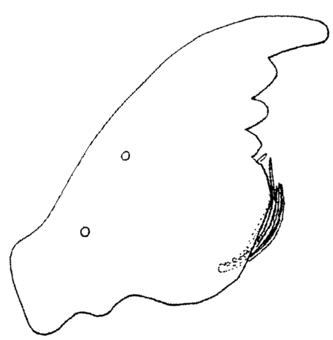
Larvae mine in submerged, partially decomposed wood.

ADDITIONAL REFERENCES: Oliver 1982; 1985.

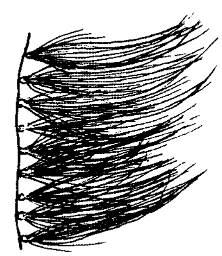


mentum

antenna



mandible



abdominal setal tufts

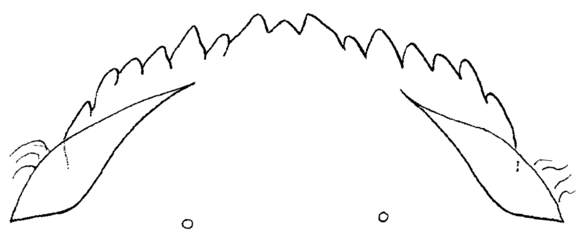
Genus *Zalutschia*

DIAGNOSIS: The plumose to coarsely pectinate S I; mentum with first lateral tooth reduced; well developed ventromental plates with weak beard; and mandible with 3 inner teeth distinguish this genus.

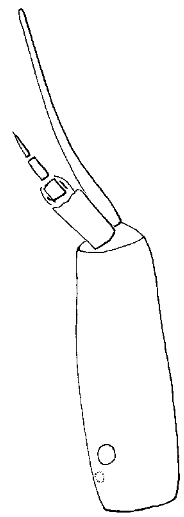
NOTES: At least three species, one undescribed, occur in the Southeast. All three taxa usually have a mentum with the median and first lateral teeth lighter in color than the remaining lateral teeth, and the three inner teeth of the mandible are usually darker than the apical tooth.

Larvae are found in lakes, streams and rivers.

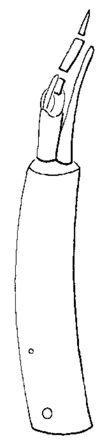
ADDITIONAL REFERENCES: Dowling & Murray 1980; Sæther 1976; Soponis 1979.



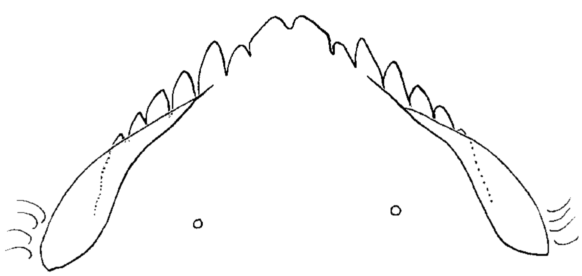
Z. cf. *zalutschicola* mentum



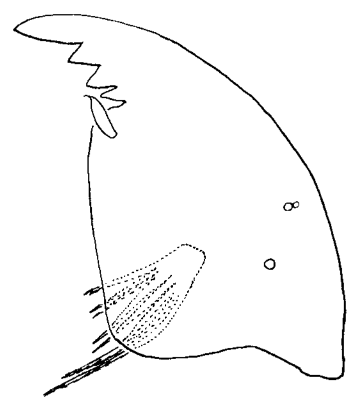
Z. cf. *zalutschicola* antenna



Z. sp. A antenna

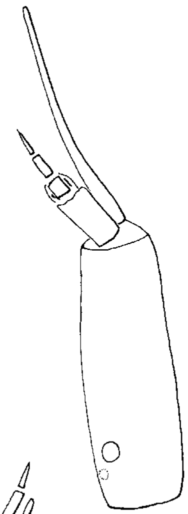


Z. sp. A mentum

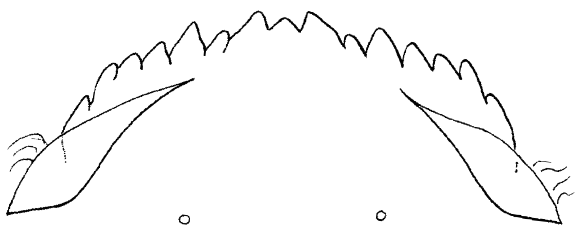


Z. sp. A mandible

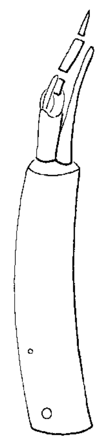
Key to *Zalutschia* larvae of the southeastern United States



1 Mentum with 2-4 median teeth and reduced 6th lateral tooth; antennal blade much longer than flagellum .... ***Z.* cf. *zalutschicola***

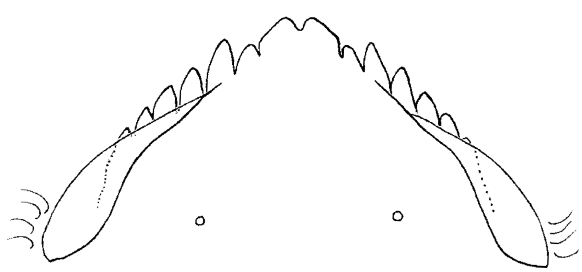


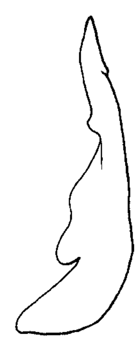
center of mentum with 4 median teeth



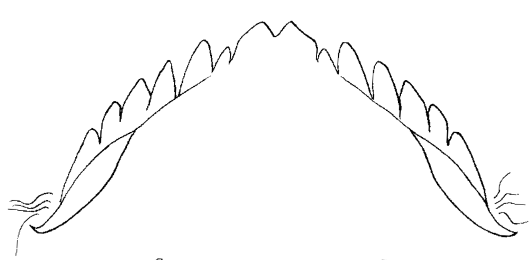
1’ Mentum with 2 median teeth (figures below); antennal blade subequal to or shorter than flagellum 2

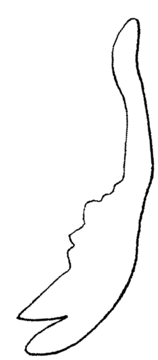
2(1’) Premandible simple .... ***Z.* sp. A**





2’ Premandible apically bifid .... ***Z. briani***





Notes on species

Z. briani - Originally described from northern Florida. Although Hudson et al. (1990) and Caldwell et al. (1997) record this species from North and South Carolina, I've seen only one larva from South Carolina that appears to be this species. Soponis (1979) found *Z. briani* larvae on aquatic vegetation in lakes. *Zalutschia obsepta* (Webb), described from Ontario and also known from Quebec, will key to *Z. briani* in the key above. Following the description of Sæther (1976), *Z. obsepta* lacks pectinate lamellae on the maxilla which are present in *Z. briani*.

Z. cf. *zalutschicola* - Larvae of this taxon appear very similar to those of *Z. zalutschicola* Lipina, and adult males (from Georgia) are similar in having ocelli and similar genitalia. However, based on associated material from Georgia, the pupa differs from those described for *Z. zalutschicola*: the frontal setae are shorter (<200 µm), the thoracic horn has only a small apical extension, not the long tooth of typical *zalutschicola*, and tergite VI has four taeniate setae, not the single one as described for *zalutschicola* by Sæther (1976: 190, 215). More Nearctic and Palaearctic material must be examined to determine the variability of *Z. zalutschicola*, and to ascertain if this taxon represents an undescribed species.

Z. sp. A - An undescribed species that appears to be widespread throughout the Southeast; I have reared it from northern Florida and B.A. Caldwell has reared it from Georgia. I've also examined unassociated larvae from North and South Carolina. Note that this species is not the same as the *Z.* sp. A of Sæther (1976). Larvae do not fit the diagnosis in Sæther (1976) and Cranston et al. (1983) in that they have a simple premandible. The adult has a gonostylus similar to that of *Z. humphriesiae* Dowling & Murray from Ireland (Dowling & Murray 1980), but the immature stages differ.

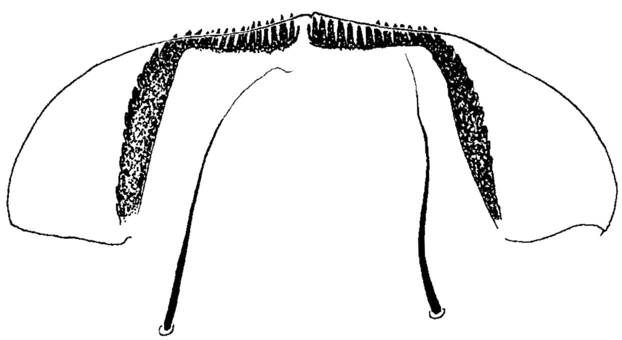
Orthocladiinae species C

DIAGNOSIS: Distinguished by the "mop-like" S I; premandible with simple apex; mandible with small inner teeth, inflated base and no seta interna; partially weakly sclerotized antennal flagellar segments; and distinctive mentum with large ventromental plates covering most of the mental teeth.

NOTES: Briefly described by Sæther (1982), the adult of this taxon remains unknown. I have examined associated pupae, but they are in poor condition, resembling *Acamptocladius* and *Parakiefferiella* pupae.

Larvae are found in sand-bottomed streams and rivers.

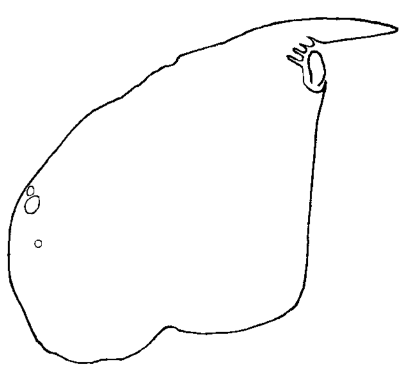
ADDITIONAL REFERENCES: Sæther 1982.



mentum

premandible

S I



mandible

antenna

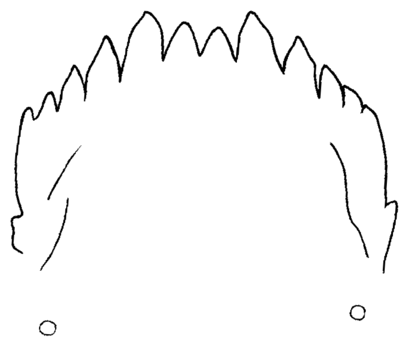
Orthocladiinae genus E

DIAGNOSIS: The coarsely plumose S I; mentum with 4 median teeth; reduced ventromental plates and lack of beard; pecten epipharyngis with more than 12 teeth; well developed posterior parapods with well developed claws; and the presence of procerci and anal tubules distinguish this taxon.

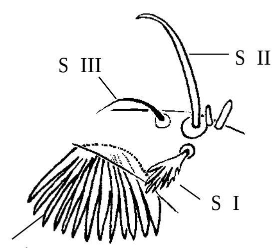
NOTES: I have only seen this taxon from northern Florida; most specimens have come from hardwood forest litter run through a Berlese funnel, indicating that the larva is terrestrial. I have also seen one specimen from the Santa Fe River in northern Florida, where it was probably washed in. Although not known from the Carolinas, in general most chironomid taxa found in northern Florida should also occur at least on the Coastal Plain in the Carolinas.

The multi-toothed pecten epipharyngis is distinctive. Another at least partially terrestrial orthoclad, *Antillocladius*, also has a multi-toothed pecten epipharyngis but lacks procerci and anal tubules, which are present in Orthocladiinae genus E.

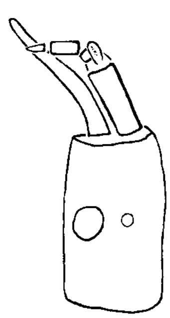
ADDITIONAL REFERENCES: None.



mentum



labrum



antenna

mandible

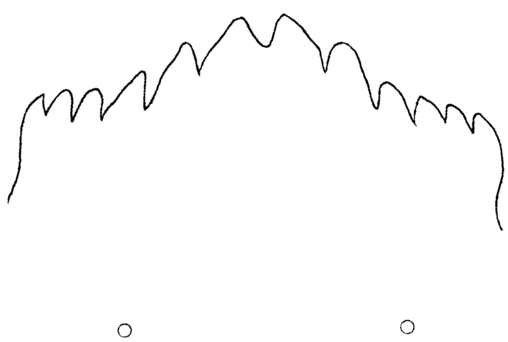
Orthocladiinae genus H

DIAGNOSIS: Distinguished by the plumose S I, with other S setae simple; lack of labral lamellae; antenna 5 segmented, with blade longer than flagellum; apically bifid premandible, without brush; mandible with 4 inner teeth; maxilla without pecten galearis; abdominal setae relatively short, less than half as long as segment bearing them; weakly developed procerci; and well developed supraanal setae.

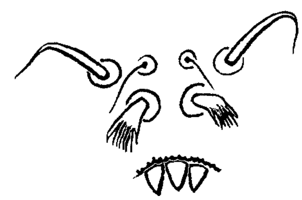
NOTES: Not known from the Carolinas; known only from bromeliad phytotelmata (plant-held water) in southern Florida.

Larvae of this taxon, collected from the arboreal bromeliad *Tillandsia*, were treated as *Metriocnemus* sp. B by Epler (1995: 6.52-6.54). I have recently reared larvae of this species from phytotelmata in terrestrial bromeliads near Lorida, FL; pupae indicate that establishment of a new genus is necessary. The taxon shows similarities to *Compterosmittia*, *Limnophyes*, *Paralimnophyes* and *Thienemannia*. Only female pupae and adults were obtained by rearing, indicating that perhaps this species is parthenogenetic.

ADDITIONAL REFERENCES: None.

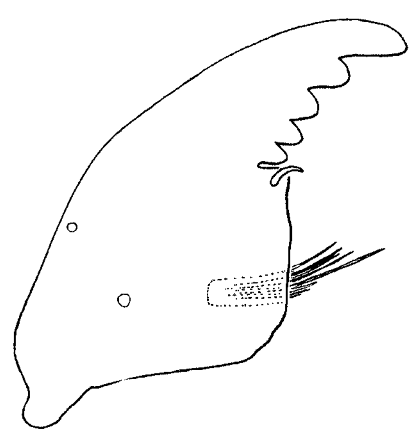


mentum



S setae and pecten epipharyngis

antenna



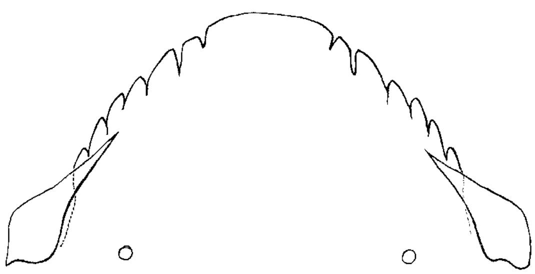
mandible

Orthocladiinae genus I

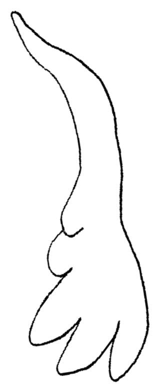
DIAGNOSIS: Distinguished by the apparently plumose SI; antenna with 6 segments, 6th segment hairlike; premandible with 3 large apical teeth, brush absent; maxilla apparently without a pecten galearis; well developed ventromental plates, without a beard; mandible with inflated apical tooth and long seta subdentalis; and normal procerci.

NOTES: This taxon is known from a single larval specimen from North Carolina. Unfortunately, some structures, such as the S I and pecten epipharyngis, are obscured, but the structures that are visible indicate that this specimen can not be placed in any known genus. The mandible, with its inflated apical tooth and long seta subdentalis, is similar to that of *Heterotrissocladius* sp. C of Sæther (1975a). However, the premandible lacks a brush (present in *H*. sp. C) and the antennae are entirely different. The larva is also somewhat similar to *Oliveridia*, but apparently lacks a pecten galearis and the mandible and premandible are different. Reared material will be necessary to elucidate this taxon's true identity.

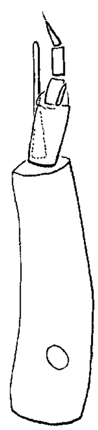
ADDITIONAL REFERENCES: None.



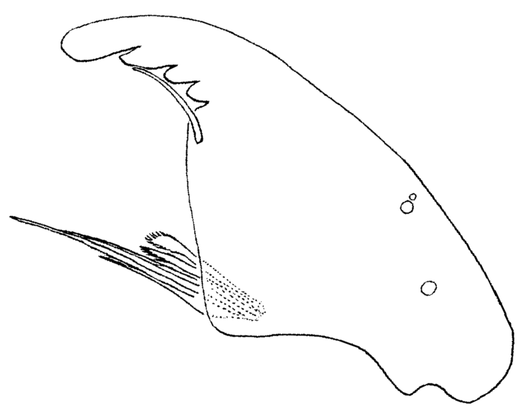
mentum



premandible



antenna



mandible

SUBFAMILY
CHIRONOMINAE 8

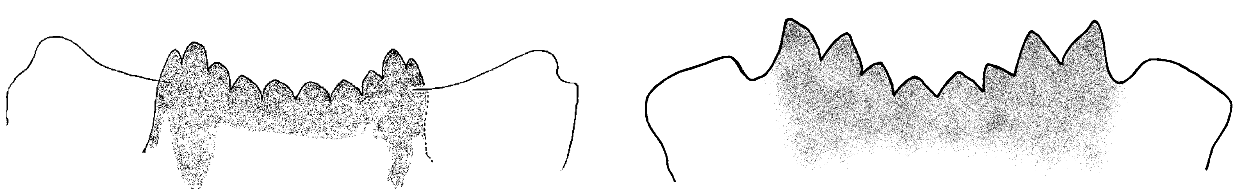
DIAGNOSIS: Antennae 4-8 segmented, rarely reduced. **Labrum** with S I simple, palmate or plumose; S II simple, apically fringed or plumose; S III simple; S IV normal or sometimes on pedicel. Labral lamellae usually well developed, but reduced or absent in some taxa. **Mentum** usually with 8-16 well sclerotized teeth; sometimes central teeth or entire mentum pale or poorly sclerotized; rarely teeth fewer than 8 or modified as seta-like projections. Ventromental plates well developed and usually striate, but striae reduced or vestigial in some taxa; beard absent. **Prementum** without dense brushes of setae. **Body** usually with anterior and posterior parapods and procerci well developed; setal fringe not present, but sometimes with bifurcate pectinate setae. Penultimate segment sometimes with 1-2 pairs of ventral tubules; antepenultimate segment sometimes with lateral tubules. Anal tubules usually present, reduced in brackish water and marine taxa.

NOTES: Usually the most abundant subfamily (in terms of individuals and taxa) found on the Coastal Plain of the Southeast. Found in fresh, brackish and salt water (at least one truly marine genus). Most larvae build silken tubes in or on substrate; some mine in plants, dead wood or sediments; some are free-living; some build transportable cases. Many larvae feed by spinning silk catch-nets, allowing them to fill with detritus, etc., and then ingesting the net; some taxa are grazers; some are predacious. Larvae of several taxa (especially *Chironomus*) have haemoglobin that gives them a red color and the ability to live in low oxygen conditions.

With only one exception (*Skutzia*), at the generic level the larvae of all described (as adults) southeastern Chironominae are known. There are several unplaceable larvae whose adult stages are unknown; these taxa are placed at the end of this chapter.

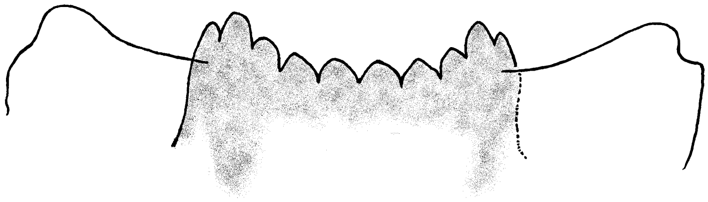
Key to the genera of larval Chironominae of the southeastern United States
(larva unknown for *Skutzia*)

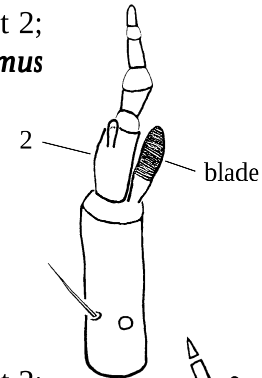
1 Ventromental plates fused to maxillae and without well defined striae so that the plates are inconspicuous; mentum concave; larvae mining in dead submerged wood and/or submerged leaves; may be common in Hester-Dendy samplers contructed of plant materials 2



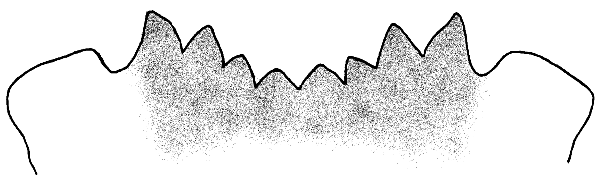
1’ Ventromental plates well developed, usually with numerous striae; mentum variable; larvae in a variety of habitats (that may include mining in leaves, plant stems or dead submerged wood) .. 3

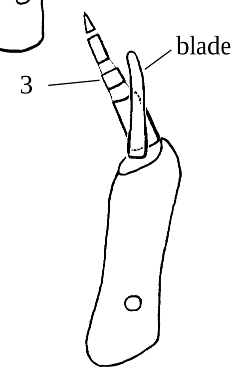
2(1) Mentum with 10-12 teeth; antennal blade extends to apex of segment 2; anal tubules with 0-2 constrictions .... ***Stenochironomus***



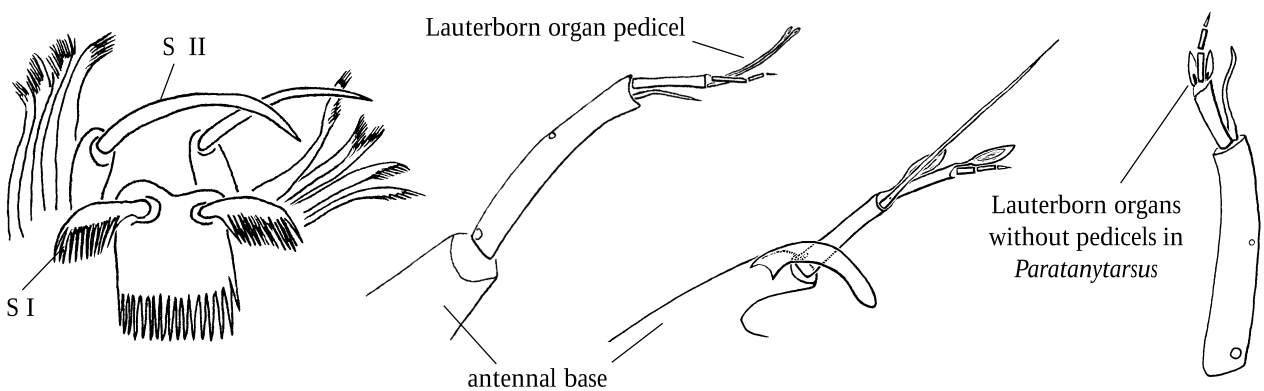


2’ Mentum with 8-10 teeth; antennal blade extends past apex of segment 2; anal tubules with 4-5 constrictions .... ***Xestochironomus***



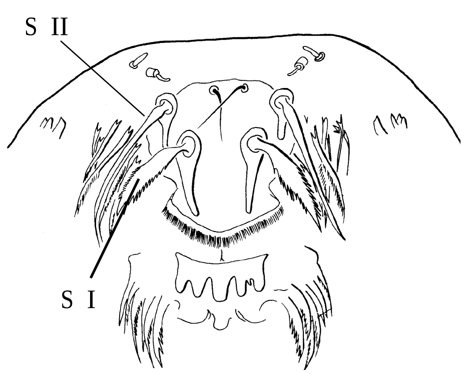


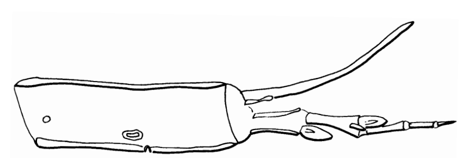
3(1’) Bases of S I fused; S II on elongate pedestal; antennae with 5 segments, mounted on distinct elongate base (base squat in one marine genus, *Pontomyia*); Lauterborn organs usually well developed and often mounted on short to long pedicels .... Tribe Tanytarsini 4



(antennal base not shown)

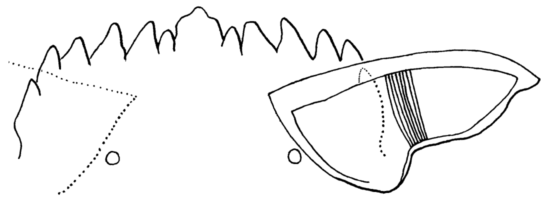
3’ Bases of S I usually separate and S II usually not on pedestal (if S I fused and/or S II on pedestal, then antennae with 6 segments and alternate Lauterborn organs at apices of segments 2 and 3); antennae with 4-8 segments, Lauterborn organs not on long pedicels 19

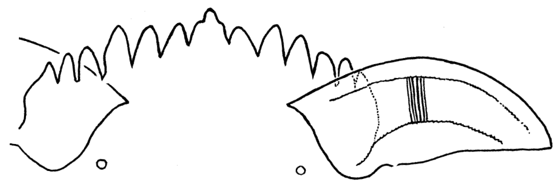




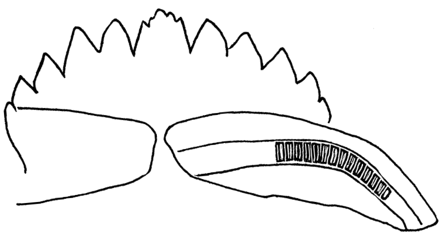
6 segmented antenna with alternate
Lauterborn organs on segments 2 and 3

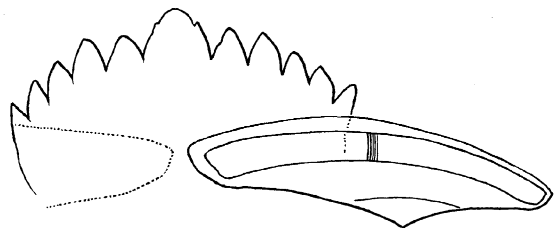
4(3) Ventromental plates squat, separated by at least the width of the 3 median teeth; larvae in transportable cases 5



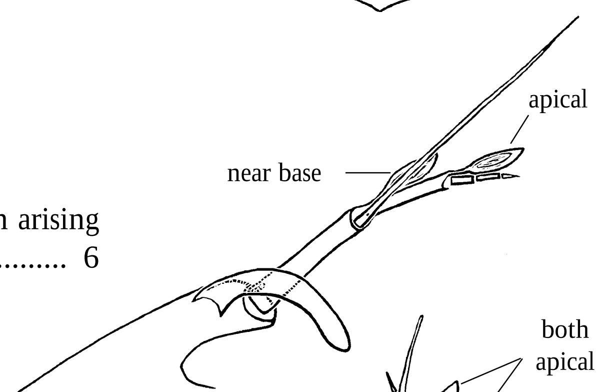


4' Ventromental plates wide, touching or almost touching medially; if larvae in cases, the cases are not transportable 10

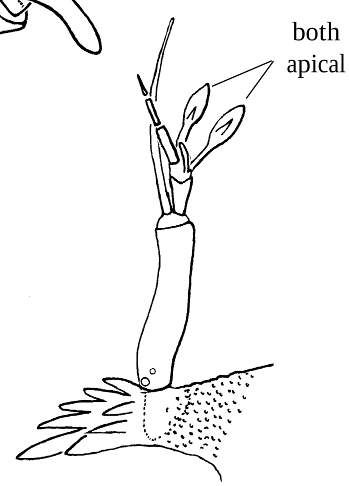




5(4) Antennal segment 2 with one Lauterborn organ arising apically, the other near the base 6

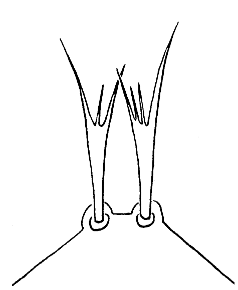


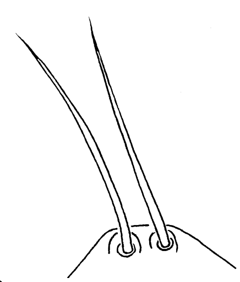
5' Antennal segment 2 with both Lauterborn organs arising apically 8



6(5) Clypeal (S 3) setae apically divided .... ***Stempellinella*** (in part)

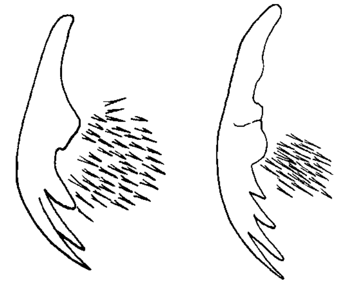
6' Clypeal setae simple 7





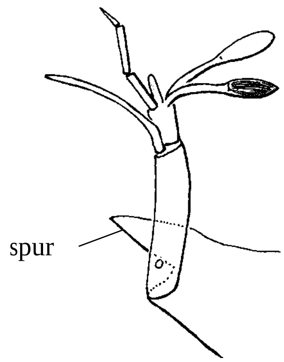
7(6') Premandible with 3 apical teeth .... ***Stempellinella*** (in part)

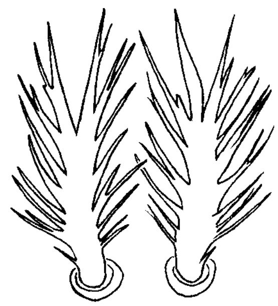
7' Premandible with 4 apical teeth .... ***Zavrelia***

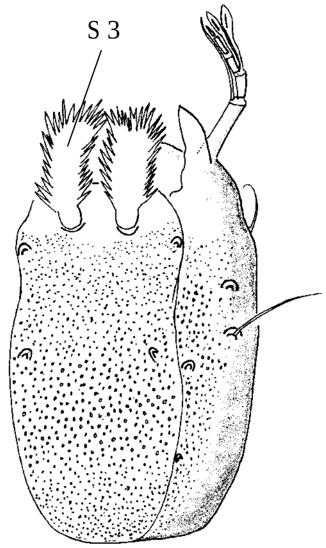


Stempellinella *Zavrelia*

8(5') Antennal base with apical spur only; clypeal (S 3) setae with numerous branches .... ***Constempellina***

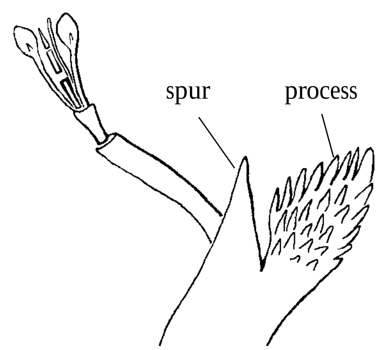




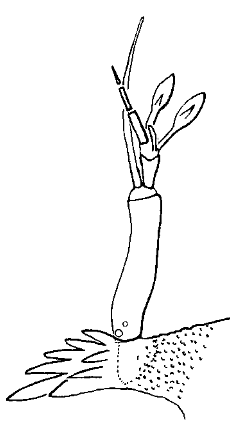


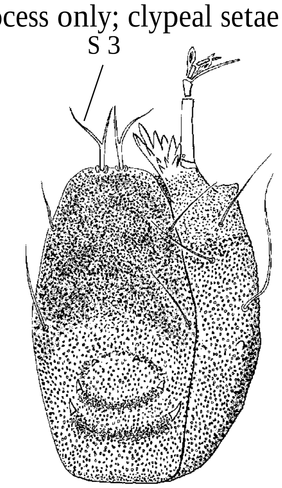
8' Antennal base with multispined process; clypeal setae simple or apically bifid (figures below) .. 9

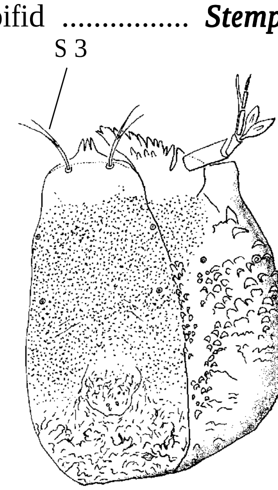
9(8') Antennal base with spur and multispined process; clypeal setae simple .... ***Neostempellina***



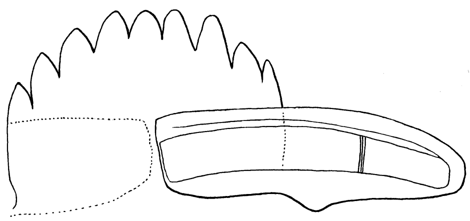
9' Antennal base with multispined process only; clypeal setae apically bifid .... ***Stempellina***



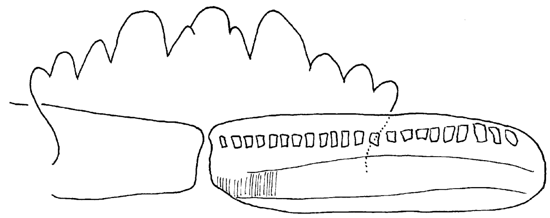




10(4') Mentum with 4 pairs of lateral teeth (some *Neozavrelia* may have a minute 5th pair) 11

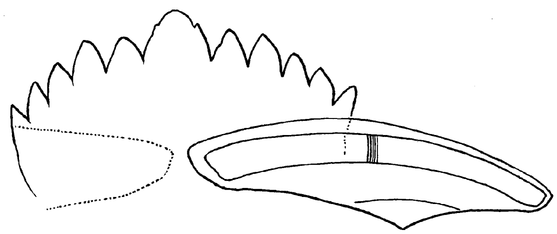


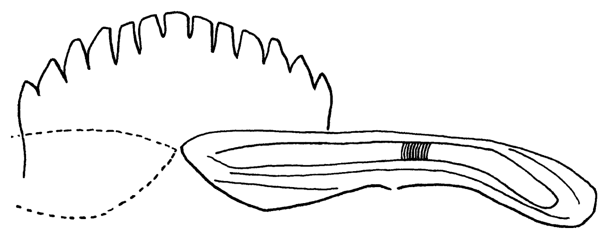
Neozavrelia



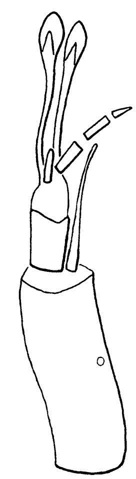
Pontomyia

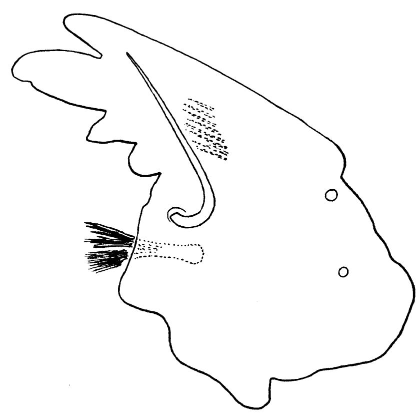
10' Mentum with 5 (or apparently more) pairs of lateral teeth 13



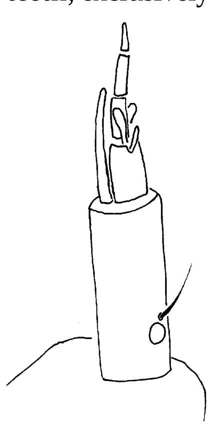


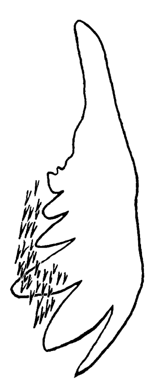
11(10) Antennae with Lauterborn organs on moderately long pedicels; premandible apically bifid; mandible with 2 inner teeth; found in freshwater .... ***Neozavrelia***

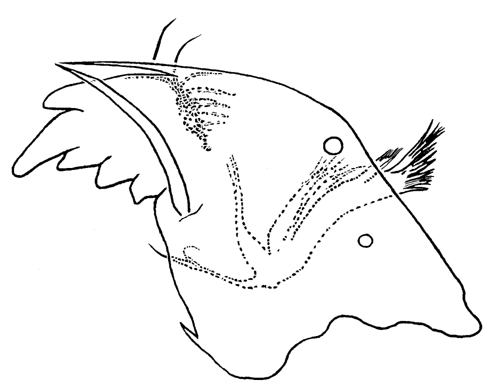




11' Antennae with sessile Lauterborn organs; premandible with numerous apical teeth; mandible with 3 inner teeth; exclusively marine, in the Southeast known only from Florida .... ***Pontomyia***

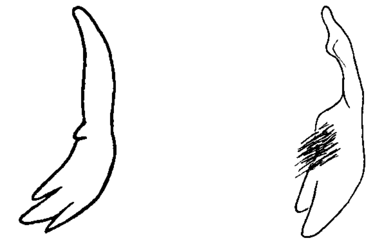






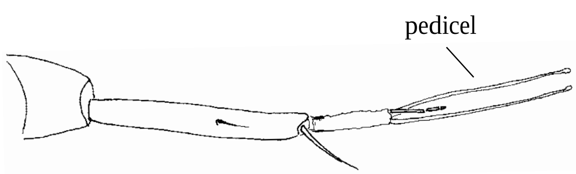
13(10') Premandible with 3 or more apical teeth 14

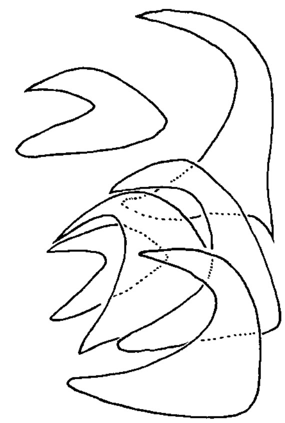
13' Premandible apically bifid 16



3 or more apical teeth | apically bifid

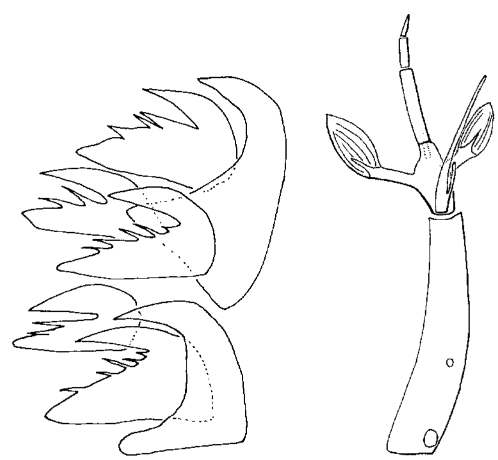
14(13) Claws of posterior parapods simple; pedicels of Lauterborn organs usually long .... ***Tanytarsus***



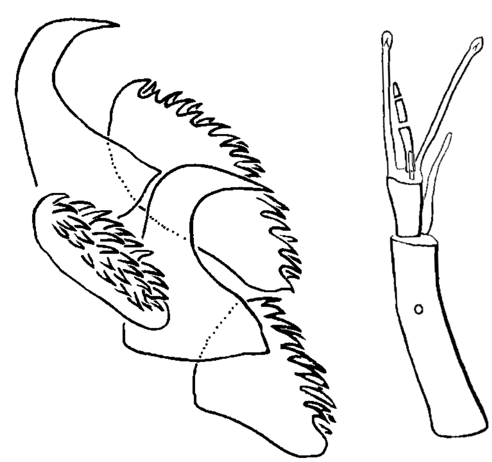


14' Claws of posterior parapods with one or more claws pectinate or with inner spines (figures below); pedicels of Lauterborn organs long or short 15

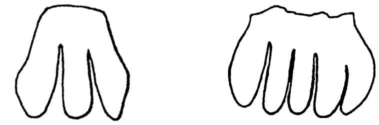
15(14') Some claws of posterior parapods with single row of inner teeth; pedicels of Lauterborn organs usually short (moderately long in one species); common .... ***Cladotanytarsus***



15' Some claws of posterior parapods with multiple rows of inner teeth; pedicels of Lauterborn organs long; rare .... ***Virgatanytarsus***

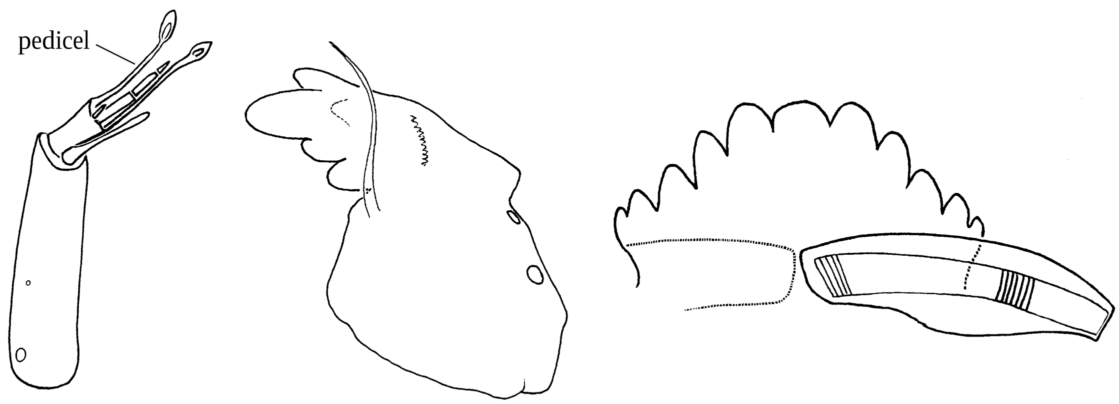


16(13’) Pecten epipharyngis a 3-5 lobed plate 17

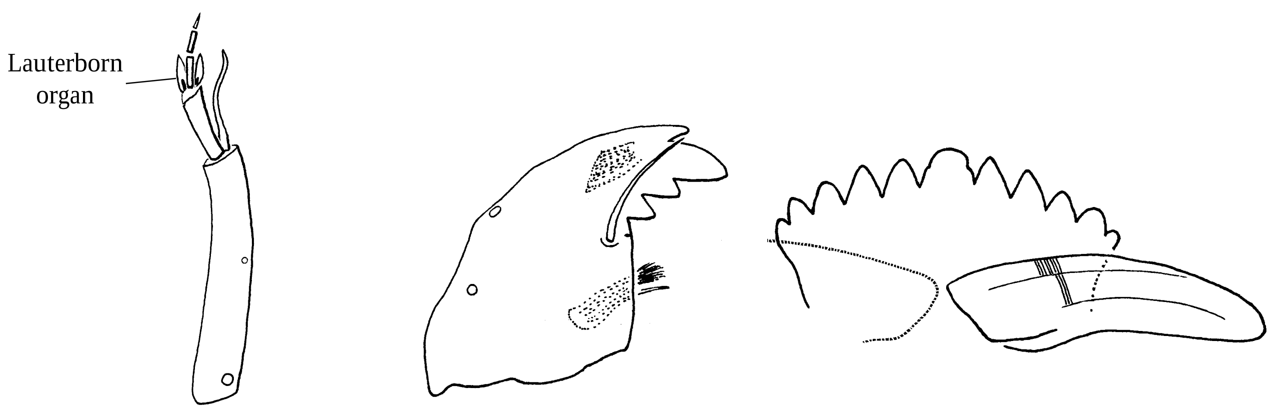


16’ Pecten epipharyngis a single multitoothed comb or of 3 platelets with numerous apical teeth 18

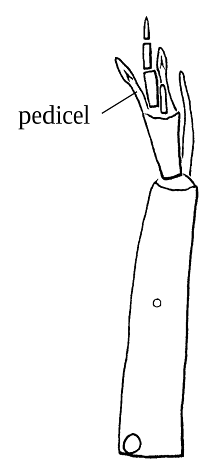
17(16) Lauterborn organs on pedicels that extend to or beyond antennal apex; mandible with pronounced outer hump; 3 central teeth of mentum usually projecting strongly above lateral teeth .... ***Sublettea***

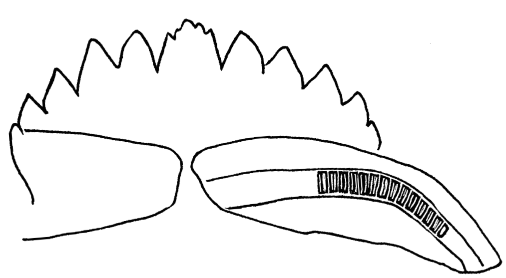


17’ Lauterborn organs sessile or on very short pedicels; mandible without pronounced outer hump; 3 central teeth of mentum not projecting as above .... ***Paratanytarsus***

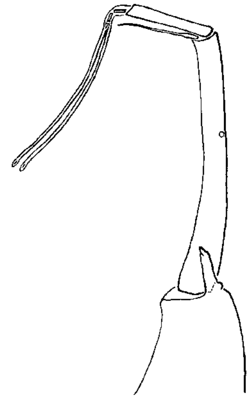


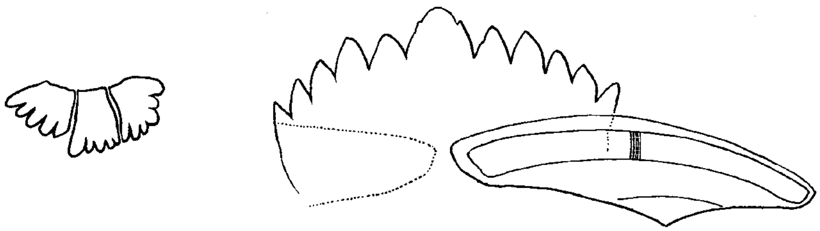
18(16’) Lauterborn organs on short pedicels that are shorter than or subequal to length of flagellum; pecten epipharyngis a single multitoothed comb; ventromental plates with striae often appearing block-like .... ***Rheotanytarsus***



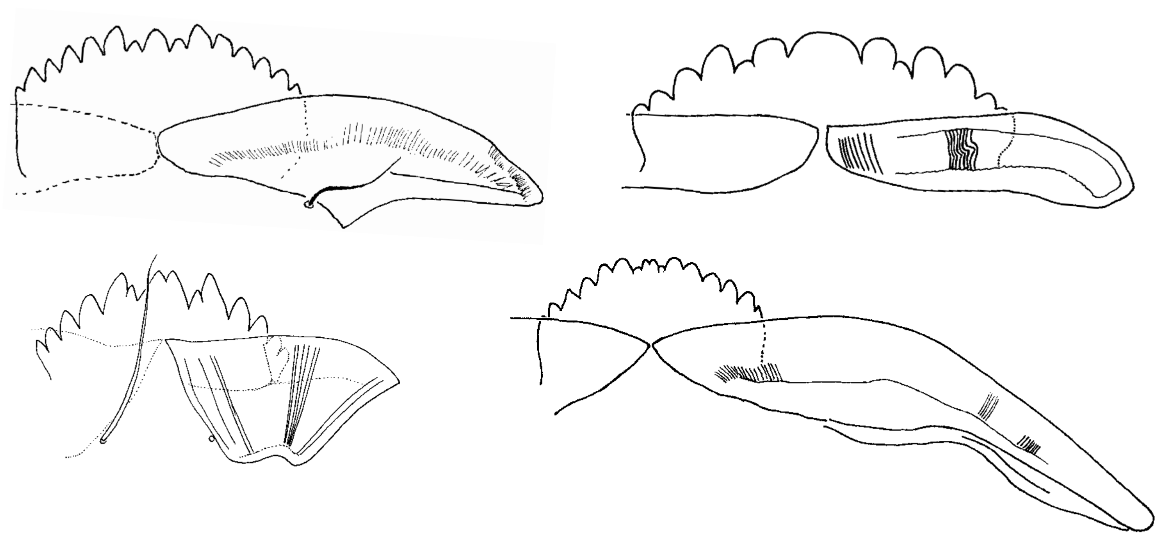


18’ Lauterborn organs on long pedicels that extend beyond flagellum; pecten epipharyngis 3 multi-toothed platelets; ventromental plates with striae not appearing block-like .... ***Micropsectra***

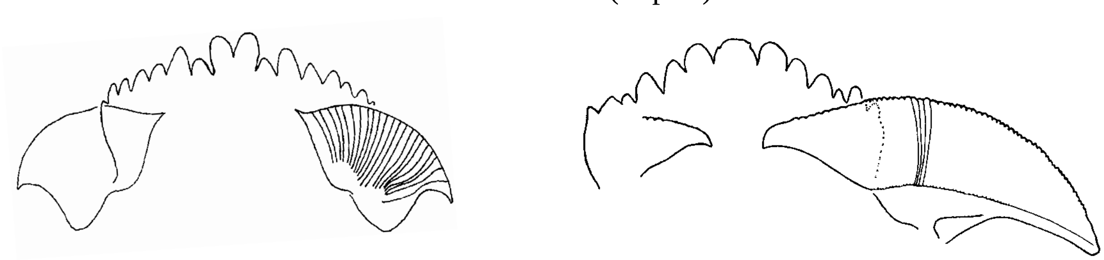




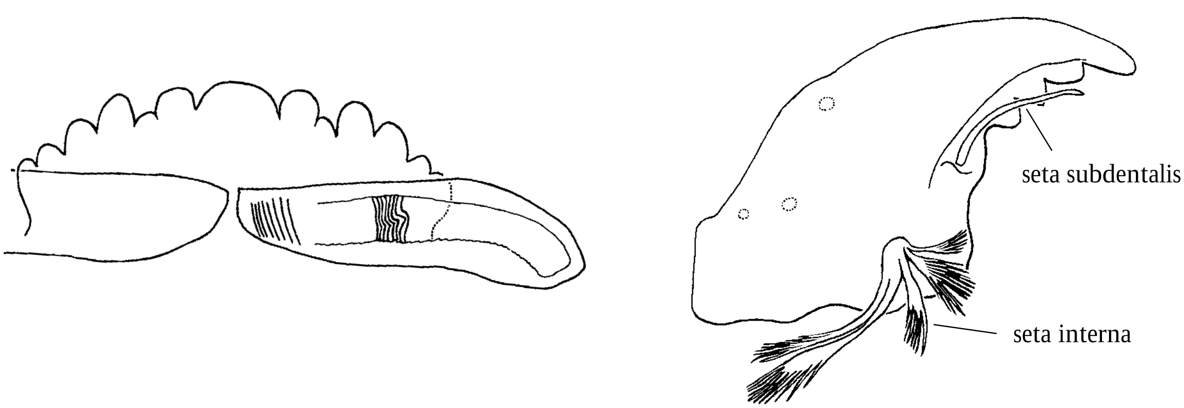
19(3’) Ventromental plates touching or almost touching medially 20



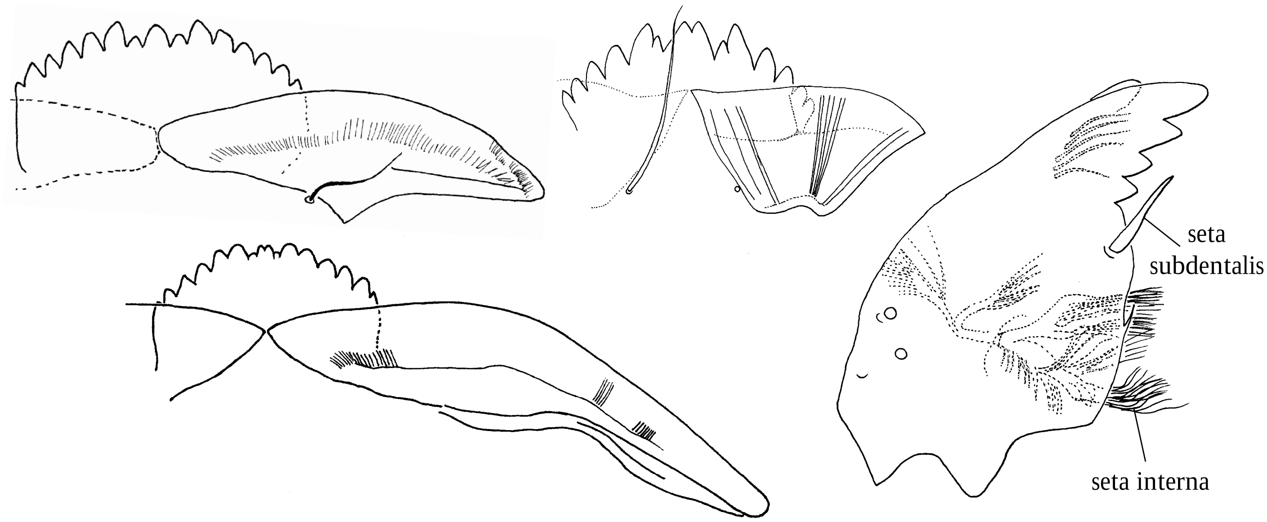
19’ Ventromental plates separated medially by at least the width of the median tooth/teeth of the mentum .... Tribe Chironomini (in part) 27



20(19) Ventromental plates bar-like; seta subdentalis dorsal, on same side of mandible as seta interna .... Tribe Pseudochironomini 21

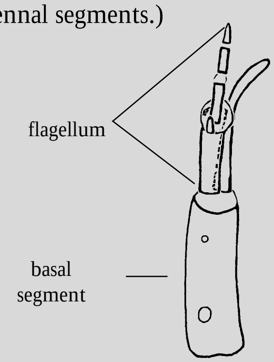


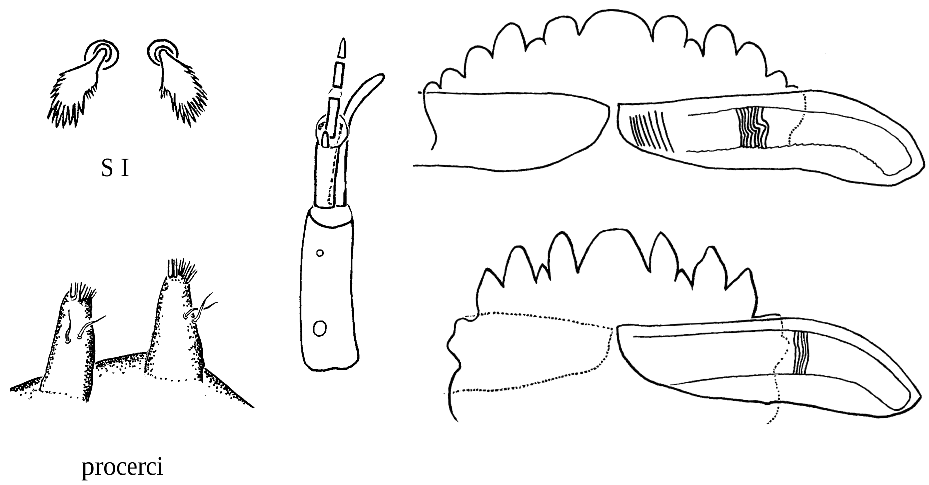
20’ Ventromental plates crescent- or wedge-shaped or extremely broad; seta subdentalis ventral, on opposite side of mandible from seta interna (seta interna may be absent) .... Tribe Chironomini (in part) 22



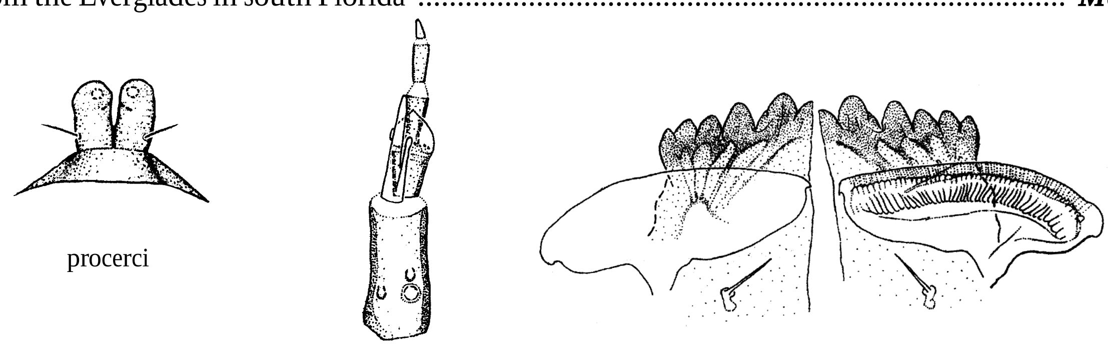
21(20) Procerci arising from separate bases; basal segment of antenna longer, AR about or more than 1.0; mentum with 2nd lateral tooth small, sometimes partially fused to 1st lateral tooth; S I arising from separate bases; common and widespread .... ***Pseudochironomus***

AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

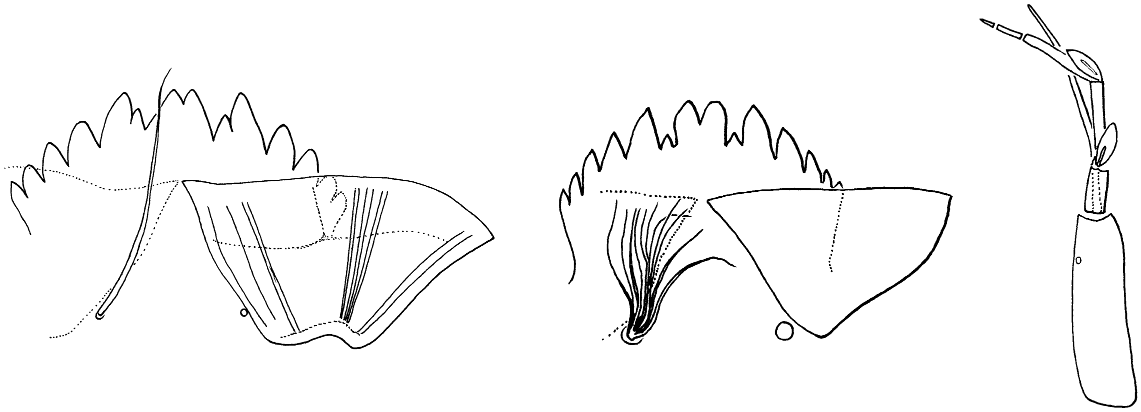




21’ Procerci fused at base; basal segment of antenna shorter, AR < 1.0; mentum with 2nd lateral tooth minute and fused to 1st lateral tooth; S I setae arising from a common base; in the US known only from the Everglades in south Florida .... ***Manoa***

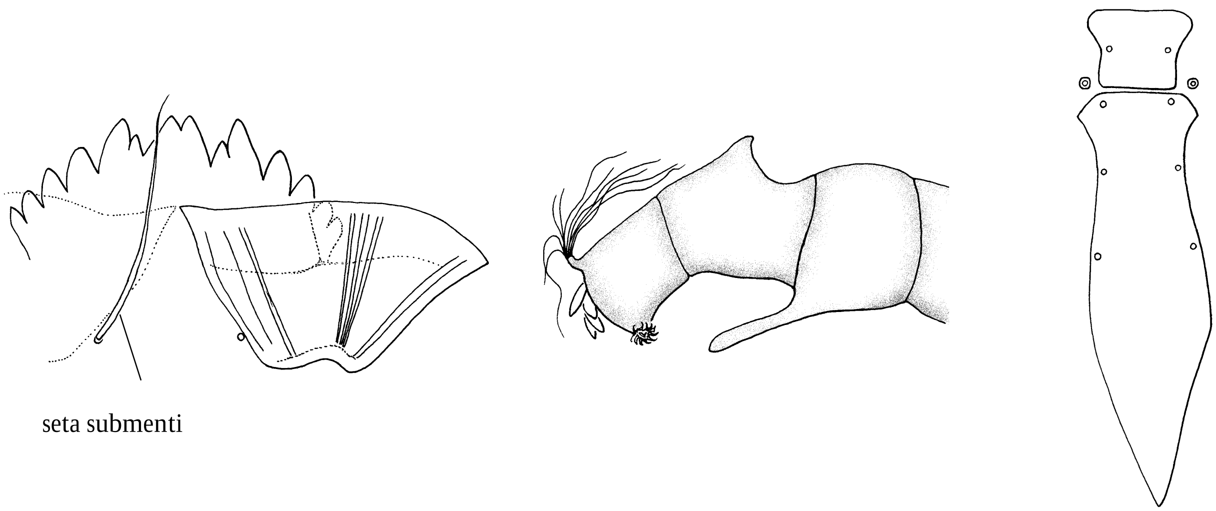


22(20') Ventromental plates wedge-shaped; antennae 6 segmented with alternate Lauterborn organs at apices of segments 2 and 3; larvae in transportable silken cases 23

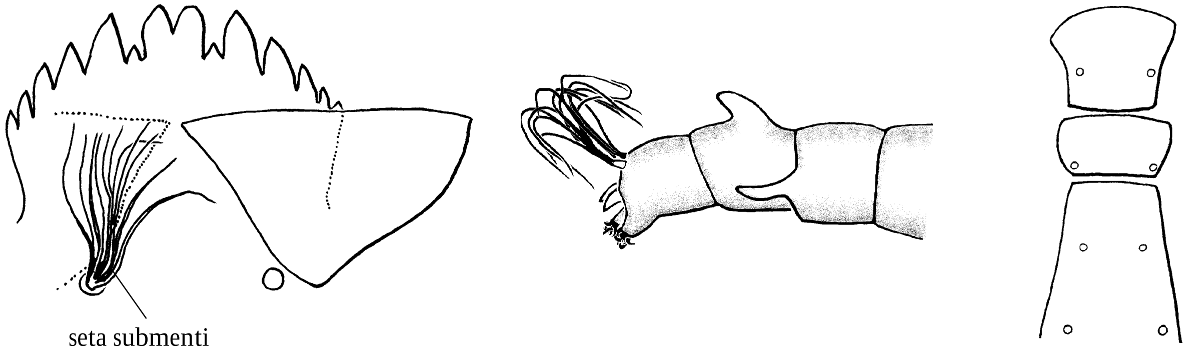


22' Ventromental plates wider; antennae 5 segmented, Lauterborn organs at apex of sgement 2 only; larvae not in transportable silken cases 24

23(22) Setae submenti simple; frontoclypeal apotome present, with one medial labral sclerite anterior to it; anteriorly directed hump on body segment 11 .... ***Zavreliella***

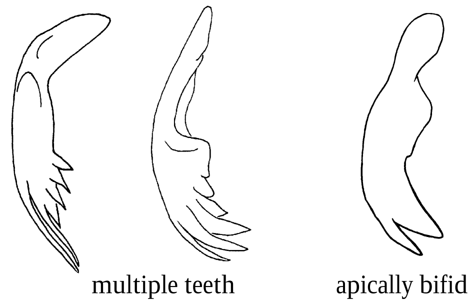


23' Setae submenti plumose; frontal apotome present, with 2 medial labral sclerites anterior to it; posteriorly directed hump on body segment 11 .... ***Lauterborniella***

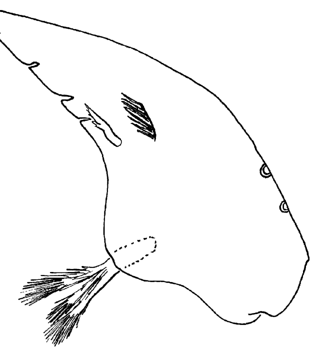


24(22') Premandibles with 3 or more apical/subapical teeth 25

24' Premandibles apically bifid 27

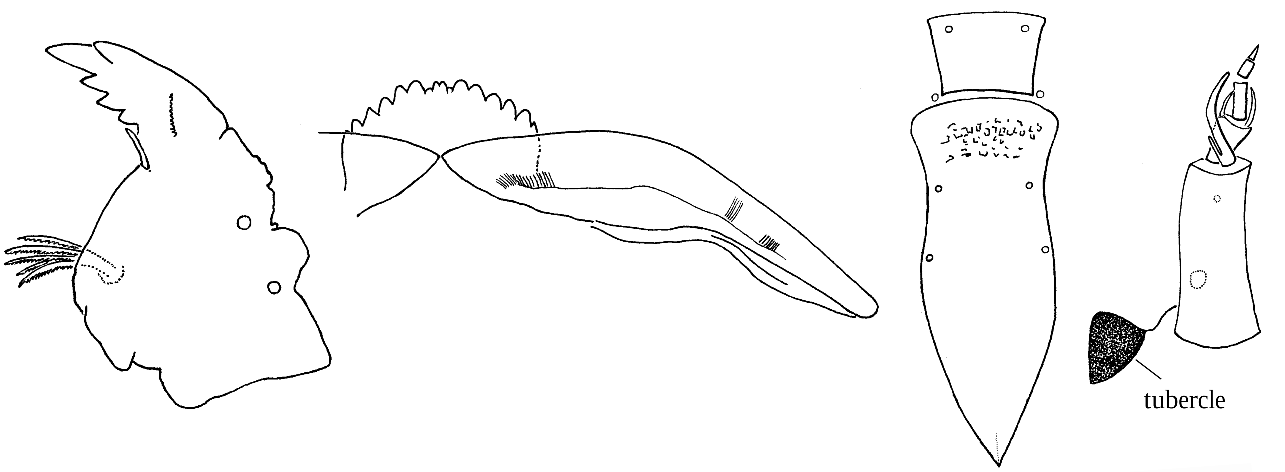


25(24) Mandible without dorsal tooth; inner teeth of mandible flattened (sometimes worn so that it appears no inner teeth are present) .... ***Axarus***

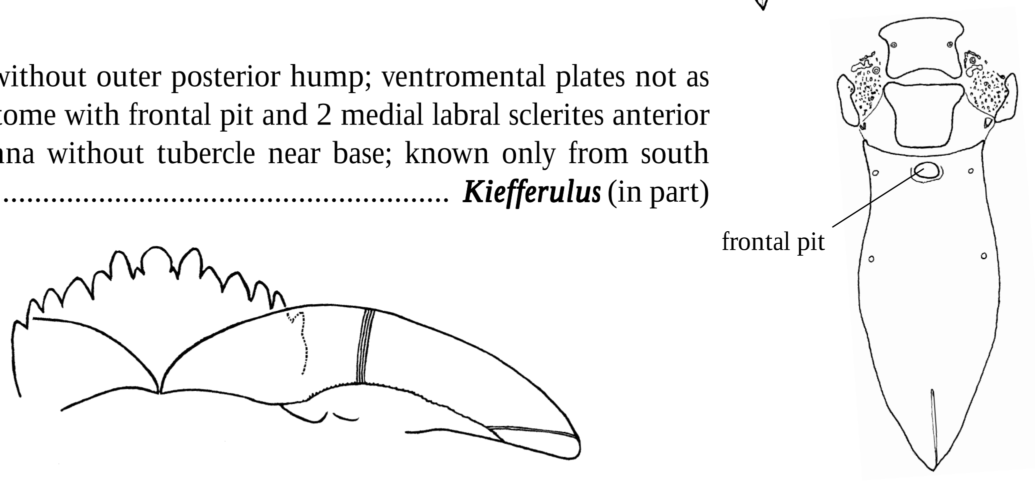


25' Mandible with dorsal tooth; inner teeth of mandible well defined 26

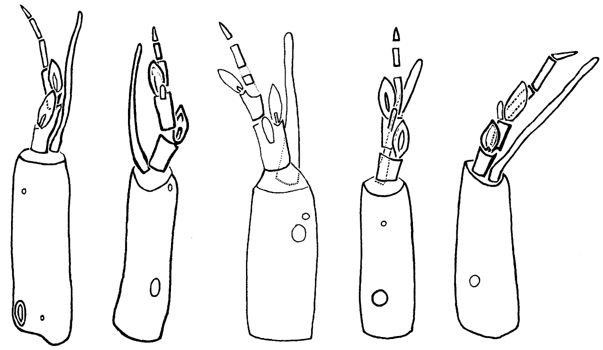
26(25') Mandible with outer posterior hump; ventromental plates extremely broad; apotome with 1 medial labral sclerite anterior to it, without frontal pit; antenna with dark tubercle near base; not confined to south Florida .... ***Lipiniella***



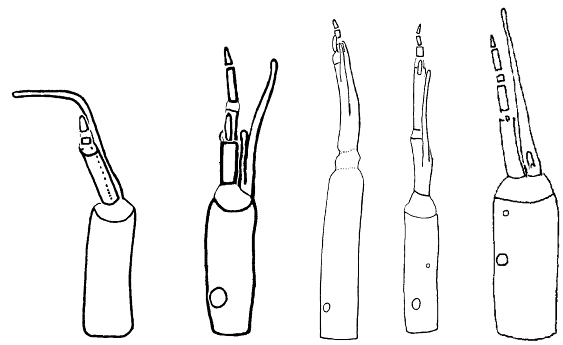
26' Mandible without outer posterior hump; ventromental plates not as broad; apotome with frontal pit and 2 medial labral sclerites anterior to it; antenna without tubercle near base; known only from south Florida .... ***Kiefferulus*** (in part)



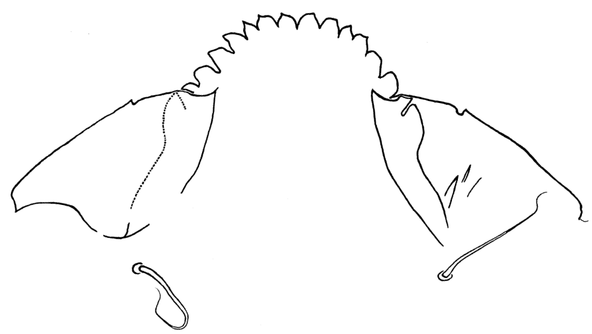
27(19', 24') Antennae with 6 well defined segments, with large Lauterborn organs at the apices of segments 2 and 3 28



27' Antennae with 4-7 segments, if 6 segments present then without alternate Lauterborn organs on segments 2 and 3 35

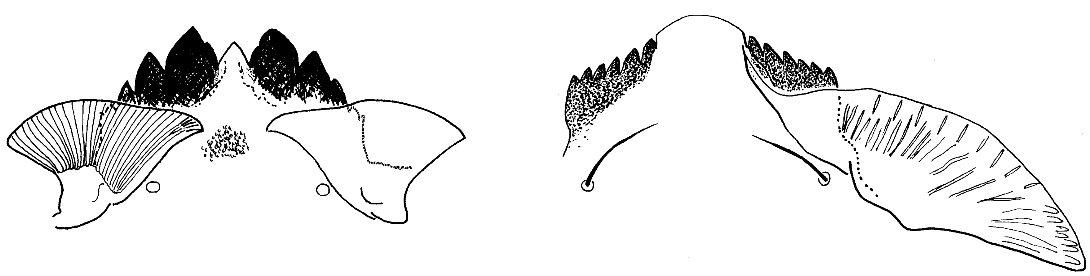


28(27) Mentum strongly arched, resembling a circular saw blade; mid-anterior margin of ventromental plate with notch .... ***Harnischia* complex genus A**

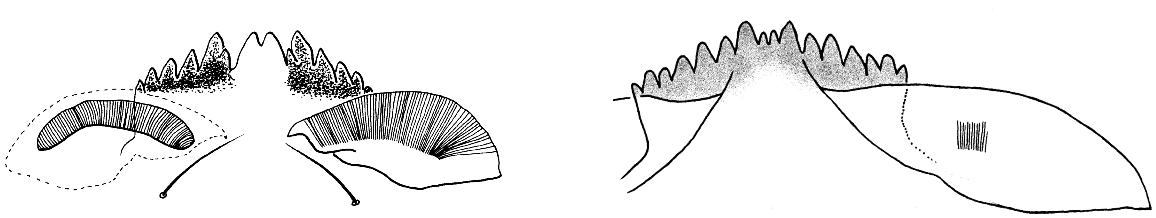


28' Mentum and ventromental plate not as above 29

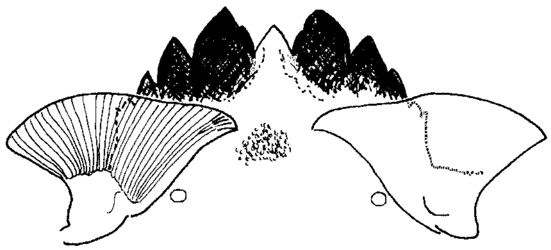
29(28') Mentum with single pale median tooth 30

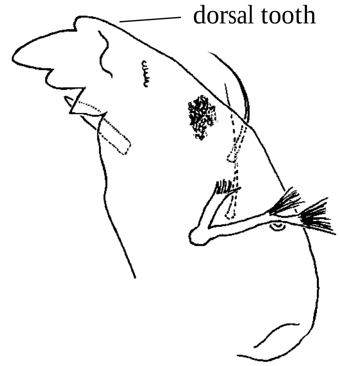


29' Mentum with 2 or more pale or dark median teeth 31

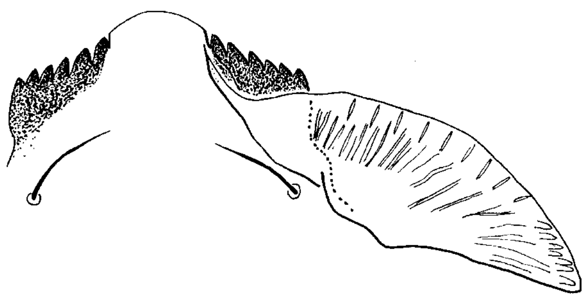


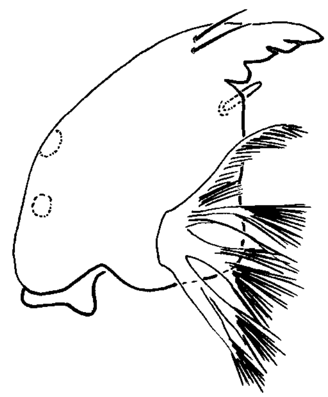
30(29) Median tooth of mentum lower than first lateral teeth; mandible with dorsal tooth .... ***Beardius*** (in part)



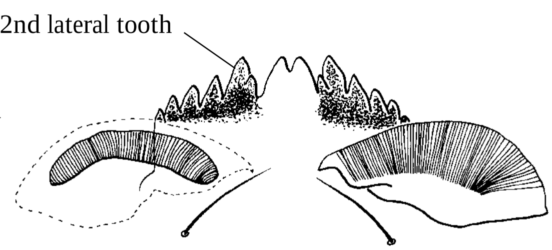


30’ Median tooth of mentum higher than first lateral teeth; mandible without dorsal tooth .... ***Paralauterborniella***

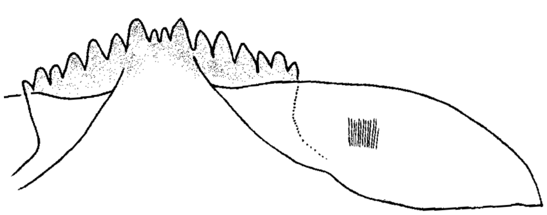


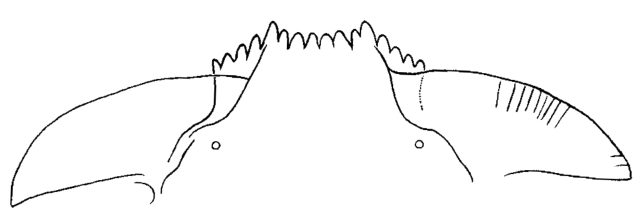


31(29’) Mentum with 2-3 pale median teeth that are subequal to ***2nd*** lateral teeth 32

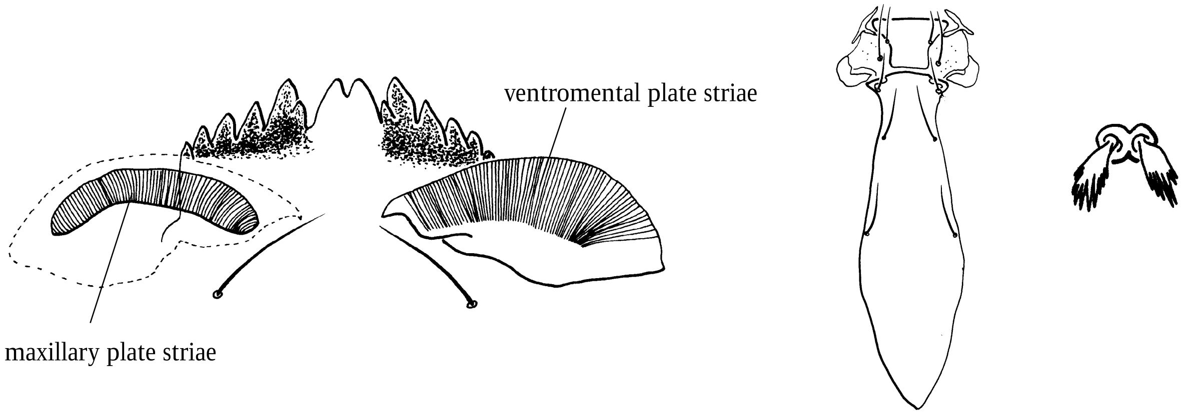


31’ Mentum with dark median teeth **or** with 4 pale median teeth that are lower than 2nd lateral teeth 33

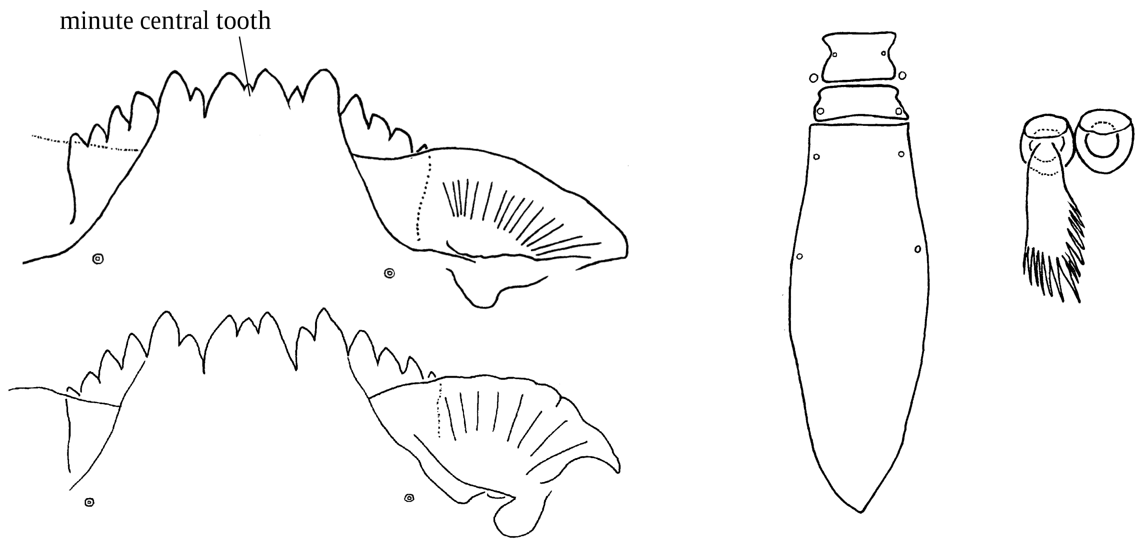




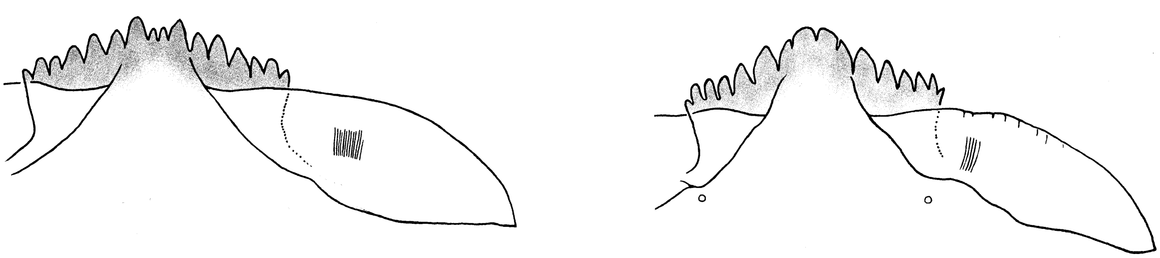
32(31) Mentum with 2 pale median teeth; maxillary plate striae well developed and more noticeable than ventromental plate striae; frontoclypeal apotome present; bases of S I fused .... ***Apedilum***



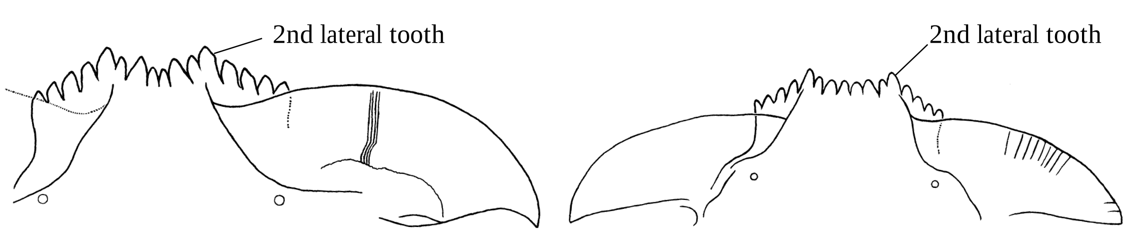
32’ Mentum with 3 pale median teeth (central median tooth may be minute); ventromental plate striae coarse and distinct, maxillary plate striae difficult to discern; frontal apotome separated from clypeus by a straight suture; bases of S I separate or contiguous .... ***Microtendipes***



33(31’) 4 median teeth of mentum dark and at least outer pair higher than remaining lateral teeth .. .. ***Stictochironomus***

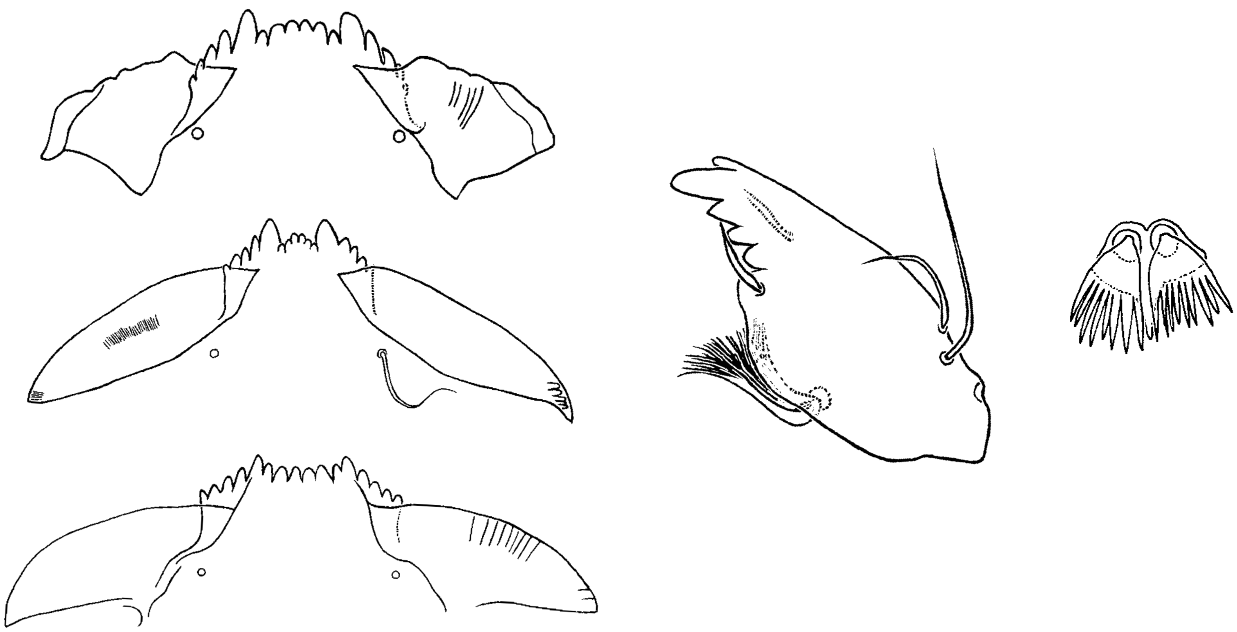


33’ Median teeth of mentum pale or dark, lower than or subequal to 2nd lateral teeth 34

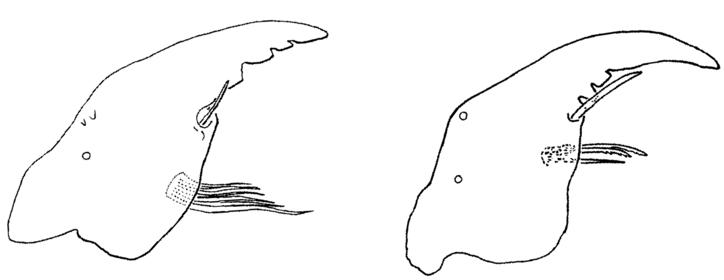


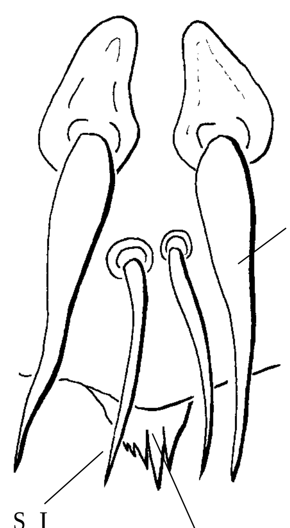
34(33') Central pair of the 4 median teeth lower and more slender than outer median teeth; bases of S I separate; mandible with 2 dorsal teeth .... ***Omisus***

34' Central pair of the 4 median teeth equal to or higher than outer median teeth; bases of S I fused or located on common triangular plate; mandible with 1 dorsal tooth .... ***Paratendipes***

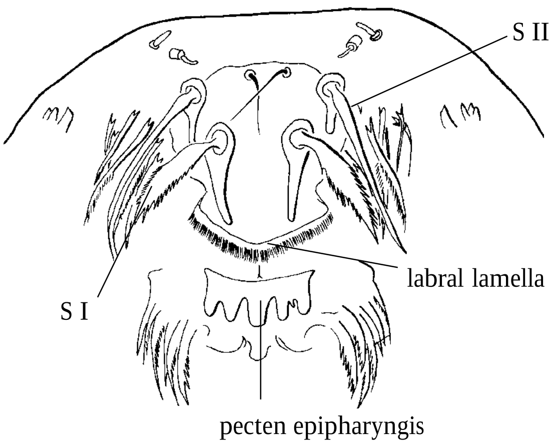


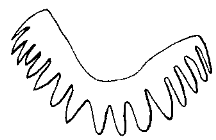
35(27') S I simple (with small accessory branches in some species of *Parachironomus*, but never plumose); S II often large and blade-like; mandible without dorsal tooth/teeth; labral lamella usually absent; pecten epipharyngis rounded or subtriangular, consisting of a single plate or scale that may be simple, serrated, notched or toothed .... the *Harnischia* complex (in part) 36



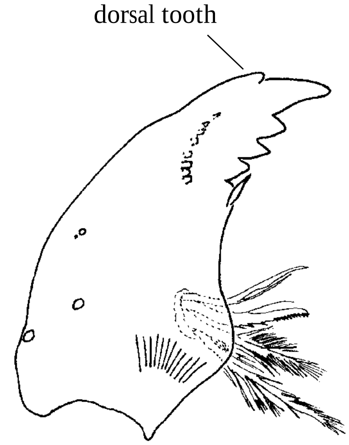


35’ S I plumose or fringed on at least one margin; S II usually not large and blade-like; labral lamella present; mandible usually with dorsal tooth/teeth; pecten epipharyngis a wide multitoothed comb **or** of 3 platelets that are usually apically toothed (but may be smooth) 52

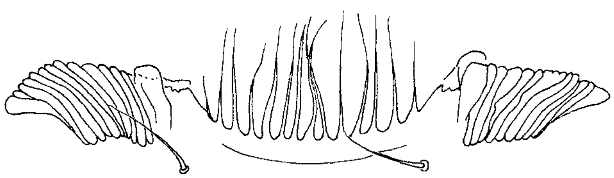



comb-like
pecten epipharyngis


3 platelet
pecten epipharyngis

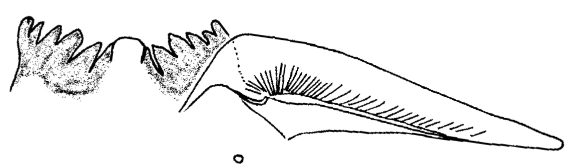


36(35) Mentum toothless, with about 15 anteriorly directed seta-like projections; mandible with dense fringe of setae on outer margin .... ***Harnischia* complex genus B**

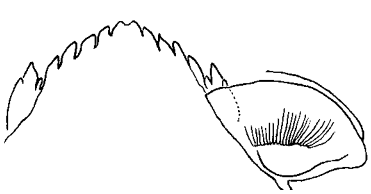


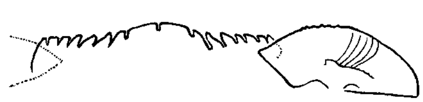
36’ Mentum and mandible not as above 37

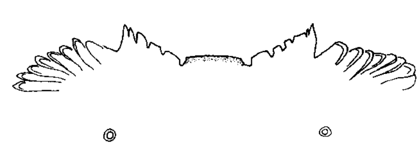
37(36’) Mentum concave, with broad pale median tooth flanked by dark well sclerotized teeth that point inward; ventromental plates at least 3X wider than long 38



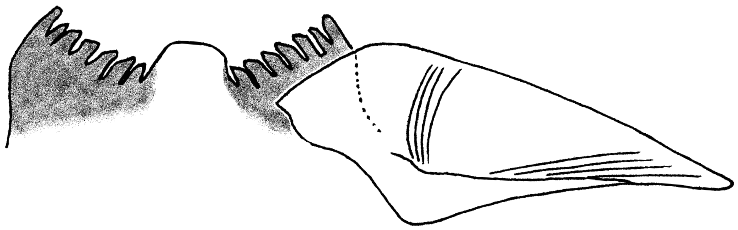
37’ Mentum convex (arched) or linear; or if concave than mentum completely pale; ventromental plates less than 2X as wide as long 41

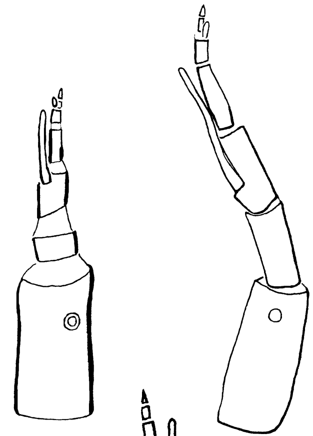

convex


linear

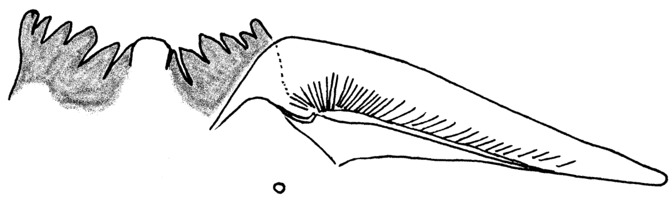

concave but pale

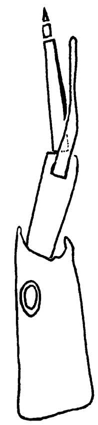
38(37) Antennae with 7 segments; mentum with 7 pairs of usually dark lateral teeth .... ***Demicryptochironomus***



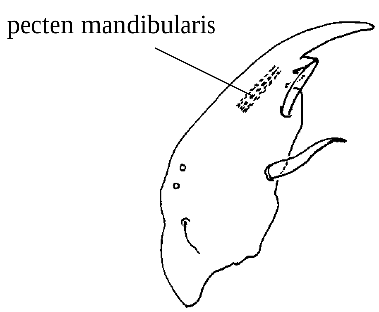


38' Antennae with 5 segments; mentum with 4-5 pairs of dark lateral teeth 39

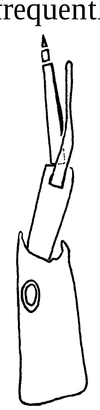


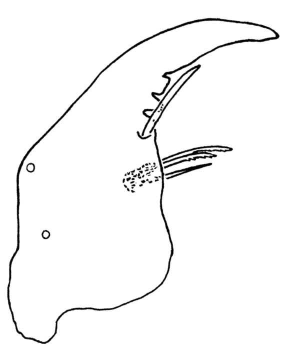


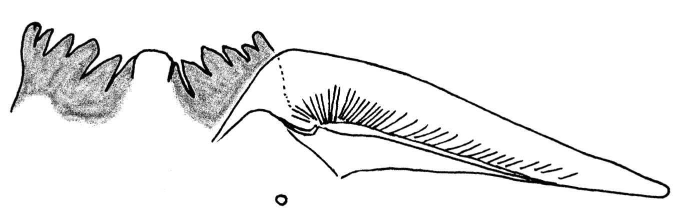
39(38') Antennal segment 3 weakly sclerotized; mandible with weak pecten mandibularis; ventromental plate about 3X as wide as long; known only from south Florida .... ***Harnischia* complex genus D**



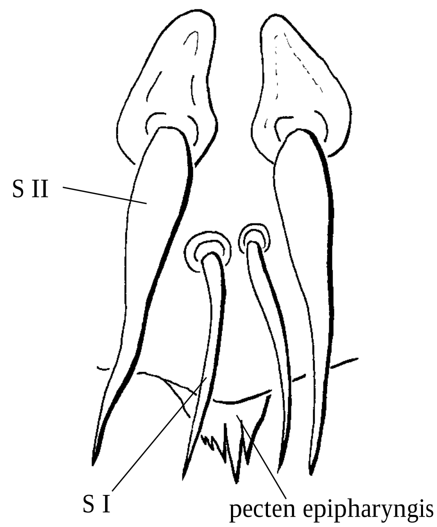
39' Antennal segment 3 well sclerotized; mandible without pecten mandibularis; ventromental plate frequently more than 3X as wide as long; widespread 40

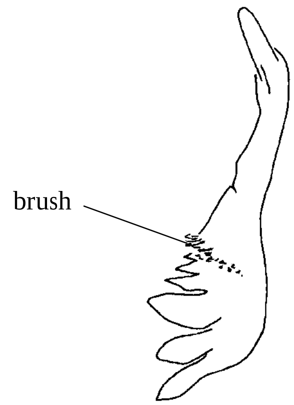




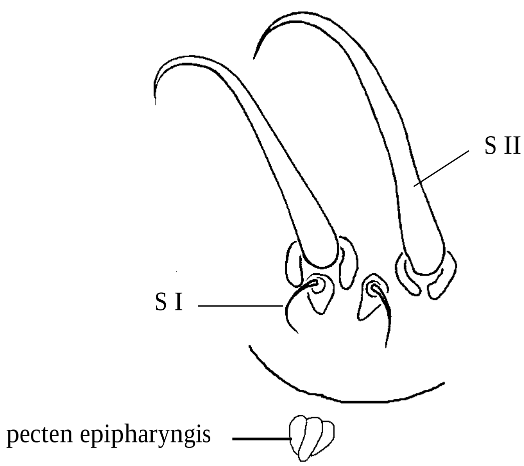


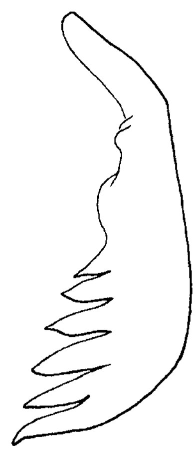
40(39’) Pecten epipharyngis a deeply trilobed scale; S I well developed, at least 1/2 as long as S II; premandible with weak brush .... ***Cryptochironomus***



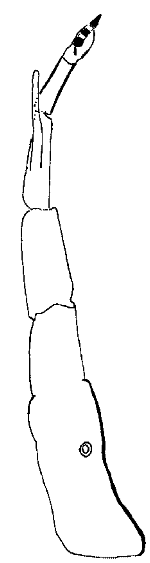


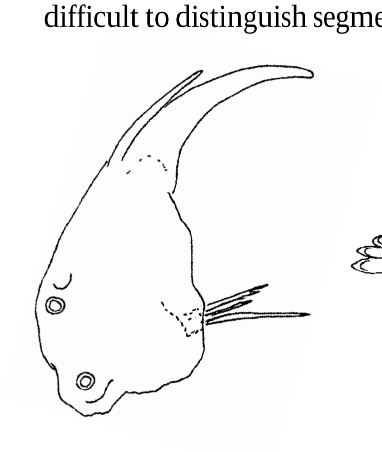
40’ Pecten epipharyngis a weakly trilobed scale; S I minute, less than 1/5 length of S II; premandible without brush .... ***Gillotia***

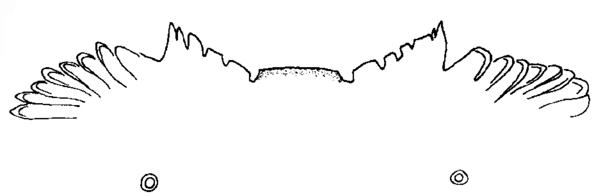




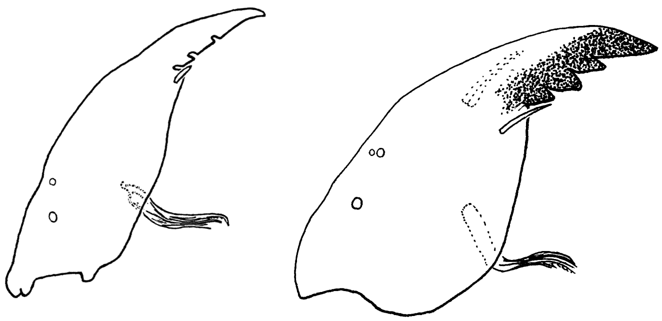
41(37’) Mandible without inner teeth (rarely with 1 inner tooth); mentum concave, with pale lateral teeth; antennae as long as head capsule, weakly sclerotized, with 8 difficult to distinguish segments .... ***Chernovskiia***

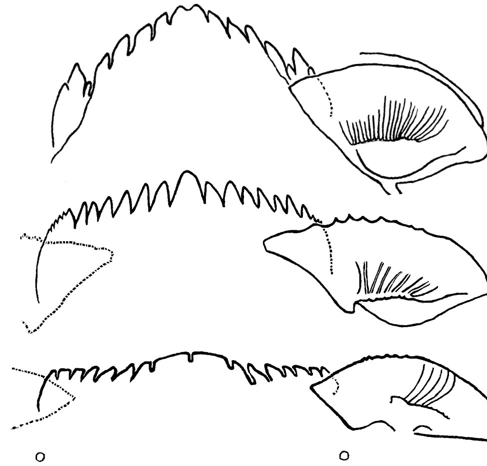






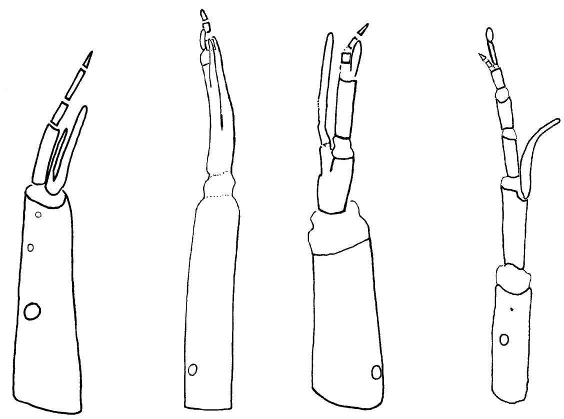
41’ Mandible with at least 2 inner teeth or notches indicating teeth; mentum convex or linear; antennae with 5-7 variably sclerotized segments 42





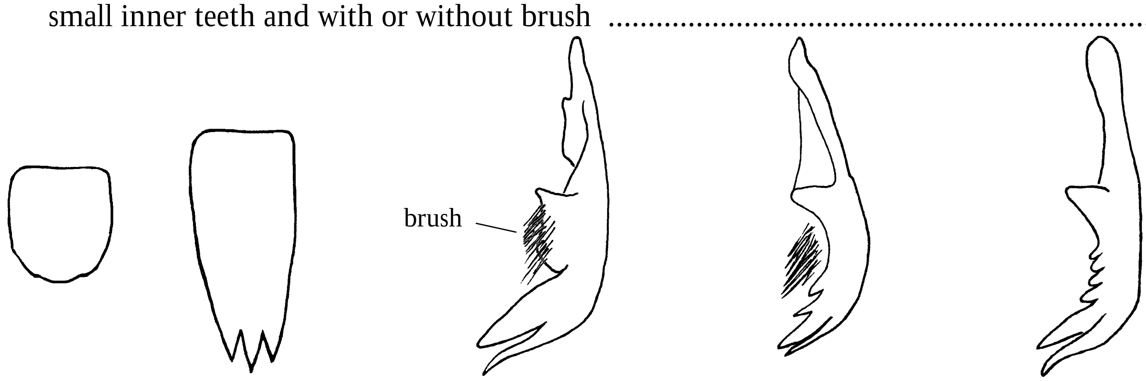
42(41’) Antennae with 5 segments 43

42’ Antennae with 6-7 segments 48



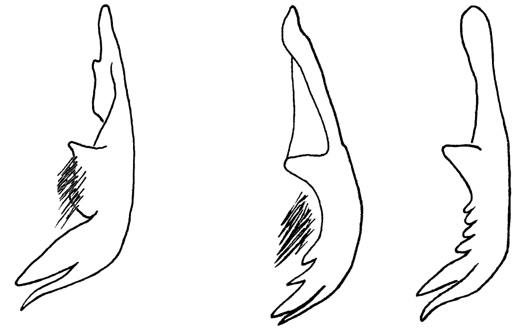
43(42) Pecten epipharyngis a wide plate with numerous apical teeth (deeply trifid in *P. alatus*); premandible with 2-4 teeth, without brush .... ***Parachironomus***

43’ Pecten epipharyngis a simple plate with or without weak distal lobes; premandible apically bifid, with brush **OR** pecten epipharyngis a shallowly trifid triangular scale (if deeply trifid then basal segment of maxillary palp almost as long as first antennal segment) and premandible with several small inner teeth and with or without brush 44



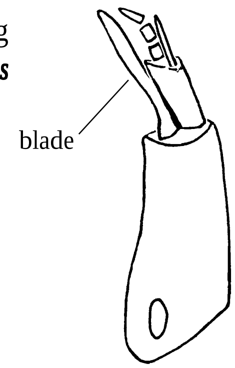
44(43’) Premandible apically bifid 45

44’ Premandible with 3 or more teeth 47



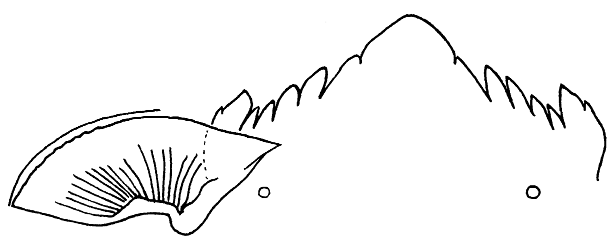
bifid 3 or more teeth

45(44) Outline of mentum nearly linear, median tooth trifid; antennal blade as long as or longer than flagellum (segments 2-5) .... ***Microchironomus***

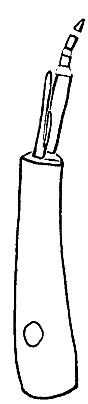


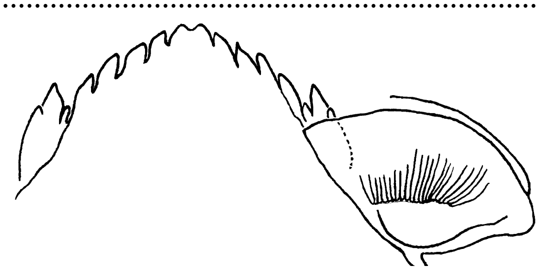
45’ Outline of mentum convex (arched), with median tooth single (may be laterally notched and appear trifid), medially notched, or double; antennal blade shorter than flagellum (figures below) 46

46(45’) Median tooth of mentum broadly rounded or laterally notched to appear trifid, set well forward of lateral teeth so that outline of central mentum slopes sharply; basal segment of antenna about 2-2.5X longer than wide and subequal to length of flagellum .... ***Cryptotendipes***

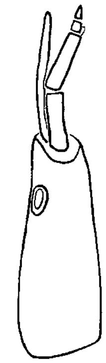


46’ Median tooth of mentum usually double or notched medially, may be broadly rounded but not extending far forward of lateral teeth, thus mentum not appearing sharply sloped; basal segment of antenna about 2.8-4.0X longer than wide and longer than length of flagellum .... ***Cladopelma***

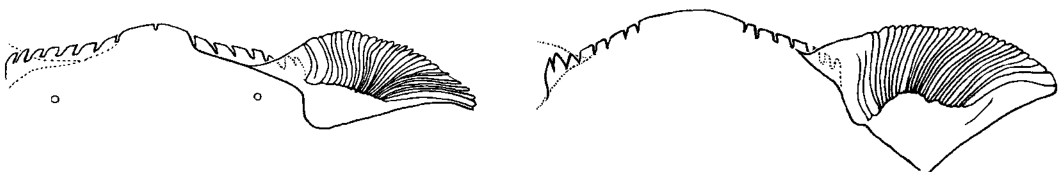


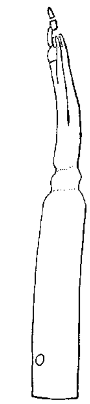


47(44’) Antennal segments 2 and 3 subequal; ventromental plates weakly striated .... ***Harnischia***

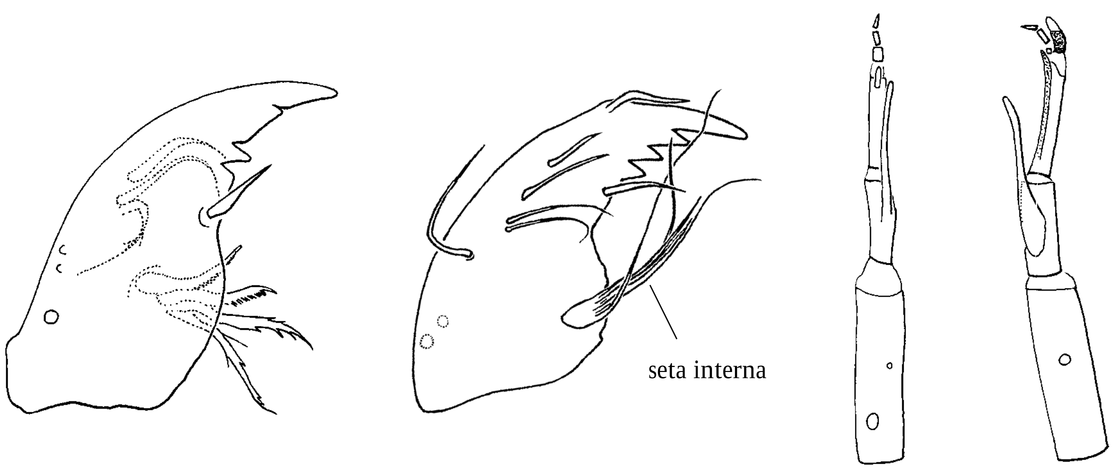


47’ Antennal segment 2 much longer than 3; ventromental plates coarsely striated .... ***Paracladopelma***

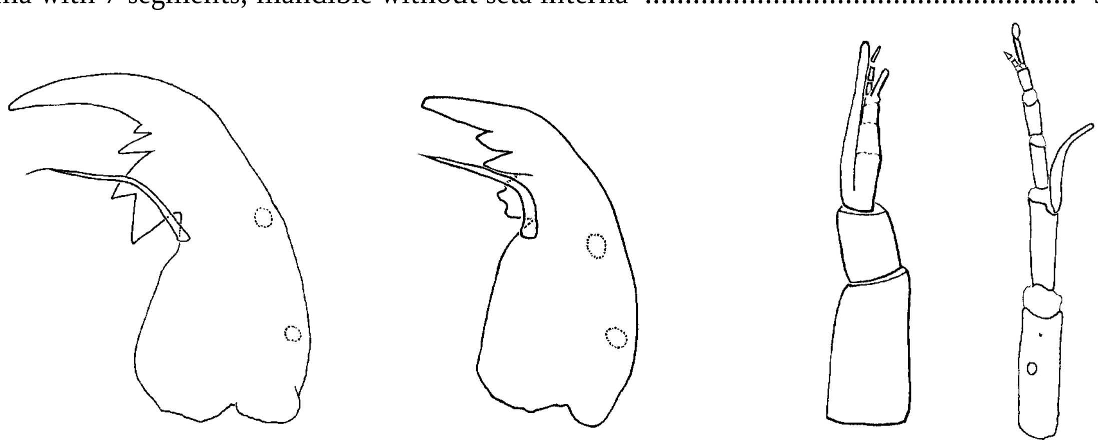




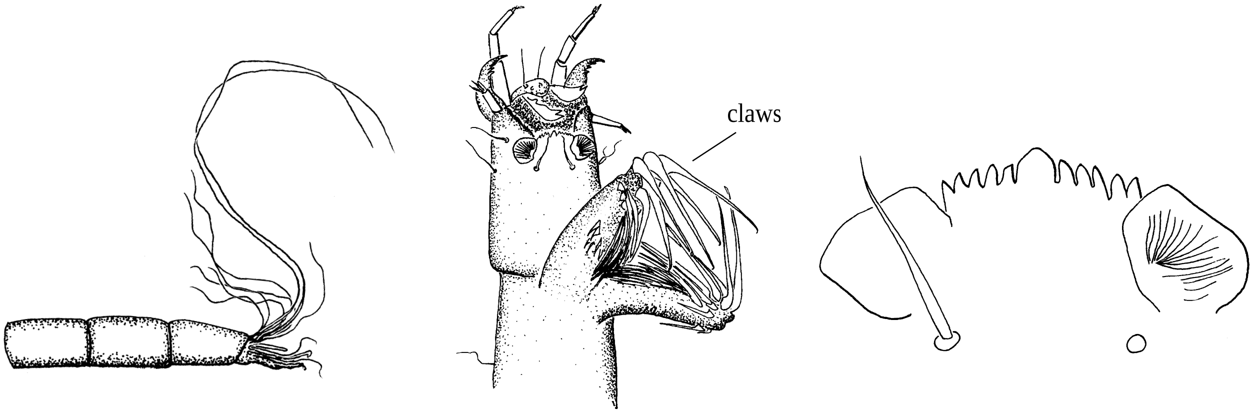
48(42’) Antenna with 6 segments; mandible with seta interna 49



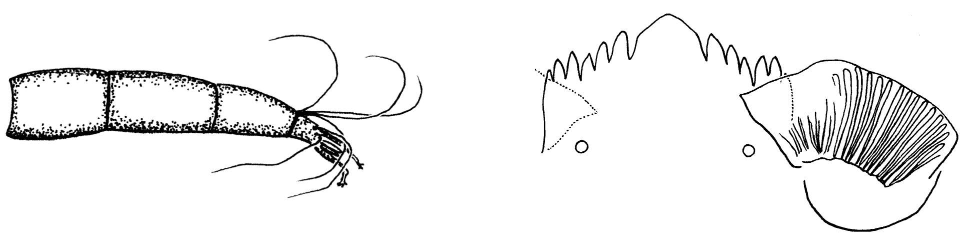
48’ Antenna with 7 segments; mandible without seta interna 51



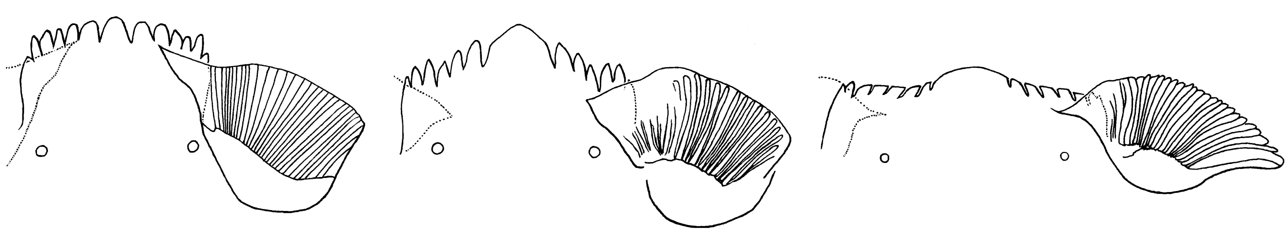
49(48) Each procercus with one very long anal seta that is about 4-5X as long as supraanal setae; anterior parapods with large claws that are about 2/3 length of head capsule; mentum with moderately broad median tooth and 5 pairs of lateral teeth .... ***Harnischia* complex genus C**



49’ Anal setae not as long, slightly longer than supraanal setae; anterior parapod claws at most 0.4 length of head capsule; if mentum with broad median tooth, then with 6 or more pairs of lateral teeth 50

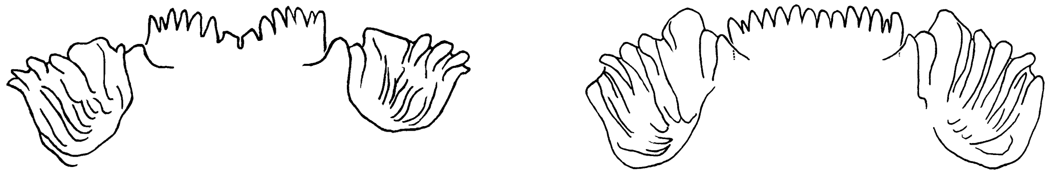


50(49’) Ventromental plates with most striae complete to anterior margin; mentum as figured below .... ***Saetheria***



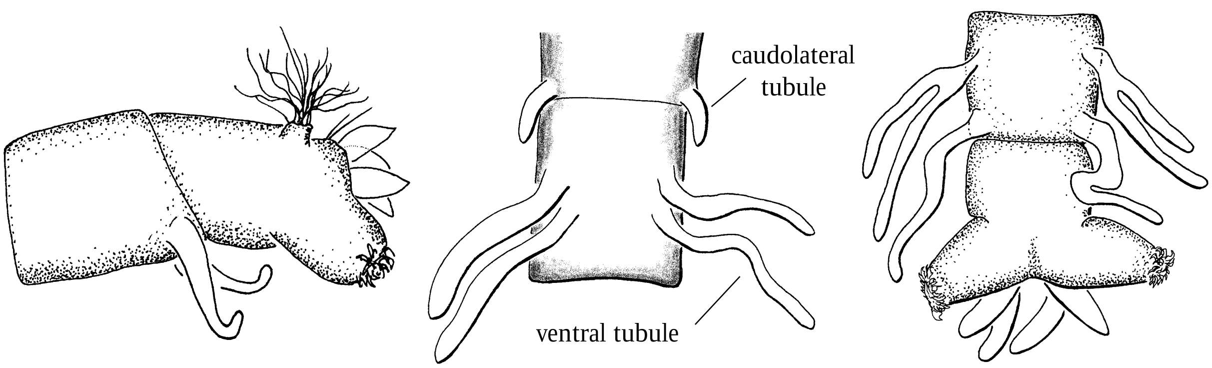
50’ Ventromental plates with striae not reaching anterior margin, a separate row of short striae present near anterior margin of plate; mentum as figured below .... ***Kloosia***

51(48’) Mentum with an even number (14) of teeth .... ***Robackia***



51’ Mentum with odd number of teeth, median tooth trifid (if worn may appear simple) .... ***Beckidia***

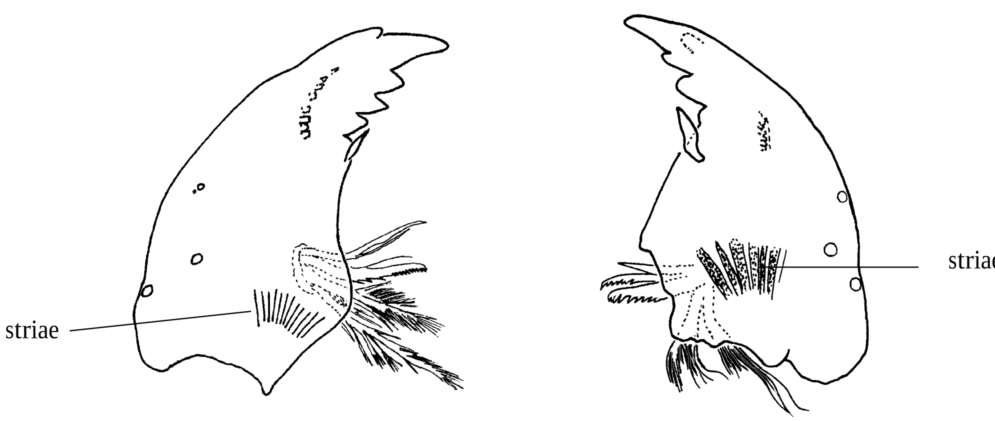
52(35’) Penultimate body segment with 1-2 pairs of ventral tubules 53



1 pair 2 pairs 2 pairs, 1st pair bifid

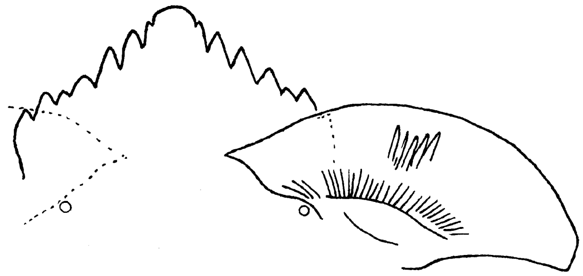
52’ Penultimate body segment without ventral tubules, although rudimentary knob-like swellings may be present 60

53(52) Mandible with a row of radially arranged striae near base 54

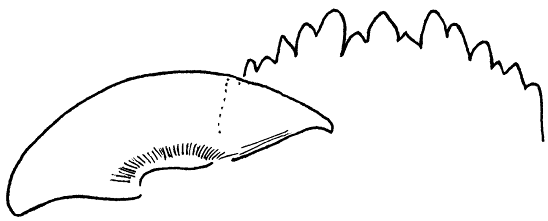


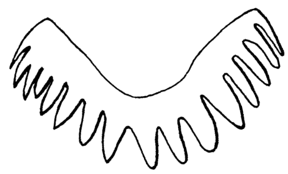
53’ Mandible without a row of radially arranged striae near base 55

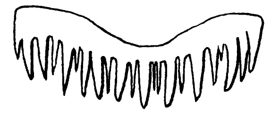
54(53) Mentum with median tooth projecting far beyond lateral teeth and 5th lateral tooth larger than 4th or 6th; pecten epipharyngis of 3 scales covered with minute spinules; 1 pair of ventral tubules .... ***Einfeldia*** (in part)



54' Median tooth of mentum not projecting far beyond lateral teeth; pecten epipharyngis a broad multitoothed comb; 1 or 2 pairs of ventral tubules .... ***Chironomus*** (in part)

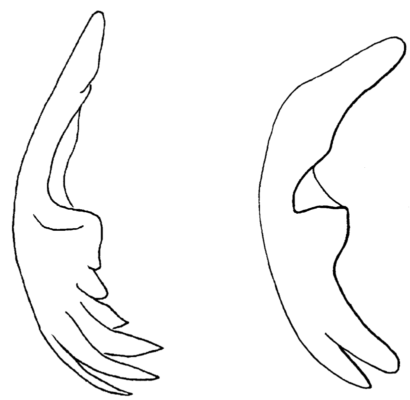






55(53') Premandible with 5 or more apical/subapical teeth .... ***Kiefferulus*** (in part)

55' Premandible apically bifid 56



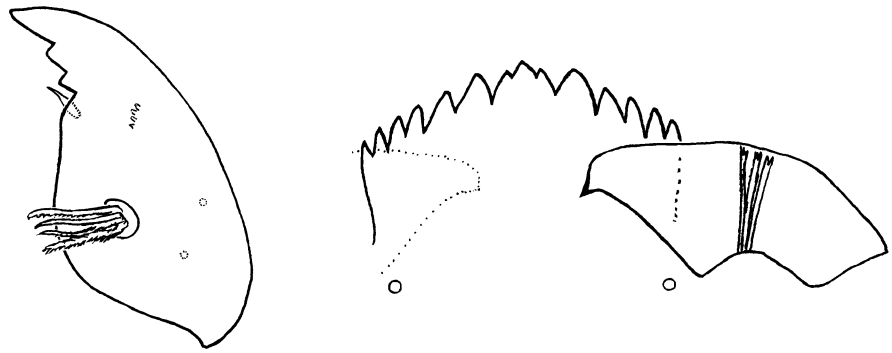
Kiefferulus

56(55) Seta subdentalis with toothed or fringed ventral margin .... ***Goeldichironomus*** (in part)

Goeldichironomus

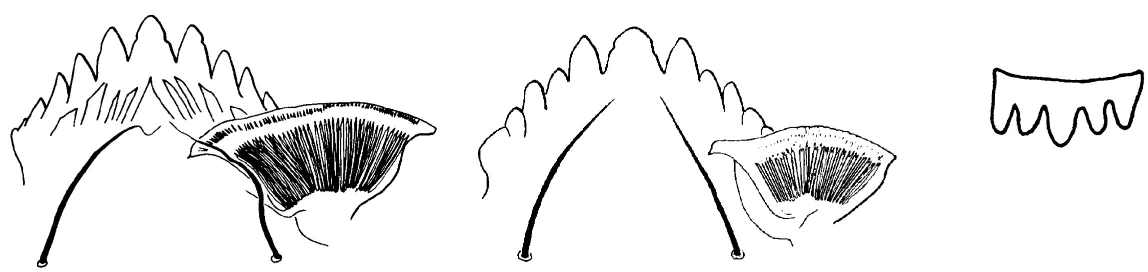
56' Seta subdentalis simple 57

57(56') Mandible with 2 inner teeth; larvae mining in sponges, bryozoans or plants .... ***Demeijerea***

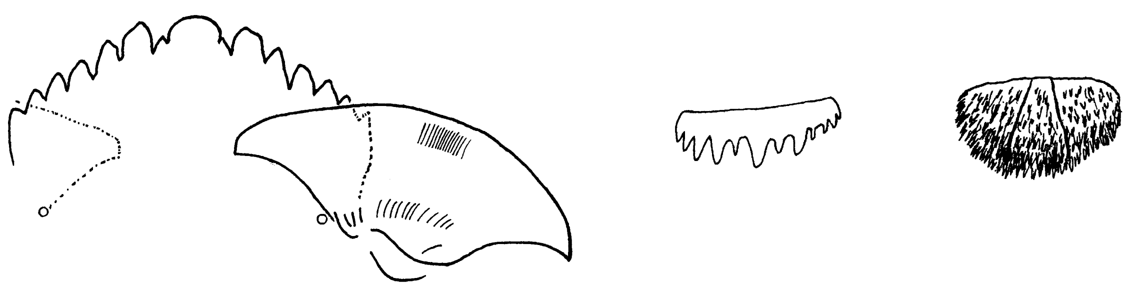


57' Mandible with 3 inner teeth; larvae free-living or mining in decaying wood or plants 58

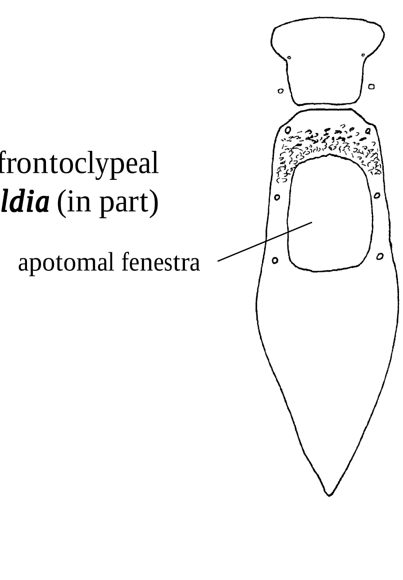
58(57') Width of ventromental plate less than width of mentum; pecten epipharyngis with fewer than 10 usually blunt lobes .... ***Dicrotendipes*** (in part)

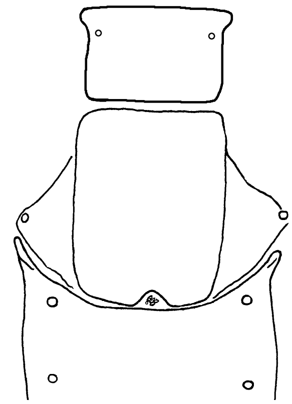


58' Width of ventromental plate greater than or subequal to width of mentum; pecten epipharyngis a comb with 10 or more teeth or weakly tripartite and covered with minute spinules 59



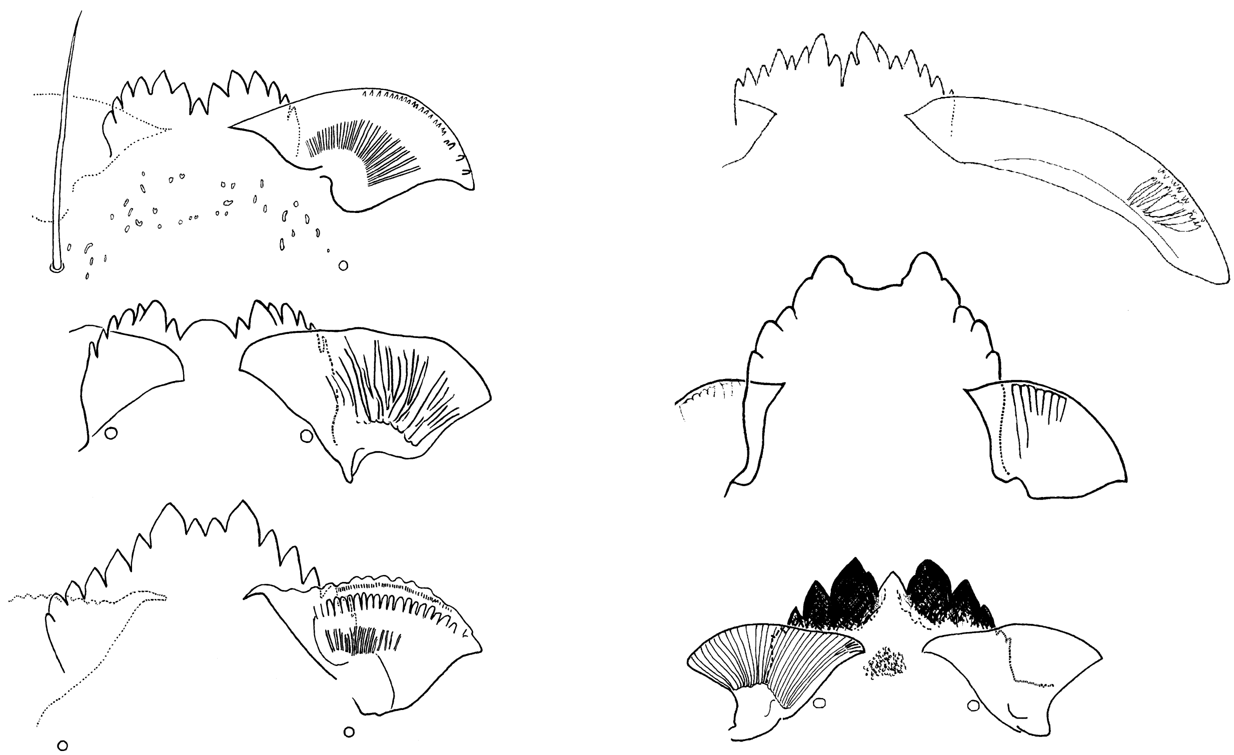
59(58') Dorsum of head with 1 medial labral sclerite anterior to frontoclypeal apotome; apotome with large apotomal fenestra .... ***Einfeldia*** (in part)





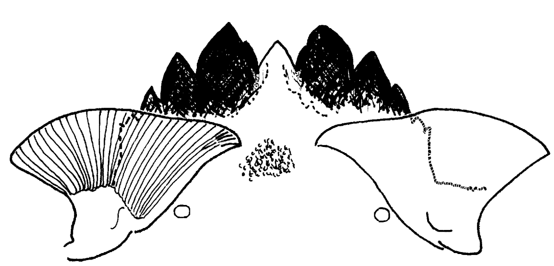
59’ Dorsum of head with 2 medial labral sclerites anterior to frontal apotome; apotome without apotomal fenestra .... ***Glyptotendipes*** (in part)

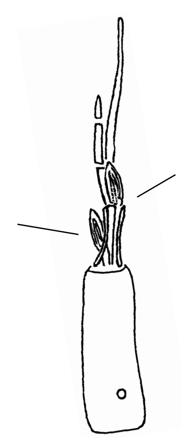
60(52’) Mentum with median tooth or teeth sunken, lower than 1st **or** 2nd lateral teeth 61



60’ Mentum with median teeth higher than or subequal to 1st or 2nd lateral teeth 67

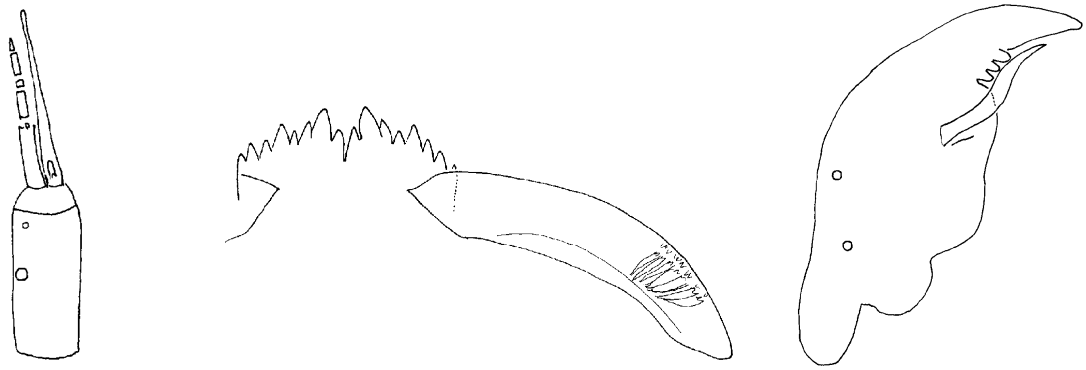
61(60) Median tooth pale; antennae with large Lauterborn organs at apices of segments 2 and 3 .... ***Beardius*** (in part)





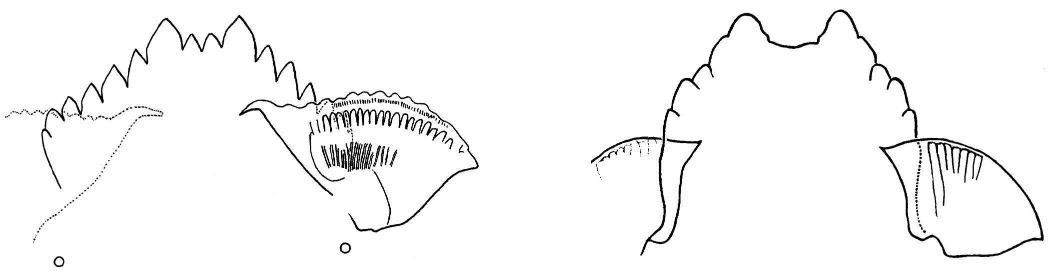
61’ Median tooth dark; antennae with Lauterborn organs at apex of segment 2 only 62

62(61') Antennae 6 segmented (with minute 4th segment); ventromental plates very broad; mandible with enlarged seta subdentalis and without seta interna and pecten mandibularis .... ***Fissimentum***

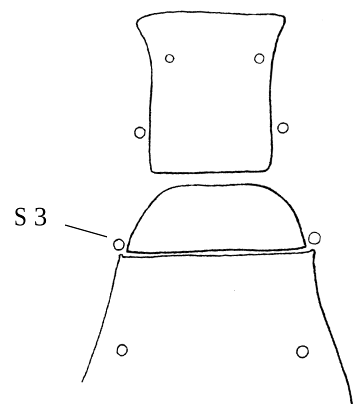


62' Antennae 5 segmented; mentum and mandible not as above 63

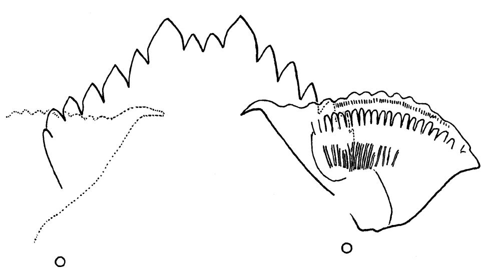
63(62') Mentum with 2 median teeth or teeth worn so that mentum has broad U-shaped median gap .. 64

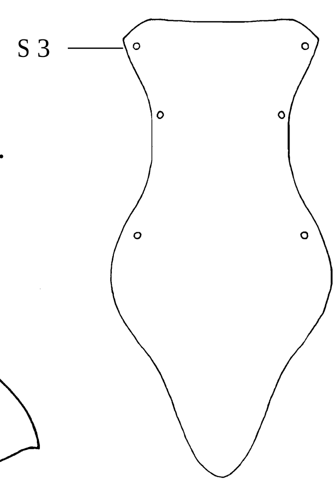


63' Mentum with single median tooth 65

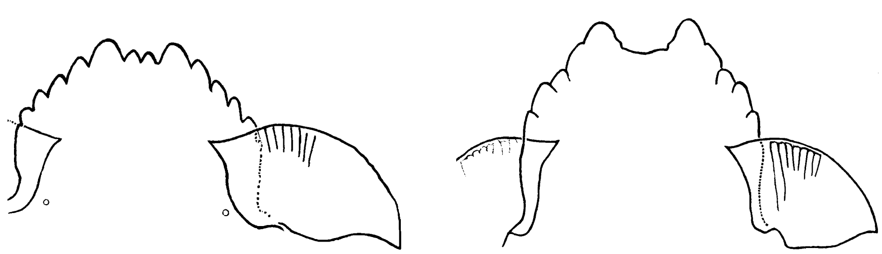


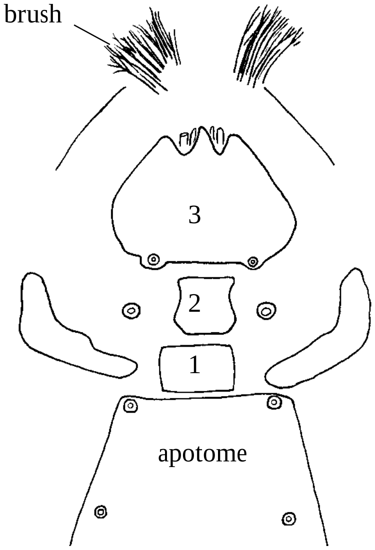
64(63) Anterior of frontal apotome narrowed, with 2 medial labral sclerites anterior to it; S 3 not placed on apotome .... ***Hyporhygma***



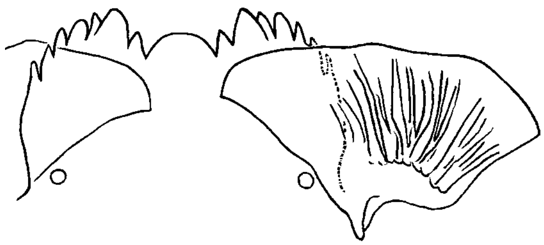


64' Anterior of frontoclypeal apotome broadened, with 1 labral sclerite anterior to it; S 3 placed anterolaterally on apotome .... ***Polypedilum*** (in part)

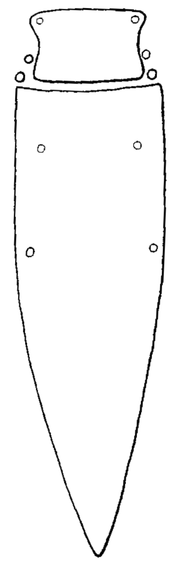




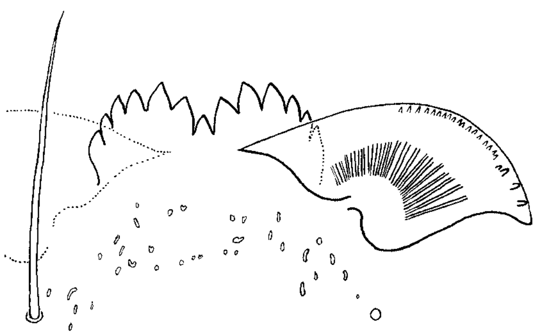
65(63’) Labrum with large brush of setae on each side; frontoclypeal apotome with 3 medial sclerites anterior to it; mining in sponges .... ***Xenochironomus***

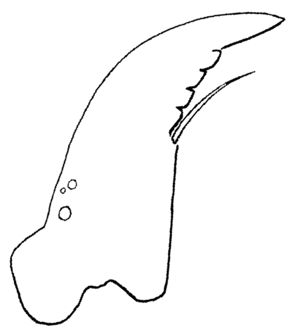


65’ Labrum without large anterolateral setal brushes; apotome with 1 or 2 medial labral sclerites anterior to it; not mining in sponges 66



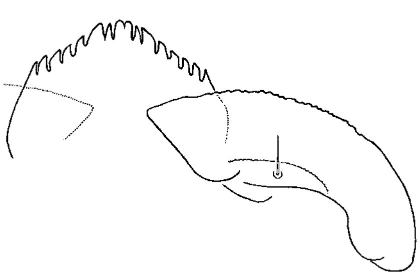
66(65’) Head capsule rectangular; mentum with median tooth deeply sunken; mandible without seta interna or pecten mandibularis; frontal apotome with 1 medial labral sclerite anterior to it .... ***Stelechomyia***

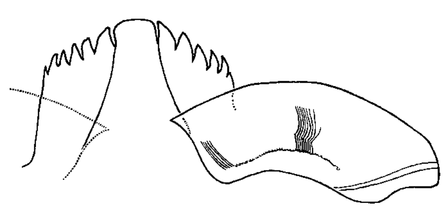


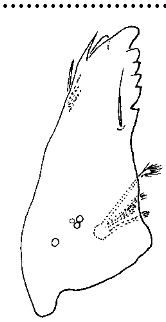


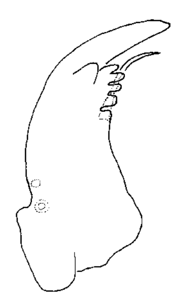
66’ Head capsule more rounded; mentum with medial tooth not as deeply sunken; mandible with seta interna and pecten mandibularis; frontal apotome with 2 medial labral sclerites anterior to it 67

67 (60’, 66’) Mentum (or at least median tooth) and mandibular teeth pale; mandible with 4 or more inner teeth and 1-2 dorsal teeth 68



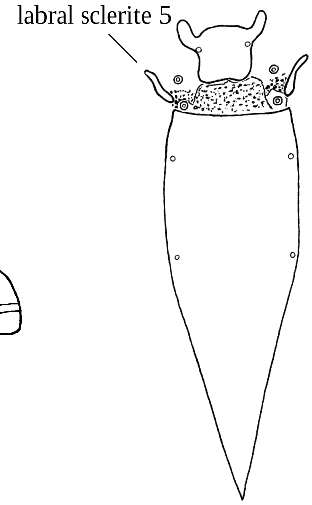


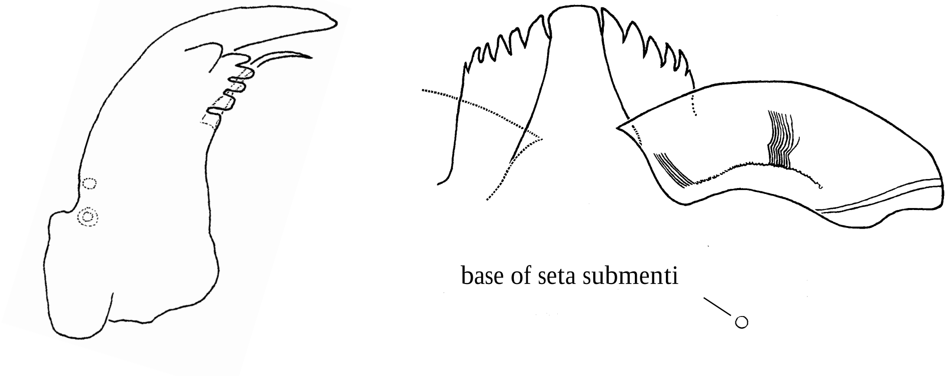




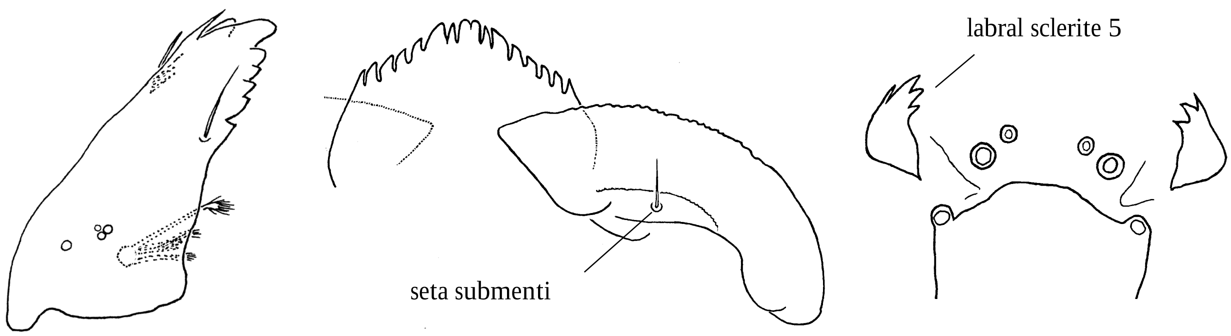
67’ Mentum and mandibular teeth brown to black; mandible with 2-3 inner teeth and 1 dorsal tooth 69

68(67) Inner mandibular teeth grouped closely together; basal antennal segment shorter than segments 2-5(6); setae submenti placed posterior to ventromental plates; labral sclerite 5 simple .... ***Nilothauma***





68’ Inner mandibular teeth spread along inner margin; basal antennal segment longer than segments 2-5; setae submenti placed on ventromental plates; labral sclerite 5 toothed apically .. ***Pagastiella***



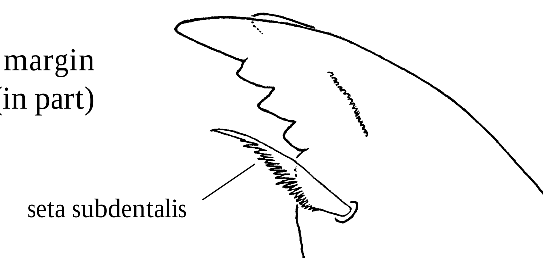
69(67’) Mentum with an odd number of teeth 70

69’ Mentum with an even number of teeth or median tooth bifid 77

70(69) Pecten epipharyngis a single plate with multiple lobes or teeth 71

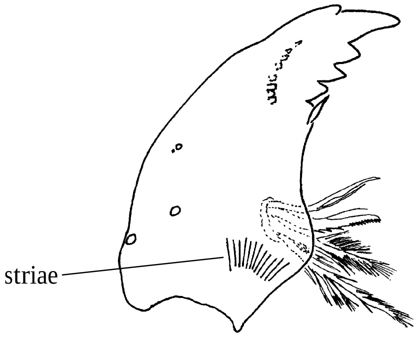
70’ Pecten epipharyngis comprised of 3 apically toothed platelets 75

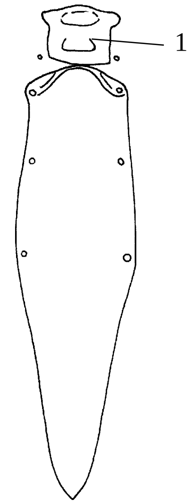
71(70) Seta subdentalis with toothed or fringed ventral margin .... ***Goeldichironomus*** (in part)



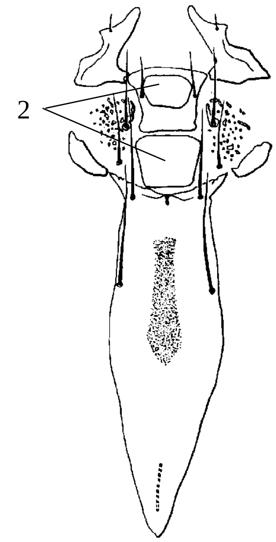
71’ Seta subdentalis simple 72

72(71’) Mandible with basal row of radially arranged striae; frontoclypeal apotome with 1 medial labral sclerite anterior to it .... ***Chironomus*** (in part)





frontoclypeal apotome with 1medial labral sclerite



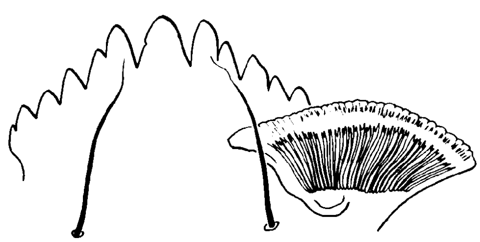
frontal apotome with 2 medial labral sclerites

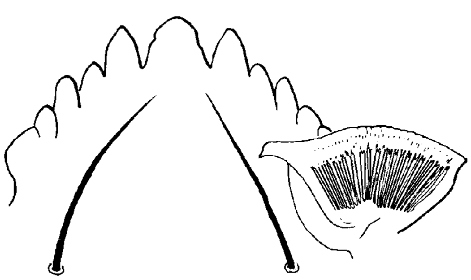
72’ Mandible without basal row of radially arranged striae; apotome with 2 medial labral sclerites anterior to it 73

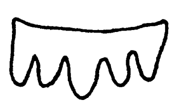
73(72’) Mandible with proximal inner tooth reduced and distal inner tooth appressed to apical tooth .... ***Glyptotendipes*** (in part)

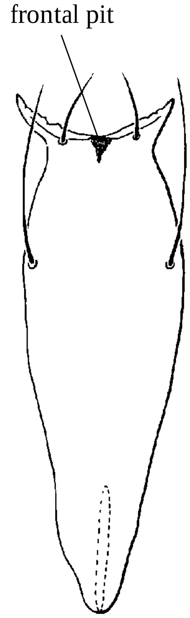
73’ Mandible with inner teeth fully developed 74

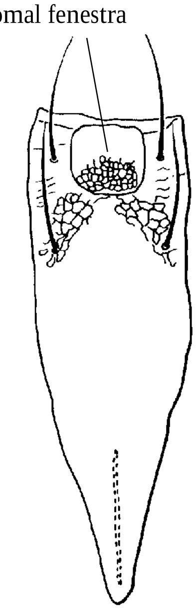
74(73’) Width of ventromental plate less than width of mentum; pecten epipharyngis with fewer than 10 usually blunt lobes; frontal apotome usually with frontal pit (absent in 1 species) or semiquadrate apotomal fenestra .... ***Dicrotendipes*** (in part)



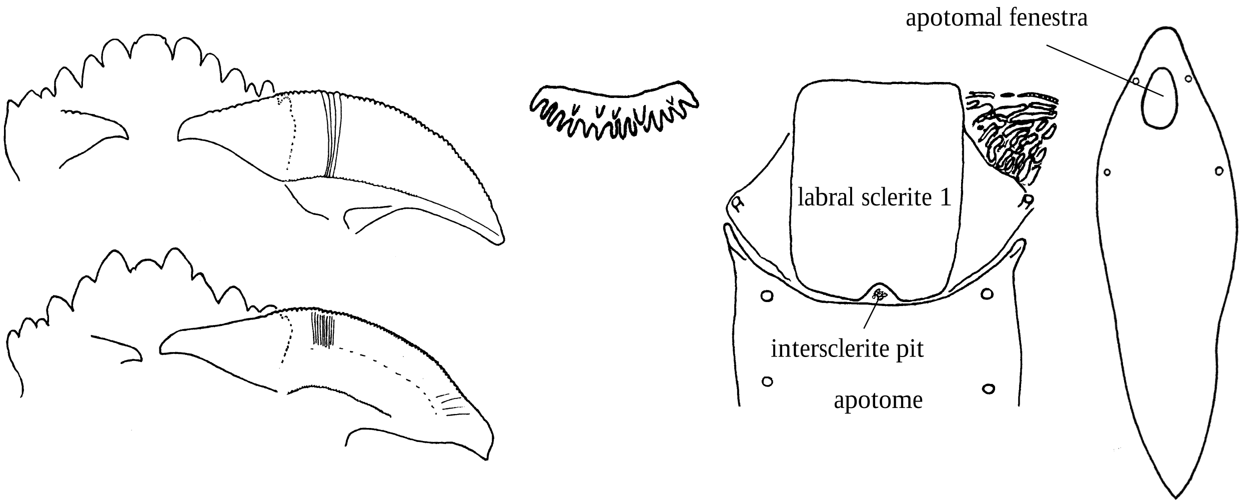




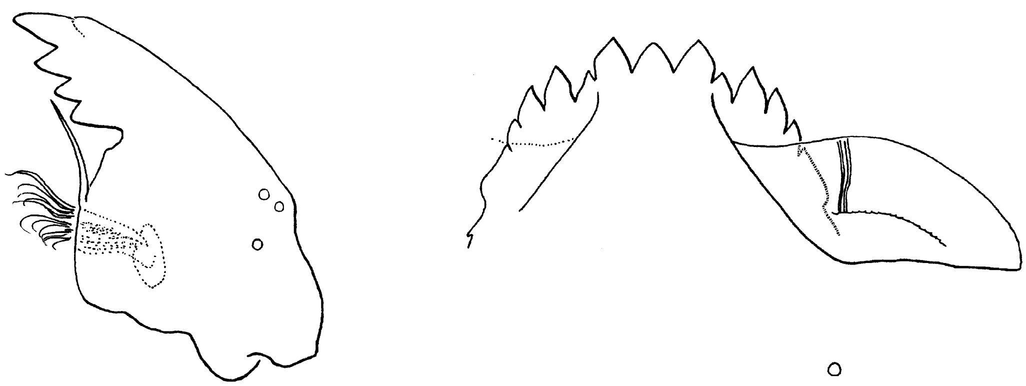




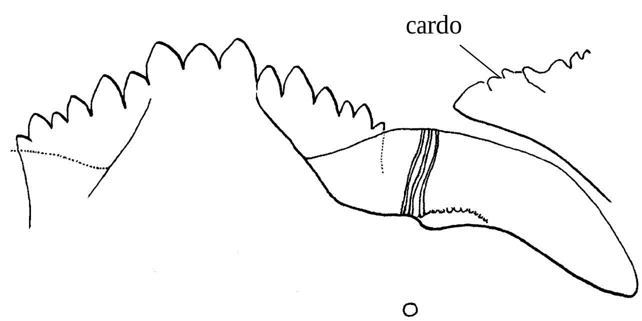
74’ Width of ventromental plate greater than width of mentum; pecten epipharyngis with 10 or more pointed teeth; frontal apotome without frontal pit (posterior margin of labral sclerite 1 may have a small pit); if apotomal fenestra present it is elongate-oval .... ***Glyptotendipes*** (in part)



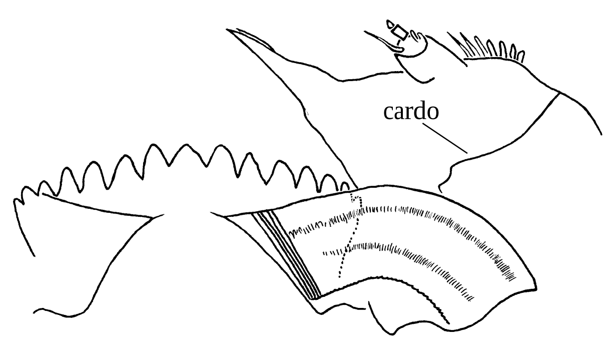
75(70’) Mandible with deeply incised area at base of inner teeth; mentum strongly arched, with 11-13 teeth .... ***Endotribelos***



75’ Mandible without incised area; mentum not strongly arched, with 15 teeth 76

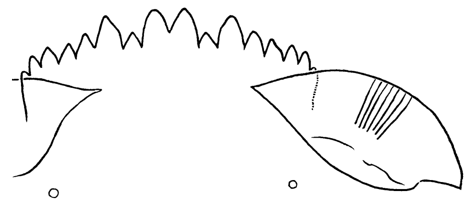


76(75’) Ventromental plate thinner, more elongate; anterior margin of cardo tuberculate .... ***Endochironomus*** (in part)



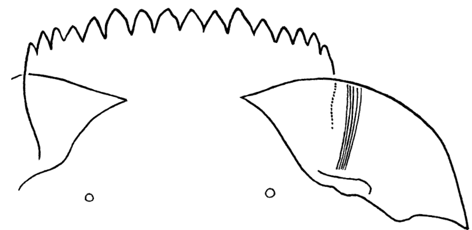
76’ Ventromental plate more squat; anterior margin of cardo smooth .... **Chironomini genus III**

77(69') Mentum distinctive, with 1st lateral teeth much lower than median and 2nd lateral teeth .... ***Polypedilum*** (in part)



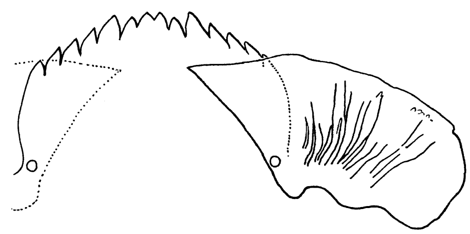
77' Mentum not as above 78

78(77') Mentum with teeth mostly equal in size, gradually smaller laterally .... ***Polypedilum*** (in part)



78' Mentum not as above 79

79(78') Mentum rounded in outline; ventromental plates tear-drop shaped, with setae submenti placed on plates .... ***Polypedilum*** (in part)

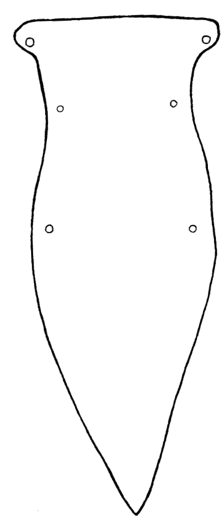


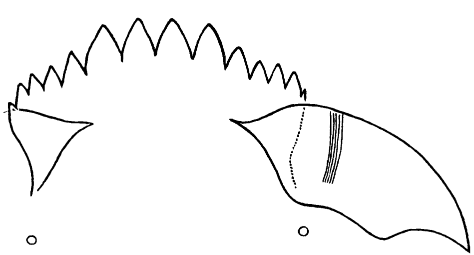
79' Mentum and ventromental plates more linear; setae submenti placed posterior to ventromental plates 80

80(79') Ventromental plate with several strong crenulations on anterior margin; mentum with 14 teeth .... **Chironomini genus IV**

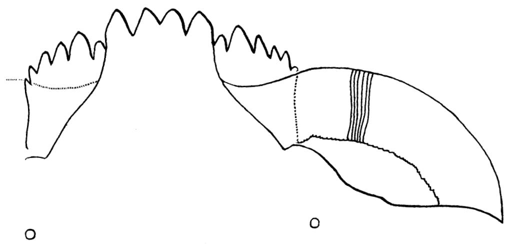
80' Ventromental plate with finely crenulated or smooth anterior margin; mentum with 14 or 16 teeth 81

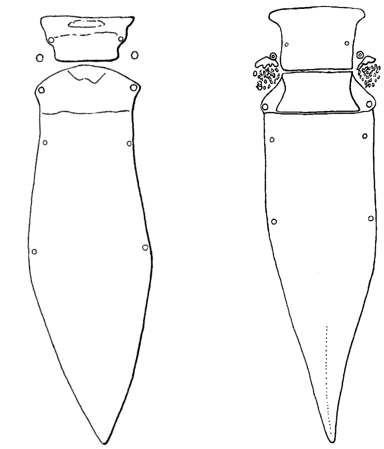
81(80') Mentum with 4 median teeth not separated by a line than runs posteriorly to the anteromedian corner of the ventromental plates; dorsum of head with a frontoclypeal apotome with a straight anterior margin; S 3 setae placed on anterolateral lobes .... ***Polypedilum*** (in part)



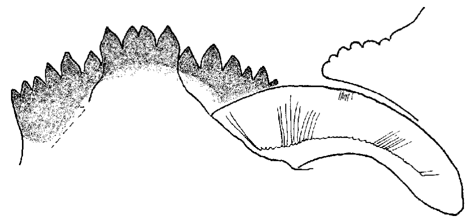


81’ Mentum with 4 median teeth separated by a line than runs posteriorly to the anteromedian corner of the ventromental plates; dorsum of head with a frontal apotome with straight anterior margin or a frontoclypeal apotome with a convex anterior margin; S 3 setae not placed on anterolateral lobes 82



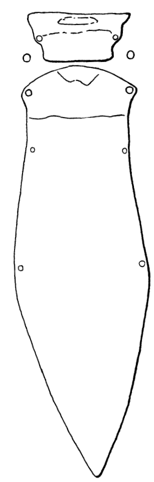


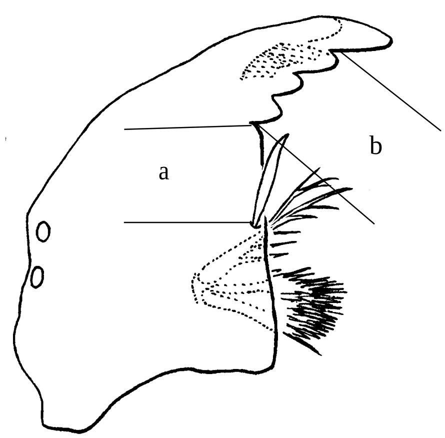
82(81’) Ventromental plates 3 or more times wider than long, with posterolateral margin generally rounded; central 2 teeth of mentum may appear partially fused .... ***Endochironomus*** (in part)

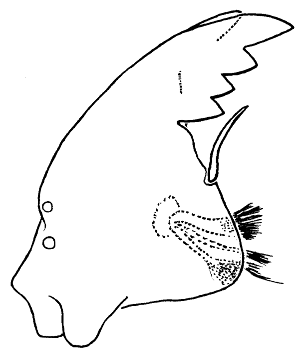


82’ Ventromental plates not as long and narrow, with posterolateral margins pointed 83

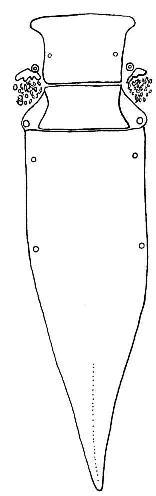
83(82’) Anterior margin of frontoclypeal apotome convex, with 1 medial labral sclerite anterior to it; distance from basal notch of inner mandibular teeth to insertion of seta subdentalis (a) at least 3/4 distance from basal notch to apical notch (b), or mandible with deep incision proximal to basal inner tooth .. ***Phaenopsectra***







83’ Anterior margin of frontal apotome straight, with 2 medial labral sclerites anterior to it; distance from basal notch of inner mandibular teeth to insertion of seta subdentalis usually less than 3/4 distance from basal notch to apical notch .... ***Tribelos***



Genus *Apedilum*

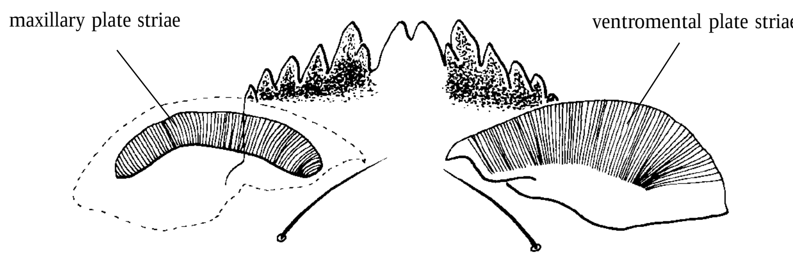
DIAGNOSIS: Distinguished by the frontoclypeal apotome; S I with bases fused medially; S II with short basal segment; pecten epipharyngis a single plate; 6 segmented antenna, with alternate Lauterborn organs; mentum with pale bifid median tooth, and first lateral teeth reduced and appressed to larger second lateral teeth; well developed maxillary plate striations; and mandible with dorsal teeth.

NOTES: Two species are described from the Nearctic; both are to be expected throughout eastern North America. Both species were formerly included in *Paralauterborniella* but were shown to be generically distinct by Epler (1988a). Larvae may be separated by maxillary plate striae counts. The maxillary plate lies dorsal to the ventromental plate; striae of the maxillary plate are particularly well developed in *Apedilum* larvae and are more noticeable than the striae of the ventromental plate. There are 90-105 striae in each plate in 4th instar *A. elachistum* larvae; 110-125 in *A. subcinctum*.

Larvae are found on submerged vegetation in ponds, canals and lakes, and the slowly moving portions of rivers; they can also be found in brackish water. Magy et al. (1970) reported *A. subcinctum* (as a *Paralauterborniella*) as a pest species due to mass emergences.

ADDITIONAL REFERENCES: Epler 1988a; Nolte 1995.

mandible

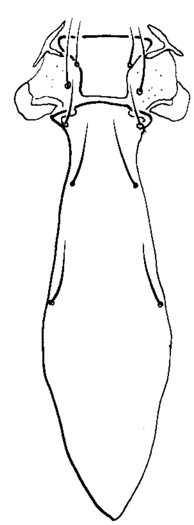


A. elachistum mentum

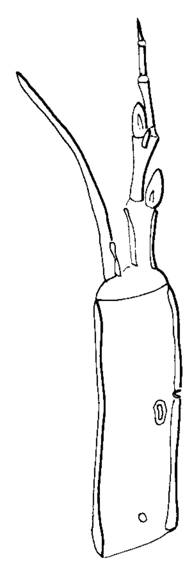
premandible

S I

pecten epipharyngis



apotome and labral sclerites



antenna

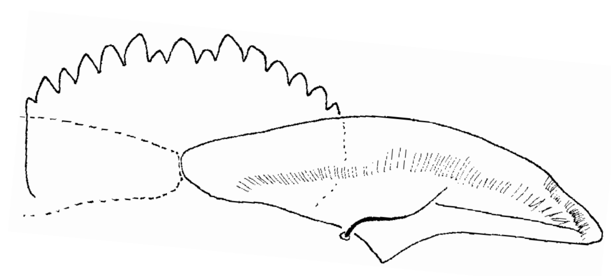
Genus *Axarus*

DIAGNOSIS: Distinguished by the 2 anteromedial labral sclerites and frontal apotome; wide ventromental plates that touch medially; mandible with 4 flattened inner teeth, no dorsal tooth and an apically serrated seta subdentalis; and the premandible with brush and 6 teeth.

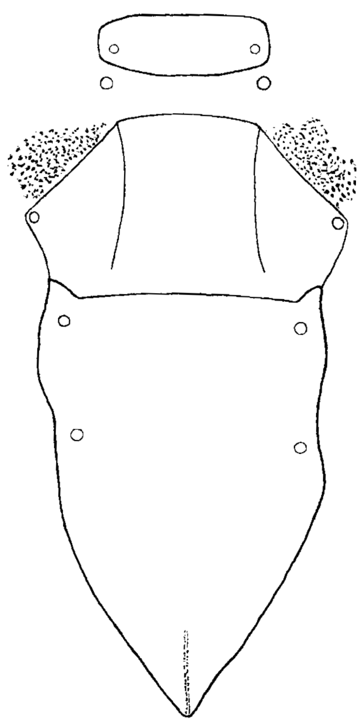
NOTES: *Axarus* is currently being revised by Dan Hansen (University of Minnesota). Three species of *Axarus* are recorded from the Carolinas by Caldwell et al. (1997). Although Roback (1963) offered a key for larvae (as *Xenochironomus (Anceus)*), it was based partially on unassociated specimens and relies mainly on antennal characters; in reality it is not possible to identify the larvae to species without associated reared adult males. The larva figured by Roback (1963) as "*Xenochironomus (Anceus) scopula* ? Townes" is probably a *Lipiniella*. Note that because larvae burrow through coarse sediments, the inner teeth of the mandible and the seta subdentalis are often worn; finding a larva with 4 inner teeth is an uncommon occurrence. It is more usual to find larvae with only 3 teeth (as figured below), 2 teeth or with no visible teeth. Larvae of the closely related *Lipiniella* almost always have 3 well defined, triangular inner teeth on the mandible, in addition to other characters, that make them easily separable from *Axarus*. All *Axarus* larvae I've examined have a dense brush of setae on the anterolateral margin of the maxilla, laterad of the maxillary palp.

Larvae are found in the bottom sediments of lakes and rivers. Ferrington (1992) found the larvae of *A. festivus* living in burrows in shale/clay sediments.

ADDITIONAL REFERENCES: Roback 1963; Ferrington 1992.

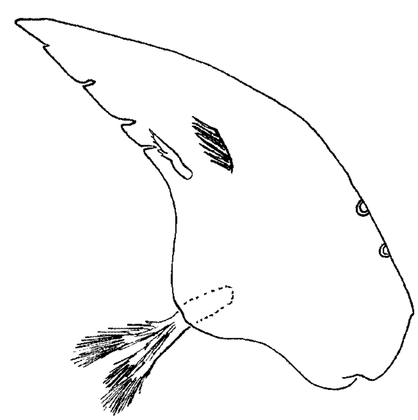


mentum



apotome and labral sclerites

premandible



mandible

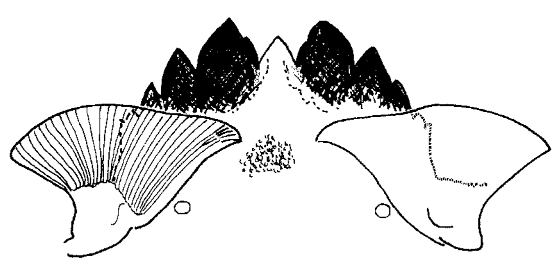
Genus *Beardius*

DIAGNOSIS: Distinguished by the 5-6 (7 in described Neotropical species) segmented antennae, with alternate Lauterborn organs; mentum with pale median tooth that is lower than first lateral teeth; and mandible with 2 inner teeth and a dorsal tooth.

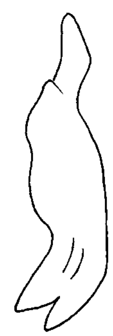
NOTES: *Beardius* has not been recorded from the Carolinas, but its presence in northern Florida indicates that it should eventually be found on the Coastal Plain. Three species are known from Florida, but apparently only *B. truncatus* Reiss & Sublette occurs in the northern portion of the state and is thus the most likely candidate to occur in the Carolinas. The antennae of *B. truncatus* are 5 segmented and its apotome has more extensive granulation; the antennae of *B. reissi* Jacobsen (*B*. sp. A in Epler 1995) have 6 segments and its apotome has less extensive granulation. The pupal *B*. sp. B of Jacobsen & Perry (2000) is *B. breviculus* Reiss & Sublette; tentatively associated larvae of this species appear to be identical to *B. truncatus*, but may be smaller (Jacobsen, pers. comm.). Thus, any *Beardius* larva from southern Florida with 5 segmented antennae may be either *B. truncatus* or *B. breviculus*; pupae or adult males are needed for accurate identification.

Beardius larvae occur in seasonally inundated wet prairie habitats and other intermittent wetlands, solution holes (Everglades), marshes, streams and rivers.

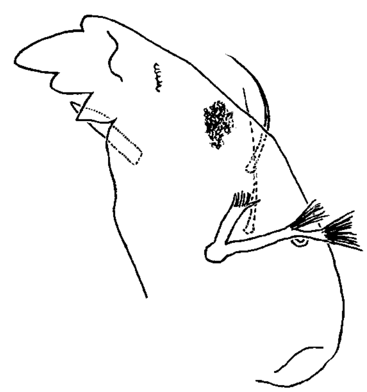
ADDITIONAL REFERENCES: Reiss & Sublette 1985; Jacobsen & Perry 2000.



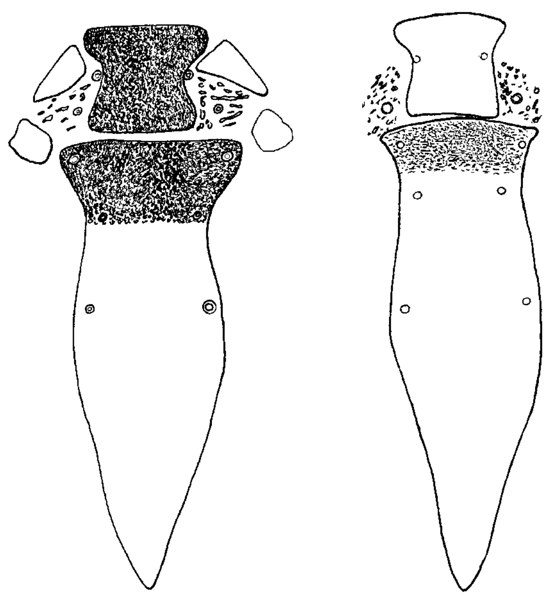
B. truncatus mentum



B. truncatus premandible

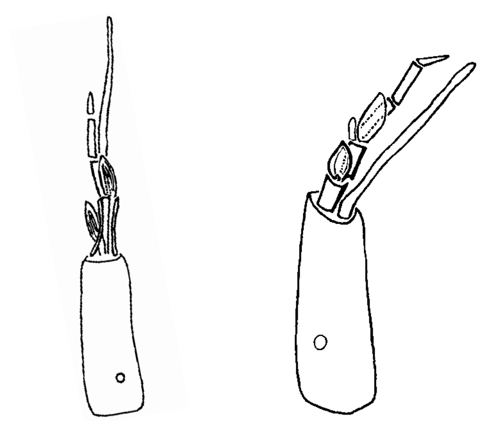


B. truncatus mandible



B. truncatus *B. reissi*

apotome and labral sclerites



B. truncatus *B. reissi*

antenna

Genus *Beckidia*

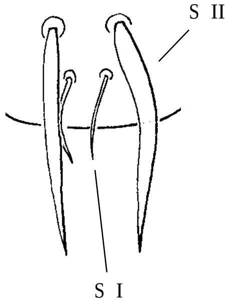
DIAGNOSIS: The small, thin S I and large, blade-like S II; 7 segmented antennae; mandible with 2 inner teeth and long seta subdentalis but without seta interna; and the mentum with an odd number of similarly colored brown teeth, with median tooth trifid, distinguish this genus.

NOTES: Although this genus has been reported from the Southeast (Hudson et al. 1990; Caldwell et al. 1997), I have not been able to examine those specimens or seen any other *Beckidia* material from this area. All putative *Beckidia* larvae I've seen from the Southeast have proven, upon my examination, to belong to other genera.

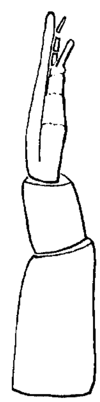
Because of weak sclerotization, the seven antennal segments are difficult to discern.

Larvae are recorded from the sandy bottoms of large rivers.

ADDITIONAL REFERENCES: Sæther 1977a.

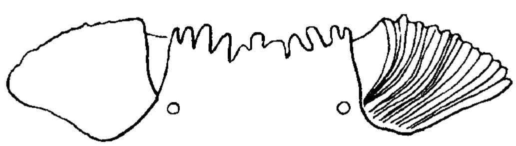


labrum



antenna

apex of mandible



mentum

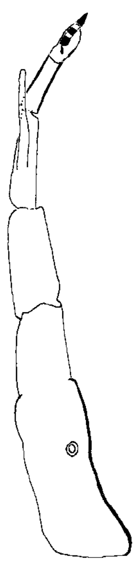
Genus *Chernovskiia*

DIAGNOSIS: Distinguished by the 8 segmented, weakly sclerotized antennae, concave mentum with pale teeth; small, coarsely striated ventromental plates; mandible with single large apical tooth and thin dorsal spine (tooth or modified pecten mandibularis?); and some body segments with apparent subdivisions.

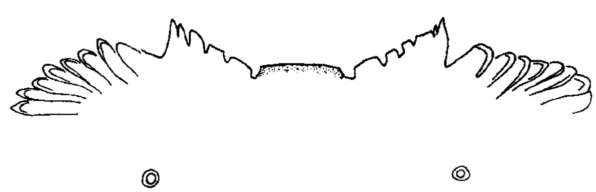
NOTES: Oliver et al. (1990) record two species from the North and South Carolina, but Caldwell et al. (1997) questioned the records of *Ch. amphitrite* (Townes) for the Carolinas. Sæther (1977a) listed *Ch. orbicus* for South Carolina based on an unassociated larva. Because the larva of *Ch. amphitrite* is unknown, no *Chernovskiia* larvae can realistically be identified at the species level without associated adults or pupae; unassociated larvae should be identified as "*Chernovskiia* sp.". Although Pinder & Reiss (1983) stated that the mandible lacked a seta interna, this structure is present in most larvae with clearly visible mandibles that I've examined from Florida and the Carolinas.

Larvae are found in sandy substrata in running water.

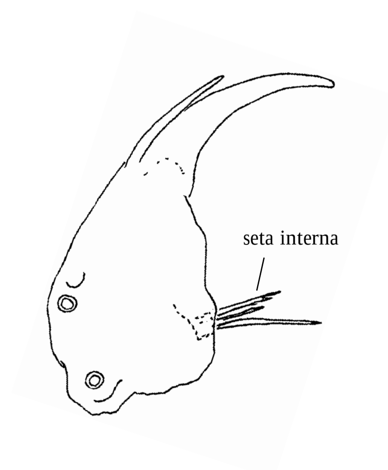
ADDITIONAL REFERENCES: Sæther 1977a.



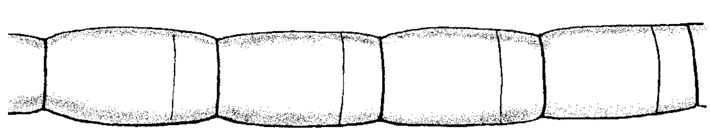
antenna



mentum



mandible



body segments

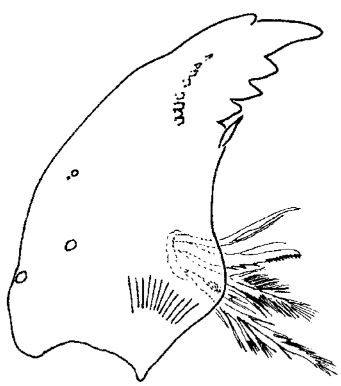
Genus *Chironomus*

DIAGNOSIS: Larvae are distinguished by the presence of a frontoclypeal apotome and one medial labral sclerite; pecten epipharyngis a single multi-toothed comb; mandible with basal radially arranged grooves and simple seta subdentalis; 0-1 pairs of caudolateral tubules and 0, 1 or 2 pairs of ventral tubules.

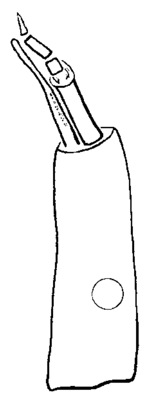
NOTES: At least 8 species of *Chironomus* in three subgenera (the subgenus *Camptochironomus* is not known from the Southeast) are known from the Carolinas, but are often difficult to identify to species as larvae; it may be necessary to utilize chromosomes or biomolecular data to accurately identify taxa.

Larvae are usually found in sediments, and can occur in highly polluted conditions or in relatively clean water. Larvae subjected to environmental pollutants may display deformities, especially of the mentum, mandibles and antennae. Larvae of the *Ch. decorus* group, *Ch. riparius* and *Ch. stigmaterus* are most often associated with high nutrient/low oxygen conditions. *Chironomus* larvae are frequently grown in lab cultures; the common lab culture species previously referred to as *Ch. tentans* in the Nearctic has recently been described as a new species, *Ch. dilutus* (Shobanov et al. 1999); this taxon is not known from the Carolinas.

ADDITIONAL REFERENCES: Lenat 1993a; Lindeberg & Wiederholm 1979; Ryser et al. 1985; Sublette & Sasa 1994; Sublette & Sublette 1974a, 1974b; Shobanov et al. 1999; Townes 1945; Webb & Scholl 1985; Wülker & Butler 1983; Wülker & Morath 1989; Wülker et al. 1989; Wülker et al. 1971.

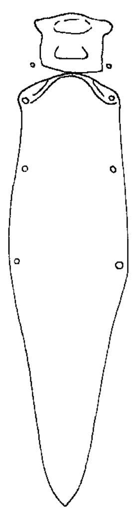


mandible

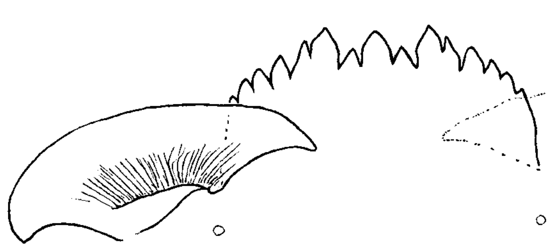


Ch. decorus group antenna

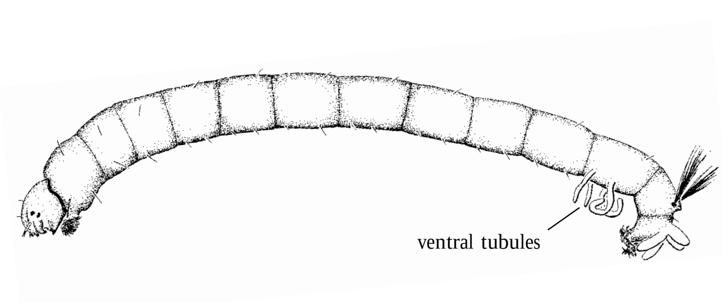
Ch. cf. *longipes* antenna



apotome & labral sclerite



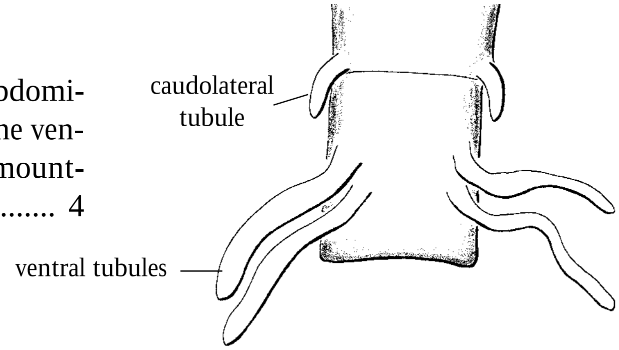
Ch. riparius mentum



larva

Key to *Chironomus* larvae of the southeastern United States

1 A pair of caudolateral tubules present on the abdominal segment anterior to the segment bearing the ventral tubules (best seen on larvae *before* slide mounting) 4



1’ Caudolateral tubules not present; ventral tubules present or absent 2

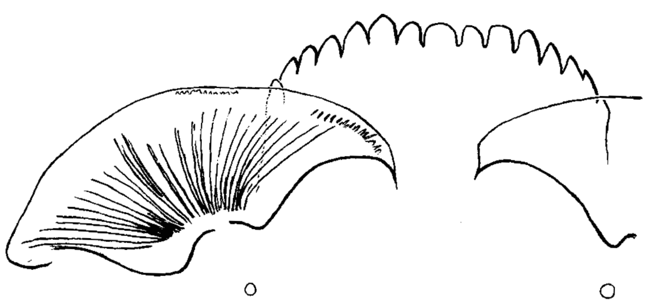
2(1’) Length of antennal segment 1/segment 2 < 3.5 .... ***Ch. ochreatus***

2’ Length of antennal segment 1/segment 2 > 3.5 3

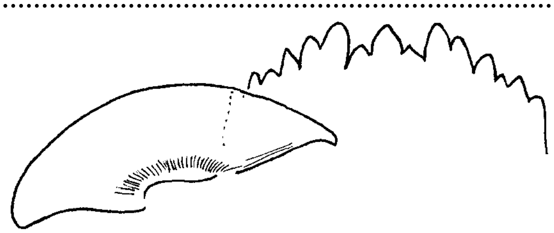
3(2’) Mandible with 2 dark inner teeth; ventral tubules absent; last instar larvae huge, total length 30-55+ mm; in lakes .... ***Ch. major***

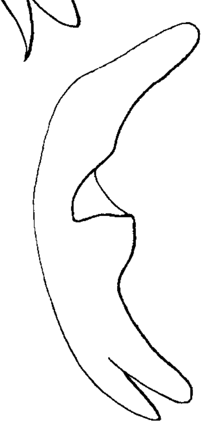
3’ Mandible with 3 dark inner teeth; 2 pairs of ventral tubules present; last instar larvae smaller, total length much less than 30 mm; in sewage treatment plants and streams downstream from them .... ***Ch. riparius***

4(1) Mentum with simple median tooth and 14 lateral teeth; premandible with numerous teeth; known only from peninsular Florida .... ***Ch.* sp. “Florida”**

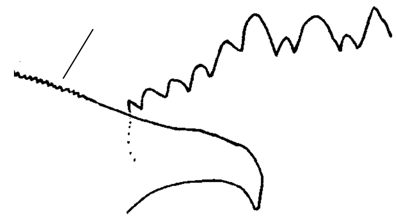


4’ Mentum with trifid median tooth and 12 lateral teeth; premandible apically bifid with at most one additional small tooth near center; widespread 5





5(4') Anteromedial margin of ventromental plate with fine teeth 6

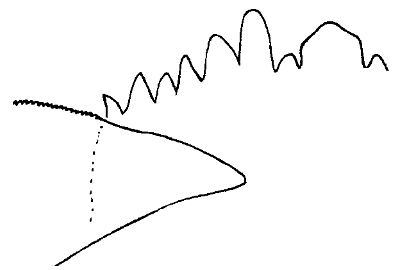


5' Anteromedian margin of ventromental plate smooth (minute teeth may be present beneath plate, but margin is smooth; or outer (lateral) margin of plate may be faintly crenulate) 8

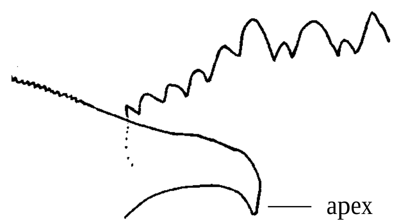
6(5) Mandible with 3 dark inner teeth .... ***Ch. plumosus***

6' Mandible with 2 dark inner teeth (if 3rd inner tooth present, it is light in color) 7

7(6') Inner apex of ventromental plate directed medially .... ***Ch. staegeri***



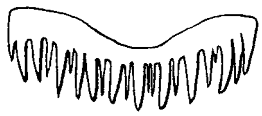
7' Inner apex of ventromental plate directed caudad .. .. ***Ch. crassicaudatus***



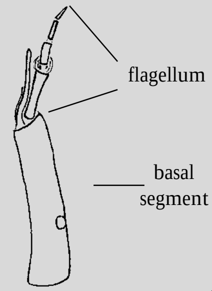
8(5') Head usually with central dark dorsal stripe (often not present on 2nd and 3rd instars); central tooth of mentum usually basally constricted .... ***Ch. stigmaterus***

8' Head without central dark dorsal stripe; median tooth of mentum straight at base or slightly constricted 9

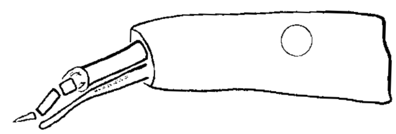
9(8’) Pecten epipharyngis with several thinner teeth interspersed among normal teeth; antenna appearing somewhat elongate, AR ≤ 1.5 .... ***Ch. (Lobochironomus)*** 10

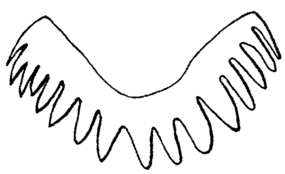


AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

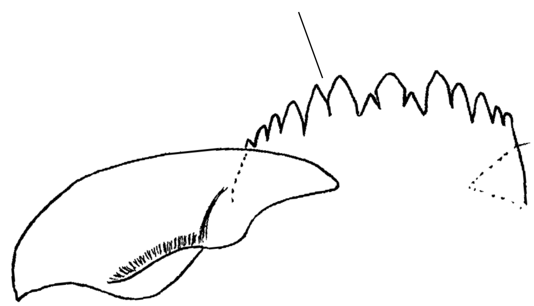


9’ Pecten epipharyngis with central teeth approximately equal, gradually becoming smaller laterally; antennae usually not appearing elongate, AR > 1.5 11

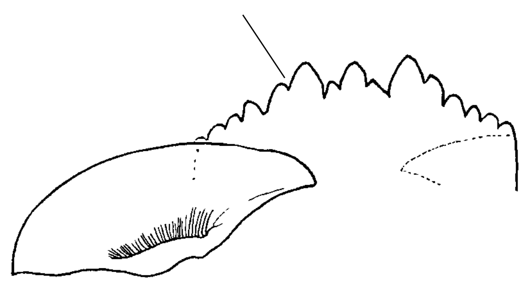




10(9) Mentum with 1st and 2nd lateral teeth mostly separate .... ***Ch.* cf. *longipes***
(see Notes!)



10’ Mentum with 1st and 2nd lateral teeth mostly fused .... ***Ch. austini***
(see Notes!)



11(9’) Mandible with one light and 2 dark inner teeth; AR 1.6-2.0 .... ***Ch. decorus* group**

11’ Mandible with 2-3 inner teeth which are variably colored; AR variable .... ***Chironomus* sp.**
(may include other specimens of *Ch. decorus* group as well as other species of *Chironomus*)

Notes on species

Ch. (Lobochironomus) austini - This species was described from Florida as an *Einfeldia*, but I am now moving it to *Chironomus (Lobochironomus)* based on adult and larval characters. This species is very similar to *Ch.* cf. *longipes*. I have examined a single larva of *Ch. austini* from North Carolina, where it was collected from an acidic (pH 3.8-4.3) stream in Juniper Swamp, Onslow Co.; this is the only specimen I've seen of this taxon other than the type series from Florida. Adults of *Ch. austini* are brown; those of *Ch.* cf. *longipes* pale green. The pupa of *Ch. austini* is darker, the abdominal tergites marked with a pair of brown longitudinal lateral stripes not found on the pupa of *Ch.* cf. *longipes*. Larvae of the two taxa are very similar. The mentum tooth character used for separation from *Ch.* cf. *longipes* may not work on additional material; your most accurate identification of unassociated larvae may be simply "*Chironomus (Lobochironomus)* sp.". More work is needed to determine the apparent differences between these two taxa.

Ch. (Ch.) crassicaudatus - A large species of lakes and ponds, closely related to *Ch. staegeri*. In addition to the ventromental plate character used in the key, the pecten epipharyngis of *Ch. crassicaudatus* has numerous smaller teeth among the large teeth; in *Ch. staegeri* the teeth are more similarly sized. Considered a nuisance species due to large emergences by Beck & Beck (1969a).

Ch. (Ch.) decorus group - Probably the most widespread and common member of the genus in the eastern United States. Several species may be included in the group, apparently separable only by chromosomes or biomolecular means; specimens may key out to either part of couplet 11 in the key above. Often found in lotic situations as well as lentic habitats and usually indicative of low water quality. In older literature, this taxon was referred to as *Chironomus* (or *Tendipes*) *attenuatus*.

Ch. (L.) cf. *longipes* - The identity of this taxon remains unclear; it probably is *Ch. longipes* but more work is needed. This taxon has been called *Einfeldia dorsalis* but the application of that name to this taxon is incorrect; the true *dorsalis* Meigen is a different species, an *Einfeldia*. A Holarctic species, *Ch. longipes* has been recorded from the Carolinas by Caldwell et al. (1997) as well as from Ontario by Oliver et al. (1990), and I have examined reared material from Florida and Georgia. The pupae of this species and *Ch. austini* do not appear to have the median gap in the hooklet row of tergite II as described for pupae of other *Lobochironomus*. See also *Ch. austini* above.

Ch. (Ch.) major - Originally described only as a larva from Georgia. I have seen larvae from lakes in Georgia, Kentucky and Tennessee. Adults and pupae are similar to *Ch. plumosus*. A member of the *salinarius* group, it lacks caudolateral and ventral tubules. It is the largest chironomid larva in the Southeast (perhaps all of North America), reaching lengths of 55 mm or more (although lengths of about 30 mm may be more the norm). Note that the name *Chironomus major* is a junior homonym and will have to be replaced by an available name.

Ch. (Chaetolabis) ochreatus - The only member of the subgenus *Chaetolabis* known from the Southeast. I've examined specimens reared from a roadside pond in Georgia. Epler (1995) noted that some specimens in collections identified as *Chaetolabis* were *Dicrotendipes simpsoni*.

Ch. (Ch.) plumosus - A large species of lakes, apparently not common.

Ch. (Ch.) riparius - A species usually found in lotic, organically polluted conditions, such as streams below sewage treatment plants.

Ch. (Ch.) staegeri - This close relative of *Ch. crassicaudatus* is recorded from several localities throughout the Southeast but is apparently never common. See also *Ch. crassicaudatus* above.

Ch. (Ch.) stigmaterus - Usually easily recognized by the dark dorsal stripe on the head capsule and the basally constricted center tooth of the trifid median tooth; early instars may not have the dorsal stripe. It is tolerant of poor water conditions; I have reared it from sulfurous springs and small pools of water with mucky bottoms in Florida.

Ch. (Ch.) tuxis - Listed for Florida and South Carolina by Caldwell et al. (1997); I have not seen material of this taxon from the Southeast; the immature stages are undescribed.

Ch.(Ch.) sp. "Florida" - Known only from peninsular Florida, where the larvae inhabit the burrows made in *Nuphar* by the aquatic moth *Bellura* (Pyralidae)(Bob Rutter, pers. comm.); I've examined specimens from two localities. The species is unusual in that the median tooth is not trifid; it appears that the lateral teeth which are normally reduced and appressed to the median tooth to form the characteristic trifid median tooth of most *Chironomus* larvae have been separated and appear as normal lateral teeth. Note also the numerous smaller teeth on the premandible; a *Chironomus* larva (pupal and adult stages unknown) with a similar premandible has been described from the Amazon (Reiss 1974b).

At least three additional *Chironomus* species are known from the Southeast. *Chironomus calligraphus* Goeldi is known from Florida (Spies & Reiss 1996), along with two additional undescribed species, based on chromosomal analysis (Wülker & Morath 1989). Although not recorded from the Southeast, *Ch. anonymus* Williston might occur in Florida; it and *Ch. calligraphus* are very similar to *Ch. decorus*.

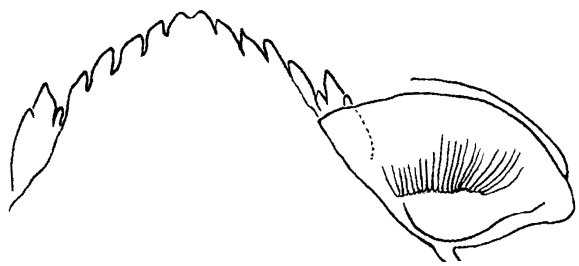
Genus *Cladopelma*

DIAGNOSIS: Distinguished by the mentum with the outer teeth enlarged and with the median tooth simple, or more usually notched or bifid, and not projecting strongly forward from the remainder of the mentum; pecten epipharyngis a simple plate; premandible with brush; mandible without pecten mandibularis; and antennae with basal segment length about 2.8X to > 4X its width.

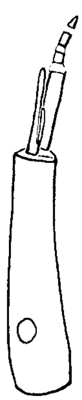
NOTES: All seven species described from the Nearctic have been collected in the Carolinas. Adults of *C. spectabile* have been collected recently in South Carolina at the Savannah River Plant site; note that this species may be a junior synonym of the Palaearctic *C. lateralis* (Goetghebuer). The descriptions of Beck & Beck (1969b) are inadequate to identify the larvae. I have examined rearings of four species and could not find characters to separate them. Note that *C. boydi* (Beck) is now considered a junior synonym of *C. forcipis* (Rempel). Also see *Parachironomus alatus*, a species whose larva closely resembles a *Cladopelma*.

Larvae are usually found on or in bottom sediments in lakes and rivers; some species are tolerant of low oxygen conditions.

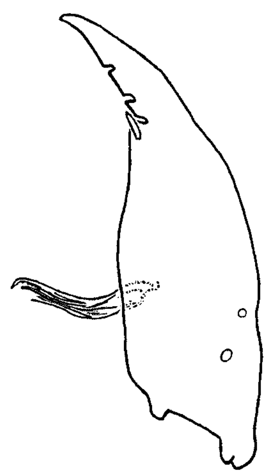
ADDITIONAL REFERENCES: Beck & Beck 1969b; Sæther 1977a; Townes 1945.



mentum



antenna



mandible

Genus *Cladotanytarsus*

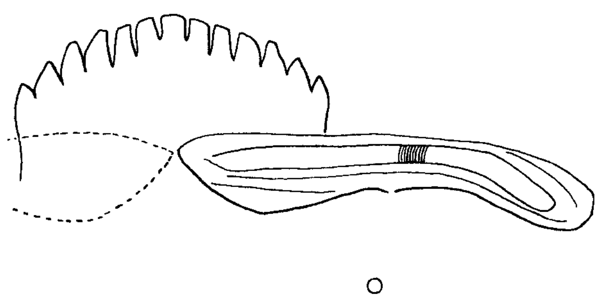
DIAGNOSIS: Distinguished by the pecten epipharyngis of 3 apically serrated scales; premandible with more than 3 apical teeth; ventromental plates touching or almost touching medially; antennae usually with 2nd segment short, wedge-shaped, with large Lauterborn organs on short pedicels (but at least one species with long pedicels); and some claws of posterior parapods with inner teeth.

NOTES: Based on the larval taxa I've examined, at least eleven species occur in the Southeast. Bilyj & Davies (1989) described seven new species from Canada, but included only adults and pupae. They found pupae to provide the best characters for species separation and provided identification keys for the pupae of 20 Holarctic species.

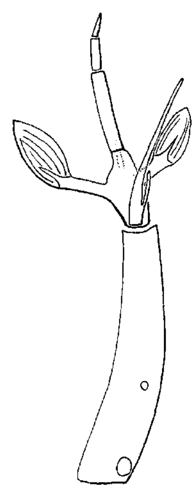
Because of the similarity of male genitalia among *Cladotanytarsus* species (see Bilyj & Davies 1989), all records of the supposedly widespread *C. viridiventris* must be treated with skepticism. The genus is currently being revised by Dr. J.E. Sublette.

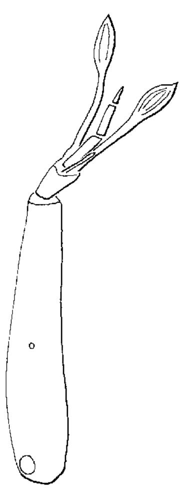
Larvae are found in many types of water bodies, including brackish water and hot springs. Bilyj & Davies (1989) found that some species were intolerant to acidification, but noted that *C. aeiparthenus* was apparently acidophilic.

ADDITIONAL REFERENCES: Bilyj & Davies 1989.



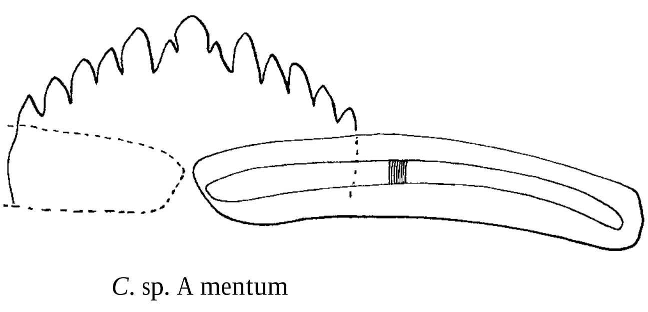
C. cf. *daviesi* mentum



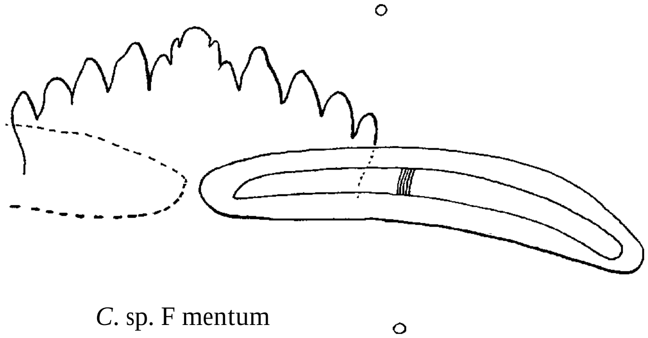


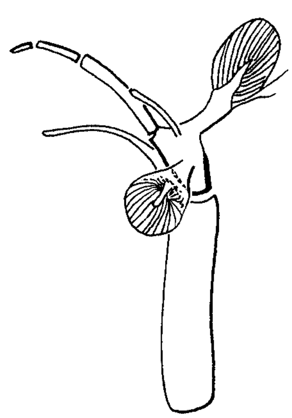
C. sp. A antenna

C. sp. C antenna



C. sp. A mentum



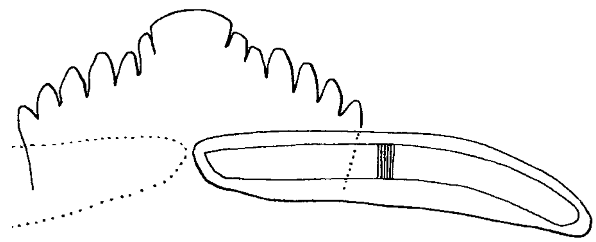


C. sp. F mentum

C. sp. G antenna

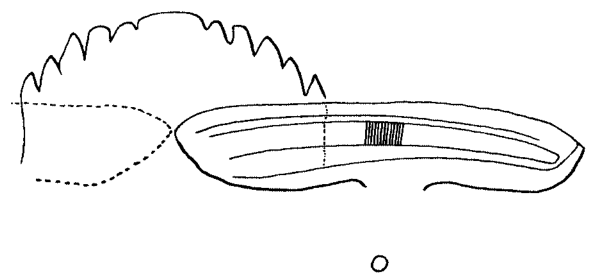
Key to *Cladotanytarsus* larvae of the southeastern United States

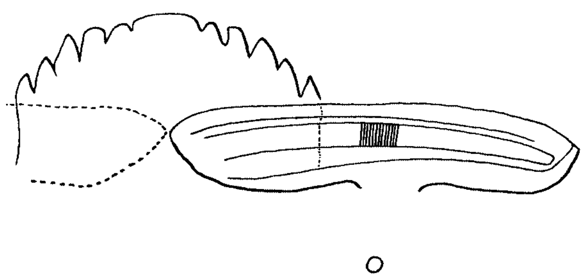
1 Mentum with large, domed median tooth that extends anteriorly far past lateral teeth ... . ***C.* sp. I**

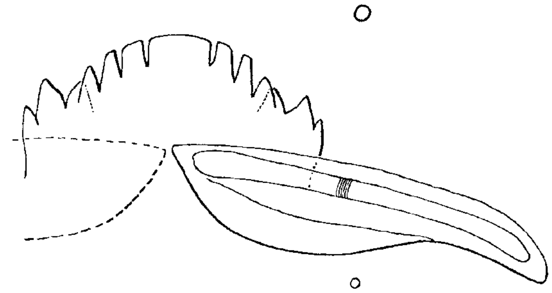


1’ Median tooth of mentum not dome-like (see figures below) 2

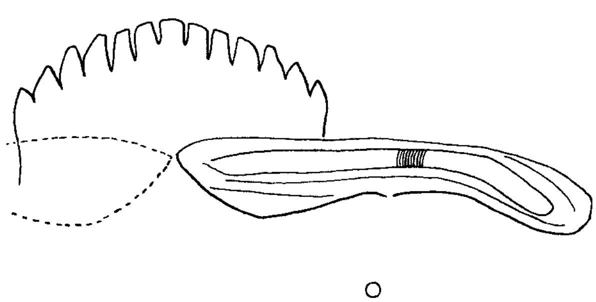
2(1’) Mentum with broad median tooth 3

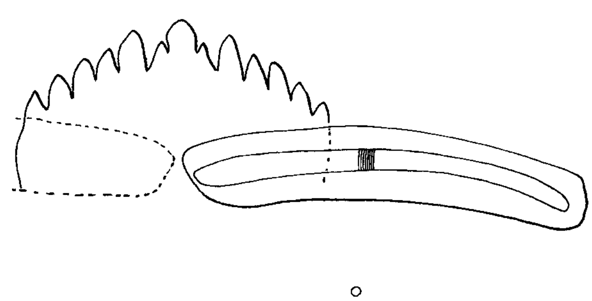




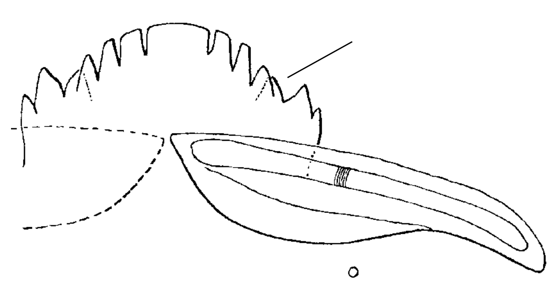


2’ Mentum with 3 subequal central teeth or trifid median tooth 5

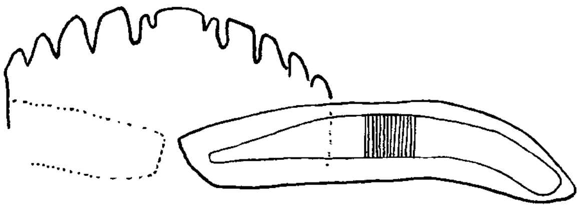




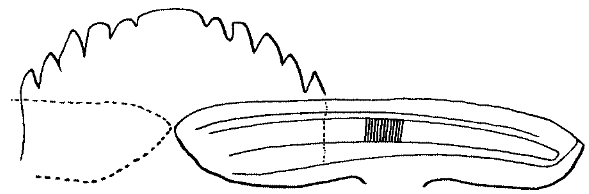
3(2) Mentum with 4th-6th lateral teeth displaced dorsally .... ***C.* sp. D**



3’ Mentum without displaced lateral teeth 4



C. aeiparthenus



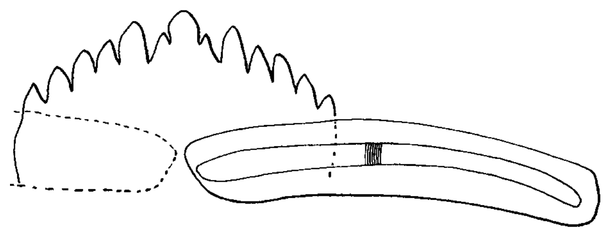
C. sp. G

4(3’) Mentum width about 75 µm; postmentum length about 130 µm .... ***C. aeiparthenus***

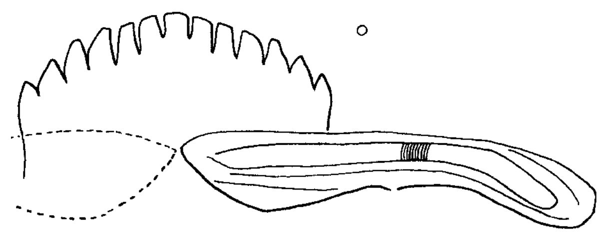
4’ Mentum width about 45 µm; postmentum length about 85 µm .... ***C.* sp. G**

NOTE:
4th instar larvae are necessary for accurate measurements!!

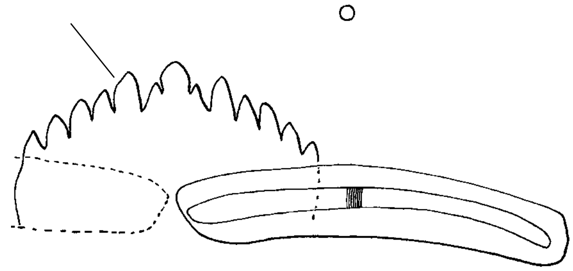
5(2’) Mentum with trifid median tooth 6



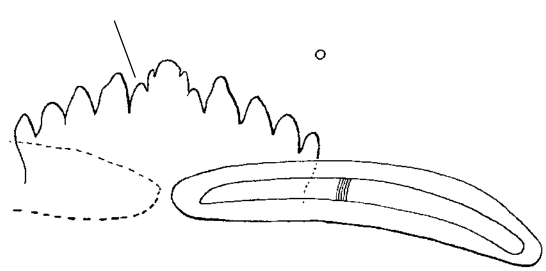
5’ Mentum with 3 teeth at center subequal 9



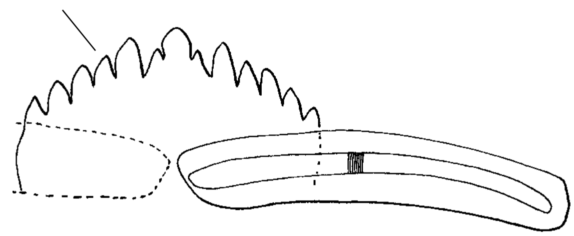
6(5) Mentum with large 1st lateral tooth 7



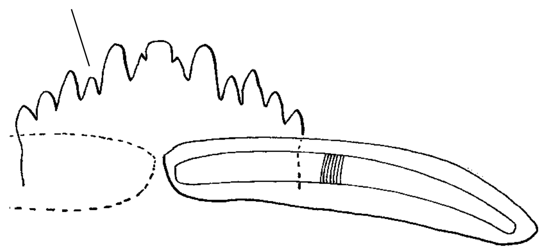
6’ Mentum with reduced 1st lateral tooth 8



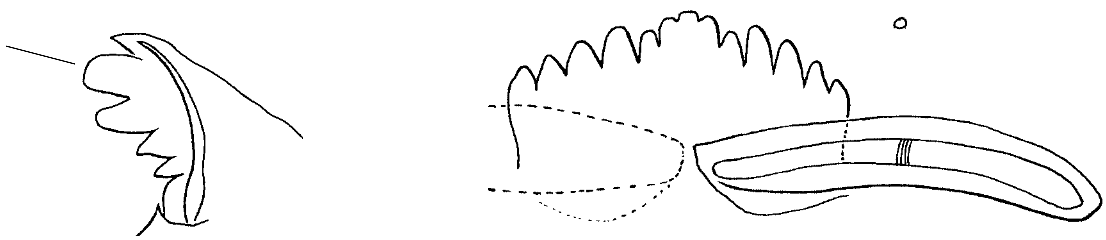
7(6) Mentum with 2nd lateral tooth subequal to 3rd .... ***C.* sp. A**



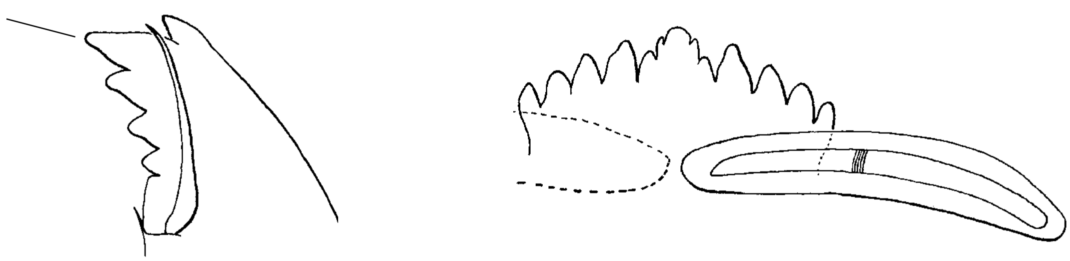
7’ Mentum with 2nd lateral tooth reduced .... ***C.* sp. B**

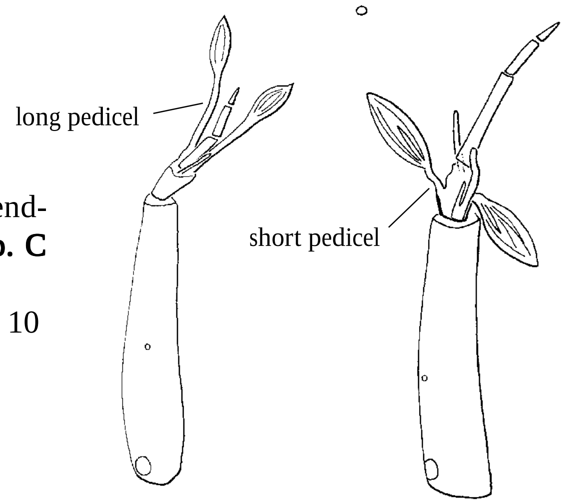


8(6’) Apical tooth of mandible rounded .... ***C.* sp. E**



8’ Apical tooth of mandible pointed .... ***C.* sp. F**

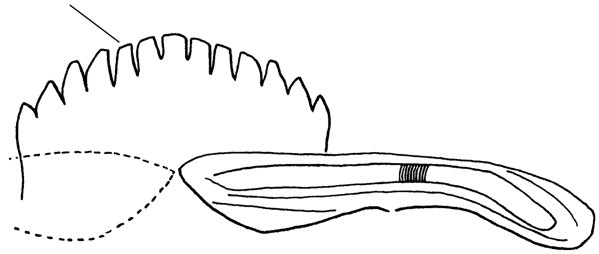




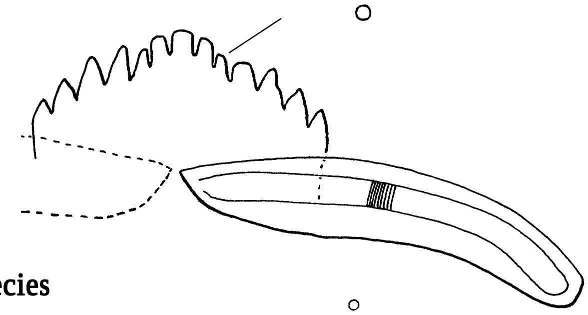
9(5’) Lauterborn organs on long pedicels, organs extending beyond last antennal segment .... ***C.* sp. C**

9’ Lauterborn organs on short pedicels 10

10(9') Mentum with 2nd lateral tooth subequal to 1st .... ***C.* cf. *daviesi***



10' Mentum with 2nd lateral tooth smaller, thinner than 1st .... ***C.* sp. *H***



Notes on species

Note that most of the taxa below are represented by larvae only. Associated pupae may demonstrate that several of these taxa may be synonyms. Note also that wear on the median teeth of the mentum may alter their appearance!

C. aeiparthenus - I have reared this species, originally described from Ontario, Canada, from peninsular Florida. It is apparently parthenogenetic; only females and female pupae are known.

C. cf. *daviesi* - I have reared larvae from Florida which appear to be *C. daviesi*, but some pupae differ in having a higher number of taeniate setae on the anal lobes (20-21, instead of the 16-19 noted in the original description). Dr. Sublette (pers. comm.) considers this taxon to be an undescribed species. I've seen material from Florida (reared), North Carolina and South Carolina. The apical tooth of the mandible is broadly rounded.

C. sp. A - Usually a lentic species, usually with a darkened postmentum. I've seen material from Florida, North Carolina and South Carolina. The apical tooth of the mandible is pointed.

C. sp. B - The trifid median tooth and reduced second lateral tooth are distinctive for this species. I've examined reared material from a small pond in North Carolina and a river discharge into a lake in South Carolina. Also known from Alabama and Florida. The apical tooth of the mandible is pointed.

C. sp. C - This species is unusual in that the Lauterborn organs are placed on long pedicels; otherwise it appears to be a typical *Cladotanytarsus*. I've seen material only from Alabama streams. The apical tooth of the mandible is broadly rounded.

C. sp. D - The displaced 4th, 5th and 6th lateral teeth of the mentum are distinctive, but may represent a deformity, although I've seen material from three sites in North Carolina and the taxon is also known from Florida. The apical tooth of the mandible is broadly rounded.

C. sp. E - I've examined material of this taxon from North and South Carolina.

C. sp. F - I've seen material from Kentucky and North Carolina; also known from Florida.

C. sp. G - This taxon is known from a single larval-pupal association from a stream in northern Florida. Although the larva strongly resembles that of *C. aeiparthenus*, and apparently differs from it only in size, the pupa is entirely different from *C. aeiparthenus* and definitely represents another species.

C. sp. H - Very similar to *C.* cf. *daviesi*, but with a smaller, thinner second lateral tooth on the mentum; it may represent a variant of that species. I've seen material from North and South Carolina.

C. sp. I - The distinctive domed median tooth of the mentum will identify this taxon, known from Florida and North Carolina. The apical tooth of the mandible is rounded.

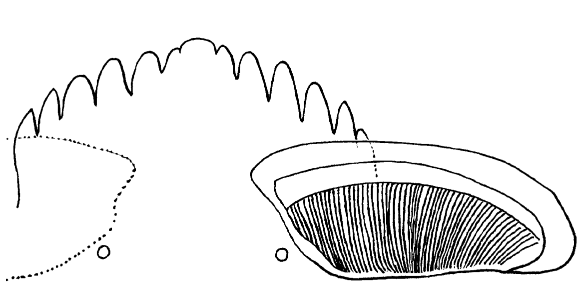
Genus *Constempellina*

DIAGNOSIS: Distinguished by the simple or plumose frontoclypeal setae; coarsely granulate frontoclypeal apotome, without tubercles; antennal base with simple spur; Lauterborn organs on pedicels arising from apex of antennal segment 2; widely separated, squat ventromental plates; procerci without spurs; and portable sand case.

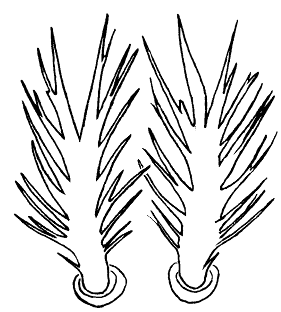
NOTES: Only one Nearctic species, *C. brevicosta*, is listed for the genus by Oliver et al. (1990). *Stempellina ranota* Webb, described from Ontario (Webb 1969), is a junior synonym of *C. brevicosta* (Sublette, pers. comm.). The taxonomy of *Constempellina*, *Neostempellina* and *Stempellina* in North America remains confused. Based on larval characters, two larval taxa from the eastern US can be tentatively placed in *Constempellina*; *C.* sp. A is known from North Carolina. It is characterized by thick, plumose frontoclypeal setae. *Constempellina* sp. B, known to me only from reared material from Ohio and a single larva from Alabama, has thinner plumose frontoclypeal setae, similar to those illustrated for *C.* sp. 2 in Oliver et al. (1978: fig. 97). However, the pupa of *C.* sp. B does not fit any described Holarctic genus (it appears closest to *Neostempellina* or *Zavrelia*) and the adult appears to be closest to *Stempellinella*! A revision of Holarctic *Constempellina*, *Neostempellina* and *Stempellina*, utilizing all life stages, is necessary to solve the problems of the taxonomy of this group. Larvae identified as *Constempellina* from Florida by Epler (1995) belong with *Stempellina* sp. C; the mesal palmate processes on the antennal bases were obscured by detritus. See *Stempellina* for information on this enigmatic taxon.

Larvae are stream dwellers; they construct portable sand cases similar to those of *Stempellina*.

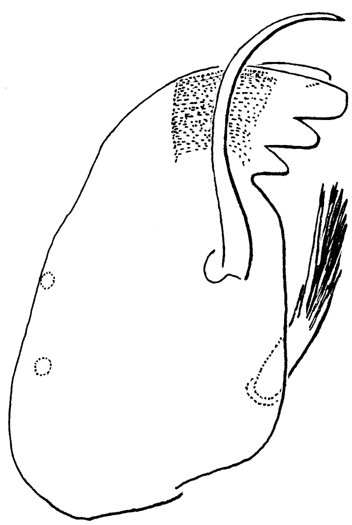
ADDITIONAL REFERENCES: Brundin 1948; Ferrington 1995; Webb 1969.



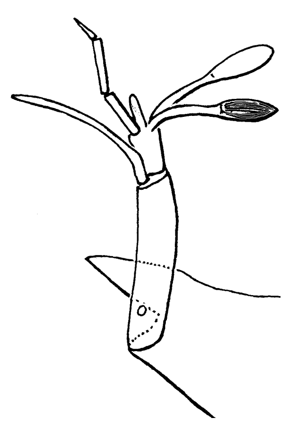
C. sp. A mentum



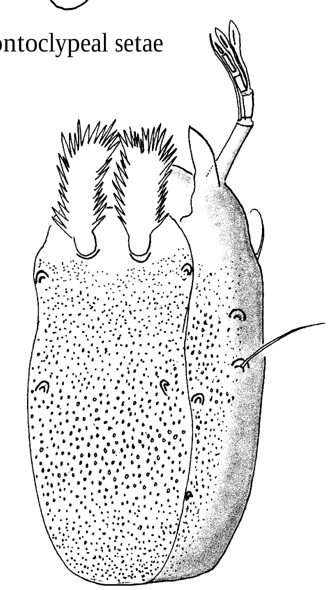
C. sp. B frontoclypeal setae



C. sp. A mandible



C. sp. A antenna



C. sp. A partial head capsule, dorsal

Genus *Cryptochironomus*

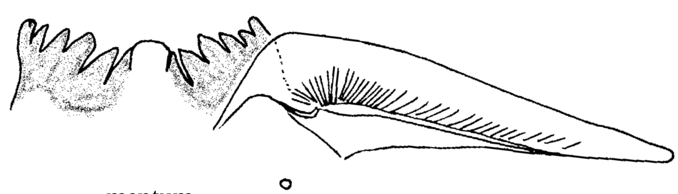
DIAGNOSIS: Distinguished by the 5 segmented antennae; well developed S I; trifid pecten epipharyngis; premandible with weak to moderate brush and several apical teeth; mandible without pecten mandibularis; mentum with clear rounded median tooth flanked by dark, pointed lateral teeth that are angled inward; and wide, laterally tapered ventromental plates.

NOTES: The genus is badly in need of a revision utilizing all life stages. It is not possible to identify *Cryptochironomus* larvae to species without an associated pupa or adult male; thus any records based solely on larvae must be regarded with skepticism. Curry (1958) offered a key to larvae, but some of his material was misidentified and more species are present than were keyed; Roback's (1957) key to larvae is also not reliable. Caldwell et al. (1997) list 11 described species for the Southeast, six of which are recorded for the Carolinas. With the exception of identifications based upon pupae, many of those records should be discounted. Identifications of "*C. fulvus*" mean little; Mason (1985b) found four species, based mainly on pupal characters, within the *C. fulvus* complex (or group) of species. Larvae of several species (*blarina*, *eminentia*, *ponderosus*) have a very long apical tooth on the mandible. Larvae from the Carolinas I've examined identified as *C. blarina* are most likely *C. ponderosus*, but pupae are required for verification; it is easy to mistake scales of the hypopharynx for the small "teeth" supposedly located on the median tooth of the mentum as described by Curry (1958).

Two other taxa referred to as "*Cryptochironomus*" by Caldwell et al. (1997) do not belong there: "*Cryptochironomus*" Pagast is *Kloosia* and "*C.* nr. *macropodus* Lyakhov" is *Harnischia* complex genus C. See also *Harnischia* complex genus D.

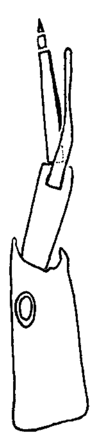
Cryptochironomus larvae are mostly benthic and seem to prefer sandy substrata.

ADDITIONAL REFERENCES: Curry 1958; Mason 1985b; Sublette 1964; Townes 1945.

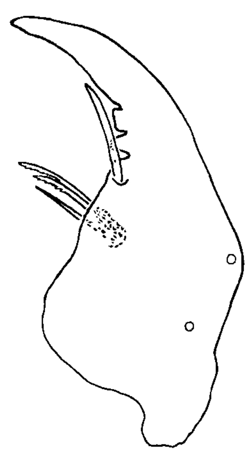


mentum

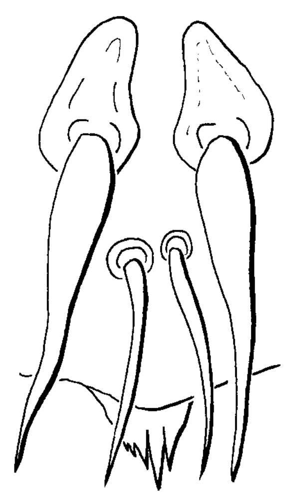
premandible



antenna



mandible



labrum

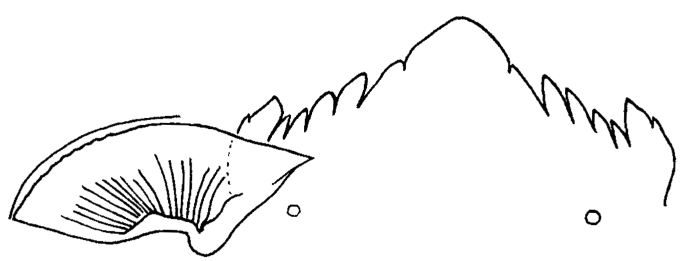
Genus *Cryptotendipes*

DIAGNOSIS: Distinguished by the distinctive mentum, with outer lateral teeth enlarged and with median tooth simple or notched laterally and projecting strongly forward from remainder of mentum; pecten epipharyngis a plate with 3 shallow rounded lobes; premandible with brush; mandible without pecten mandibularis; and antenna with length of basal segment about 2-2.5X its width.

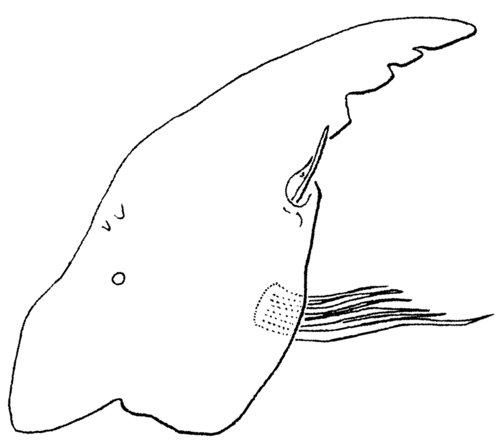
NOTES: Three species are recorded for the Southeast and from the Carolinas. In addition, I have reared an undescribed species from Lake Okeechobee, Florida, in which the male resembles *C. emorsus* but the pupa is radically different, bearing huge setae on the abdominal tergites and sternites. Confusion exists over separating *C. casuarius* from *C. emorsus* in the adult stage; the material described as *C. casuarius* by Beck & Beck (1969b) appears to be *C. emorsus*. Sæther (1977) offered a key to known Holarctic adults but his Fig. 34B of the genitalia of *C. emorsus* appears to be inaccurate or the specimen illustrated is misidentified. *Cryptotendipes* larvae are not identifiable at the species level.

Cryptotendipes larvae are found in lentic and lotic situations; they are usually benthic and appear to tolerate organically enriched habitats.

ADDITIONAL REFERENCES: Sæther 1977a; Townes 1945.



mentum



mandible

antenna

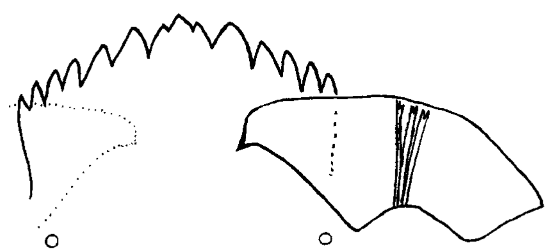
Genus *Demeijerea*

DIAGNOSIS: Distinguished by the frontoclypeal apotome with apotomal fenestra; pecten epipharyngis a single plate with multiple teeth; bifid premandible; mandible with 2 inner teeth, without basal striae; and a single pair of ventral tubules.

NOTES: Of the four species placed in the genus in the Nearctic, three species are recorded for the Southeast and from the Carolinas. Heyn (1992) noted that of the four species placed in the genus by Townes (1945) (as a subgenus of *Glyptotendipes*), only two, *D. brachialis* and *D. atrimana* are true *Demeijerea*; the other two species, *D. abrupta* (Townes) and *D. obrepta* (Townes), do not appear to belong to *Demeijerea* or *Glyptotendipes*.

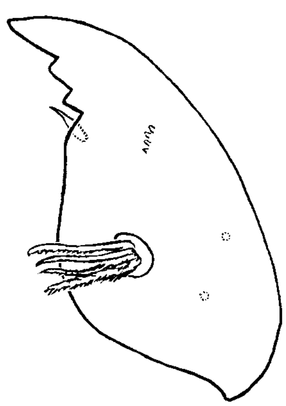
Larvae are not often encountered because they mine in freshwater sponges, bryozoans and plants such as Bur-reed, *Sparganium americanum* (Nuttall), habitats not usually collected by benthologists. Note that mouthparts may be quite worn due to mining activities. At present it is not possible to identify larvae to species.

ADDITIONAL REFERENCES: Heyn 1992; Townes 1945.

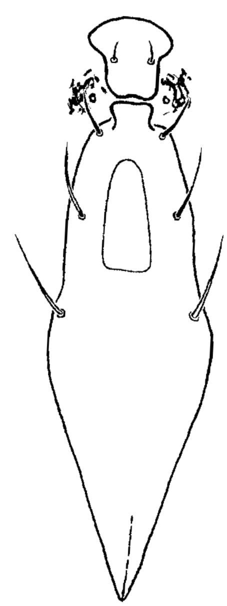


mentum

pecten epipharyngis



mandible



frontoclypeal apotome

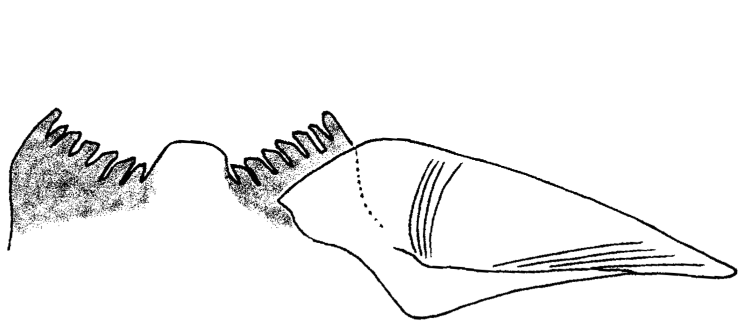
Genus *Demicryptochironomus*

DIAGNOSIS: Distinguished by the small, thin S I; 7 segmented antennae; premandible without a brush; mentum with mostly clear, apically round median tooth flanked by 7 pairs of usually dark, pointed lateral teeth that are angled inward; wide, laterally tapered ventromental plates; and mandible with pecten mandibularis.

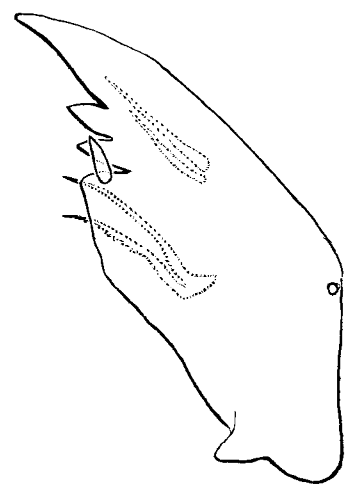
NOTES: Two described species are known from North America; *D. cuneatus* is recorded from the Carolinas. I have examined what appear to be four larval types from the eastern US; they are keyed below.

Larvae are recorded as predators on oligochaetes; most guts I've examined were filled with sandy detritus. Larvae occur in sandy substrata in lakes, rivers and streams.

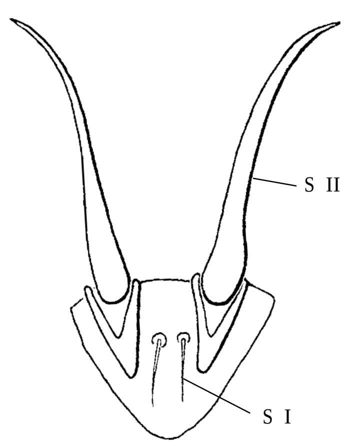
ADDITIONAL REFERENCES: Reiss 1988a; Sæther 1977a; Townes 1945.



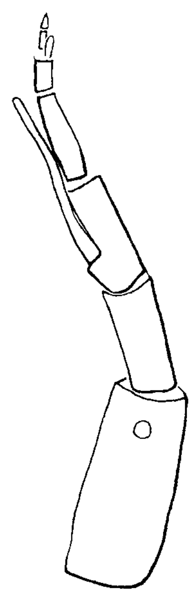
D. cuneatus mentum



D. cuneatus mandible



D. sp. A labrum

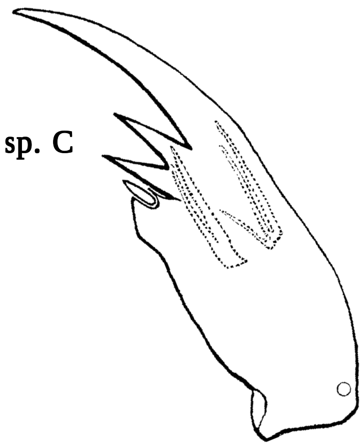


D. sp. A antenna

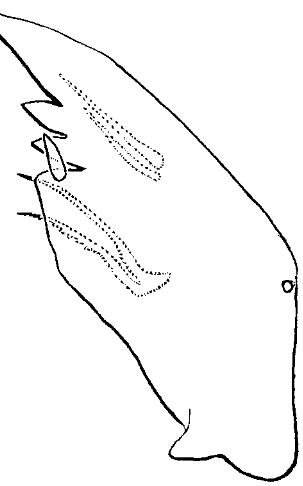
D. cuneatus antenna

Key to *Demicryptochironomus* larvae of the southeastern United States

1 Mandible with apical tooth and inner teeth long and thin .... ***D*. sp. C**

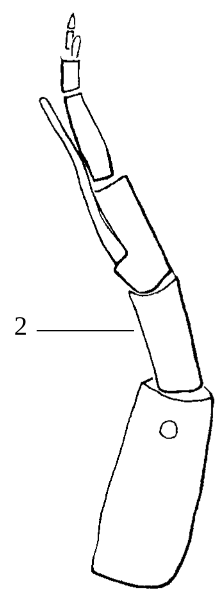


1’ Mandible with apical tooth and inner teeth shorter and squatter ... 2



2(1’) Antennal segment 2-2.25 times as long as wide .... ***D*. sp. A**

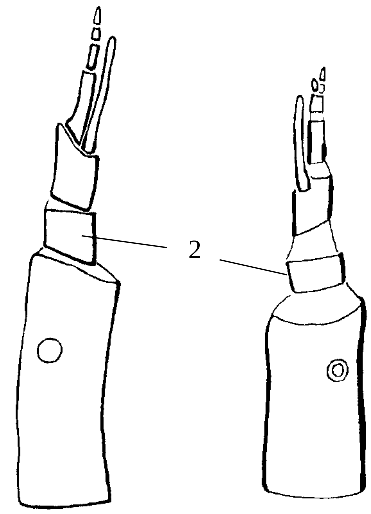
2’ Antennal segment 2 as long as wide or wider than long 3



D. sp. A

3(2') Antennal segment 2 as long as wide .... ***D.* sp. B**

3' Antennal segment 2 wider than long .... ***D. cuneatus***



D. sp. B *D. cuneatus*

Notes on species

D. cuneatus - The only described species known from the Southeast, but because it was the only species described as a larva (Sæther 1977a), many records may apply to one or several of the other taxa keyed here. Hudson et al. (1990) posited that this was the only species of *Demicryptochironomus* to occur in lakes; all material I've examined has come from rivers and streams. I've examined larval material from North Carolina and Pennsylvania, and have adults from Alabama.

D. sp. A - I've examined larvae of this taxon from streams in North Carolina.

D. sp. B - This taxon may be a variant of *D. cuneatus*; reared material is necessary to determine its true status. I've seen material from streams in Florida, North Carolina and Pennsylvania.

D. sp. C - This taxon is easily recognizable by its distinctive mandible, with its long, thin and sharply pointed apical and inner teeth. A river and stream species, I've examined material from Georgia, North Carolina and Ohio.

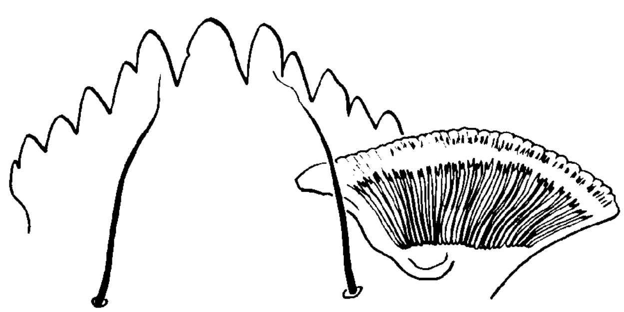
Genus *Dicrotendipes*

DIAGNOSIS: Southeastern larvae are distinguished by the frontal apotome which usually has a frontal pit (sometimes absent) or an apotomal fenestra (one species), with 2 median labral sclerites anterior to the apotome (an extralimital species, *D. lobiger* (Kieffer), has a frontoclypeal apotome); pecten epipharyngis with fewer than 12 teeth/lobes (usually 3-6); mentum with an odd number of teeth; ventromental plate width less than width of mentum; and narrow triangulum occipitale. Two southeastern species may have a single pair of ventral tubules.

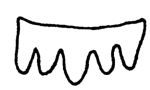
NOTES: Eleven described species are known from the Southeast (including Tennessee); ten species are recorded from the Carolinas. There are two undescribed species in Florida, one of which, *D*. sp. A, will probably eventually be found on the Coastal Plain in the Carolinas. Larvae of some *Dicrotendipes* species have often been misidentified due to incorrect keys (Beck 1976, 1979; Webb & Brigham 1982); thus older literature records must be veiwed with skepticism. Several species are distinctive as larvae, but others must be associated with pupae or adult males for correct identification.

Larvae are found in brackish and fresh water, in lotic and lentic conditions, in pristine or degraded habitats. Larvae occur in sediments but are most often encountered on vegetation.

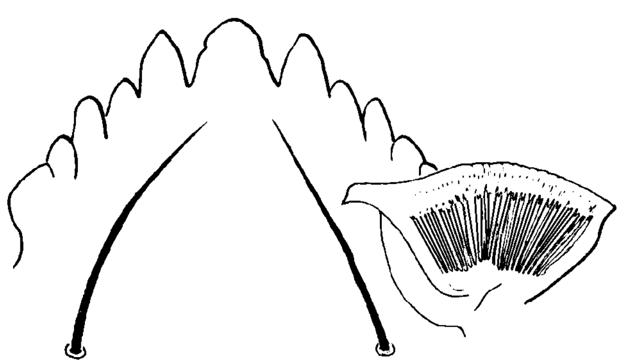
ADDITIONAL REFERENCES: Epler 1987, 1988b.



D. modestus mentum

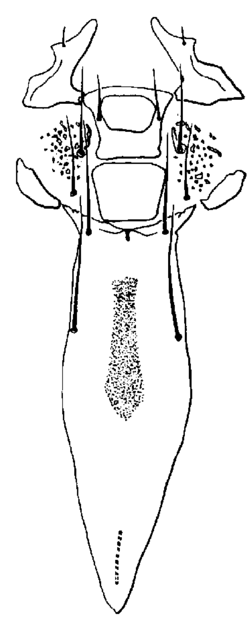


pecten epipharyngis



D. simpsoni mentum

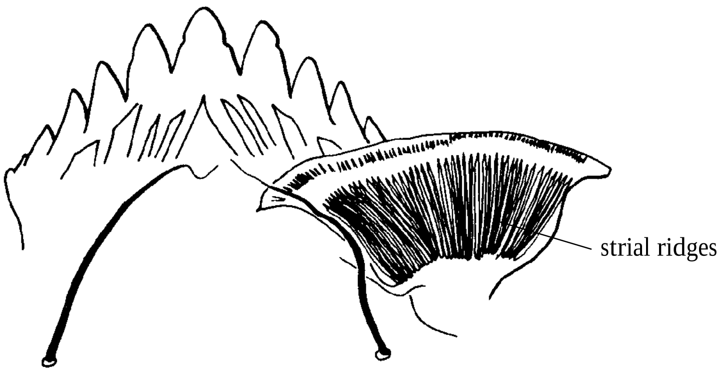
D. neomodestus antenna

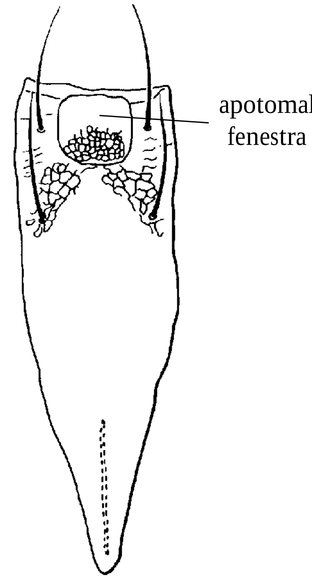


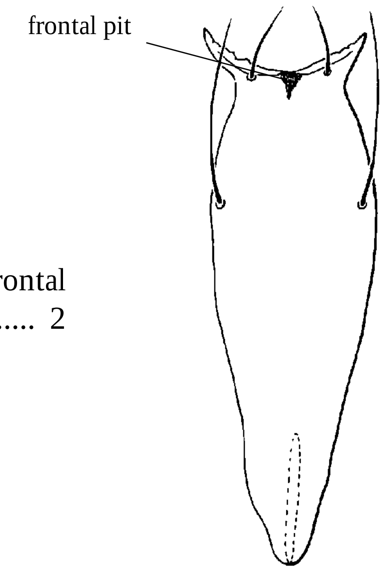
D. neomodestus apotome and labral sclerites

Key to *Dicrotendipes* larvae of the southeastern United States

1 Apotome with large oval-quadrate apotomal fenestra near anterior margin; ventromental plates usually with more than 40 strial ridges .... ***D. leucoscelis***

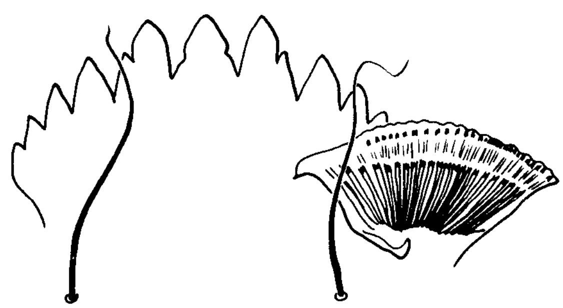




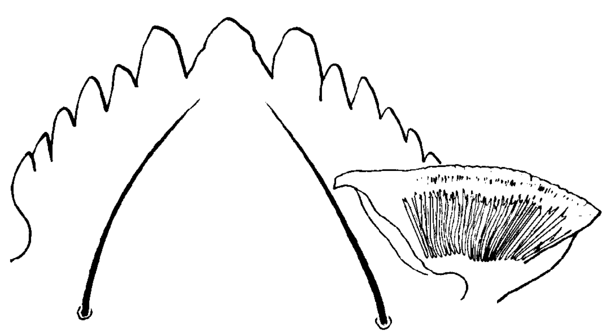


1’ Apotome without apotomal fenestra, but usually with frontal pit; ventromental plates with less than 40 strial ridges 2

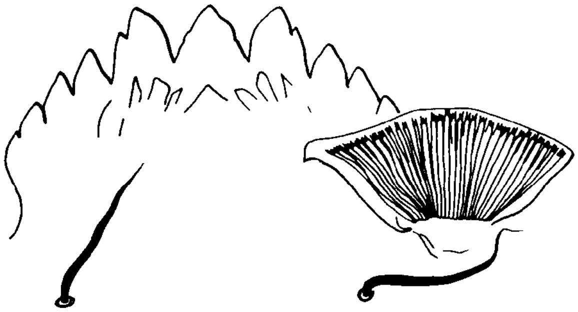
2(1’) Mentum with second lateral tooth fused or closely appressed to first lateral tooth for most of its length 3
(see Notes on *D. neomodestus* and *D. modestus*)

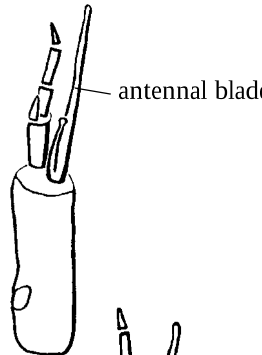


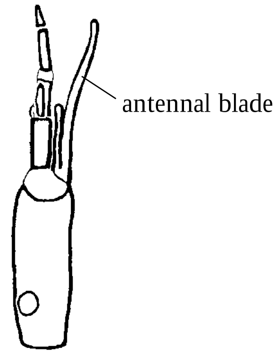
2’ Mentum with second lateral tooth not fused or cloesly appressed to first lateral tooth for most of its length 6



3(2) Anterior margin of ventromental plate smooth; antennal blade longer than flagellum; anal tubules reduced; brackish water/estuarine species .... ***D. lobus***

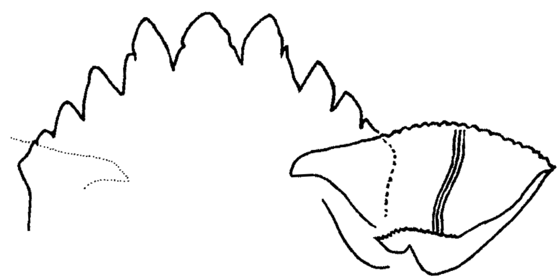






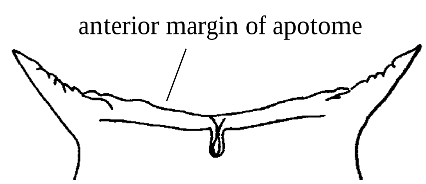
3’ Anterior margin of ventromental plate at least partially crenulated; antennal blade subequal to or shorter than flagellum; anal tubules not reduced; mostly freshwater species (but some may occur in brackish water) 4

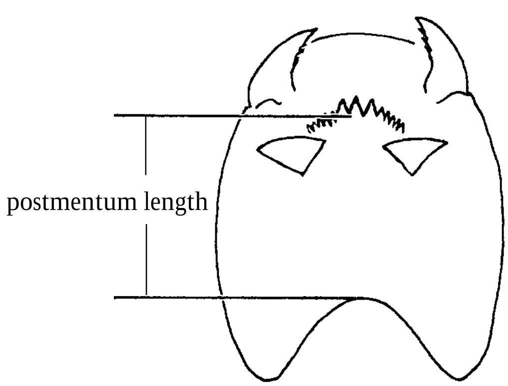
4(3’) 6th lateral tooth of mentum rounded and fused/appressed to 5th lateral tooth; at present known only from Florida .... ***D.* sp. A**

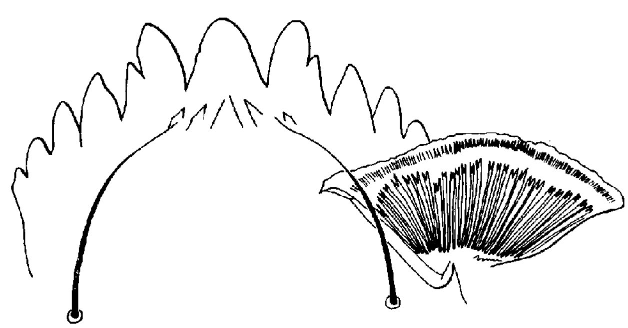


4’ 6th lateral tooth of mentum distinct, not fused/appressed to 5th lateral tooth 5

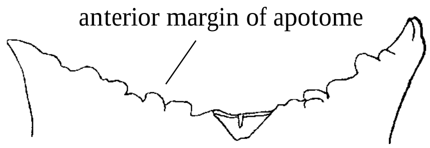
5(4’) Large species (4th instar only!): postmentum length > 250 µm; mentum width > 150 µm; anterior margin of frontal apotome mostly smooth; pecten mandibularis with more than 12 setae (usually 14); head capsule integument appears coarsely granular at 400X; first lateral teeth of mentum turn out slightly; uncommon .... ***D. fumidus*** (in part)

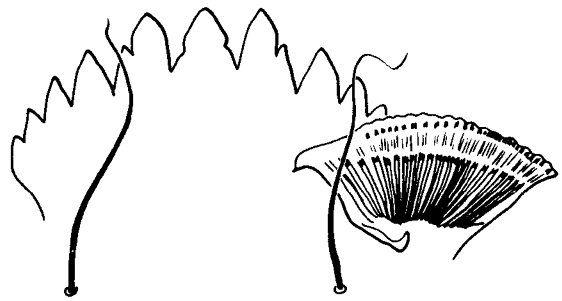




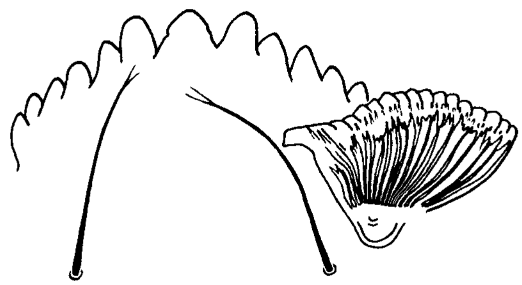


5’ Smaller species (4th instar only!): postmentum length < 250 µm; mentum width < 150 µm; pecten mandibularis with 12 or fewer setae (usually 9); anterior margin of frontal apotome tuberculate; head capsule integument usually not coarsely granulate, or if so, then granulation restricted to roughly longitudinal bands/spots; first lateral teeth not directed outward; common in running water .... ***D. neomodestus***



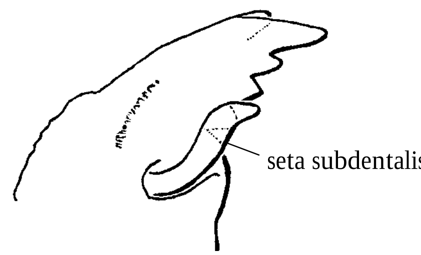


6(2’) Anterior margin of ventromental plates coarsely scalloped, plate with < 22 strial ridges; head capsule usually pale yellow with strong reticulation .... ***D. thanatogratus***



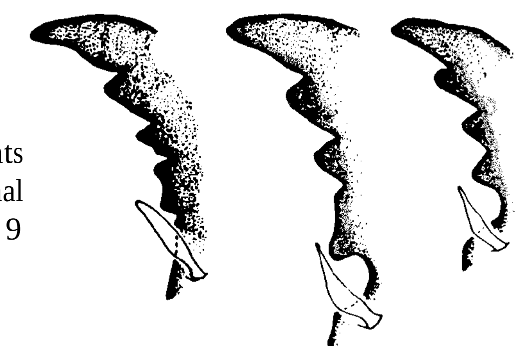
6’ Anterior margin of ventromental plates not as scalloped, plate with > 22 strial ridges; head capsule color variable, if pale yellow then without strong reticulation 7

7(6’) Mandible with giant seta subdentalis; known only from peninsular Florida .... ***D.* sp. B**

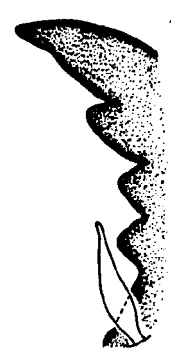


7’ Mandible with normal seta subdentalis 8

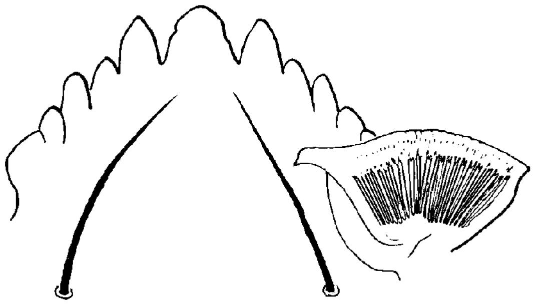
8(7’) Proximal tooth of mandible saddle-shaped or with 2 points OR with inner surface of mandible adjacent to proximal tooth with deep semicircular incision 9



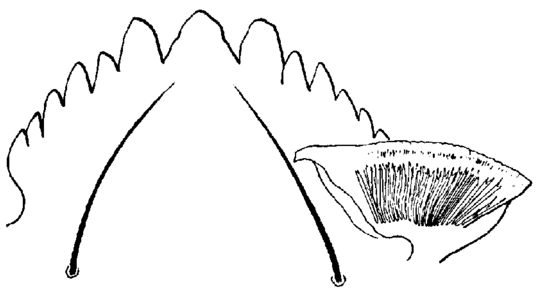
8’ Proximal tooth of mandible mostly triangular in outline; no deep semicircular incision present 10



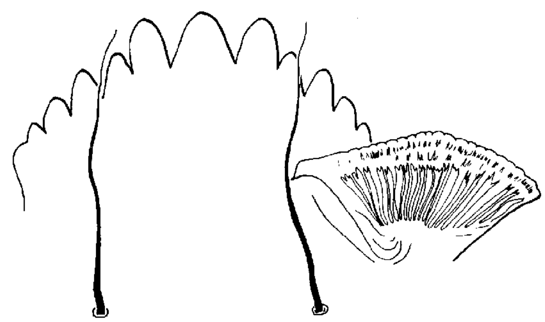
9(8) 6th lateral tooth of mentum rounded and fused/appressed to 5th lateral tooth; inner surfcae of mandible adjacent to proximal tooth with deep semicircular incision .... ***D. simpsoni***



9’ 6th lateral tooth of mentum distinct, pointed; mandible without deep incision .... ***D. lucifer***



10(8’) 6th lateral tooth of mentum rounded and fused/appressed to 5th lateral tooth .... ***D. nervosus***
(some 3rd instar *D. simpsoni* will key here)

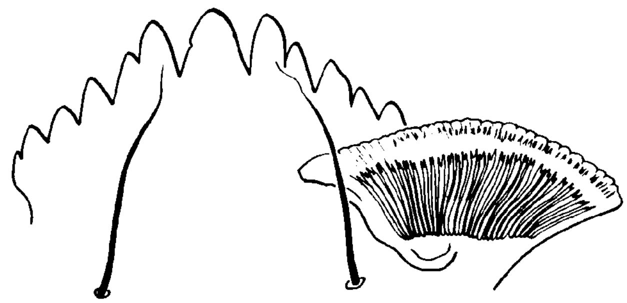


10’ 6th lateral tooth of mentum distinct, pointed, not appressed to 5th lateral tooth 11

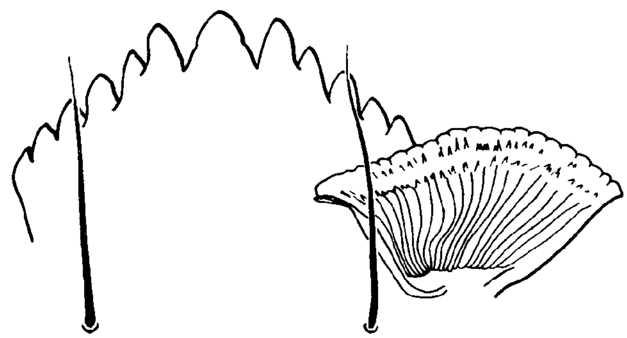
11(10’) Large species (4th instar only!): postmentum length > 250 µm; mentum width > 150 µm; pecten mandibularis with more than 12 setae (usually 14); head capsule integument appears coarsely granular at 400X; first lateral teeth of mentum turn out slightly; uncommon .... ***D. fumidus*** (in part)
(some *D. fumidus* will key here; see couplet 5 and Notes)

11’ Smaller species (4th instar only!): postmentum length < 250 µm; mentum width < 150 µm; pecten mandibularis with 12 or fewer setae (usually 9); head capsule integument usually not coarsely granulate, or if so, then granulation restricted to roughly longitudinal bands/spots; first lateral teeth not directed outward; common 12

12(11') Ventromental plate with 28-36, mean 32, strial ridges; postmentum usually darkened, but occasionally pale .... ***D. modestus***



12' Ventromental plate with 23-29, mean 25, strial ridges; postmentum usually pale, occasionally slightly darkened near posterior margin .... ***D. tritomus***



Notes on species

D. fumidus - An uncommon species that is sometimes difficult to identify without associated pupae or adult males. This species is keyed twice in the key due to variation of the first and second lateral teeth of the mentum. The head capsule of *D. fumidus* usually has a yellowish-reddish-brown cast, unlike most other southeastern species which are usually much paler and, with the exception of *D. leucoscelis* and some members of the *D. nervosus* group, do not show much reddish-brown. The head capsule integument appears coarsely granular; this is best seen on a phase contrast scope using the lowest power objective lens (on my scope 4X) but with the phase device set to match a higher power objective (on my scope 400X); the granularity "fluoresces". Although Epler (1987) recorded the species from the Carolinas based on adults and pupae, all larvae I've seen identified as *D. fumidus* in the NCDENR collection have been either *D. modestus* or *D. neomodestus*.

D. leucoscelis - An uncommon species, often found in enriched habitats, most often ditches, ponds, marshes and slow flowing streams. I've also seen a Florida specimen reared from a bromeliad. The head capsule is light reddish brown with a yellowish cast. This is the only known North American species with an apotomal fenestra. The larva sometimes has a single pair of ventral tubules. It is not keyed correctly in Beck (1976, 1979).

D. lobus - A brackish water/estuarine species, I have found it to be most abundant in salt marshes, coastal swamps and near the mouths of rivers. The second lateral teeth are very small, much smaller than those of *D. neomodestus*, and the antennal blade is longer than the flagellum. The species is not keyed correctly in Beck (1976, 1979). the taxon referred to in that key as *D. lobus* is most probably *D. thanatogratus*.

D. lucifer - A member of the *D. nervosus* group that is usually not common. As with the closely related *D. simpsoni*, *D. lucifer* is tolerant of organic wastes. This species was referred to as *D. nervosus* Type I in Simpson & Bode (1980).

D. modestus - The most common species of the genus throughout most of North America, but sometimes difficult to identify correctly in any life stage. The larval stage can easily be confused with *D. neomodestus* (with which it may hybridize?) and *D. tritomus*. Many specimens of *D. modestus* have dark markings on the dorsum of the head and postmentum, but these markings are often absent.

Note that several other *Dicrotendipes* species may have dark markings on the head capsule. Larvae of *D. tritomus* are difficult to separate from *D. modestus* larvae without dark markings; you will have to resort to associated pupae for accurate identifications of such specimens. See also *D. neomodestus*. Larvae of *D. modestus* are found in a wide variety of (usually) lentic habitats, including brackish water, and can tolerate moderate levels of organic pollution.

D. neomodestus - A common species of rivers and streams, somewhat tolerant of high nutrients/organic wastes. Although most specimens have a dark dorsal head stripe and darkened postmentum, occasional populations occur without such markings. The roughly tuberculate anterior margin of the frontal apotome is a good character for separation from some other species, especially *D. modestus* larvae in which the second lateral tooth of the mentum may appear to be fused to the first lateral tooth; some *D. modestus* may have tubercles on the anterior margin of the apotome, but rarely as large and numerous as those on *D. neomodestus*.

D. nervosus - An uncommon species in the Southeast, sometimes not clearly separable from *D. simpsoni*, especially in earlier instar larvae. Records of *D. nervosus* prior to my revision of the Nearctic *Dicrotendipes* (Epler 1987) must be viewed with skepticism, since at least two other species (*D. lucifer* and *D. simpsoni*) have been mistakenly identified as *D. nervosus*. Note that second or third instar larvae of *D. lucifer* and *D. simpsoni* usually lack the modifications of the proximal inner mandibular teeth and will key to *D. nervosus*. Fourth instar larvae are necessary for an accurate identification, which should ideally be backed up by associated adult males. Head capsule coloration of most *D. nervosus* group members is usually a darker yellow-brown than species such as *D. modestus* and *D. tritomus*.

D. simpsoni - A common species normally associated with high nutrient levels or low dissolved oxygen. Note that second or third instar larvae usually lack the modifications of the proximal inner mandibular teeth and will key to *D. nervosus* (q.v.). Larvae sometimes have a single pair of ventral tubules. This species was called *Einfeldia* by Mason (1973) and *D. nervosus* Type II in Simpson & Bode (1980).

D. thanatogratus - This uncommon species of rivers and streams is recorded from South Carolina by Caldwell et al. (1997), but I have not seen any material of this species from anywhere but Florida. Since it was described from northern Florida (Epler 1987), it probably does occur throughout the Southeast, but all larval specimens I've examined that were identified as *D. thanatogratus* by benthologists from sites in the Southeast were *D. modestus* or *D. tritomus*.

D. tritomus - Epler (1988: 12) considered *D. incurvus* (Sublette) a junior synonym of *D. tritomus*. Larvae of *D. tritomus* are difficult to separate from *D. modestus* larvae without dark markings; you will have to resort to associated pupae or adult males for accurate identifications of such specimens.

D. sp. A - An undescribed species that I originally reared from Lake Okeechobee in southern Florida, I have since found it in the Suwannee River basin in northern Florida. In general, any midge found in the Suwannee River basin should also occur on the Coastal Plain in the Carolinas, so I expect that *D*. sp. A will eventually be found there. Adult males are very similar to *D. modestus*, separable only by the reduced number of dorsocentral and squamal setae. This species will be described in a forthcoming publication.

D. sp. B - Apparently an undescribed species, known only as a larva from peninsular Florida.

Webb & Brigham (1982) keyed *D. aethiops* in their key to *Dicrotendipes*, but this was based on a misidentification of *D. fumidus* in Webb (1972) (see Epler (1987). *Dicrotendipes botaurus* was recorded for Tennessee by Epler (1987) based on an adult; the immature stages are undescribed.

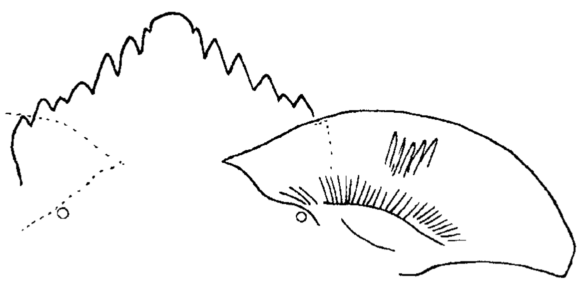
Genus *Einfeldia*

DIAGNOSIS: Southeastern larvae are distinguished by the frontoclypeal apotome, which may have an apotomal fenestra; pecten epipharyngis either a simple comb, 3 separate scales bearing minute spinules, or weakly tripartite and bearing minute spinules; and usually one pair of ventral tubules.

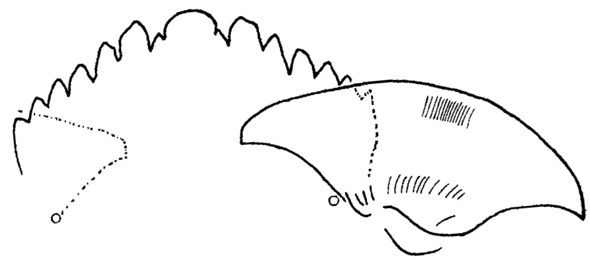
NOTES: *Einfeldia* is in need of revision; generic limits are unclear. Note that *Einfeldia* species groups B and C of Pinder & Reiss (1983) are now placed in *Chironomus*. One southeastern species formerly placed in *Einfeldia*, *E. austini*, is now moved (in this manual) to *Chironomus (Lobochironomus)*. I have seen only two species of *Einfeldia* from the Southeast; prior records of *E. pagana* probably refer to *E.* sp. A.

Larvae are found most often in eutrophic standing water, but can occur in lotic situations.

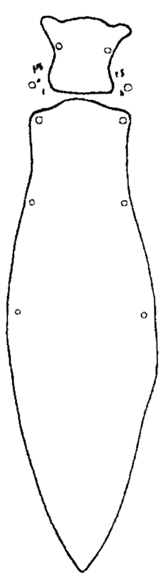
ADDITIONAL REFERENCES: Oliver 1971; Sublette 1964.



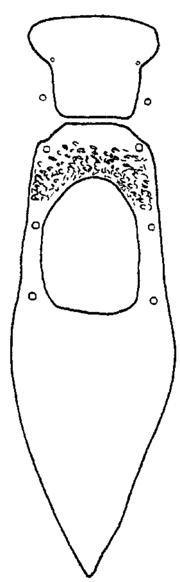
E. natchitocheae mentum



E. sp. A mentum

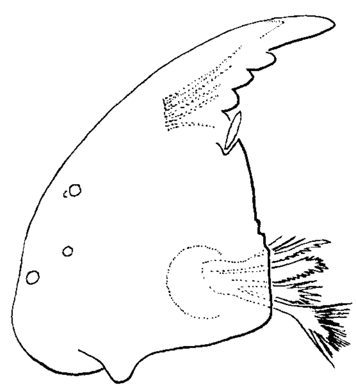


E. natchitocheae

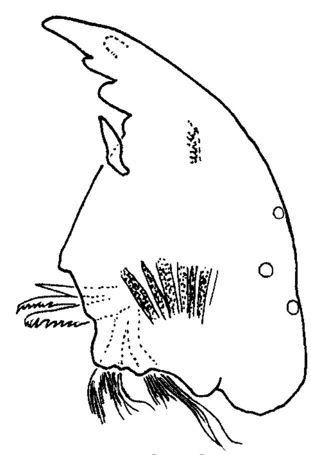


E. sp. A

frontoclypeal apotomes and labral sclerites



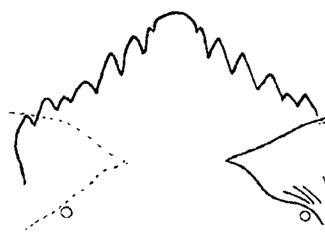
E. sp. A

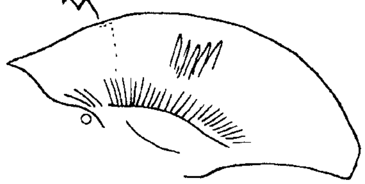


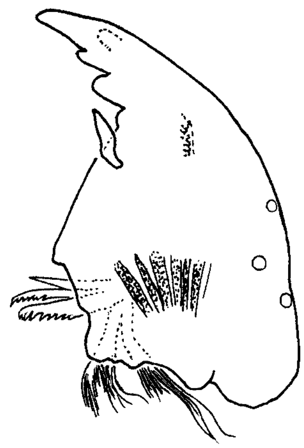
mandibles *E. natchitocheae*

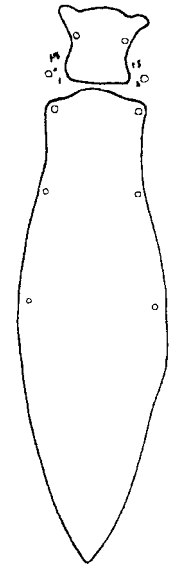
Key to *Einfeldia* larvae of the southeastern United States

1 Median tooth of mentum projecting far beyond first lateral teeth; 5th lateral tooth of mentum larger than 4th and 6th; dark spot at base of antenna; apotome without fenestra; mandible with 2 inner teeth and wide radial grooves near base; pecten epipharyngis composed of three small scales .... ***E. natchitocheae***

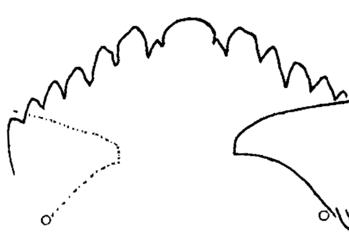


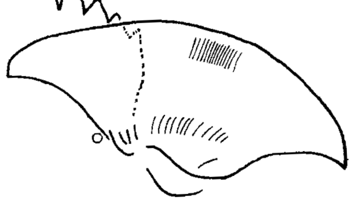


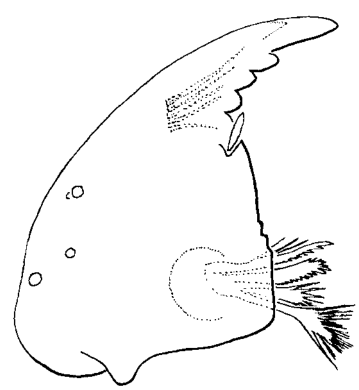


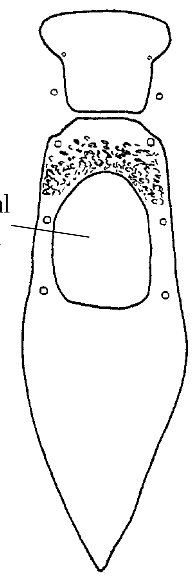


1’ Median tooth and 5th lateral tooth of mentum not as above; no dark spot at base of antenna; apotome with fenestra; mandible with 3 inner teeth and without grooves near base; pecten epipharyngis a simple comb or weakly tripartite scales 2

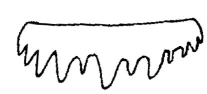




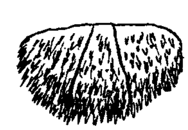




2(1’) Pecten epipharyngis a simple multitoothed comb .... ***E. pagana***
(see Notes)



2’ Pecten epipharyngis weakly tripartite and covered with minute spinules .... ***E.* sp. A**



Notes on species

E. natchitocheae - A common and widespread species of eutrophic lakes and ponds on the Coastal Plain, but it also occurs in streams and rivers. This is a species that is easily identified while still in fluid preservative or alive; the darkened postmentum, spots at the base of the antennae and the single pair of ventral tubules are distinctive.

E. pagana - This species is recorded for North Carolina by Hudson et al. (1990) and Caldwell et al. (1997), apparently based on an adult male with pupal exuviae from a pond, determined by J.E. Sublette. However, my examination of this specimen indicates that it is an *Einfeldia* sp. A; the pupal exuviae and adult are similar to reared material of *E*. sp. A from Georgia and differ from reared material of *E. pagana* I've examined. I have not seen any material of *E. pagana* from the Southeast.

E. sp. A - An undescribed species that I've seen from Florida, Georgia and North Carolina. I've examined material from wetlands, lakes and streams. Broughton Caldwell has provided complete rearings of this taxon from Georgia; it will be described in a forthcoming publication.

Einfeldia brunneipennis and *E. chelonia* also occur in the Southeast; their immature stages are undescribed.

Genus ***Endochironomus***

DIAGNOSIS: Distinguished by the mentum with the 3 (rare) or 4 (usual) median teeth separated from the lateral portion of the mentum by a distinctive line which runs posteriorly from the median teeth to the anteromedial corner of the ventromental plates; ventromental plates with anterior and posterior margins parallel for most of their length, and lateral apex rounded; and the tuberculate anterior margin of the cardo.

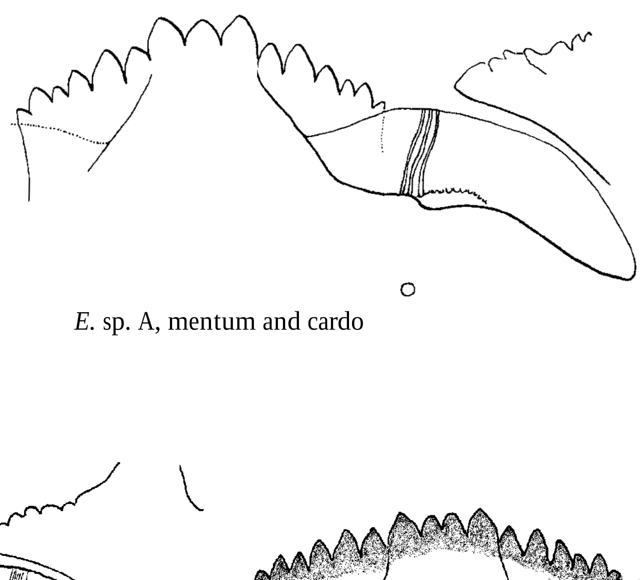
NOTES: Grodhaus (1987a) reviewed the genus for North America. Three species of *Endochironomus* occur in the Carolinas; one, *E. nigricans*, is common; the other two are uncommon to rare. The three species can be separated by their menta.

A single specimen of *E.* sp. A has been found in brackish water in North Carolina (Eaton 1994); it is identified by its three median teeth. I have also examined a specimen of *E.* sp. A from northeastern Florida. Grodhaus (1987a) described a taxon from Oregon with 3 median teeth from larvae only, and noted that it could be placed in the *E. signaticornis* group, a group established by Lenz (1921), not Grodhaus (1987a) as alluded to in Eaton (1994). Grodhaus's record is the only other record of this formerly Palaearctic group in North America. Note that the name "*signaticornis*" is now considered a *nomen dubium* and should not be used.

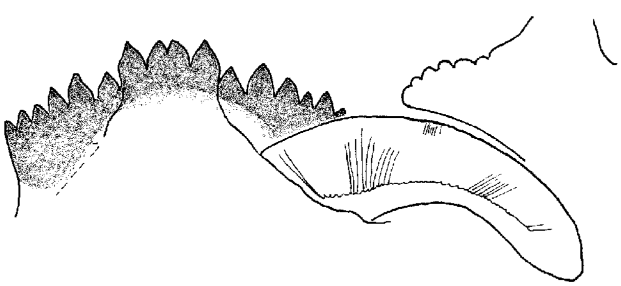
The other two species are members of Lenz's *E. nymphoides* group; they are separated by the amount of dark coloring of the mentum: in *E. nigricans* the coloring is more extensive and extends more posteriorly; in *E. subtendens* the dark coloring is restricted mostly to the teeth.

Larvae are often associated with moderate eutrophic conditions and occur in lentic and lotic situations.

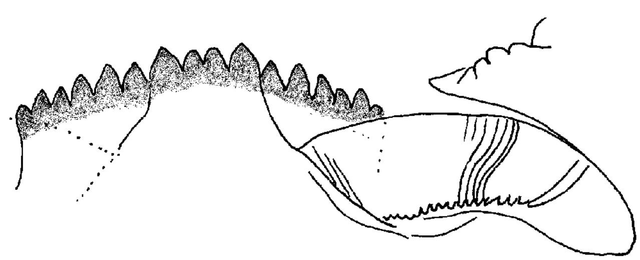
ADDITIONAL REFERENCES: Grodhaus 1987a.



E. sp. A, mentum and cardo



E. nigricans, mentum and cardo



E. subtendens, mentum and cardo

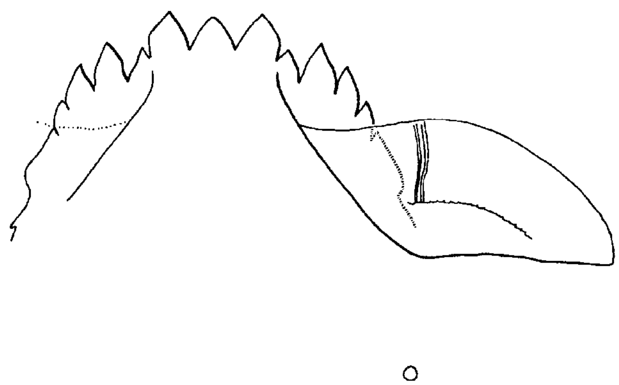
Genus *Endotribelos*

DIAGNOSIS: Distinguished by the strongly arched mentum, with 3 large central teeth; with second lateral teeth of mentum very small and mostly fused to first lateral teeth (following Grodhaus's (1987a) terminology for the mental teeth); and the mandible with large incised area at the base of the inner teeth.

NOTES: A single species, *E. hesperium*, is known from the Southeast. Caldwell et al. (1997) record this species from South Carolina in addition to previous records from Florida. Grodhaus (1987a) established *Endotribelos* as a new genus and included the previous described *Tribelos hesperium* in it. It has been assumed (by Grodhaus 1987a and others) that southeastern US larvae are *E. hesperium* but I have never seen a reared/associated specimen of this taxon from the Southeast. Several other species are known from Central America (Sublette & Sasa (1994) and my unpublished data and specimens), including one that has a mentum with an even number of teeth and a mandible that lacks the deep incision of *E. hesperium*. I have specimens of another undescribed species from Costa Rica that closely resembles *E. hesperium*.

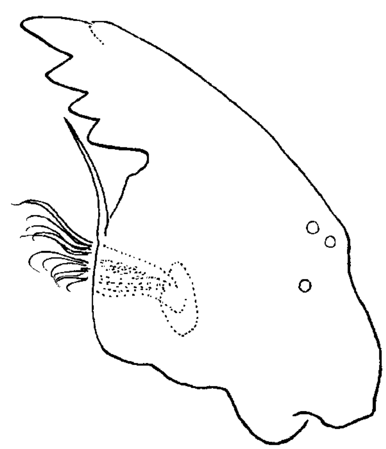
Larvae are associated with aquatic macrophytes; Grodhaus (1987a) found larvae inside the leaves of *Sagittaria* and *Typha* in California.

ADDITIONAL REFERENCES: Grodhaus 1987a; Sublette & Sasa 1994.



E. hesperium mentum

E. hesperium antenna



E. hesperium mandible

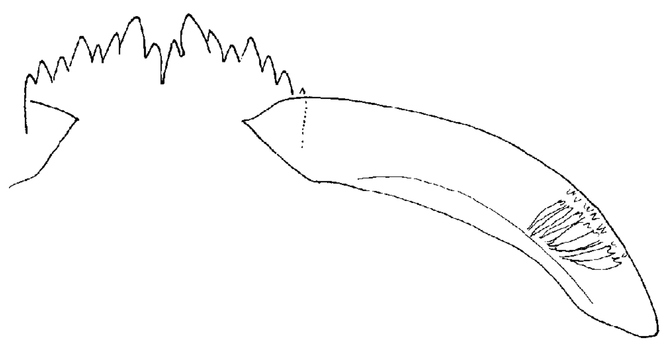
Genus ***Fissimentum***

DIAGNOSIS: Distinguished by the 6 segmented antenna, with Lauterborn organs at apex of segment 2 only; mentum with deeply sunken pair of median teeth; long setae submenti that extend anteriorly past the mentum; and mandible with large seta subdentalis but without pecten mandibularis and seta interna.

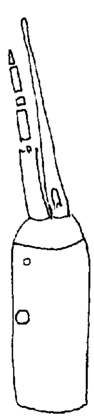
NOTES: *Fissimentum* was established as a new genus by Cranston & Nolte (1996) for some South American and Australian taxa. One southeastern US larva can be placed in *Fissimentum*, originally referred to as Tendipedini genus A by Roback (1966c). Note that Roback's first reference to a Tendipedini sp. A (Roback 1953: 99, 120; fig. 27) refers to *Stelechomyia perpulchra*; the mentum has a single median tooth. *Fissimentum* was referred to as Chironominae genus A in Epler (1995); in this manual the taxon is now called *Fissimentum* sp. A. The pupa and adult of *F*. sp. A remain unknown. There is nothing similar to the adult described by Cranston & Nolte (1996) as *F. dessicatum* known from the United States; the identity of *F.* sp. A remains a mystery.

Larvae are reported from sediments of rivers and lakes; Cranston & Nolte (1996) noted that some larvae were drought tolerant.

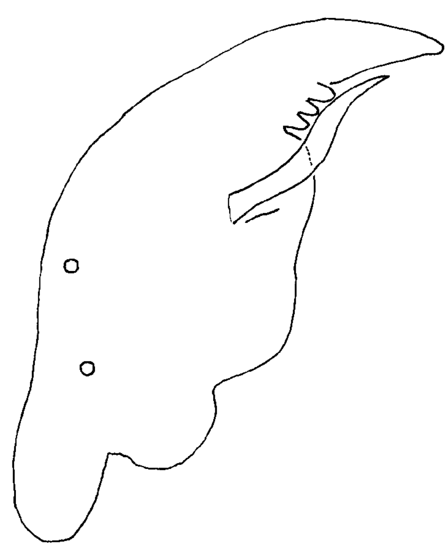
ADDITIONAL REFERENCES: Cranston & Nolte 1996.



mentum



antenna



mandible

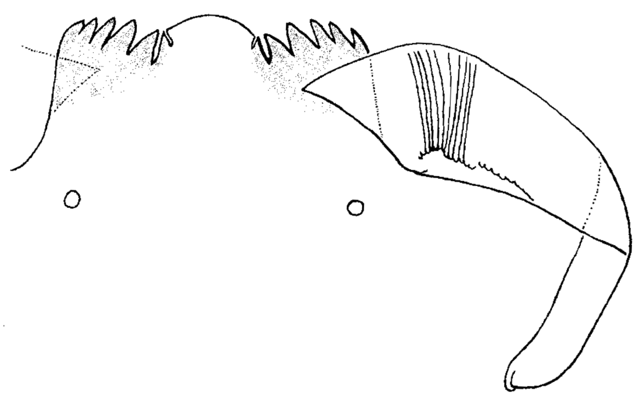
Genus *Gillotia*

DIAGNOSIS: The thin S I; small, weakly trilobed pecten epipharyngis; 5 segmented antenna; premandible with 6 teeth and without brush; mandible without pecten mandibularis; mentum with pale median tooth and obliquely arranged lateral teeth; and extremely wide ventromental plates distinguish this genus.

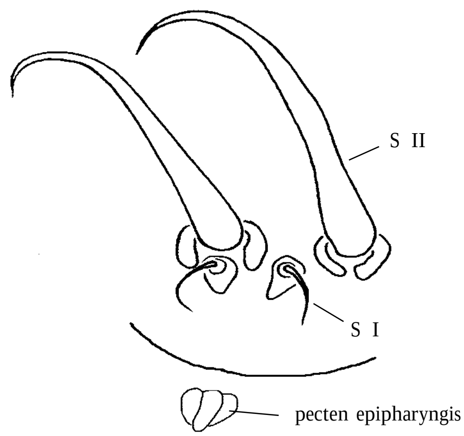
NOTES: The single southeastern US record of the single Nearctic species, *G. alboviridis*, is based on a pupal exuviae from South Carolina. The specimen illustrated below was collected in Ohio. Note that its ventromental plates are much wider than those illustrated for *Gillotia* in Sæther (1977a) and Pinder & Reiss (1983); the plates curve around the lateral margin of the head capsule.

Nothing is published on the ecology of *Gillotia.*

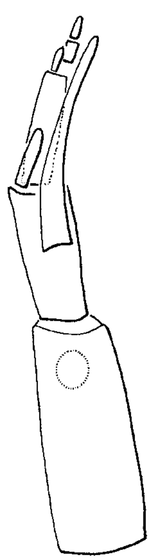
ADDITIONAL REFERENCES: Sæther 1977a.



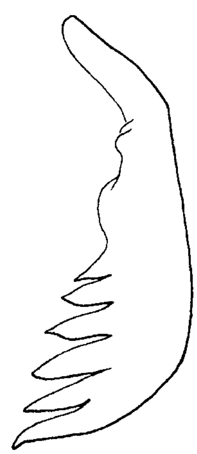
mentum with ventromental plates curling around head capsule



labrum



antenna



premandible

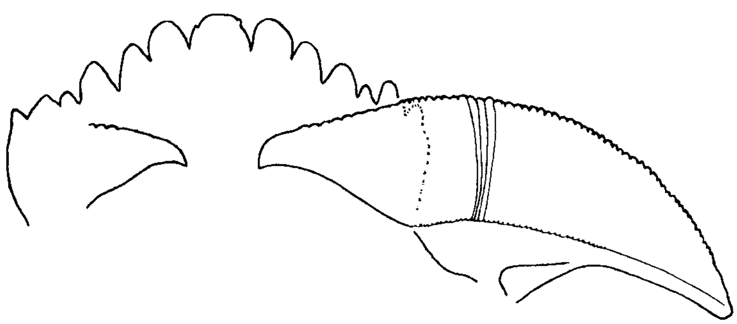
Genus *Glyptotendipes*

DIAGNOSIS: Distinguished by the frontal apotome (thus having two labral sclerites anterior to it); pecten epipharyngis a comb with 10 or more sharp teeth; usually simple seta subdentalis (may be notched or roughly serrated, but never fringed with small teeth as in *Goeldichironomus*); mentum with 13 teeth, width usually less than width of one ventromental plate, wide triangulum occipitale; and no, rudimentary, or one pair of ventral tubules.

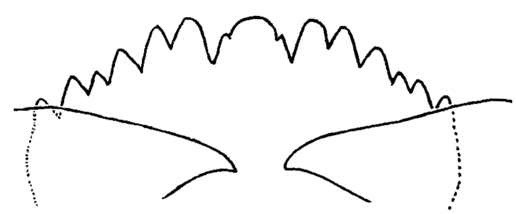
NOTES: *Glyptotendipes* is being revised by Michael Heyn (FDEP, Tallahassee, FL); hopefully his revision will be published soon. He has graciously provided material and comments regarding this genus. Note that due to taxonomic confusion and variation among species, many earlier records of several species (especially *G. lobiferus*) must be viewed with skepticism. Heyn (1992) established three subgenera that replaced the subgenera used by Townes (1945) and species groups A-C of Pinder & Reiss (1983). All three subgenera occur in the Southeast; the majority of southeastern taxa are members of the subgenus *G. (Glyptotendipes)*; one species, *G. amplus*, is placed in the subgenus *G. (Trichotendipes)* and two species, *G. dreisbachi* and *G. seminole* are placed in the subgenus *G. (Caulochironomus)*.

Larvae occur in usually eutrophic standing and slow moving water, where they are found in or on sediments and aquatic plants; several species are miners in plants or decaying wood (or they live in burrows in plant material made by other organisms). At least one common species, *G. paripes*, is considered a nuisance in the Southeast because of mass emergences from eutrophic ponds and lakes near human habitations.

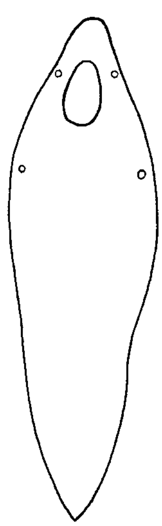
ADDITIONAL REFERENCES: Heyn 1992; Sublette & Sublette 1973; Townes 1945.



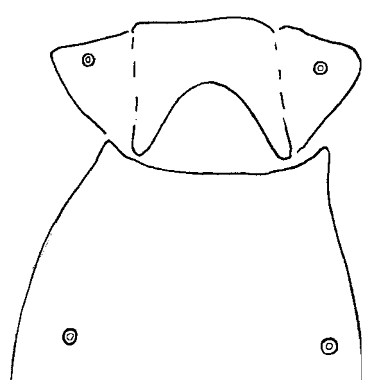
G. sp. B mentum



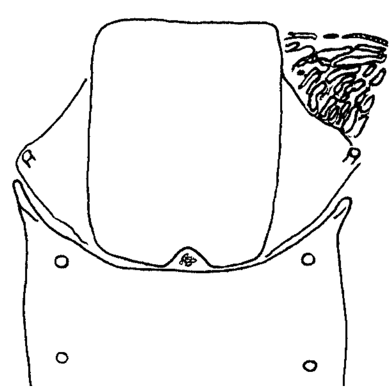
G. paripes mentum



G. (Trichotendipes) amplus apotome



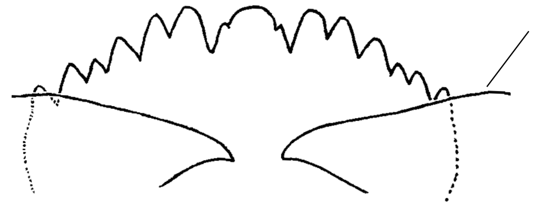
G. (Caulochironomus) seminole apotome and labral sclerite 1



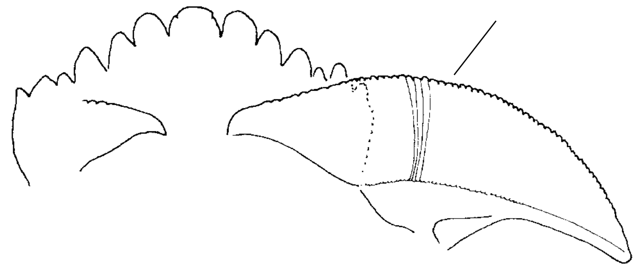
G.(Glytptotendipes) sp. B apotome and labral sclerite 1

Key to *Glyptotendipes* larvae of the southeastern United States

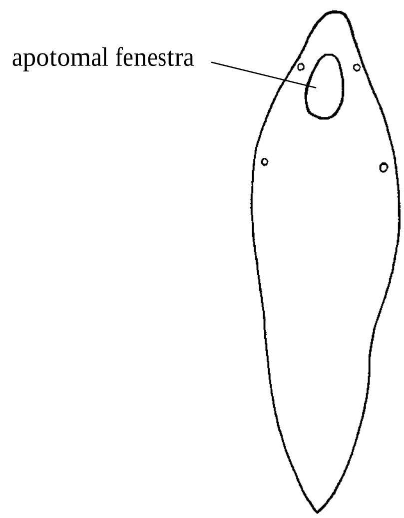
1 Anterior margin of ventromental plate smooth or almost so (tiny points may be visible near margin at high magnification) 2

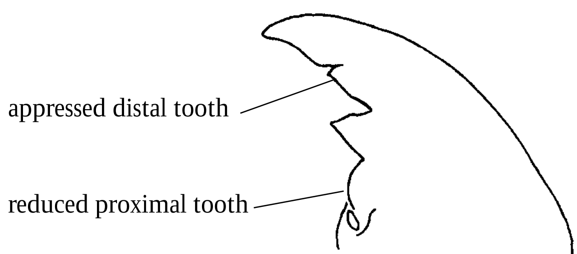


1' Anterior margin of ventromental plate noticeably crenulated 4

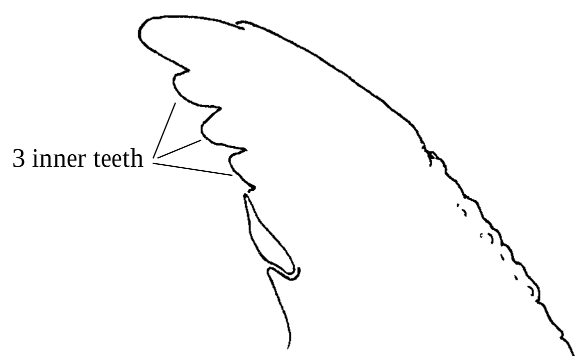


2(1) Mandible with proximal inner tooth reduced/vestigial and distal tooth appressed to apical tooth; apotome with oval apotomal fenestra .... ***G. amplus***

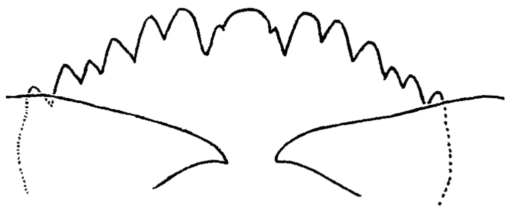


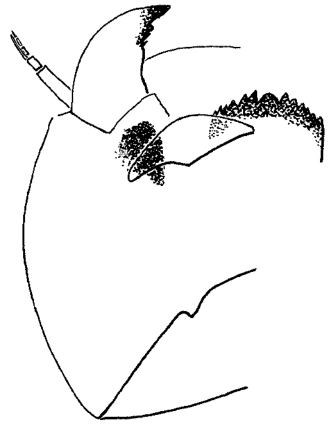


2' Mandible with 3 well developed inner teeth; apotome without fenestra 3

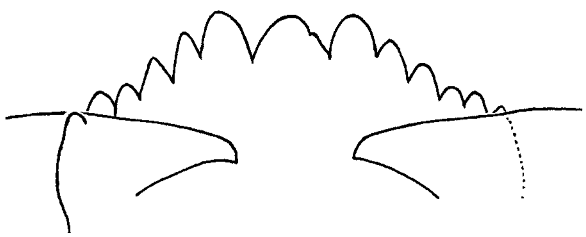


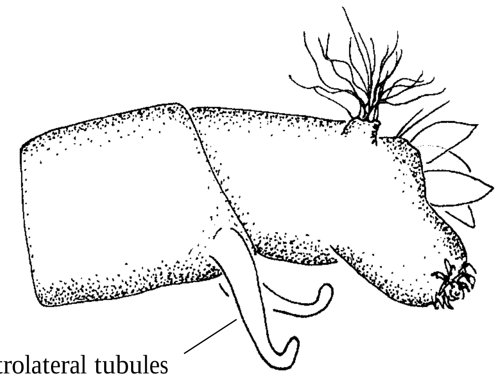
3(2’) Ventromental plates separated by less than the width of the median tooth of the mentum; at most rudimentary ventrolateral tubules present; head capsule with dark mark below mandible .... ***G. paripes***



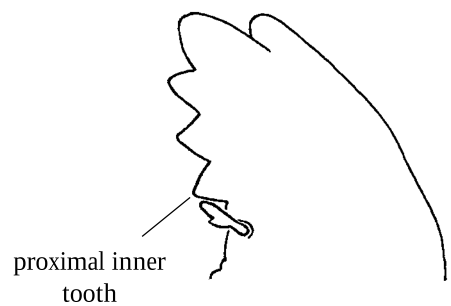


3’ Ventromental plates separated by width of median tooth of mentum (or more); well developed ventrolateral tubules present; head capsule without dark mark below mandible .... ***G. barbipes***





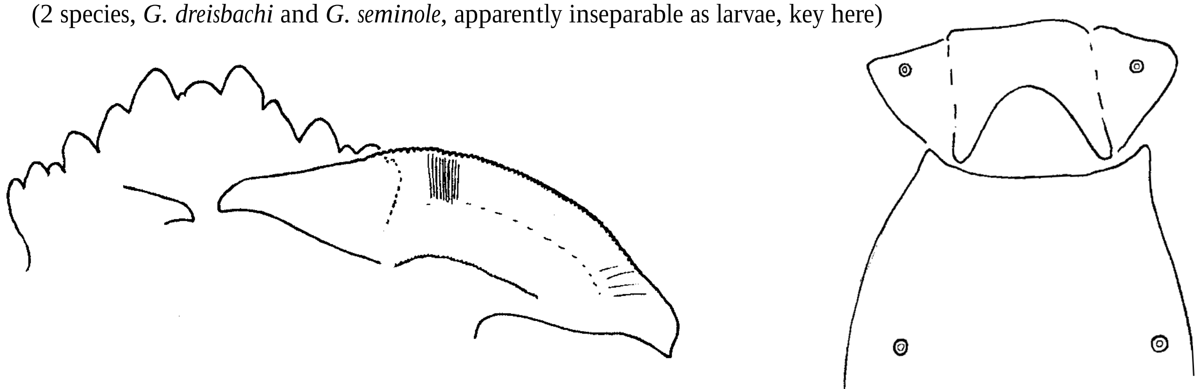
4(1’) Proximal inner tooth of mandible subequal to middle tooth; pecten epipharyngis with blunt teeth and may appear weakly tripartite; known only from south peninsular Florida .... ***G.* sp. E**



4’ Proximal inner tooth of mandible smaller than middle tooth; pecten epipharyngis a comb with irregular or sharp teeth; more widespread distribution 5

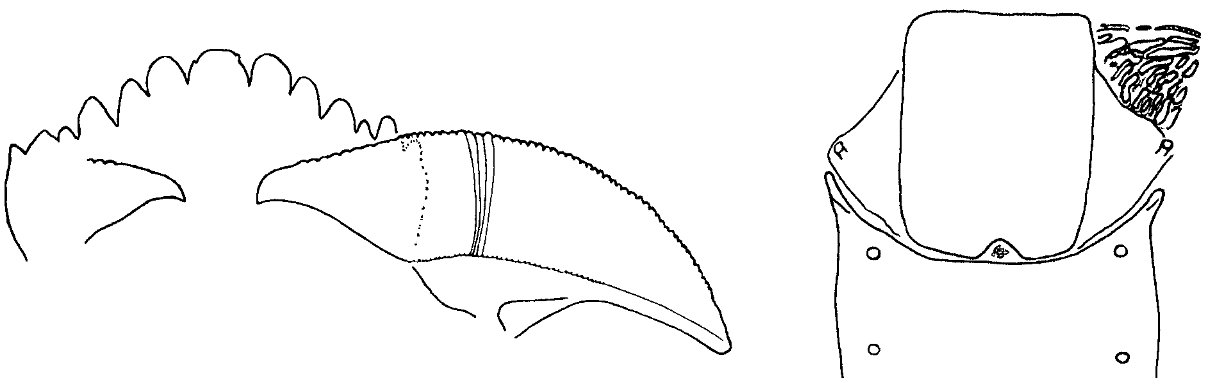
5(4') 3 central teeth of mentum project forward from other lateral teeth; posterior margin of labral sclerite 1 deeply concave .... ***G. (Caulochironomus)* sp.**

(2 species, *G. dreisbachi* and *G. seminole*, apparently inseparable as larvae, key here)



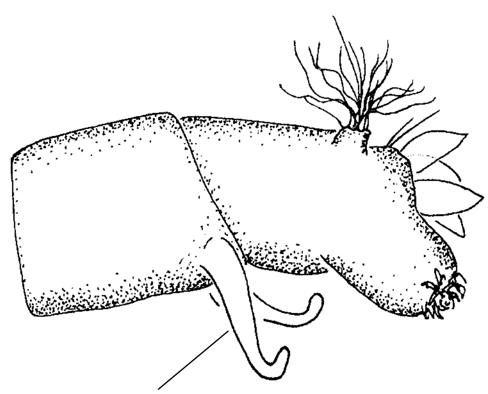
mentum and apotome/labral sclerite 1 of *G. seminole*

5' Mentum with teeth in an even arch; posterior margin of labral sclerite 1 with small concave notch 6



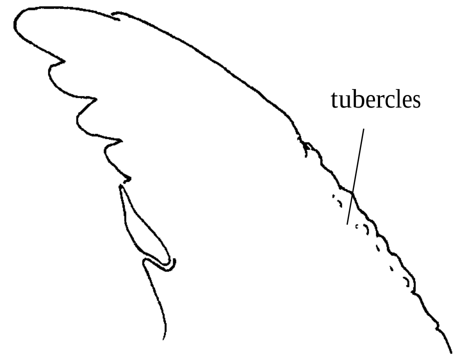
6(5') Well developed ventrolateral tubules present (at least twice as long as wide) 7

6' Ventrolaterla tubules absent or rudimentary 8

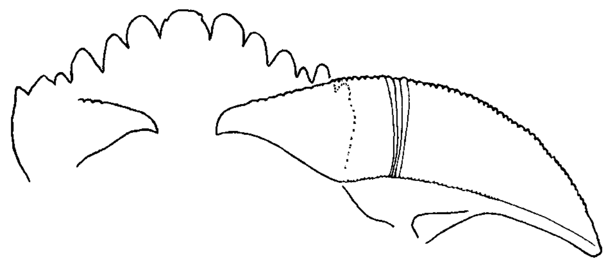


ventrolateral tubules

7(6) Subapical lateral outer lateral margin and dorsal surface of mandible smooth; ventrolateral tubules at least 2X length of anal tubules; mines in decaying wood .... ***G. testaceus***

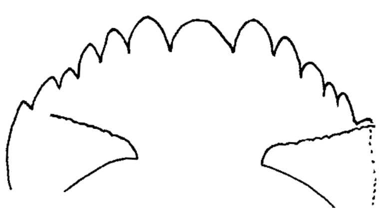


7’ Subapical lateral margin and dorsal surface of mandible rugose or adorned with low, mound-like tubercles; ventrolateral tubules subequal to length of anal tubules; not restricted to decaying wood .... ***G.* sp. F**



8(6’) Width of median tooth of mentum subequal to distance between ventromental plates .... ***G.* sp. B**

8’ Width of median tooth of mentum about 0.5-0.7 distance between ventromental plates 9



G. meridionalis

G. sp. G

9(8’) 4th instar only: mentum width < 200 µm; postmentum length about 300 µm ...... ***G. meridionalis***

NOTE: 4th instar larvae are necessary for accurate measurements!!

9’ 4th instar only: mentum width > 200 µm; postmentum length about 400 µm .... ***G.* sp. G**

Notes on species

G. amplus - I've seen larvae of *G. amplus* from North Carolina (where they were misidentified as *Einfeldia* sp.), Florida and Mississippi (where they were misidentified as *Dicrotendipes* sp.); Heyn (pers. comm.) has seen specimens from South Carolina. This species occurs in rivers and streams as well as the usual lentic habitats of other *Glyptotendipes*.

G. barbipes - A species of extremely nutrient rich water bodies, such as sewage lagoons. Although recorded for North and South Carolina, I have only seen southeastern specimens from Georgia.

G. dreisbachi - The larva of this species is apparently inseparable from that of *G. seminole*; associated adult males would be necessary for species level identification. Townes (1945) noted that the larvae were burrowers in the stems of *Potamogeton*.

G. lobiferus - This species has been recorded for the Carolinas by Hudson et al. (1990) and Caldwell et al. (1997). However, Heyn (pers. comm.) believes *G. lobiferus* to be a more northern species that probably does not occur in the Southeast. Records of *G. lobiferus* probably refer to *G. meridionalis*, *G*. spp. B, F or G.

G. meridionalis - A difficult species to identify; fourth instar larvae are needed because it appears that only size separates it from similar taxa. The larvae described as *G. meridionalis* by Manual (1976) are *G*. sp. F.

G. paripes - A common species of lakes and ponds on the Coastal Plain, often abundant enough in eutrophic lakes and ponds near human habitation to be a nuisance when large numbers of adults emerge. The dark spot below the mandible may not be apparent in second or third instar larvae.

G. seminole - The larva of this species is apparently inseparable from that of *G. dreisbachi*; associated adult males would be necessary for species level identification. Heyn (pers. comm.) noted that the larvae were burrowers in the stems of Bur-reed, *Sparganium*.

G. testaceus - A large species with elongate ventrolateral tubules. It apparently is an obligate miner of decaying wood (Heyn, pers. comm.).

G. sp. B - A common and widespread species throughout the Coastal Plain of the Southeast; I've seen material from North Carolina in addition to Florida. This species has been confused with *G. lobiferus* and *G. meridionalis*.

G. sp. E - A distinctive undescribed species known only from Lake Annie in Highlands County in southern Florida. I have reared larvae collected from tunnels in decaying submerged wood. Epler (1995) figured the pecten epipharyngis as weakly tripartite. However, additional material indicates that such a pecten is probably abnormal or broken; more recently collected specimens have a typical *Glyptotendipes* single-piece comb-like pecten epipharyngis. The adults of this species have very short palpi compared to other *Glyptotendipes*.

G. sp. F - This taxon is what Manuel (1976) called *G. meridionalis*. Heyn (pers. comm.) believes it represents a separate, undescribed species.

G. sp. G - This species was called *G. lobiferus* by Beck & Beck (1969a). Heyn (pers. comm.) believes it represents an undescribed species. It is difficult or impossible to separate unassociated larvae of this species from unassociated larvae of *G. meridionalis*.

It is difficult to confirm many of the records of *Glyptotendipes* species, described or letter-designated, from the Carolinas. With the possible exception of *G*. sp. E, all the letter designated species above probably occur throughout the Southeast. Heyn's revision, when published, will help immensely in the identification of this common genus.

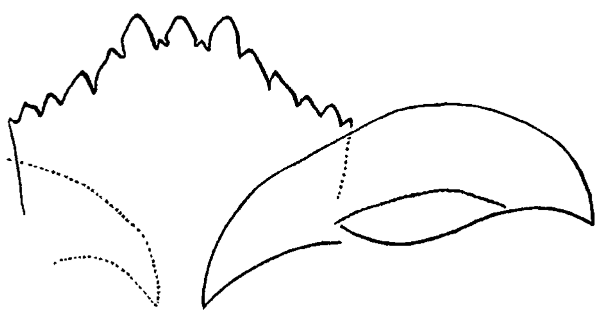
Genus *Goeldichironomus*

DIAGNOSIS: Distinguished by the frontoclypeal apotome (S 3 setae are on apotome, with 2 median labral sclerites anterior to it); ventromental plates with median (inner) margin angled posteriorly; elongate seta subdentalis with toothed or fringed lower margin; and 0, 1 or 2 pairs of ventral tubules.

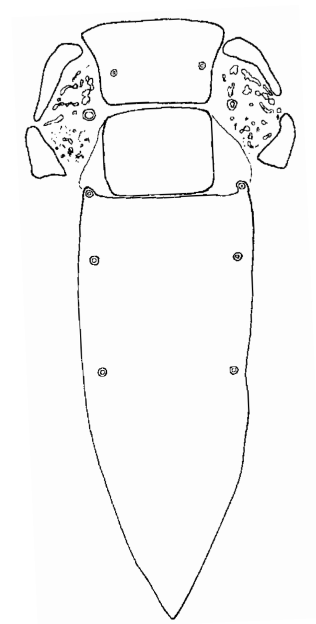
NOTES: Six species are known from the Southeast; four species are known to occur in the Carolinas. The genus is mostly Neotropical, but many species now appear to reach their northern limit in Florida or South Carolina. The species most often encountered, usually in eutrophic standing water, are *G. carus* and the widespread *G. holoprasinus*.

Larvae are found mostly in lentic habitats, and may occur in sediments, in or on plants and in floating mats of vegetation and wood, under conditions ranging from oligotrophic to hypereutrophic.

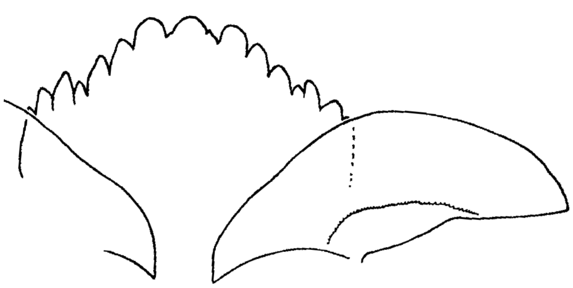
ADDITIONAL REFERENCES: Reiss 1974; Wirth 1979.



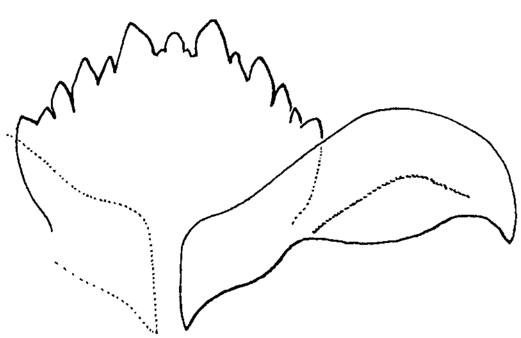
G. holoprasinus mentum



G. devineyae, apotome and labral sclerites



G. carus mentum



G. fluctuans mentum

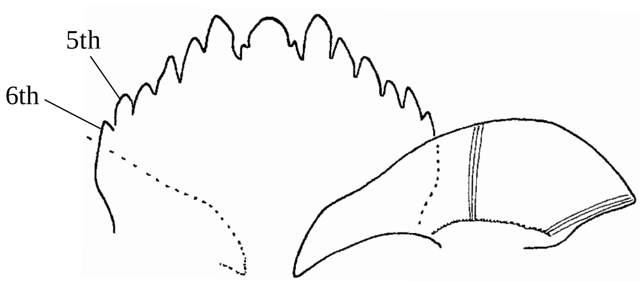
G. carus, apex of mandible

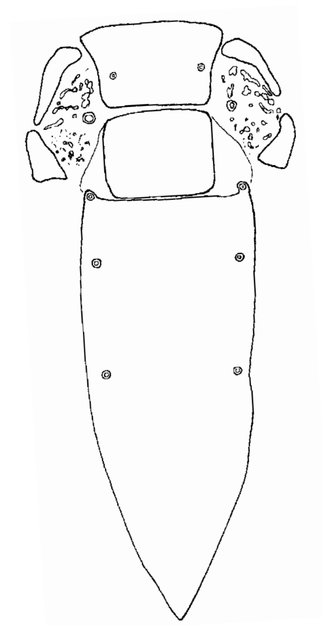
Key to *Goeldichironomus* larvae of the southeastern United States

1 Ventral tubules absent or rudimentary (length < 5X width) 2

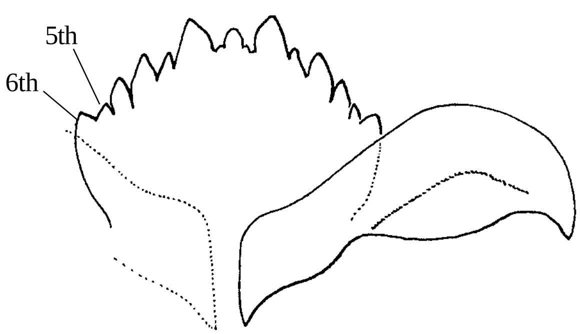
1’ At least one pair of ventral tubules present (length > 5X width) 3

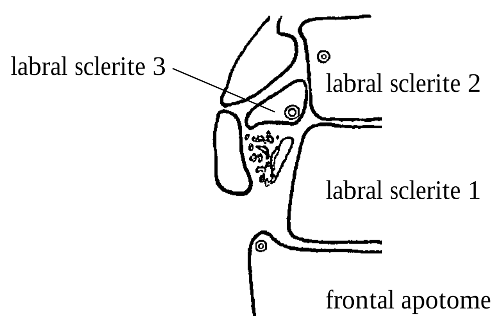
2(1) 6th lateral tooth of mentum smaller than 5th; labral sclerites 3 and 4 unconsolidated; anal tubules reduced; usually brackish water/salt marsh/estuarine species .... ***G. devineyae***
(some *G. holoprasinus* may key here; see Notes on species)



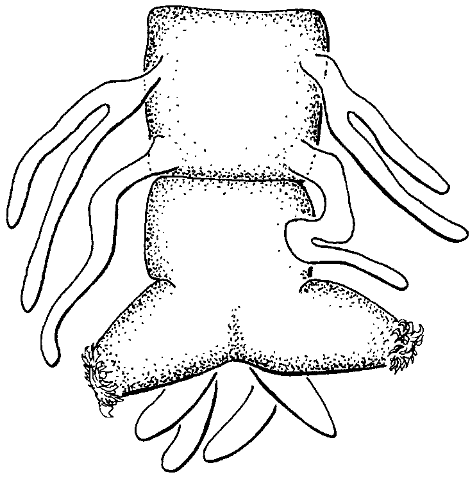


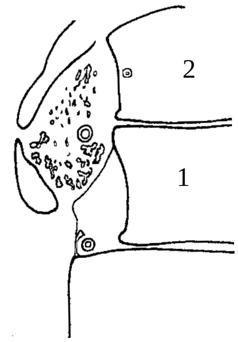
2’ 6th lateral tooth of mentum larger than 5th; labral sclerite 3 present; anal tubules normal; usually freshwater species (but may occur in estuaries) .... ***G. fluctuans***



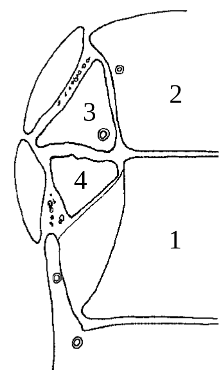


3(1') Anterior pair of ventral tubules forked; labral sclerites 3 and 4 unconsolidated .... ***G. holoprasinus***

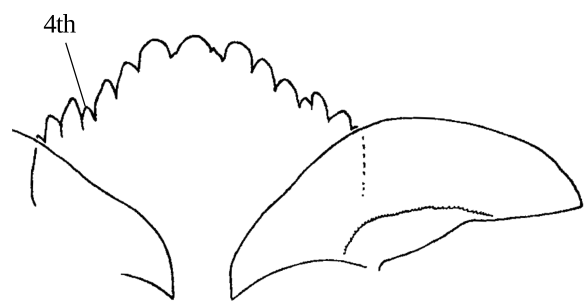




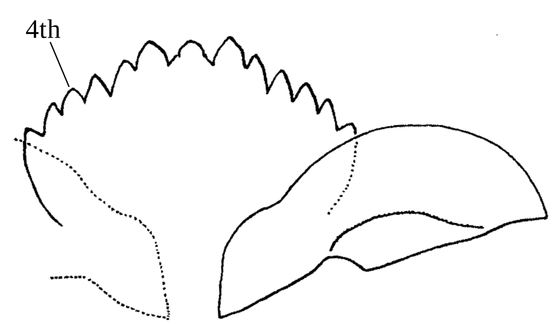
3' Anterior pair of ventral tubules simple; labral sclerite 3 **or** labral sclerites 3 and 4 present 4



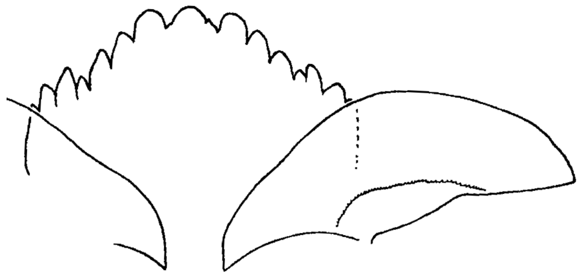
4(3') 4th lateral tooth of mentum smaller than 3rd or 6th 5

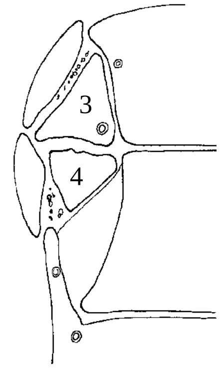


4' 4th lateral tooth of mentum subequal to 3rd and 5th 6

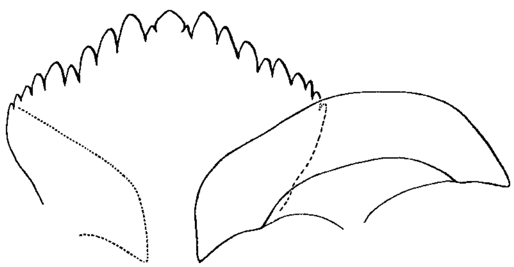


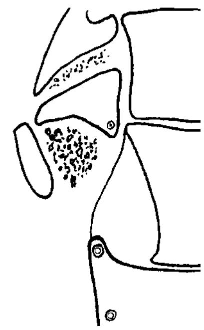
5(4) Mentum with 15-17 teeth; labral sclerites 3 and 4 present; postmentum without tubercles; common in organically enriched habitats .... ***G. carus***



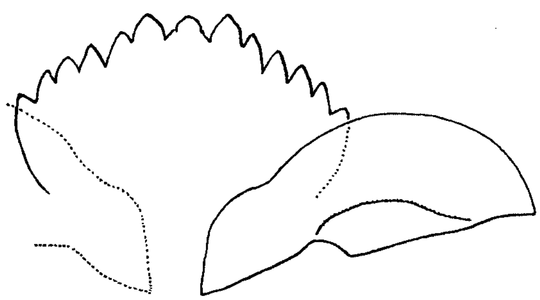


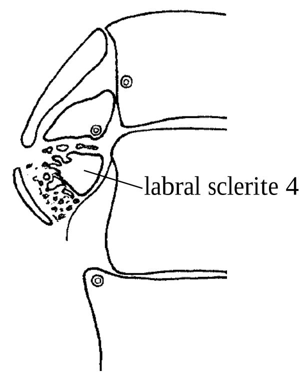
5' Mentum with more than 17 teeth (outer margin of mentum may appear serrated); labral sclerite 3 present but 4 unconsolidated; postmentum with pair of tubercles near hind margin (best seen in lateral view); more common in floating vegetation .... ***G. pictus***
(not known from the Southeast; see Notes on species)



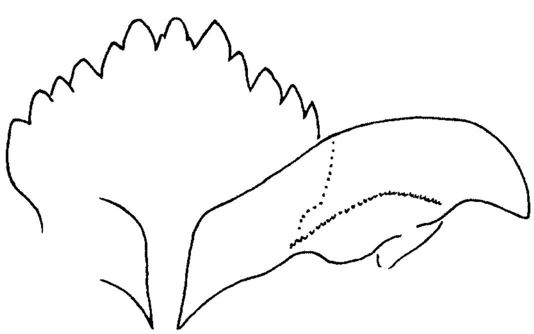


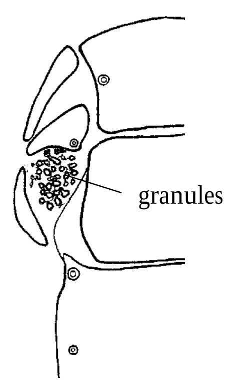
6(4') Labral sclerite 4 partially consolidated on inner side .... ***G. amazonicus***





6' Labral sclerite 4 completely unconsolidated, consisting of rounded granules .... ***G.* cf. *natans***





Notes on species

G. amazonicus - To date, this taxon is only known from Florida in the Southeast. However, since it does occur in northern Florida, it will probably eventually be found on the Coastal Plain in South Carolina. This benthic species can be easily confused with *G*. cf. *natans*; be sure to observe the labral sclerites. Formerly referred to as *Siolimyia amazonica*.

G. carus - Once placed in *Chironomus* (originally in *Tendipes* in Townes (1945)), this widespread species was considered a nuisance species by Beck & Beck (1969a); Caldwell et al. (1997) record it form North Carolina and Georgia. The species may be abundant below pulp mills, where it frequently occurs with *G. holoprasinus*. I've also collected it from small pools in an estuarine swamp in Florida.

G. devineyae - Originally placed in *Nilodorum*, this species is usually restricted to salt marshes or estuaries. However, Caldwell (pers. comm.) has found an adult in inland Georgia. Larvae can be confused with *G. holoprasinus*, which also may occur in salt marshes, especially if the posterior body segments have been lost. Both species have labral sclerites 3 and 4 unconsolidated, but note the additional dorsal mandibular tooth on *G. holoprasinus* (see below).

G. fluctuans - Formerly known only from Florida in the Southeast, I have seen a series of larvae from the Savannah River Plant area in South Carolina. I've also seen a single larva from near the mouth of the Suwannee River in Florida, indicating some tolerance for brackish water.

G. holoprasinus - A common to abundant, widespread species, especially in organically enriched habitats. It is a pioneer species, often invading temporary water bodies. Specimens with damaged or lost posterior body segments may be confused with *G. devineyae*. However, *G. holoprasinus* larvae have an additional dorsal tooth near the inner teeth of the mandible. Also, early instar larvae may have only simple ventral tubules; rely on the absence of labral sclerites 3 and 4 and the additional dorsal tooth of the mandible to identify such specimens. It was formerly known as *Chironomus fulvipilus* Rempel.

G. holoprasinus mandible showing 4th inner tooth

G. cf. *natans* - I've only seen larvae of this taxon; hence its identity is unclear. Its presence in northern Florida (the Fenholloway and Santa Fe Rivers) indicates that it might be found on the Coastal Plain in the Carolinas. It is uncommon in the oligotrophic saw grass (*Cladium*) stands of the northern Everglades.

G. pictus - This species is not known from the Southeast, but was reported by Hudson et al. (1990) for Florida. I have not seen any specimens from Florida.

Several other species of *Goeldichironomus* occur in the Neotropics; some of these may eventually be found in the US, especially in southern Florida. See Reiss (1974) and Strixino and Strixino (1991) for more information.

Genus *Harnischia*

DIAGNOSIS: Distinguished by the premandible with more than 3 teeth; the scale-like, distally trifid pecten epipharyngis; antennal segment 2 subequal to 3; outermost lateral teeth of mentum not larger than inner teeth; and the weakly striated ventromental plates.

NOTES: Two species of *Harnischia*, *H. curtilamellata* and *H. incidata*, occur in the Southeast; only the larva of *H. curtilamellata* is described. Thus, *Harnischia* larvae can only be identifed as "*Harnischia* sp.".

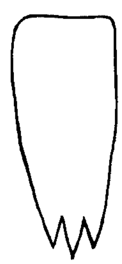
Harnischia forms the center of a group of closely related genera known as the *Harnischia* complex. Several "genera" are known only as larvae and can be found at the end of this chapter. Beck and Beck (1969b) and Sæther (1977) have published synopses on this complex.

Larvae occur in rivers and streams; they may be limited to relatively clean waters (Simpson & Bode 1980).

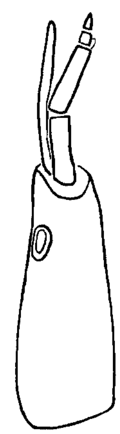
ADDITIONAL REFERENCES: Sæther 1977a; Townes 1945.

mentum

premandible



pecten epipharyngis



antenna

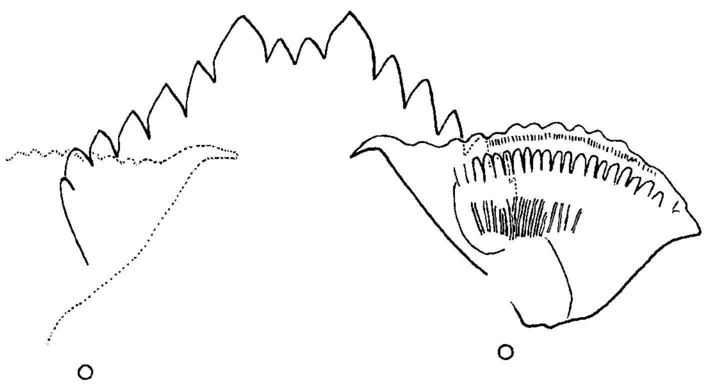
Genus *Hyporhygma*

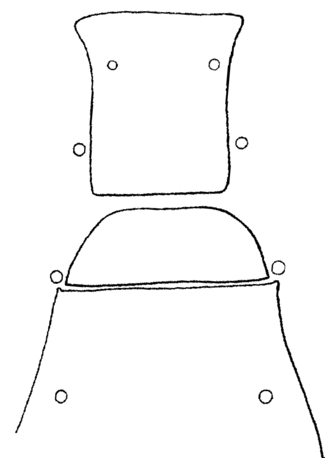
DIAGNOSIS: Distinguished by the frontal apotome, with 2 median labral sclerites anterior to it; pecten epipharyngis of three scales, each with 46 smaller teeth on surface; mentum with 2 median teeth lower and smaller than first lateral teeth; ventromental plates with scalloped anterior margin and strong striae and sculpturing; and leaf-mining habit.

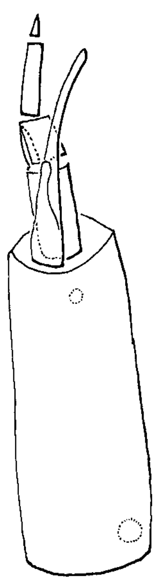
NOTES: One species, *H. quadripunctatum*, is known from North America. It was previously placed in *Tribelos* and *Endochironomus* until Reiss (1982) placed it in its own genus.

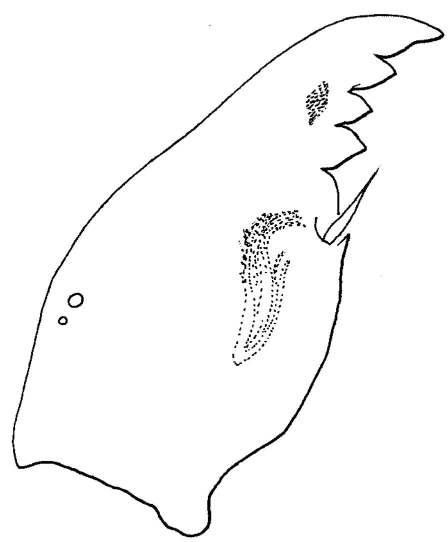
Larvae mine in the leaves and stems of *Nuphar* and *Nymphaea*.

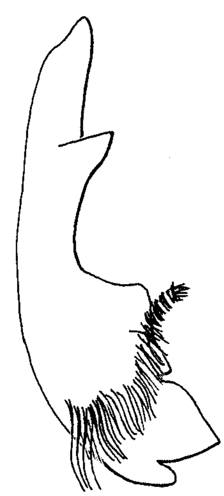
ADDITIONAL REFERENCES: Reiss 1982.


mentum


apotome and median labral sclerites


antenna


mandible


premandible

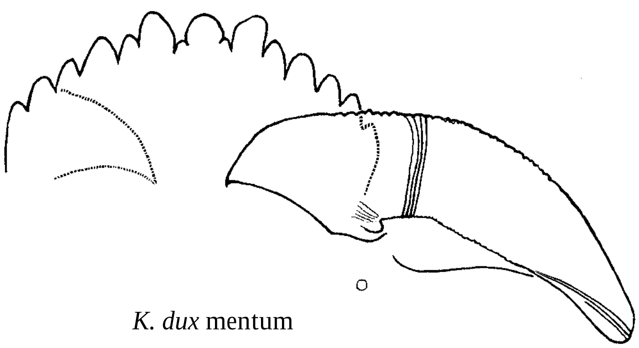
Genus *Kiefferulus*

DIAGNOSIS: Distinguished by the frontal apotome (thus with 2 median labral sclerites anterior to it); apotome with small, oval, anteromedian fenestra; premandible with 5 or more teeth; mandible without basal radial striae or grooves; and body with single pair of ventral tubules.

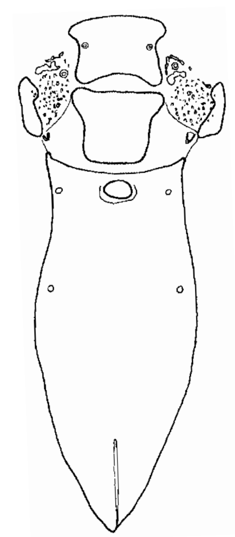
NOTES: Four species are known from the Southeast, two of which are undescribed; Caldwell et al. (1997) record three species from the Carolinas. Note that many records of the common species, *K. dux*, must be veiwed with skepticism, since it was earlier thought that only this one species of *Kiefferulus* was present in the eastern United States. Two subgenera are present, *K. (Kiefferulus)* and *K. (Wirthiella)*, each with two species in the Southeast. These subgenera can only be identified using pupae: *K. (Wirthiella)* pupae have rows of needle-like spines on sternites I-III; *K. (Kiefferulus)* pupae lack these spines. Characters used to sepaarte the adults of the subgenera used in Cranston et al. (1989) do not appear to work with material from the Southeast.

Larvae are found in or on sediments and vegetation; they can tolerate low dissolved oxygen conditions.

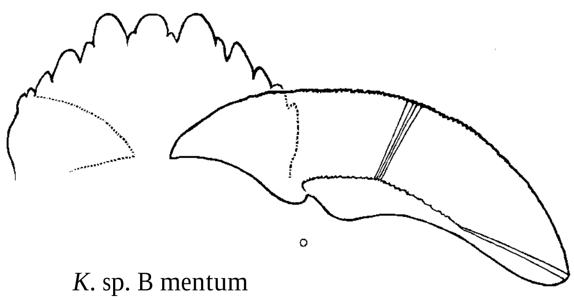
ADDITIONAL REFERENCES: Townes 1945.



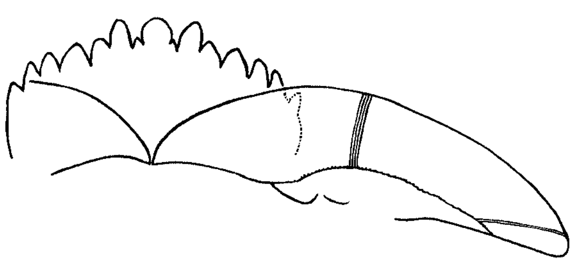
K. dux mentum



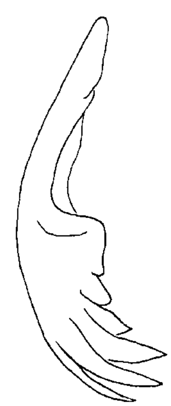
apotome and labral sclerites



K. sp. B mentum



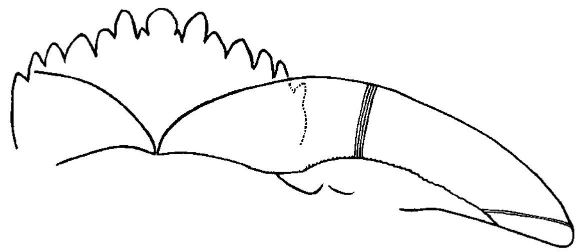
K. sp. A mentum



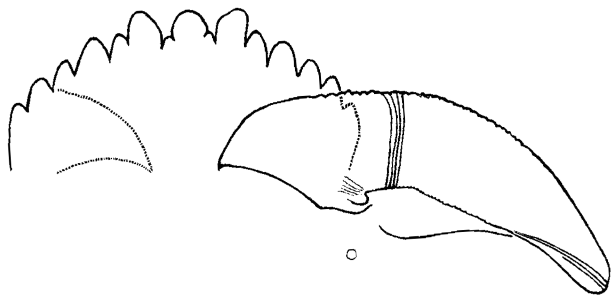
premandible

Key to *Kiefferulus* larvae of the southeastern United States

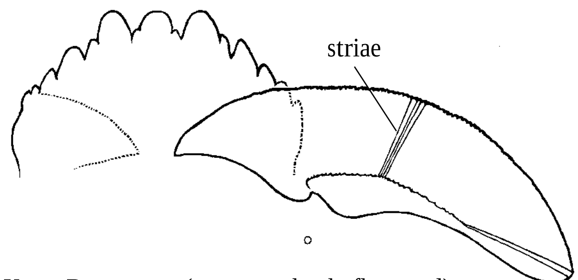
1 Ventromental plates touching medially or nearly so; anterior margin of ventromental plates smooth; peninsular Florida only (?) .... ***K.* sp. A**



1' Ventromental plates separated medially; anterior margin of plates finely scalloped; widespread 2



2(1') Ventromental plate with about 100 striae .. .. ***K.* sp. B**

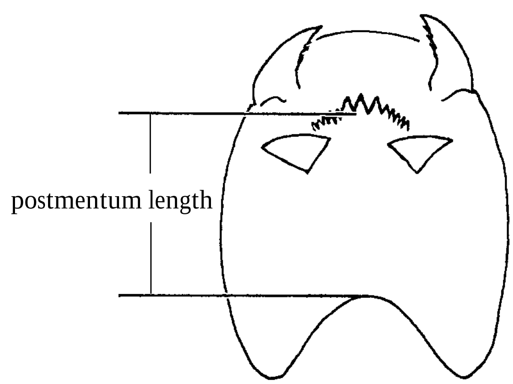


K. sp. B mentum (not completely flattened)

2' Ventromental plate with fewer than 75 striae 3

3(2') 4th instar larvae only: postmentum length 255-290, mean 270 µm; basal antennal segment length 75-98, mean 88 µm .... ***K. pungens***

NOTE:
4th instar
larvae are necessary
for accurate
measurements!!



3' 4th instar larvae only: postmentum length 275-380, mean 335 µm; basal antennal segment length 95-145, mean 113 µm .... ***K. dux***

Notes on species

K. dux - A common and widespread species, but possibly confused with *K.* sp. A as an adult and *K. pungens* and *K.* sp. B as a larva (see below). I measured larvae of 18 reared *K. pungens* and 15 reared *K. dux* to obtain the numbers in the key used for separating the larvae of these two taxa; there is some overlap and the species are best identified with associated pupae. Adults and pupae of *K. dux* are very similar to those of *K.* sp. A but larvae are easily separable using the above key.

K. pungens - Formerly placed in *Chironomus*, reared material indicates that this species belongs with *K. (Wirthiella)*. The larva is very similar to *K. dux* and is separable only by its smaller size (see key); larvae are best identified with associated pupae or adults. Pupae of *K. pungens* have needle-like spines on sternites I-III and a massive caudolateral comb on tergite VIII; pupae of *K. dux* lack the ventral spines and have a reduced caudolateral comb. Adults of *K. pungens* are distinctive from other Nearctic species of the genus (see Townes 1945).

K. sp. A - In the Southeast known only from peninsular Florida; I have reared this undescribed species from the northern Everglades (description in preparation). This unusual species is similar to larvae of the closely related African genus *Acinoretracus* (Epler et al. 1999), but differs in the simple ventromental plate striae; those of *Acinoretracus* are forked. The pupa and adult of *K.* sp. A are very similar to those of *K. dux*; more work is needed to ascertain characters that may separate the two taxa.

K. sp. B - Known only from larvae and one pupa; Caldwell et al. (1997) report this species from South Carolina but I have not examined material from there. All material I've seen came from peninsular Florida; adults are unknown. The presence of needle-like spines on sternites I-III of the pupa place this species in *K. (Wirthiella)*.

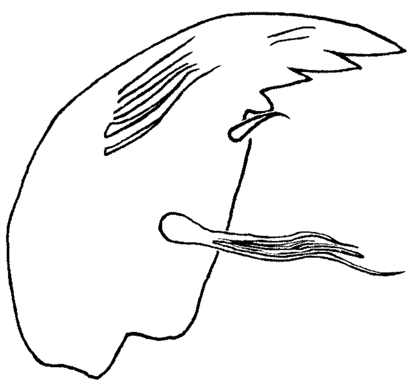
Genus *Kloosia*

DIAGNOSIS: Distinguished by the small, thin S I setae, much smaller than large, blade-like S II; 6 segmented antennae; premandible with 3 apical teeth; mandible without dorsal spine; mentum with 6 pairs of lateral teeth; rounded ventromental plates; large claws of anterior parapods at most about 0.4 length of head capsule; body segments appearing subdivided; and anal setae short, slightly longer than supraanal setae.

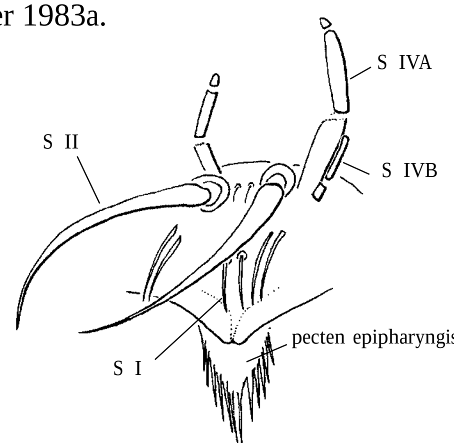
NOTES: One species, *K. dorsenna* (originally described in the genus *Oschia*), is known from the Southeast. Larvae are very similar to those of *Harnischia* complex genus C, but can be differentiated by the characters listed above. The median tooth of the mentum might be considered deeply trifid in *Kloosia*; if viewed in this manner, the first pair of lateral teeth are partially fused to the second (i.e., the division between the first and second lateral teeth is shallow).

Larvae are found in sandy substrata of running waters.

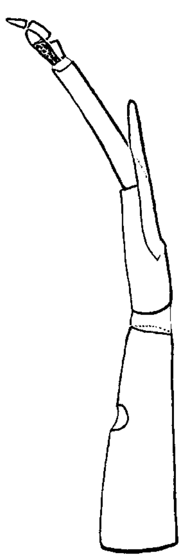
ADDITIONAL REFERENCES: Reiss 1988b; Sæther 1983a.



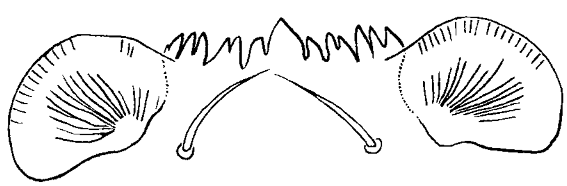
mandible



labrum

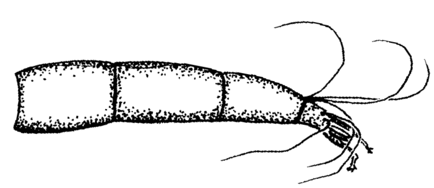


antenna



mentum

premandible



posterior end

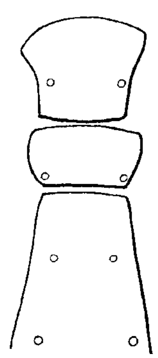
Genus *Lauterborniella*

DIAGNOSIS: Distinguished by the frontal apotome, with 2 median sclerites anterior to it (clypeus and labral sclerite 2); 6 segmented antennae with alternate Lauterborn organs at the apex of segments 2 and 3; plumose setae submenti placed posteromedially to ventromental plates; short lateral tubules on body segment 10; and body segment 11 with a posteriorly directed hump.

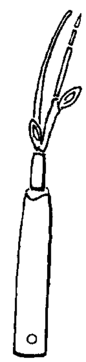
NOTES: One species, *L. agrayloides*, is known from North America. Other Nearctic species formerly placed in *Lauterborniella* are now placed in *Stelechomyia* or *Zavreliella*.

Larvae live in transportable cases resembling those of the caddisfly *Hydroptila*. Larvae are found among vegetation in ponds and slow moving areas of streams.

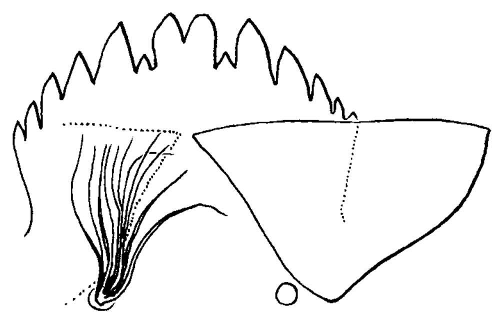
ADDITIONAL REFERENCES: None.



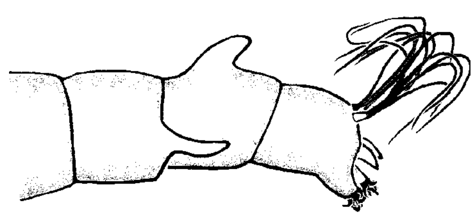
apotome and median labral sclerites



antenna



mentum



posterior end

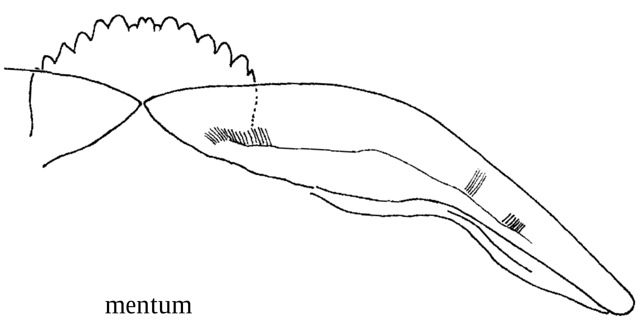
Genus ***Lipiniella***

DIAGNOSIS: Distinguished by the frontoclypeal apotome with 1 labral sclerite anterior to it; a dark, blunt tubercle present mediad to antennal base; mandible with a dorsal tooth, 3 triangular inner teeth, a short, simple seta subdentalis and an outer, posterior hump; mentum with bifid median tooth; wide ventromental plates that touch medially; premandible with brush and 5-6 teeth; and a pair of short ventral tubules on abdominal segment 8.

NOTES: No described species are recorded from the Nearctic, but at least one species does occur in the Southeast. The larva figured by Roback (1963) as "*Xenochironomus (Anceus) scopula* ? Townes" is probably a *Lipiniella*; his figure 14 of the mentum of a "juvenile labial plate" of *X. festivus* may also be a *Lipiniella*. The maxillae of *Lipiniella* larvae I've examined have a brush of setae near the base of the maxillary palp, but the setae are not as long as those observed on *Axarus* larvae maxillae.

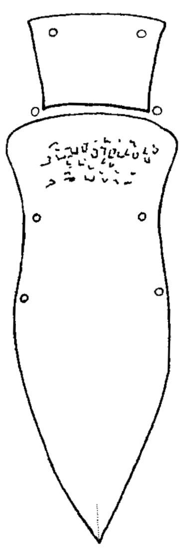
Larvae are found in sandy sediments in lotic and lentic habitats.

ADDITIONAL REFERENCES: Shilova 1961, 1963; Shilova et al. 1992.



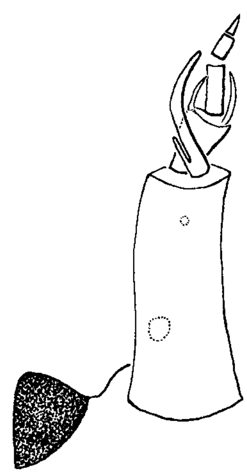
mentum

mandible



apotome and labral sclerite

premandible



antenna and tubercle

Genus *Manoa*

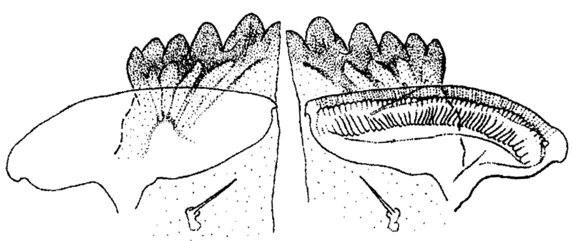
DIAGNOSIS: Distinguished by the S I setae arising from a common base; antennae not mounted on elongate pedestal; mandible without dorsal tooth and with seta subdentalis on dorsal side; mentum with second lateral tooth reduced and mostly fused with first lateral tooth; large bar-like ventromental plates that touch or almost touch medially; mandible with proximal inner tooth pointed; and procerci that arise from a common base that overhangs the last body segment.

NOTES: Rick Jacobsen (pers. comm.) has recently found an undescribed species of this tropical genus in Everglades National Park, Florida. He has graciously sent figures and information from a manuscript describing this new species. *Manoa* is only the second representative genus of the tribe Pseudochironomini in continental North America (the other genus being *Pseudochironomus*). *Manoa* is not known from the Carolinas.

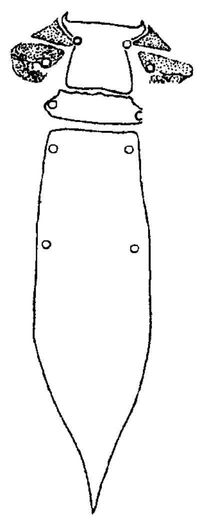
Fittkau (1963) originally described *Manoa* with one species, *M. obscura*, from the Amazon. The larva of *M. obscura* has very long procerci and anal tubules. Jacobsen's new species from the Everglades has normal anal tubules but does have long procerci that arise from a common base; the procerci of *Pseudochironomus* are shorter and arise separately.

Florida *Manoa* are found in shallow water areas subject to fluctuating water levels and seasonal drying.

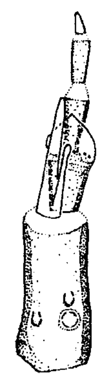
ADDITIONAL REFERENCES: Fittkau 1963; Jacobsen & Perry (in press).



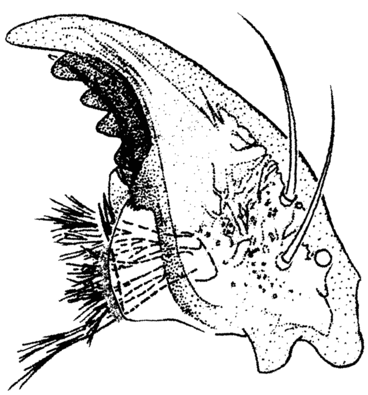
mentum



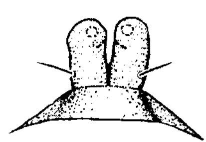
apotome and labral sclerites



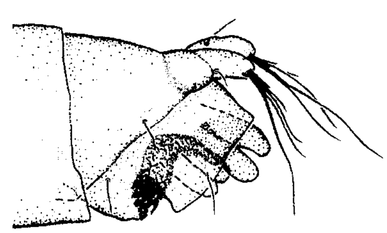
antenna



mandible



procerci, dorsal



body posterior, lateral

(all figures by R.E. Jacobsen)

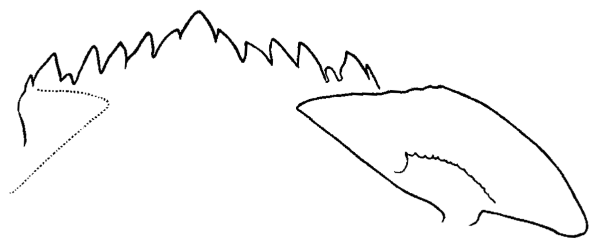
Genus ***Microchironomus***

DIAGNOSIS: Distinguished by the linear mentum (not arched) with outer teeth enlarged and trifid median tooth; pecten epipharyngis a simple plate or with 3 apical lobes; bifid premandible with brush; mandible without dorsal tooth or pecten mandibularis; and antennal blade as long as or longer than the flagellum.

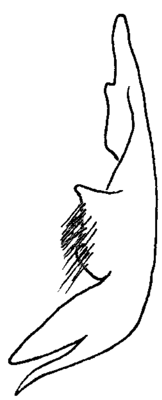
NOTES: A member of the *Harnischia* complex of genera, *Microchironomus* appears to be represented by at least two species in the Southeast; only one, *M. nigrovittatus*, is described. Any unassociated larva should be indentified as "*Microchironomus* sp. ". The genus was formerly referred to as *Leptochironomus*.

Larvae have been found in lakes, large rivers and ditches; little is known of their ecology.

ADDITIONAL REFERENCES: Sæther 1977a.



mentum



premandible

antenna

Genus *Micropsectra*

DIAGNOSIS: This tanytarsine is distinguished by its pecten epipharyngis with 3 lobes, each lobe with numerous distal teeth/serrations; bifid premandible; ventromental plates touching or almost touching medially; and antenna with Lauterborn organs on pedicels that greatly exceed the antennal flagellum (segments 2-5), and with antennal blade about as long as segment 2.

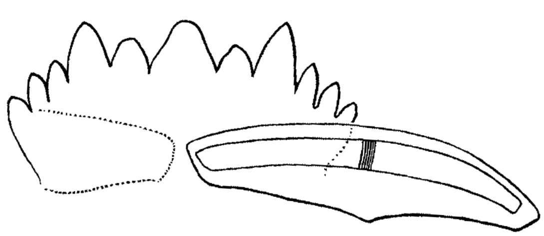
NOTES: Caldwell et al. (1997) listed two described and more than four undescribed species of *Micropsectra* for the Carolinas; the key that follows deals with eight taxa. Like all tanytarsine genera in North America, *Micropsectra* is in need of revision. The Tanytarsini are being revised by Dr. J.E. Sublette and it is anticipated that revisions of some genera will be published in the future.

Micropsectra and *Tanytarsus*, as well as other tanytarsine genera, have been confused in the past because it was erroneousely believed that tanytarsines with long Lauterborn organ pedicels, medially touching ventromental plates and a spur on the antennal pedestal were *Micropsectra*. However, many *Tanytarsus* have such a spur and some *Micropsectra* lack one.

The larva of *Parapsectra* is known only from a single European species, *P. uliginosa* Reiss, that has a hump on the outer margin of the mandible, similar to *M*. sp. B, C and E in the following key. The antennal blade of *P. uliginosa* is short and squat, not long as in *M*. sp. B, C and E. The true placement of *M*. sp. B and C will be unclear until the larvae are associated with pupae; *M*. sp. E has been reared and is a true *Micropsectra*.

Micropsectra larvae are found in a wide range of lentic and lotic habitats, but in the Carolinas are usually most abundant in mountain streams; the genus is uncommon to rare on the Coastal Plain.

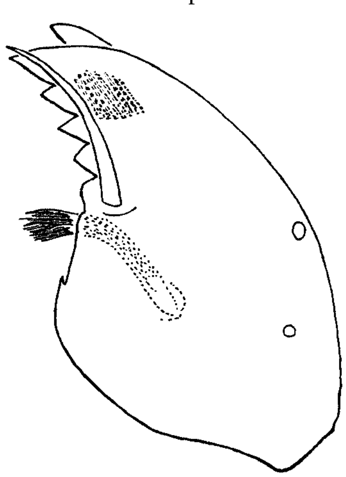
ADDITIONAL REFERENCES: Oliver & Dillon 1994a; Säwedal 1982; Webb 1981.

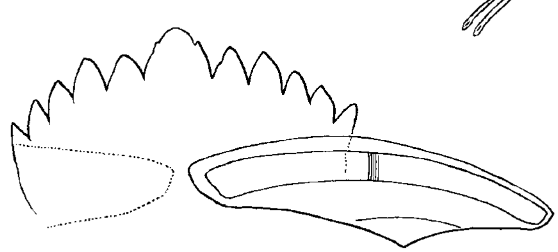


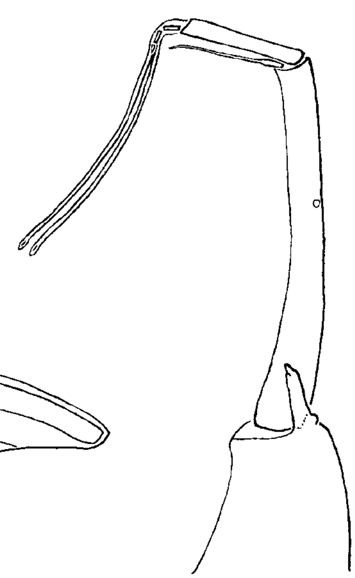
M. sp. B mentum

premandible

pecten epipharyngis



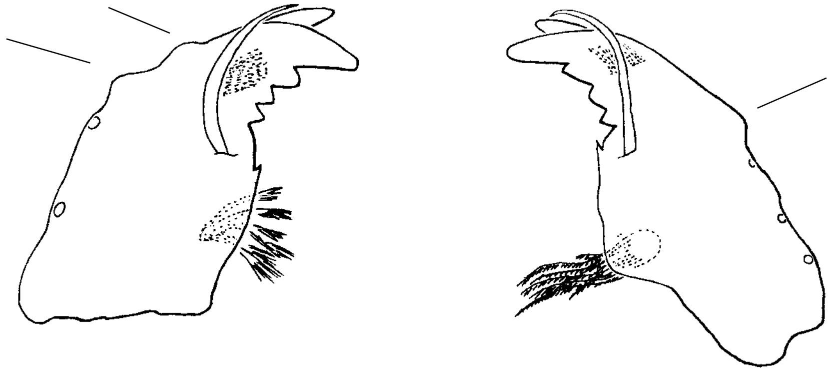




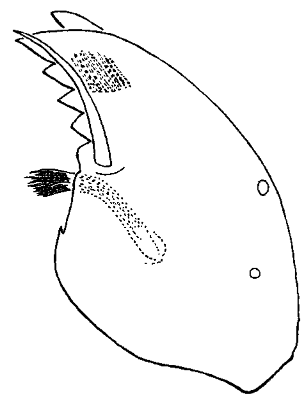
M. sp. A mandible, mentum and antenna

Key to *Micropsectra* larvae of the southeastern United States

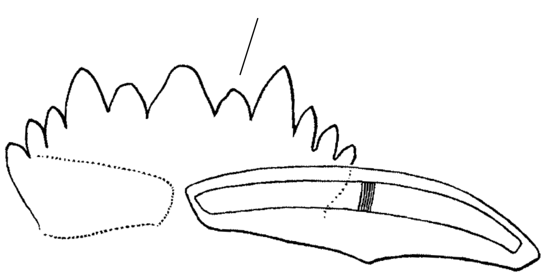
1 Outer margin of mandible with 1 or 2 small humps 2

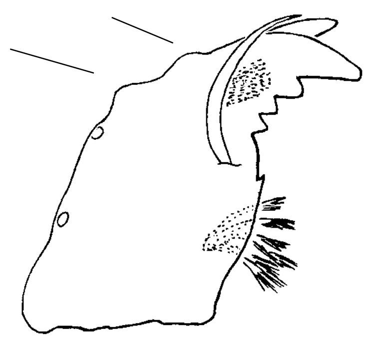


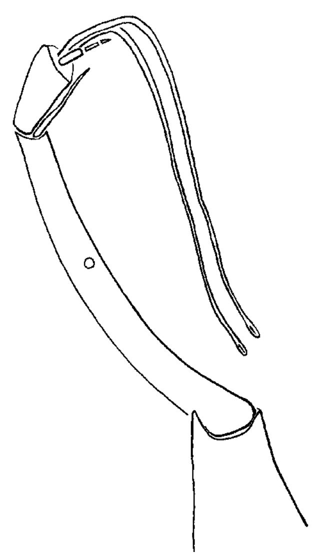
1’ Outer margin of mandble smooth or nearly so 4



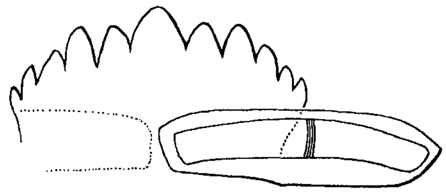
2(1) Mentum with reduced first lateral tooth; outer margin of mandible with 2 humps; antenna with second segment wider at apex than at base; first antennal segment 4-6X as long as second segment .... ***M.* sp. B**



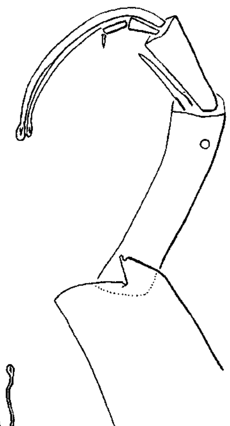


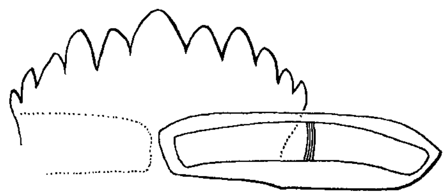


2’ Mentum with first and second lateral teeth subequal (first may appear slightly lower than second); outer margin of mandible with 1 hump; antenna not as above 3

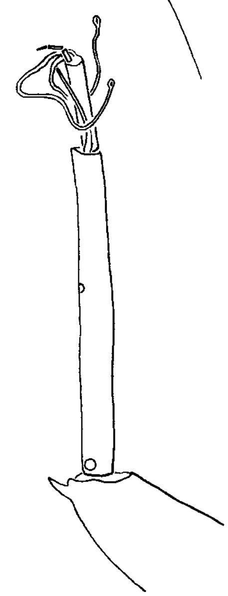


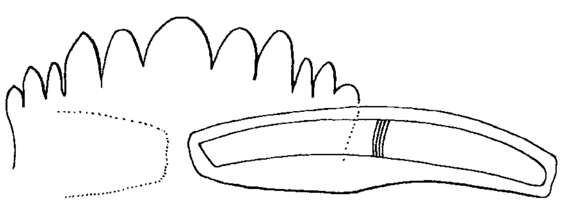
3(2’) First antennal segment 2-2.5X as long as second; second antennal segment wider at apex than at base .... ***M*. sp. C**



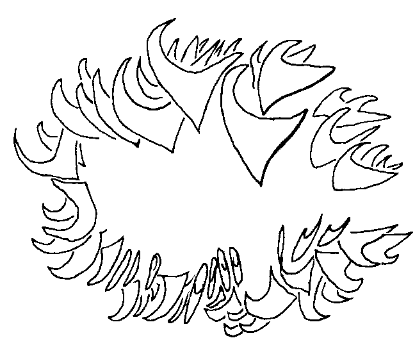


3’ First antennal segment about 4X as long as second; second antennal segment about as wide at apex as at base .... ***M*. sp. E**

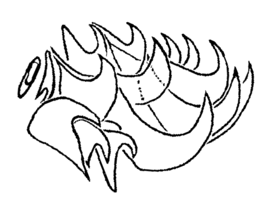




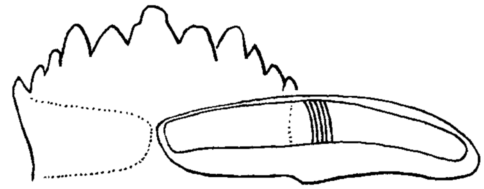
4(1’) Each hind parapod with 40 or more claws 5



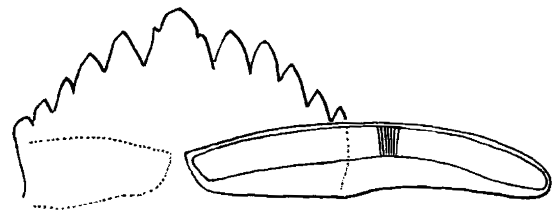
4’ Each hind parapod with 25 or fewer claws (usually around 15) 6



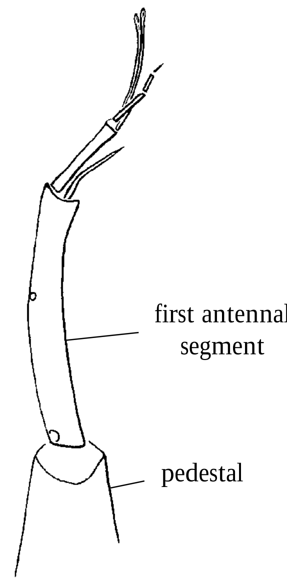
5(4) Mentum with first lateral tooth lower than or even with second so that mentum appears straight across median and first 2 pairs of lateral teeth .... ***M. dives*** and ***M. geminata***
(identify larvae that key to here as "*M. dives/geminata*")

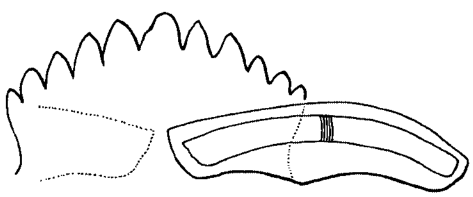


5' Mentum with teeth more in an even arch .... ***M. polita***
(see Notes on species)

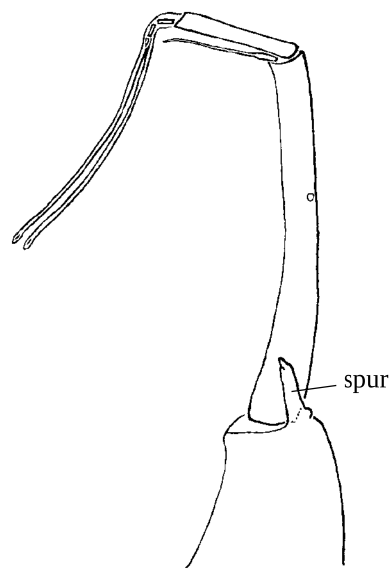


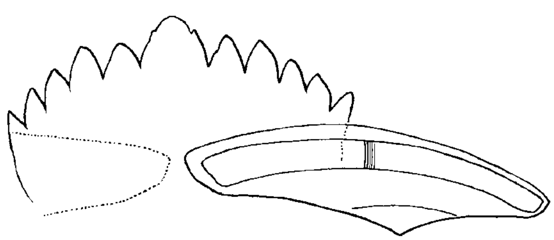
6(4') Antenna pedestal without spur .... ***M.* sp. D**





6' Antenna pedestal with spur .... ***M.* sp. A**





Notes on species

M. dives - I've seen adults of this species from the Smoky Mountains in North Carolina; it is very similar to the more recently described *M. geminata*. It is quite possible that some records of *M. dives* in the literature may refer to *M. geminata*. See *M. geminata* below.

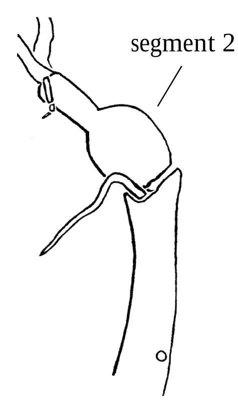
M. geminata - Oliver & Dillon (1994) described this species, which is very similar to *M. dives*. I have seen adults from North and South Carolina. The mentum width character used by Oliver & Dillon (1994:204) to separate the larvae of *M. dives* and *M. geminata* (that of *M. dives* > 100 µm, of *M. geminata* < 95 µm) will not work, based on reared material of *M. geminata* from the Canadian National Collection in which the mentum widths of two larvae were 124 and 134 µm. Unassociated larvae that key to couplet 5 should be identified as "*M. dives/geminata*".

M. polita - I have not seen this larvae of this species from the Southeast; adults are recorded from South Carolina (J.E. Sublette, pers. comm.). It was redescribed by Webb (1981) and Oliver & Dillon (1994) but not in sufficient detail. Its placement in the key is based on reared material from New York. At least one other taxon in the Carolinas, *M*. sp. E, has a pupa similar to that of *M. polita*, but the adults are decidedly different. Another species, *M. nigripila* (Johannsen), may occur in the Southeast and will probably key to *M. polita* in the key above. Following Oliver & Dillon (1994), the larva of *M. nigripila* has 14-22 bluntly rounded teeth on its labral lamella (*M. polita* has 24-31 narrower, more pointed teeth), the scales of its pecten epipharyngis have 3-5 teeth, with the middle one usually with 3 teeth (*M. polita* 4-7 teeth, with middle one usually with 4) and the median mental teeth are usually uniformly dark or with slightly lighter edges (*M. polita* with definite light medial area). However, Oliver & Dillon (1994) did not describe the claws of the posterior parapod; I have not seen associated larval material of *M. nigripila* and thus do not know if the species will actually key with *M. polita* in my key.

M. recurvata - Listed for North and South Carolina by Oliver et al. (1990); I have not seen any material of this species; the larva is undescribed. It is possible that records of this species may actually refer to *M. dives* or *M. geminata*.

M. xantha - Listed for the Southeast by Oliver et al. (1990); I have not seen any material of this species; the larva is undescribed. The adult of *M. xantha* is also similar to *M. dives*, *polita* and *recurvata*.

M. sp. A - The most common and widespread *Micropsectra* larva in the material available to me; I've seen material from North Carolina to northern Florida. Several species may be "lumped" into this taxon. Differences in the length of the spur on the antenna pedestal and the distance between the bases of the S 3 (clypeal) setae might be useful characters for separation, but in the material I've examined there were no clear cut boundaries between character states. Without associated pupae or adult males I am reluctant to assign "species" status to any of the "variants" assigned to this taxon. Steiner et al. (1982) keyed a species with a bulbous base on the second antennal segment (*M*. sp. 5, figs. 3l and 35); I've seen a similar specimen from North Carolina and consider it to be an aberrant *M*. sp. A.



aberrant second antennal segment of *M*. sp. A

M. sp. B - I've examined larvae of this taxon from North Carolina. The mandible has two small lateral humps, the first lateral teeth of the mentum are much smaller than the second lateral teeth and the apex of the second antennal segment is wider than the base.

M. sp. C - I've seen larvae of this taxon from a seep in the Smoky Mountains in North Carolina. It is somewhat similar to *M*. sp. B but the mandible has only one lateral hump, the first lateral teeth of the mentum are not as small and the ratio of the length of the second antennal segment to the first is lower.

M. sp. D - An unusual larva; it has a trifid pecten epipharyngis with numerous apical toothlets and long pedicels bearing the Lauterborn organs, which should place it as a *Micropsectra*. However, a pharate pupa within a larva has an abdominal spine pattern similar to *Paratanytarsus penicillatus* (Goetghebuer), an arctic/boreal species, except that it lacks the anterior round spine patches on tergite VI. *Paratanytarsus* is closely related to *Micropsectra*; a series of reared specimens of *M*. sp. D will be necessary to determine its true generic placement. Note also the long third antennal segment.

M. sp. E - I've examined specimens (reared but in less than satisfactory condition) from a creek in South Carolina. The pupa has an abdominal spinule pattern similar to *M. polita*, but the adult and larva are quite different. The larva has a small hump on the outer margin of the mandible.

M. sp. 4 - Known from adults and pupae from the Smoky Mountains in North Carolina; the pupa is similar to *M. polita*.

M. sp. 6 - Known only from adults from the Smoky Mountains in North Carolina.

Genus *Microtendipes*

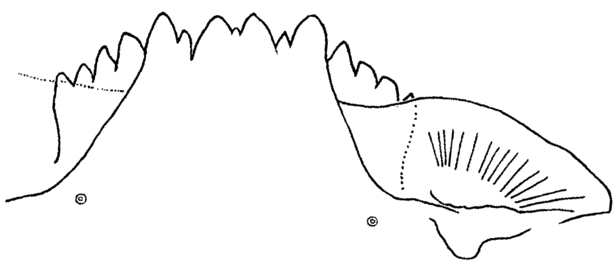
DIAGNOSIS: Distinguished by the frontal apotome with straight anterior margin separating it from the clypeus; bases of S I separate or contiguous; 6 segmented antenna with alternate Lauterborn organs at the apices of segments 2 and 3; mentum with 3 pale median teeth (median tooth may be minute); and the coarsely striated ventromental plates.

NOTES: Four described species are known from the Southeast; three of these occur in the Carolinas. There are probably at least two undescribed species present here. Larvae can not be identified to species without associated males and even then the possibility of an identification is low. Correct identification of males requires a revision of the genus utilizing type material from Europe; an attempt at a revision of the Nearctic *Microtendipes* by a graduate student was abandoned several years ago.

Larvae can be separated into two groups, named after European species: 1) the *rydalensis* group is distinguished by 3 large median teeth on the mentum, premandible with 5 inner teeth and pecten epipharyngis with numerous apical teeth; 2) the *pedellus* group, with 2 large median teeth and a much smaller (sometimes vestigial or absent) central tooth on the mentum, a 3 toothed premandible (proximal tooth very small) and pecten epipharyngis with 3-4 coarse teeth. I have associations of *M. caelum*; it is a member of the *rydalensis* group. Simpson & Bode (1980) figured a *pedellus* group larva but misidentified it as or incorrectly associated it with *M. caelum*.

Larvae occur in streams, rivers, ponds and lakes.

ADDITIONAL REFERENCES: Townes 1945.


mentum

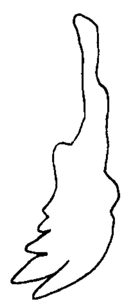

premandible


pecten epipharyngis

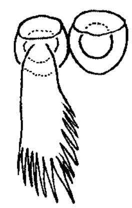

antenna

M. pedellus group

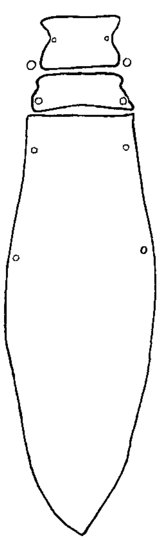

mentum


premandible


pecten epipharyngis


S I

M. rydalensis group


apotome and labral sclerites

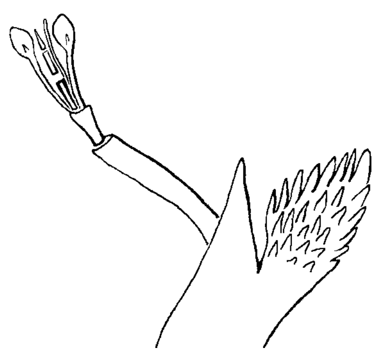
Genus *Neostempellina*

DIAGNOSIS: Distinguished by the simple frontoclypeal setae; finely granulate frontoclypeal apotome, without tubercles; antennal base with spur and mesal palmate process; Lauterborn organs on pedicels arising from the apex of antennal segment 2; widely separated, squat ventromental plates; procerci with dark, simple apical spurs; and portable sand case.

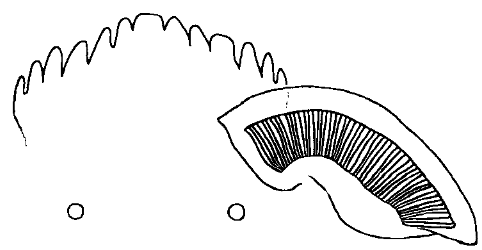
NOTES: One species, *N. reissi* Caldwell, has been described from the eastern US (Maine); this species has not been recorded from the Carolinas. B.A. Caldwell (pers. comm.) has collected a *Neostempellina* adult from a stream near the Apalachicola River in northern Florida. I have not seen any Nearctic larvae of *Neostempellina*; the diagnosis above and figures below are based on a European species, *N. thienemanni* Reiss. Note that *N. thienemanni* is the species whose larvae and pupae were erroneously identified as *Stempellina montivaga* in many previous works, such as Pinder & Reiss (1983: figs. 10.71 A,C, E and F); see Reiss (1984) for a full listing of those publications. Also note that the "real" *S. montivaga* is a junior synonym of *S. bausei* (Kieffer), a species not known to occur in the Nearctic. See also *Stempellina*.

Larvae of the Palaearctic species *N. thienemanni* occur in moss in cold springs and spring-fed streams.

ADDITIONAL REFERENCES: Caldwell 2000b; Reiss 1984.



N. thienemanni antenna



N. thienemanni mentum

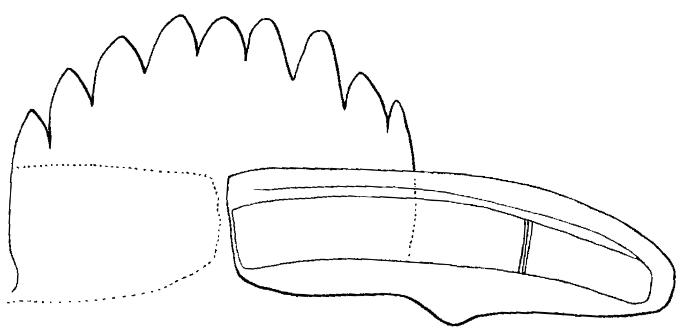
Genus ***Neozavrelia***

DIAGNOSIS: This tanytarsine genus is distinguished by the pecten epipharyngis of 3 scales with numerous fine apical teeth; bifid premandible; antennae with well developed Lauterborn organs on moderately long pedicels; mandible with 1 dorsal tooth and 2 inner teeth; mentum with 4 pairs of lateral teeth (a minute 5th pair is sometimes evident); and ventromental plates almost touching medially.

NOTES: *Neozavrelia* has only recently been found in North America; I've seen putative unassociated larvae from Ohio and North Carolina, and Caldwell et al. (1997) recorded a pupal exuviae from Georgia. Larvae are similar to *Sublettea* but have one less pair of teeth on the mentum, only one dorsal tooth on the mandible and a pecten epipharygnis with numerous fine apical teeth. Pinder & Reiss (1983) noted that *Neozavrelia* may have 5 pairs of lateral teeth on the mentum, but I have not seen such material from the Southeast. North American larvae I've examined have a distinct hump on the outer margin of the mandible that is not illustrated for European species.

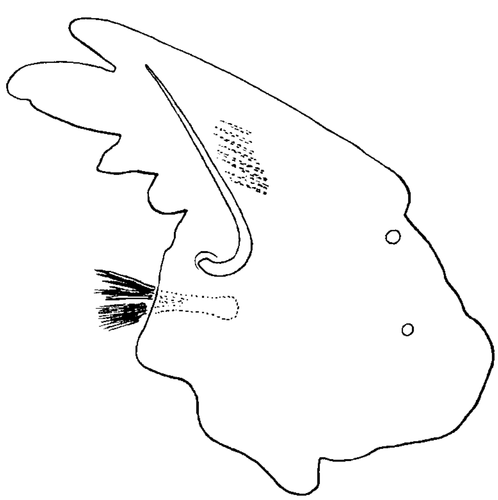
Larvae are recorded from hygropetric habitats as well as streams, rivers and lakes.

ADDITIONAL REFERENCES: Thienemann 1942.

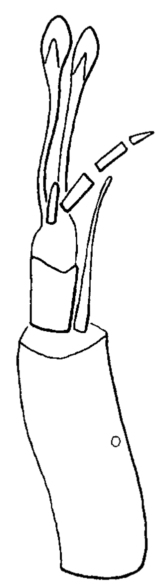


mentum

pecten epipharyngis



mandible



antenna

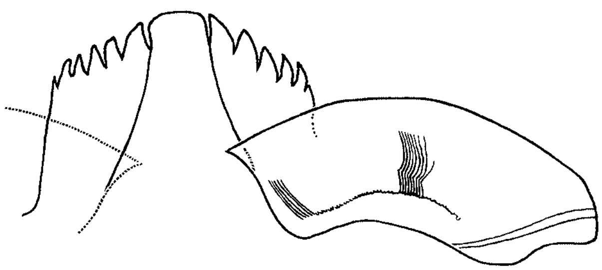
Genus *Nilothauma*

DIAGNOSIS: Distinguished by the simple labral sclerite 5; antenna with basal segment shorter than flagellum (segments 2-6; 6th segment is vestigial and usually not apparent); mandible with inner teeth grouped closely together and a single dorsal tooth; mentum with pale, usually rounded median tooth; and setae submenti placed posterior to ventromental plates.

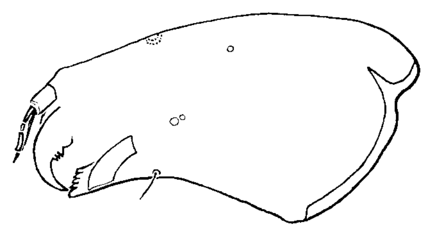
NOTES: Three described species are known from the Southeast; I have specimens of an additional undescribed species, known only as an adult, from Alabama, Florida and North Carolina. Although Adam & Sæther (1999) offered a key to larvae, in reality it is not possible to identify isolated larvae to species. They tentatively associated a larva with *N. mirabile*, but their measurement of its postmental length (246 µm) is far in excess of a reared specimen of this species in my collection with a postmentum length of only 108 µm. Their specimen may belong with the undescribed species, which has a large adult; I have in my collection an unassociated large larva from a lake in north Florida that is probably this same species. In "perfect" larvae, the median tooth is composed of 4-6 tiny teeth; however, these are invariably worn in most specimens so that the mentum appears to have a simple, dome-like tooth. The 6th antennal segment noted by Adam & Sæther (1999) is very small and difficult to observe. In lateral view, the head capsule is flattened anteriorly, appearing "bean-like"; note also that the 4th antennal segment is usually slightly curved.

Larvae are found most often in rivers and streams, but also occur in lakes.

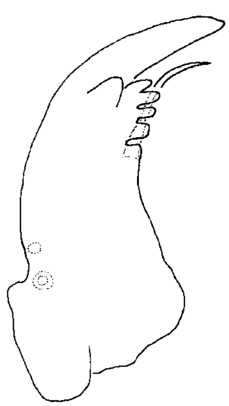
ADDITIONAL REFERENCES: Adam & Sæther 1999; Townes 1945 (as *Kribioxenus*).



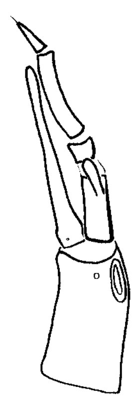
N. bicorne mentum



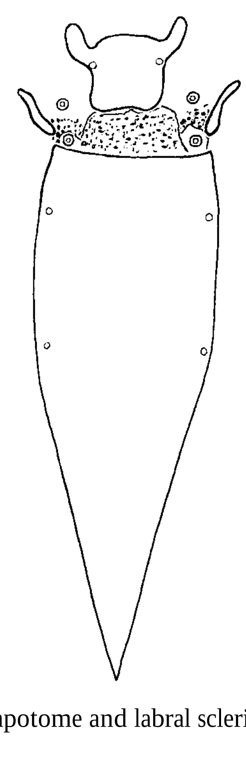
head, lateral



mandible



N. bicorne antenna



apotome and labral sclerites

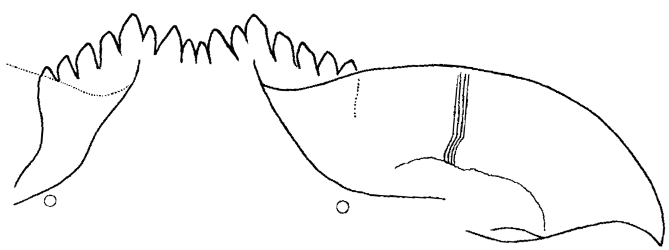
Genus *Omisus*

DIAGNOSIS: Distinguished by the broad plumose S I setae with separate bases; 6 segmented antenna with Lauterborn organs at the apices of segments 2 and 3; mandible with 2 dorsal teeth; and mentum with central pair of median teeth lower and more slender than outer median teeth.

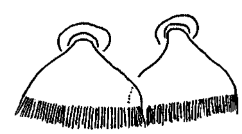
NOTES: Two species of *Omisus* are found in the Southeast; the larvae of the two species are inseparable at this time. The larva figured as *O.* sp. A in Epler (1995) was described, along with its adult and pupal stages, as *O. browni* by Caldwell (2000a). He noted that the Beck's (Beck & Beck 1970) larval material of *O. pica* was aberrant in having only 14 teeth on the mentum. Most *O. pica* larvae have a 16 toothed mentum, but the number of mental teeth may be 14, 15 or 16. Because only one species of *Omisus* was supposed to occur in the Southeast before Hudson et al. (1990), Epler (1995) and Caldwell (2000a), there is little doubt that some previous records of *O. pica*, in any life stage, refer to *O. browni*. Unassociated larvae of *Omisus* must be identified as "*Omisus* sp."

Larvae are known from seeps, small streams, ponds, marshes and peat bogs; Caldwell (2000a) also reported *Omisus* larvae from soil core samples in cypress domes in Florida.

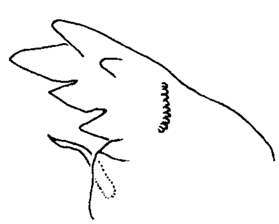
ADDITIONAL REFERENCES: Beck & Beck 1970; Caldwell 2000a.



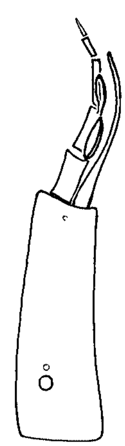
mentum



S I



apex of mandible



antenna

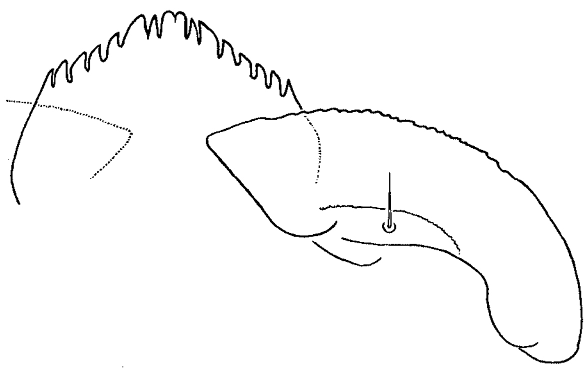
Genus ***Pagastiella***

DIAGNOSIS: Distinguished by the apically toothed labral sclerite 5; antenna with basal segment longer than flagellum; mandible 2 dorsal teeth and with inner teeth spread along inner margin; distinctively shaped pale mentum; and setae submenti placed near the posterior margin of the ventromental plates.

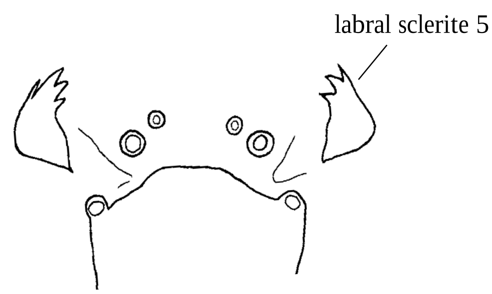
NOTES: The status of which species of *Pagastiella* occur in the Nearctic is uncertain. The species described from the Nearctic, *P. ostansa* (Webb), is probably the same as (and thus a junior synonym of) the European species *P. orophila* (Edwards). Examination of type material of the two taxa is necessary to determine the true identity of the Nearctic species. Hudson et al. (1990) stated that “an undescribed species has been collected in coastal streams”, but nothing else is known of this taxon. *Pagastiella* larvae should be identified as “*Pagastiella* sp.”.

Larvae are found in littoral sediments of ponds, lakes and the slower reaches of streams and rivers.

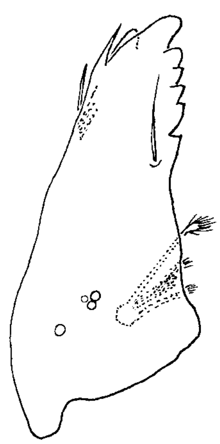
ADDITIONAL REFERENCES: Webb 1969.



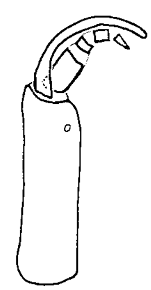
mentum



apex of apotome and labral sclerite 5



mandible



antenna

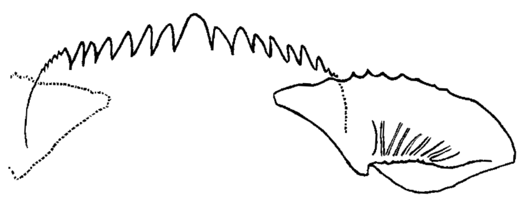
Genus *Parachironomus*

DIAGNOSIS: Distinguished by the simple S I (with small accessory branches in *P. frequens*); pecten epipharyngis a wide, transparent plate with 5 or more apical teeth (only 3 in *P. alatus*); 5 segmented antenna; absence of premandible brush; and mandible without dorsal tooth.

NOTES: At least 16 species of *Parachironomus* are known from the Southeast; at least one of those species, *P. abortivus*, may not actually occur in the area. At least eight other species occur in the Nearctic that have not been recorded from the Southeast (Spies 2000). Spies (2000) has shown that one commonly recorded species, *P. monochromus*, does not occur in the Nearctic (in the Southeast the species referred to as *P. monochromus* is *P. hazelriggi*). At least two species complexes occur in Nearctic members of the genus, the larvae of which are inseparable (see key). Contrary to Pinder & Reiss (1983), the mandible may have two or three inner teeth, and a pecten mandibularis is present in several species as two to three large setae dorsally on the mandible that run from midway to near the apex. The most accurate method for identifying *Parachironomus* is to rear the larvae and identify the adult males with Spies (2000).

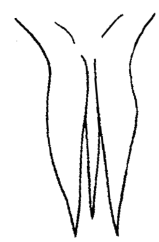
Larvae are found in lentic and lotic water bodies under a wide range of conditions.

ADDITIONAL REFERENCES: Beck & Beck 1969b; Lehmann 1970a; Spies 2000; Spies et al. 1994; Townes 1945.

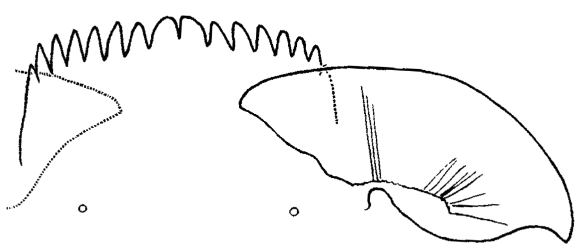


P. carinatus mentum

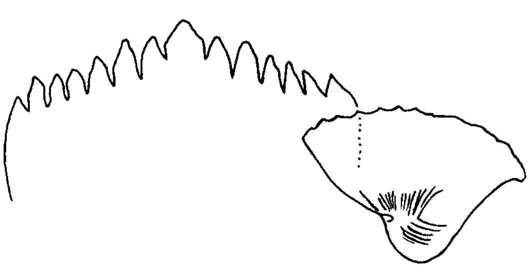
P. hazelriggi pecten epipharyngis



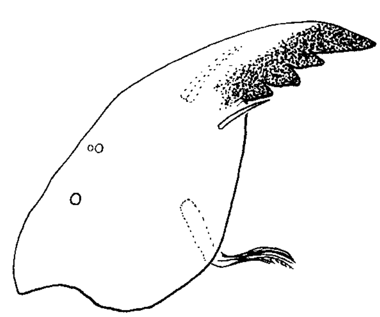
P. alatus pecten epipharyngis



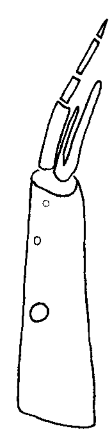
P. frequens mentum



P. hazelriggi mentum



P. supparilis mandible

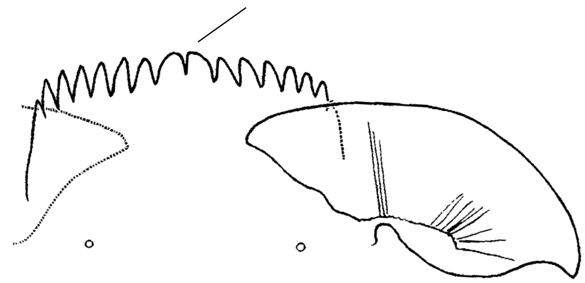


P. carinatus antenna

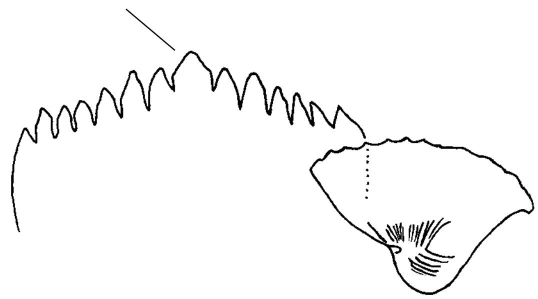
Key to *Parachironomus* larvae of the southeastern United States

(the larvae of *P. digitalis* and *P. guarani* are unknown)

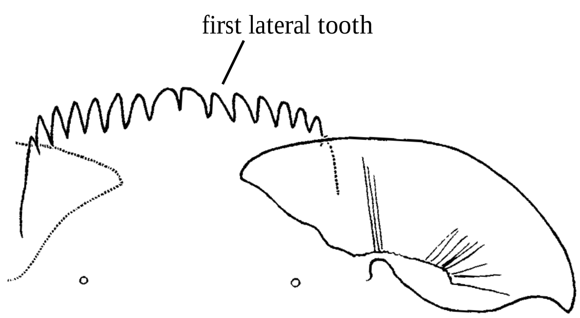
1 Median tooth of mentum bifid 2



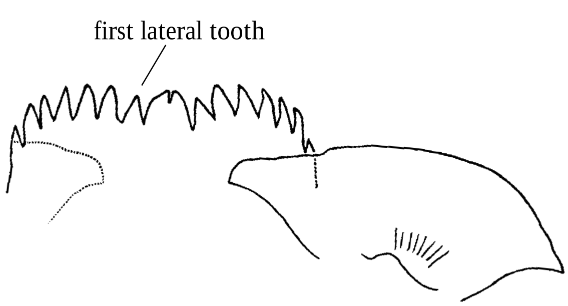
1’ Median tooth of mentum simple 3

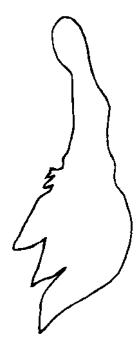


2(1) First lateral tooth of mentum equal to second lateral tooth; premandible with 4 large teeth .... ***P. frequens***

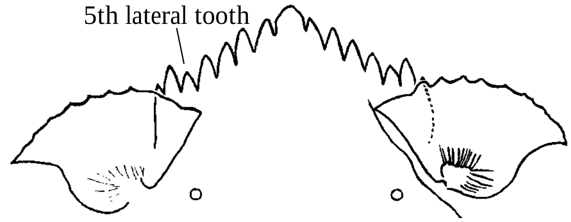


2’ First lateral tooth of mentum smaller than second lateral tooth; premandible with 3 large teeth .... ***P. pectinatellae***

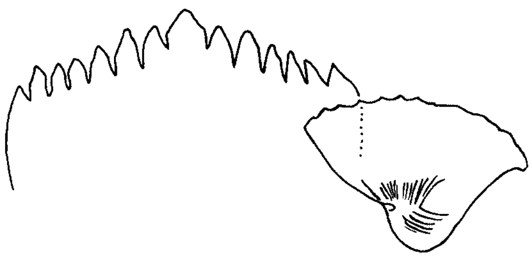


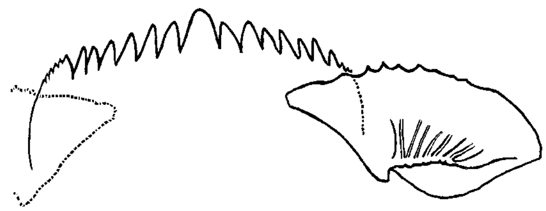


3(1') 5th lateral tooth of mentum distinctly smaller than its neighbors 4

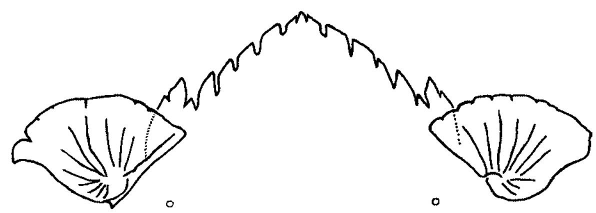


3' 5th lateral tooth of mentum subequal to 6th 5

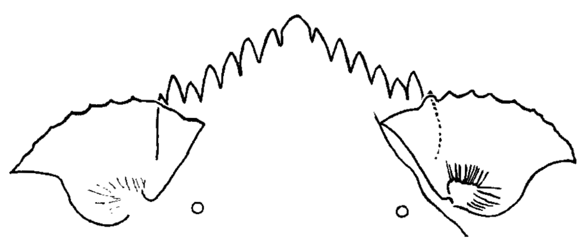




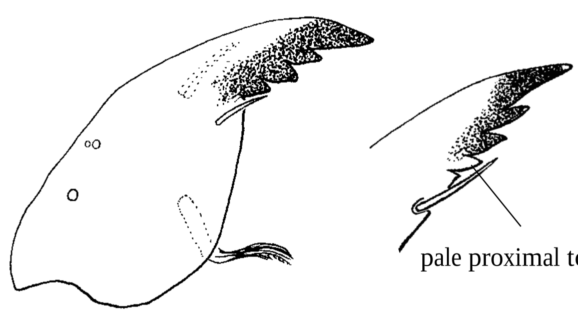
4(3) Mentum outline strongly arched; anterior margin of ventromental plate smoothly scalloped .... ***P. alatus***



4' Mentum not as strongly arched; anterior margin of ventromental plate with blunt points .... ***P. chaetoalus* complex** (includes *P. chaetoalus*, *P. hirtalatus* and some "unresolved" material; see Notes on species)



5(3') Mandible with 3 well developed, dark inner teeth 6

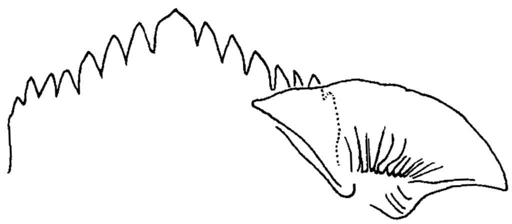


with 3 dark inner teeth

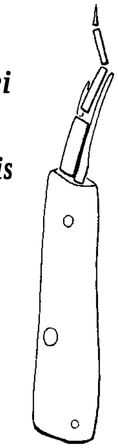
5' Mandible with 2 well developed inner teeth or with 3 inner teeth, the proximal tooth smaller and pale 7

6(5) 3rd antennal segment longer than or subequal to 4th .... ***P. sublettei***

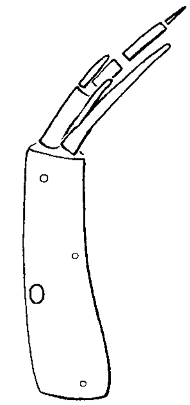
6’ 4th antennal segment longer than 3rd .... ***P. supparilis***



P. supparilis mentum

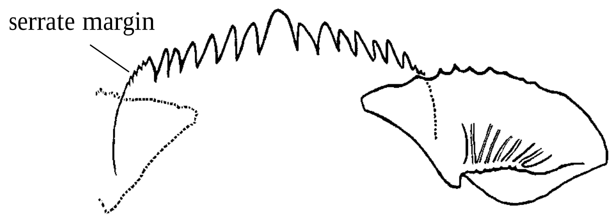


P. sublettei

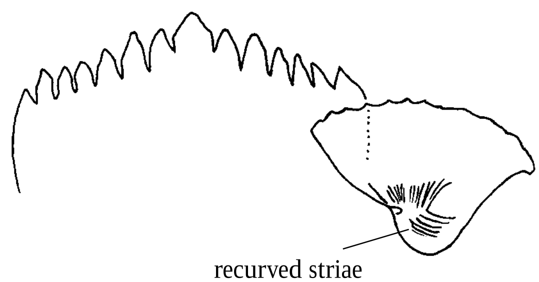


P. supparilis

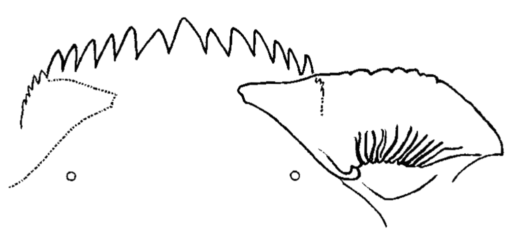
7(5’) Outer margin of mentum serrate (may require observation at 1000X); ventromental plate without recurved striae or transverse ridges posterolaterally 8



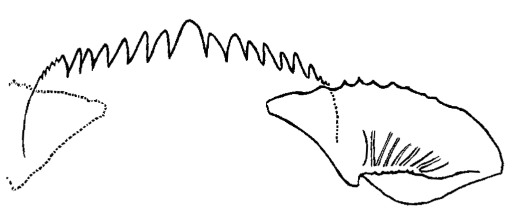
7’ Outer margin of mentum not serrated (last lateral tooth may be finely dissected or notched); ventromental plate with recurved striae or transverse ridges posterolaterallly 9

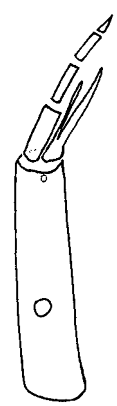


8(7) Antennal segments 3 and 4 subequal; anterior margin of ventromental plate smoothly crenulated .... ***P. directus***

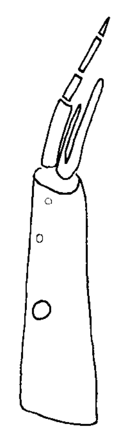


8’ Antennal segment 4 longer than 3; anterior margin of ventromental plate with blunt points .... ***P. carinatus***



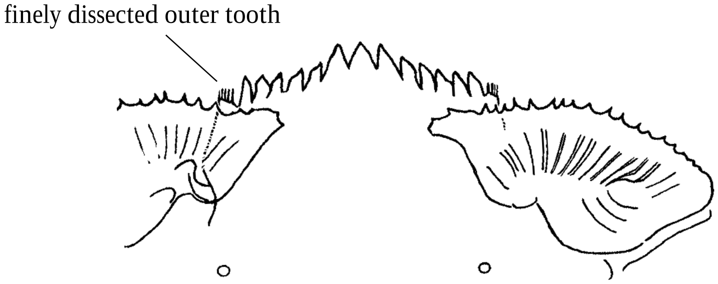


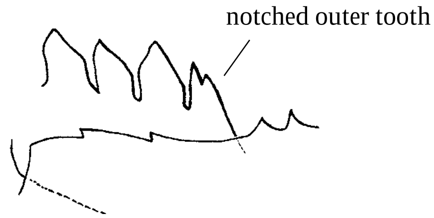
P. directus



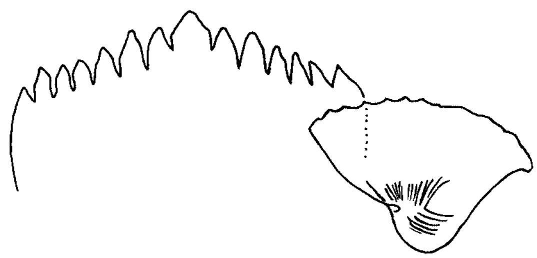
P. carinatus

9(7’) Mentum with 3 middle teeth subequal; outer tooth of mentum often finely dissected or notched (but may be simple); anterior margin of ventromental plate with sharp points .... ***P. potamogeti***





9’ Mentum with median tooth wider than 1st lateral teeth; outer tooth of mentum simple; anterior margin of ventromental plate with blunt points 10



10(9’) Premandible dark; antennal segments 1-3 usually brown; 1st antennal segment about 5X length of 2nd .... ***P. schneideri***

10’ Premandible light; antennal segment 1 may be dark yellow, remaining segments pale; 1st antennal segment about 4X length of 2nd .... ***P. tenuicaudatus* complex**
(includes *P. abortivus*, *P. hazelriggi*, *P. tenuicaudatus*; see Notes on species)

Notes on species

P. abortivus - Recorded for the Carolinas by Hudson et al. (1990) and Caldwell et al. (1997). However, only the adult male can be identified with certainty; larvae are inseparable from *P. hazelriggi* and *P. tenuicaudatus*. If the records in the two publications above were based only on larvae, they must be considered dubious. Note that inclusion of *P. abortivus* in the “*tenuicaudatus* group” does not indicate a close phylogenetic relationship between it and the other two species.

P. alatus - An unusual species that may deserve separate subgeneric or generic placement, for its larva and pupa are atypical for *Parachironomus*. This larva of this species may be mistaken for a *Cladopelma* because of the similar mentum, but note that in *P. alatus* the premandible lacks a brush, the pecten epipharyngis is trifid, the antennae have a long fourth segment and there are recurved striae on the posterior portion of the ventromental plates.

P. carinatus - A common species in the eastern US, but often misidentified, probably because the serrated outer margin of the mentum is not noted.

P. chaetoalus - Larvae of *P. chaetoalus* are inseparable from those of *P. hirtalatus* and specimens I’ve examined that, as adults, key to “Unresolved” in Spies (2000). Adult males are necessary for correct identification; larvae are best identified as “*P. chaetoalus* complex”. Although Epler (1995) noted that *P. chaetoalus* and *P. hirtalatus* might be synonymous, Spies (2000) treated them as separate species; adult males are separable by the structure of the superior volsella. *Parachironomus chaetoalus* occurs throughout the Southeast; both species occur in Florida (adults listed as *P*. sp. C in Epler

(1995) are *P. chaetoalus*, determined by Martin Spies). See also "Unresolved" below.

P. digitalis - The larva of this species is undescribed; I've seen adult males from the Savannah River Plant area in South Carolina and from Alabama. These records constitute, along with records from Georgia, the first reports of this European species from the Nearctic (Spies 2000).

P. directus - This species, described from Alabama, has been reported from North Carolina as well as Florida and Georgia. There appears to be some variation in the anterior points of the ventromental plate; separation of the larvae of this species from *P. carinatus* can only be done if the antennae are flat, otherwise the difference in length of segments 3 and 4 can not be accurately measured.

P. frequens - Epler (1995) noted that *P. frequens* may be more common that previously thought because larvae had been confused with *P. pectinatellae*. Simpson & Bode (1980) considered it to be uncommon and noted that it often occurred with *P. abortivus*. Note, however, that larvae identified as *P. abortivus* may actually belong to *P. hazelriggi* or *P. tenuicaudatus*. The larva of *P. frequens* differs from most other *Parachironomus* in that the S I has small accessory branches ("split ends").

P. guarani Spies, Fittkau & Reiss - Not known from the Carolinas; I have an adult from Alabama, identified by Martin Spies, in my collection. The larva is unknown. See Spies et al. (1994) for more information on this Neotropical species.

P. hazelriggi - For many years this species has been misidentified as *P. monochromus*, a European species that apparently does not occur in the United States. See Spies (2000) for a detailed account including past erroneous records. The larva is not separable from those of *P. abortivus* (but see comments under that name), *P. tenuicaudatus* and the true *P. monochromus*.

P. hirtalatus - Not recorded from the Carolinas, but may occur there. I have seen a reared male from Ohio and Oliver et al. (1990) record it from Illinois south to Mississippi and Florida. Larvae are inseparable from those of *P. chaetoalus* and specimens I've examined that, as adults, key to "Unresolved" in Spies (2000). Adult males are necessary for correct identification; larvae are best identified as "*P. chaetoalus* complex". See also *P. chaetoalus* and "Unresolved".

P. pectinatellae - This species was originally described by Dendy & Sublette (1959) from larvae taken from the freshwater bryozoan *Pectinatella magnifica*. It has often been confused with *P. frequens* but can be separated by the characters given in the key above.

P. potamogeti - Larvae I've placed here may have the last lateral tooth of the mentum finely dissected (like a fork), notched or entire. Referred to as *P.* sp. B in Epler (1995), the identity of *P. potamogeti* and apparently related taxa is confused. In Spies (2000), adults with *potamogeti*-like genitalia but without setae in apical wing cells (present on the holotype of *P. potamogeti*) key to "Unresolved" (see below).

P. schneideri - Known from Florida, Georgia and North Carolina in the Southeast (Caldwell et al. 1997). Oliver et al. (1990) also record it from Kentucky, but some of their records from Kentucky (such as records of the marine genera *Clunio* and *Thalassomya*) are dubious. Identifications based solely on larvae are suspect; an associated male is necessary for accurate identification. Do not assume that any *Parachironomus* larva with a darkened premandible is *P. schneideri*; other species, such as *P. supparilis*, may have darkened premandibles.

P. sublettei - Not recorded from the Carolinas; to date known only from Florida and Georgia. The mentum and ventromental plates of this species are paler than those of most other *Parachironomus* species. Note that although Beck & Beck (1969b) stated that recurved striae were not present on the ventromental plates, such striae are visible under high magnification. I've reared this species from a tidally influenced, brackish water habitat in peninsular Florida.

P. supparilis - A widespread species in the Neotropics, this taxon was referred to as *P.* sp. A in Epler (1992). Spies et al. (1994) considered this taxon to be a superspecies and described four varieties; the form found in the US is the variety *centralis*. Not yet found in the Carolinas, it will probably eventually be found there; known from Florida and Georgia.

P. tenuicaudatus - A species confused with "*P. monochromus*" by Beck & Beck (1969b). Their reared male of "*P. tenuicaudatus*" from Lake St. Clair in Polk County, Florida, is a *P. hazelriggi*, noted in Epler (1995) as a "*P. monochromus*". The larva of *P. tenuicaudatus* is inseparable from those of *P. abortivus* (but see comments under that name), *P. hazelriggi* and the true *P. monochromus* (a European species; see *P. hazelriggi* above). Identifications of *P. abortivus* and *P. tenuicaudatus* in the literature based on larvae are suspect.

"Unresolved" - Spies (2000: 141) noted a complex of species with partially intergrading character states that includes some specimens with genitalia close to *P. potamogeti* (q.v.). I have examined one reared specimen from Ohio with such male genitalia but without wing cell setae; the larva appears to be inseparable from those of *P. chaetoalus* and *P. hirtalatus* (species in which the adults have wing cell setae, as does the holotype of *P. potamogeti*). This may indicate that the presence or absence of wing cell setae is a variable character that may not be useful in phylogenetic analysis or as a character to define and/or identify species in *Parachironomus*.

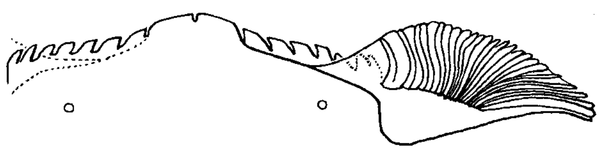
Genus ***Paracladopelma***

DIAGNOSIS: Distinguished by the small, seta-like S I and large S II; 5 segmented antennae with second segment much longer than third; mandible without dorsal tooth; premandible with 4 or more teeth, with brush; coarsely striated ventromental plates; and pale mentum or mentum with at least a broad, pale median tooth/teeth.

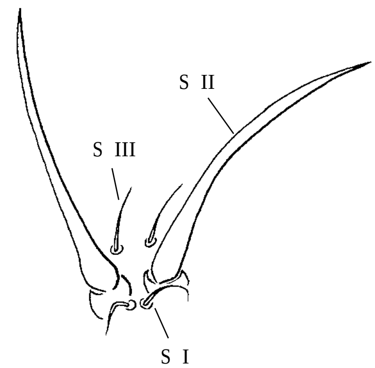
NOTES: Six species are known from the Carolinas, but only four have described adults and available names; an additional species known only from larvae is included in this manual. Contrary to the diagnosis in Pinder & Reiss (1983), a brush is present on the premandible, although it is hyaline and easily overlooked.

Larvae are found in sand substrata in lentic and (usually) lotic conditions. Some species may be sensitive to eutrophication (Pinder & Reiss 1983).

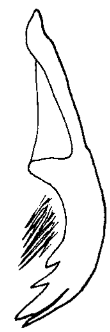
ADDITIONAL REFERENCES: Jackson 1977; Sæther 1977a.



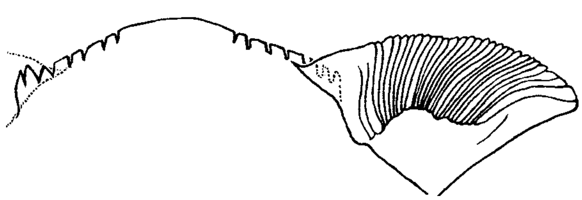
P. undine mentum



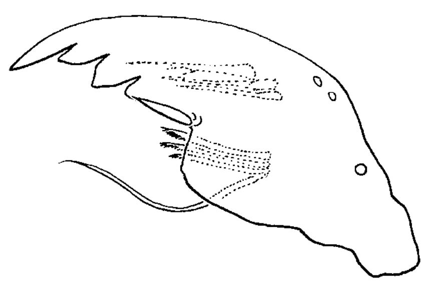
P. doris labrum



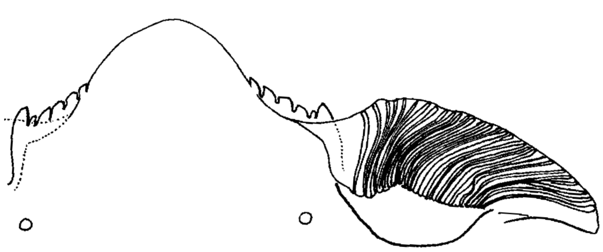
P. undine premandible



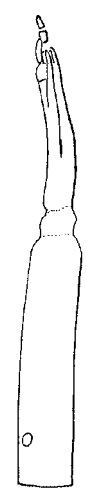
P. nereis mentum



P. undine mandible



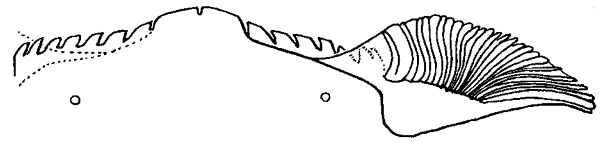
P. loganae mentum



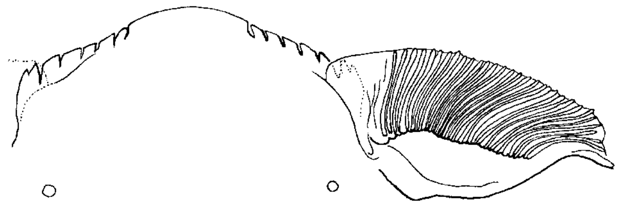
P. sp. 1 antenna

Key to *Paracladopelma* larvae of the southeastern United States

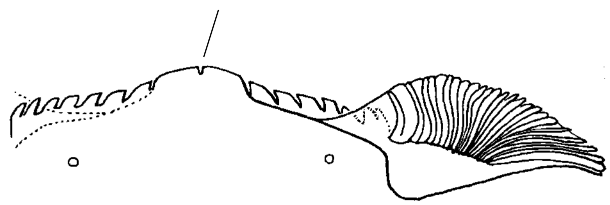
1 Ventromental plate with 25 or fewer full length striae 2



1’ Ventromental plate with more than 25 full length striae 4

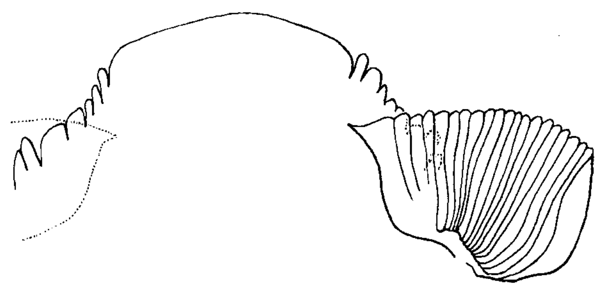


2(1) Median tooth of mentum bifid (may require observation at 1000X) .... ***P. undine***

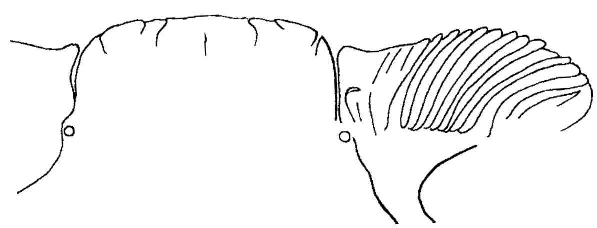


2’ Median tooth simple (figures below) 3

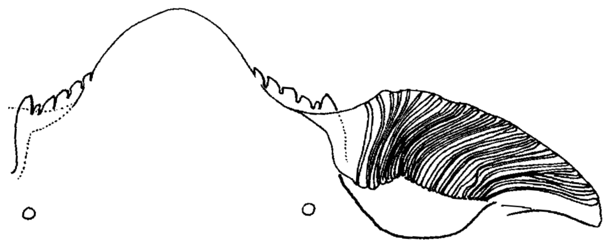
3(2’) Mentum strongly arched, with broad median tooth and 7 pairs of lateral teeth .... ***P.* sp. 2**



3’ Mentum more linear, with median tooth not as broad, not dome-like, and with 3 pairs of poorly defined lateral teeth .... ***P. doris***

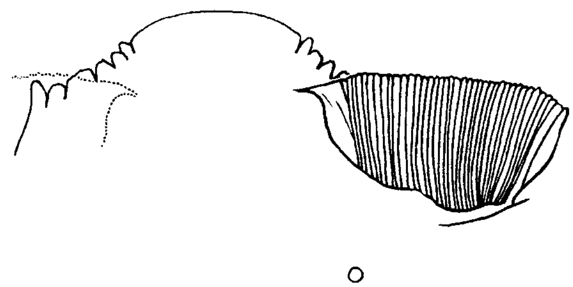


4(1') Mentum with broad, dome-shaped median tooth that projects strongly forward .... ***P. loganae***



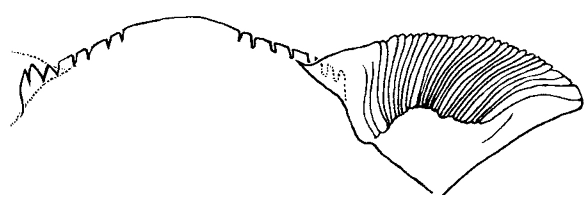
4' Median tooth of mentum not projecting strongly forward (figures below) 5

5(4') Ventromental plate squat; median tooth of mentum very broad and bulging forward .. .. ***P. sp. A***

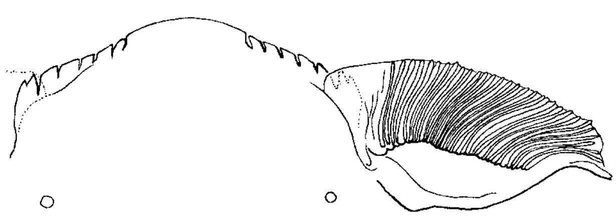


5' Ventromental plate wider; median tooth of mentum not as broad and not bulging forward 6

6(5') Ventromental plate with about 30 full length striae .... ***P. nereis***



6' Ventromental plate with about 38-40 striae .... ***P. sp. 1***



Notes on species

P. doris - Known from Florida and both Carolinas. Note the low mental teeth and squat ventromental plates. This species was described as "*Cryptochironomus* near *rolli* Kirp." in Sæther (1977).

P. loganae - The broad ventromental plates, with about 30 full length striae, and the strongly projecting median tooth (often difficult to observe unless high power is used) distinguish this larva. Caldwell et al. (1997) record this species from all of the states in the Southeast.

P. *nereis* - Caldwell et al. (1997) record this species for the entire Southeast, but it appears to be rather uncommon. Many specimens I've seen identified as *P. nereis* have been *P. undine*. Following Jackson (1977), the median tooth and first lateral teeth of the mentum are clear. However, this character state is often difficult to see because many menta are so translucent overall. The count of full length ventromental plate striae, about 30, is perhaps a better identifying character.

P. *undine* - The most common species in the Southeast, often misidentified as one of several other species. The broad ventromental plate with only about 25 full length striae is distinctive; it may require observation at 1000X to see the cleft median tooth of the mentum. I've seen some larvae without a cleft in the middle tooth that I'm assigning to this taxon, until reared material proves otherwise.

P. sp. 1 - Known from North Carolina and northern Florida (Suwannee River basin). The wide ventromental plates have about 38-40 full length striae, which separates this species from specimens I've assigned to *P. undine*, which has only about 25 full length striae.

P. sp. 2 - The broad median tooth and the squat ventromental plates, with only about 18-19 full length striae, distinguish this taxon, known from Georgia and North Carolina. Jackson (1977) hypothesized that this taxon, based on a single larva from Georgia, might have been a 3rd instar larva. It is possible that *P*. sp. A below is the 4th instar of this same species.

P. sp. A - I've seen one larva of this taxon from North Carolina. It is similar to *P*. sp. 2, with a broad, bulging median tooth and squat ventromental plates, but this taxon has about 35 full length striae and is much larger (width of ventromental plate of *P.* sp. 2 is around 34 µm; that of *P*. sp. A around 53 µm). This taxon may represent the 4th instar of *P*. sp. 2. If so, this would mean that the number of ventromental plate striae doubles from instar 3 to instar 4.

Several additional species, including *P. galaptera* (Townes), *P. nais* (Townes) and *P. winnelli* Jackson, occur in the eastern Nearctic but have not been recorded from the Southeast. If you have specimens that do not fit in the key above, see Jackson (1977).

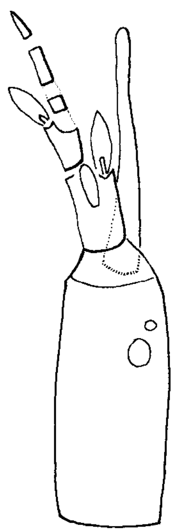
Genus *Paralauterborniella*

DIAGNOSIS: Distinguished by the long basal segment of S II; pecten epipharyngis of 2 plates; 6 segmented antennae, with alternate Lauterborn organs on the apices of segments 2 and 3; distinctive mentum with broad, pale median tooth; wide ventromental plates with coarse striae; and mandible without a dorsal tooth.

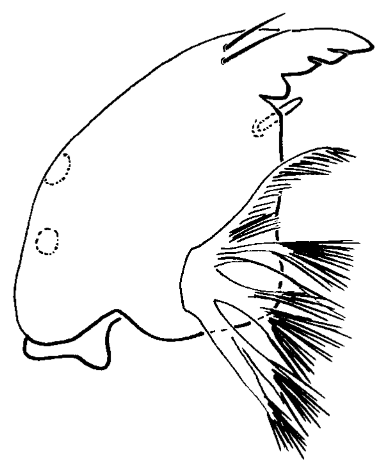
NOTES: One species, *P. nigrohalteralis*, is known from North America. Hudson et al. (1990) noted an undescribed species based on an adult collected from Lake Norman in North Carolina, but the specimen was not available for examination. Note that *Paralauterborniella* in Pinder & Reiss (1983, 1986) includes two species that were returned to *Apedilum* by Epler (1988a), the genus in which they were originally described by Townes (1945). Although Pinder & Reiss (1983) described the S II as simple, it is fringed.

Larvae usually occur in streams and rivers, but have been found in lakes.

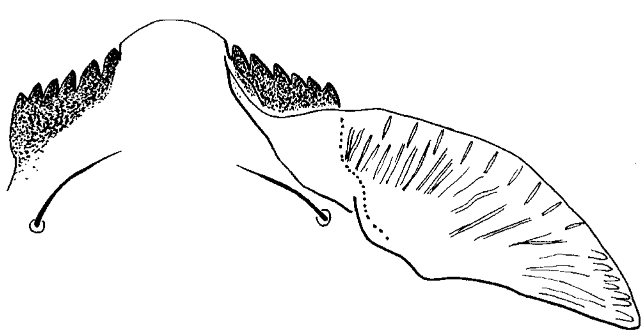
ADDITIONAL REFERENCES: Epler 1988a.



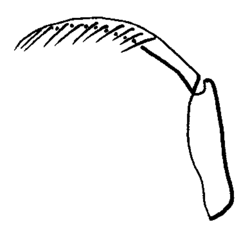
antenna



mandible



mentum



S II

Genus *Parapsectra*

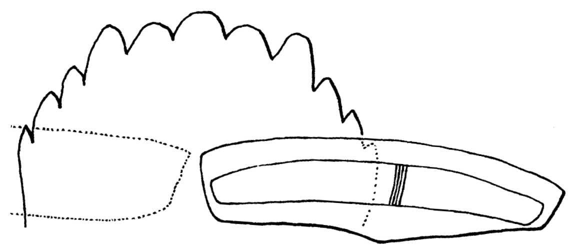
DIAGNOSIS: Distinguished by the pecten epipharyngis of 3 scales with apical teeth; bifid premandible; antennae with Lauterborn organs on long pedicels and short, squat antennal blade; and ventromental plates almost touching medially.

NOTES: *Parapsectra* is known from the Southeast from a male reported from North Carolina by Hudson et al. (1990) and from males and pupae I've examined from the Smoky Mountains of North Carolina and Tennessee. The diagnosis above and figures below are based on the only described larva of the genus, the European *P. uliginosa* Reiss.

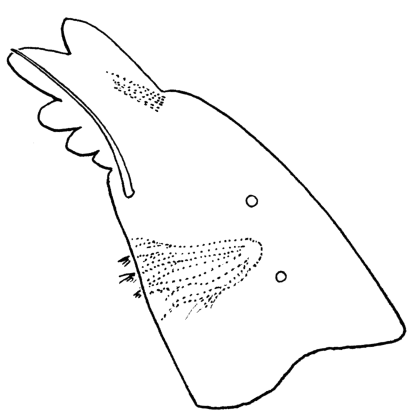
The larva of *P. uliginosa* has a hump on the outer margin of the mandible, similar to *M*. spp. B, C and E. The antennal blade of *P. uliginosa* is short and squat, not long as in *M*. spp. B, C and E. However, correct placement of *M*. spp. B and C will be unclear until the larvae are associated with pupae.

Larvae are reported from cold mountain streams and pools in bogs ("moors").

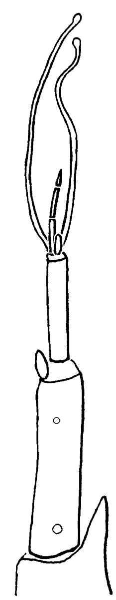
ADDITIONAL REFERENCES: Reiss 1969.



mentum



mandible



antenna

Genus *Paratanytarsus*

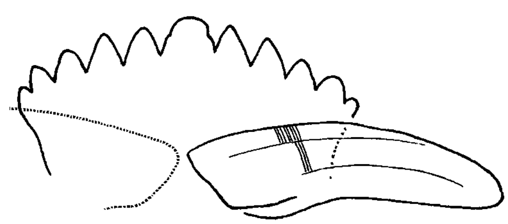
DIAGNOSIS: This tanytarsine genus is distinguished by the single plate pecten epipharyngis with 3-5 apical lobes; bifid premandible; sessile, or nearly so, Lauterborn organs at the apex of antennal segment 2; ventromental plates touching or almost touching medially; and the mandible without a pronounced hump on the outer margin.

NOTES: Caldwell et al. (1997) list four described species for the Southeast, three of which occur in the Carolinas (see checklist); to this can be added *P. quadratus* and *P.* cf. *laccophilus*, both known from North Carolina. *Paratanytarsus*, like most tanytarsine genera, is in need of revision. The key below can only be considered tentative; it is quite possible that some of the taxa keyed may represent more than one species, and it is almost certain that more species are present.

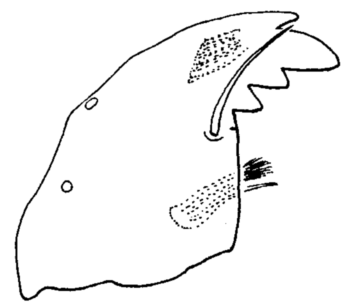
The mandible of most larvae has two inner teeth, although the molar area is darkly sclerotized and is sometimes notched to give the appearance of a small third inner tooth.

Larvae are found in a variety of aquatic habitats, including brackish water.

ADDITIONAL REFERENCES: Langton et al. 1988; Reiss and Säwedal 1981.



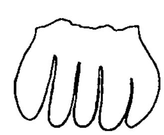
P. dissimilis mentum



P. quadratus mandible

P. quadratus antenna

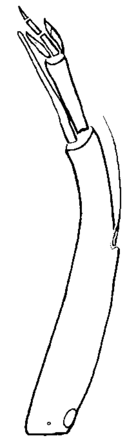
P. dissimilis antenna



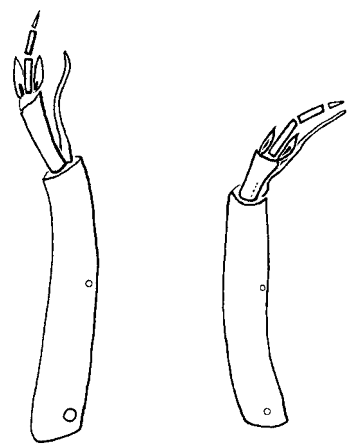
P. dissimilis pecten epipharyngis

Key to the *Paratanytarsus* larvae of the southeastern United States

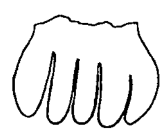
1 Second antennal segment longer than combined segments 3-5 2

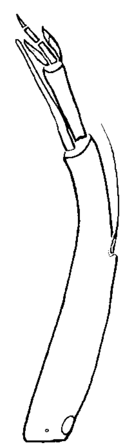


1’ Second antennal segment equal to or shorter than combined segments 3-5 3

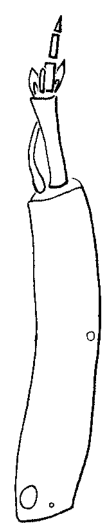


2(1) Pecten epipharyngis with 5 lobes .... ***P. dissimilis***



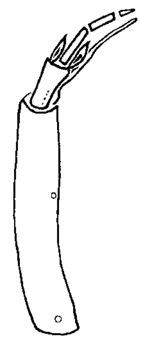


2’ Pecten epipharyngis with 3 lobes .... ***P.* sp. D**



3(1’) Second antennal segment shorter than combined segments 3-5 4

3’ Second antennal segment subequal to combined segments 3-5 .... ***P. quadratus*, *P. grimmii*, *P.* sp. E** 5
(these taxa can not be separated as larvae, but can be identified by pupal structures)



P. sp. B

shorter

P. quadratus

subequal

4(3’) First antennal segment about 65-75 µm long .... ***P.* sp. B**

NOTE:
4th instar larvae are necessary for accurate measurements!!

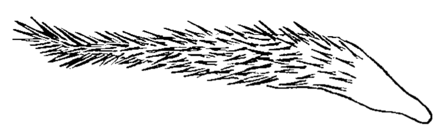
NOTE:
this couplet must be considered very tentative!

4’ First antennal segment about 108 µm long .... ***P.* cf. *laccophilus***

The larvae of the following 3 species are inseparable. However, if you have a late 4th instar larva with developing pupal characters visible, it may be keyed below.

5(3’) A well developed thoracic horn present, covered with numerous fine spines .... ***P. quadratus***

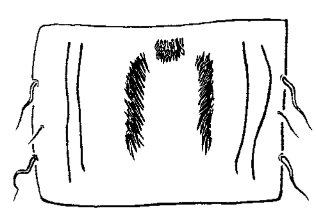
5’ Pupal thoracic horn absent or vestigial 6



P. quadratus thoracic horn

6(5’) Pupal abdominal tergite IV with longitudinal bands of spines; often found in drinking water systems .... ***P. grimmii***

6’ Pupal abdominal tergite IV without longitudinal bands of spines; found in ponds .... ***P.* sp. E**



P. grimmii tergite IV

Notes on species

P. dissimilis **-** This species was recorded from Florida by Epler as *P*. sp. A.; it has also been recorded from both Carolinas.

P. dubius - The larva of this species is undescribed; records for the Southeast are based on adult males.

P. grimmii - A parthenogenetic species that is sometimes a pest in drinking water supplies; Caldwell et al. (1997) recorded it from Georgia. The larva is apparently inseparable from *P. quadratus* and *P.* sp. E. See Langton et al. (1988) for more information on this unusual species, found world-wide in drinking water systems.

P. cf. *laccophilus* - The North Carolina record for this species is based on a larval exuviae/pupa association from Lake Norman. This may be the same taxon as *P.* sp. B, the only apparent difference in the larvae being size.

P. quadratus - Originally described in *Tanytarsus* (Sublette 1964), this species belongs with *Paratanytarsus*. It was called *P*. sp. C in Epler (1995). I have associated material from northern Florida, where it is very common in the Suwannee River basin. Caldwell et al. (1997) record *P. quadratus* from North Carolina. The larva is apparently inseparable from those of *P. grimmii* and *P.* sp. E

P. *recens* - As an adult, this species is very similar to *P. quadratus* and like it, was originally described in *Tanytarsus* (Sublette 1964). The larva is unknown.

P. sp. B - Known only as a larva from Florida; not known from the Carolinas. Larvae are apparently separable only by size from *P*. cf. *laccophilus*; the two taxa may represent the same species.

P. sp. D - Known from a single larva from North Carolina that is similar to *P. dissimilis*, but has a 3 lobed pecten epipharyngis.

P. sp. E - Known from a single reared female from a beaver pond in central Georgia. It is possible that it represents *P. recens*.

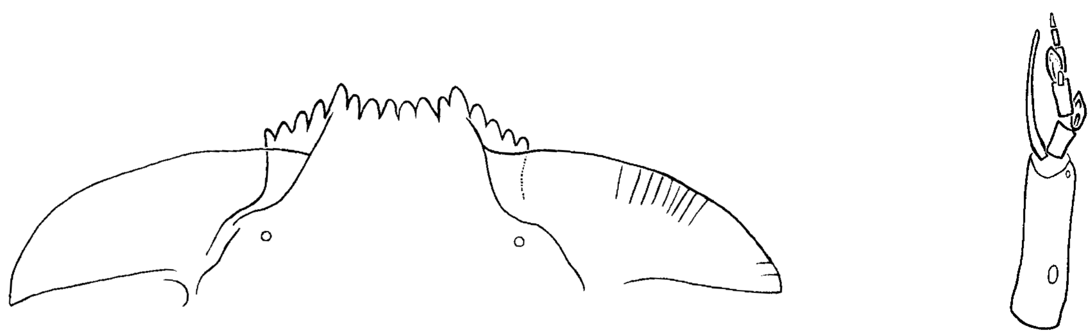
Genus *Paratendipes*

DIAGNOSIS: Distinguished by the S I setae with bases fused or located on a common triangular plate; 6 segmented antennae, with alternate Lauterborn organs at the apex of segments 2 and 3; mentum with median teeth often lighter in color than remaining lateral teeth and central pair of median teeth equal to or higher than outer median teeth; and mandible with one dorsal tooth.

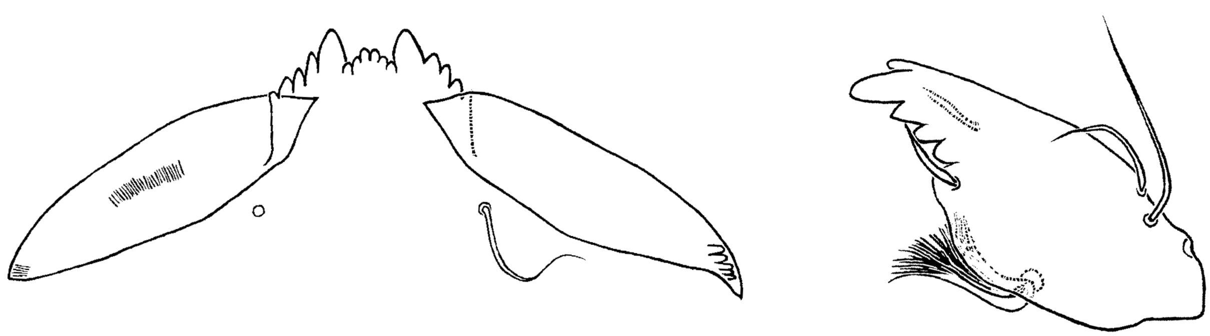
NOTES: *Paratendipes* was recently revised by Barbara Hayford (now at Wayne State College, NE); her revision should be published some time in 2002. Caldwell et al. (1997) reported five species from the Southeast; only the larvae of *P. albimanus*, *P. basidens* and *P. subaequalis* are known. I have not seen any material of the two other species; the Carolinas records of *P. duplicatus*, based on Oliver et al. (1990), might be considered dubious. The three known species can be separated by their menta and ventromental plates, although note that the larva of *P. thermophilus* Townes, not known from the Southeast, is very similar to *P. subaequalis*. It can be separated by its pecten epipharyngis of three apically toothed platelets; that of *P. subaequalis* appears to be of three simple spines. The larva of *P. basidens* has been known as "*Paratendipes connectens* group" (see Epler & Ferrington 1994).

Larvae occur in a variety of habitats; *P. basidens* prefers sandy bottoms of streams and rivers.

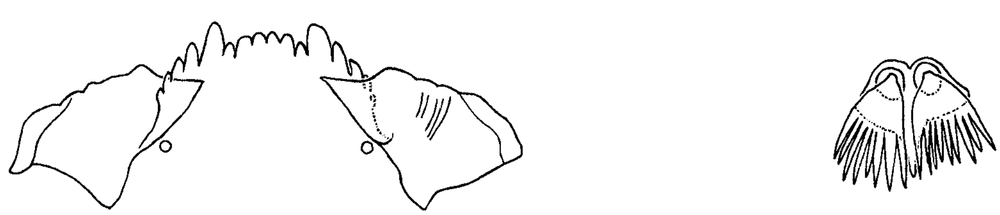
ADDITIONAL REFERENCES: Epler & Ferrington 1994; Townes 1945.



P. albimanus mentum and antenna



P. basidens mentum and mandible



P. subaequalis mentum and S I

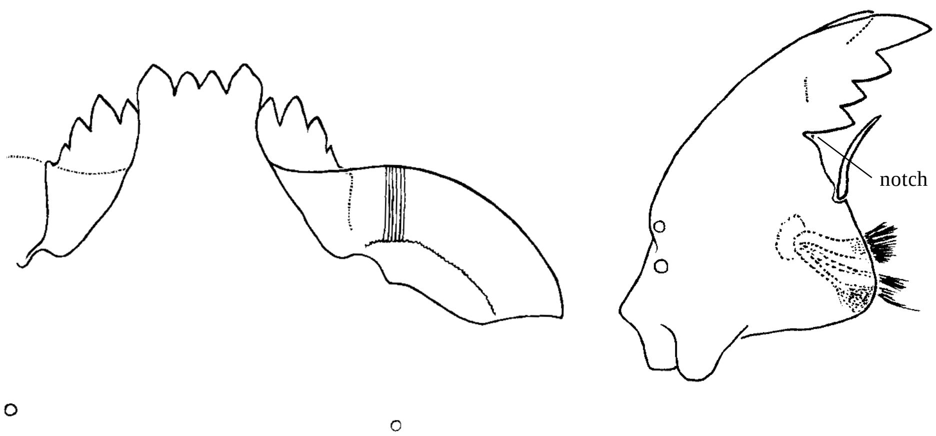
Genus *Phaenopsectra*

DIAGNOSIS: Distinguished by the frontoclypeal apotome with 1 medial labral sclerite anterior to it (may appear to be a frontal apotome with clypeus and labral sclerite 1 anterior to it); mentum with a distinct line running from the posterior margin of the outer median teeth to the anteromedial margin of the ventromental plate; mandible with 3 inner teeth and with distance from basal notch of proximal inner tooth to insertion of seta subdentalis at least 3/4 distance from the basal notch to apical notch of distal inner tooth.

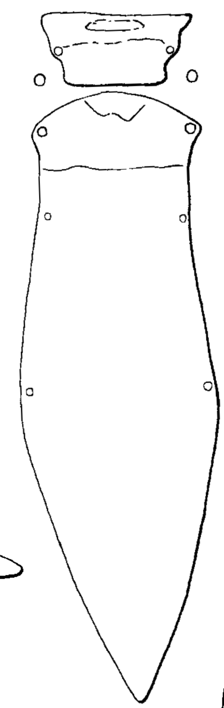
NOTES: Five species are recorded from the Southeast (but see Notes); four species are recorded from the Carolinas. *Phaenopsectra* requires revision utilizing all life stages; it is not possible to identify larvae to the species level without an adult male. Larvae can be identifed to species groups: the *punctipes* group, with a mandible with a large notch at the base of the inner teeth and apparently 14 toothed mentum (subject to wear); and the *obediens* group, with normal mandible and 16 toothed mentum.

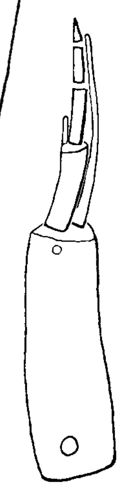
Larvae usually occur in streams; some western US species are resistant to drought and can withstand drying by remaining in silk and silt cocoons.

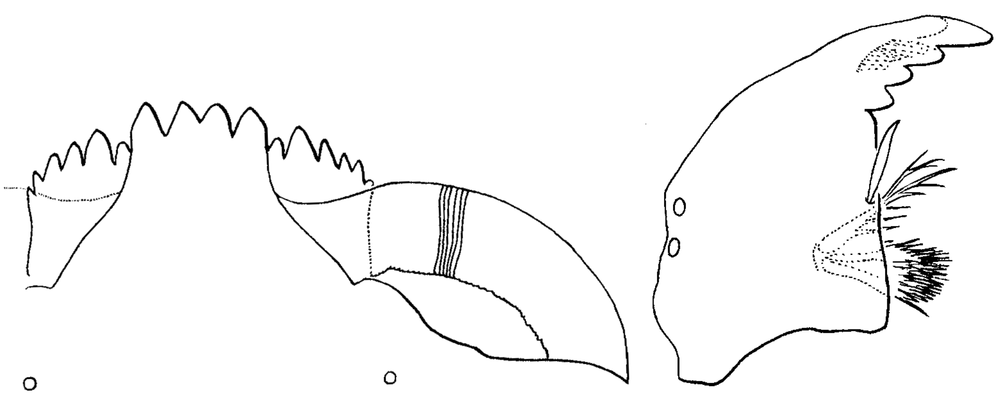
ADDITIONAL REFERENCES: Grodhaus 1976, 1987b; Townes 1945.



Ph. punctipes group mentum & mandible
(*Ph. flavipes*)







Ph. obediens group mentum, mandible, apotome and antenna
(*Ph. obediens*)

Notes on species

Ph. dyari - This species was recorded from Florida by Beck & Beck (1959). I have not seen any material of this species from the Southeast and consider the Beck & Beck record dubious. Simpson & Bode (1980: 78) included a larva they identified as "*Phaenopsectra* prob. *dyari*"; I have examined their material and consider it to be *Ph. obediens*. This would settle Grodhaus's (1987: 144) concern that if Simpson & Bode's (1980) identification were correct, it would be the first instance in which the larva of a species belonged to the *obediens* group while the adult belonged to the *punctipes* group. Hudson et al. (1990: 36) speculated that a species with four equal median teeth, known only as a larva (referred to in NCDENR collections as "*Phaenopsectra* sp. 4") from Mountain and Piedmont areas appeared to be equivalent to Simpson & Bode's *Ph.* prob. *dyari* (which it is not, the menta are different) and Roback's *Tanytarsus* sp. 2 (which does appear to be the same taxon); this larva was called *Polypedilum* sp. C in Epler (1995), and is found on the Coastal Plain as well. It has the distinctive frontoclypeal apotome of a *Polypedilum* (q.v.) and is identified as *P. laetum* in this manual.

Ph. flavipes - Townes (1945) recorded this species from South Carolina; I've seen one male reared from a larva from Florida. The outer lateral teeth of the mentum are frequently worn so that the mentum appears to have only 14 teeth. The larva is inseparable from that of *Ph. punctipes*; unassociated larvae should be referred to as "*Ph. punctipes* group sp.". There appear to be no structural characters that separate the adults of *Ph. flavipes* from *Ph. punctipes*, the only difference being abdominal coloration (dark brown-blackish in *Ph. flavipes*; green in *Ph. punctipes*). Because color in insects can be environmentally influenced, perhaps the two taxa should be synonymized.

Ph. obediens - A common species, and probably the only member of the *Ph. obediens* group in the Southeast. Grodhaus (1987b) was incorrect in stating that this species had a frontal apotome and clypeus; the larva has a frontoclypeal apotome (S 3 is located at the anterolateral corner of the apotome). On reared specimens from North Carolina, the clypeus is fused to the frontal apotome, but is considerably lighter and/or thinner. The clypeus may appear as a separate sclerite, apparently depending on the specimen and the mounting medium used.

Ph. punctipes - Recorded from the same locality in South Carolina as *Ph. flavipes* by Townes (1945). I've examined associated material from New York. The larva is inseparable from that of *Ph. flavipes*; unassociated larvae should be referred to as "*Ph. punctipes* group sp.".

Ph. vittata - The larva of this species is unknown. Townes (1945) placed the adult in the *punctipes* group; the larva probably resembles those of *Ph. flavipes* and *Ph. punctipes*.

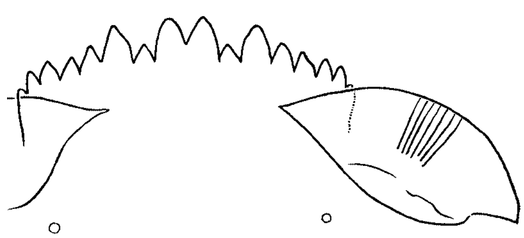
Genus *Polypedilum*

DIAGNOSIS: The distinctive mentum, with median and second lateral teeth longer than first lateral teeth, will distinguish most members of the genus. Other larvae may be identified by the frontoclypeal apotome with straight anterior margin expanded laterally into lobes in which the S 3 setae are located (except in *P. ontario*); 5 segmented antennae (4 segmented in 2 species); and the 4 median teeth of the mentum not separated from the rest of mentum by a distinct line.

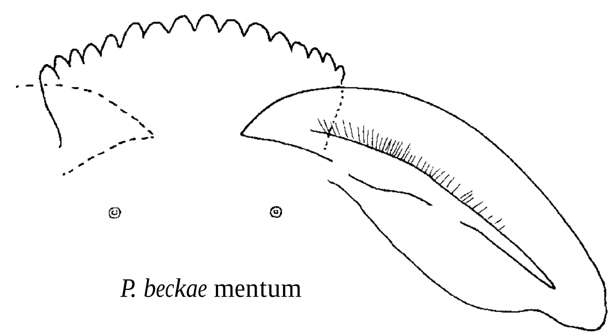
NOTES: A speciose genus, with over 30 species in the Southeast, *Polypedilum* has received attention from several workers recently, the most important being the long overdue publication of Maschwitz & Cook (2000). Where once there were three subgenera, there are now six (see Notes); the former genus *Asheum* is now considered a subgenus of *Polypedilum*. The larvae of many *Polypedilum* species are known, but it is still not possible to identify to species larvae of the *fallax*, *halterale*, *illinoense* and *scalaenum* groups without associated pupae or adult males (see Notes on species); much work remains to be done.

Larvae are found in a wide range of habitats under a variety of environmental conditions, ranging from pristine to heavily degraded.

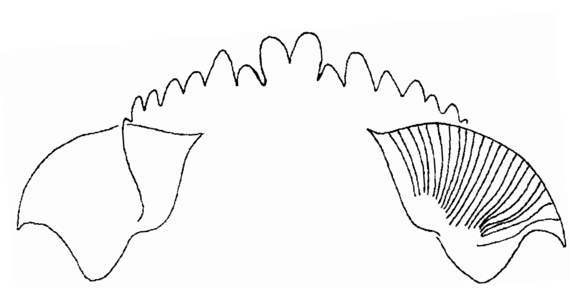
ADDITIONAL REFERENCES: Boesel 1985; Bjørlo et al. 2000; Maschwitz & Cook 2000; Rossaro 1985; Sæther & Sundal 1999; Soponis 1983; Soponis & Russell 1982; Soponis & Simpson 1992; Townes 1945.



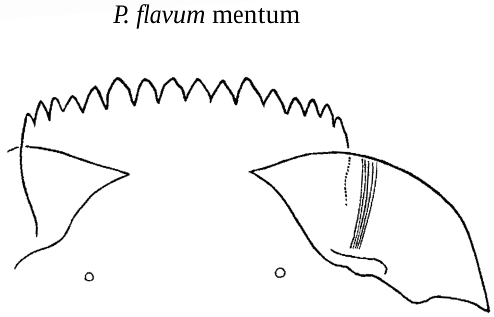
P. illinoense mentum



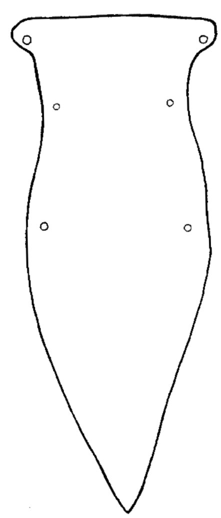
P. beckae mentum



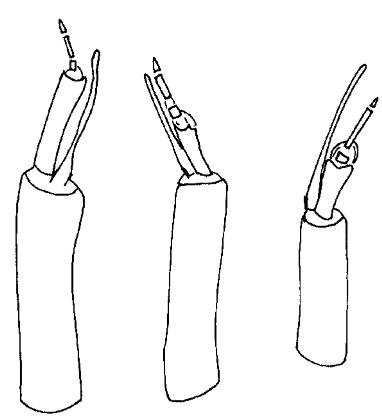
P. flavum mentum



P. sp. A mentum



apotome



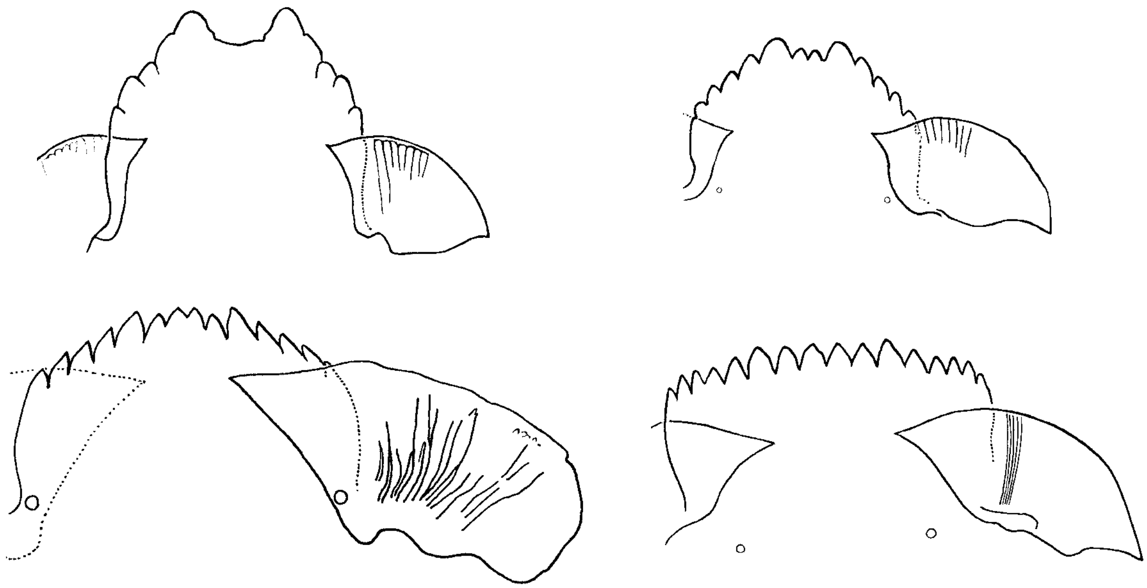
P. aviceps *P. flavum* *P. halterale*

antennae

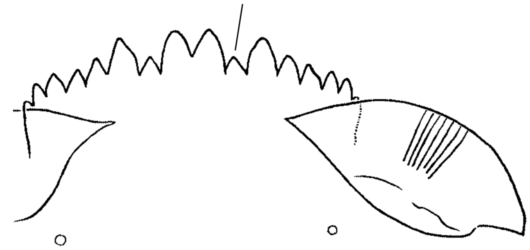
Key to *Polypedilum* larvae of the southeastern United States

(the larvae of many species are unknown)

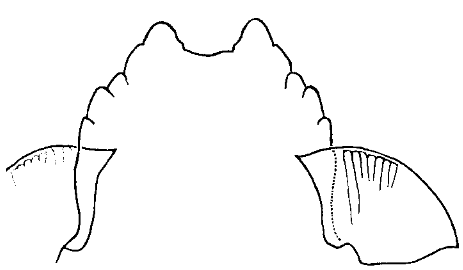
1 Mentum with median teeth lower than lateral teeth, or teeth subequal, or apparently missing .. 2



1' Mentum with median and second lateral teeth much higher than first lateral teeth 8

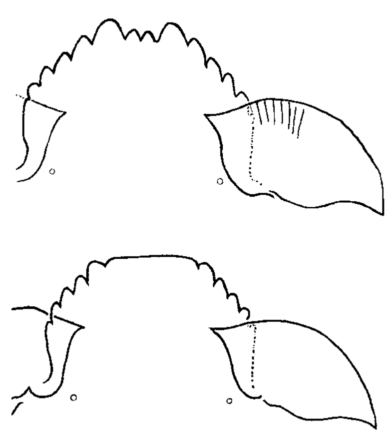


2(1) Mentum with median teeth lower than lateral teeth, or with 1 apparent broad median tooth, or with deep, wide median notch; pecten epipharyngis with 3 blunt teeth; mining in floating leaves of *Brasenia*, *Nymphaea* or other aquatic plants .... ***P. braseniae***



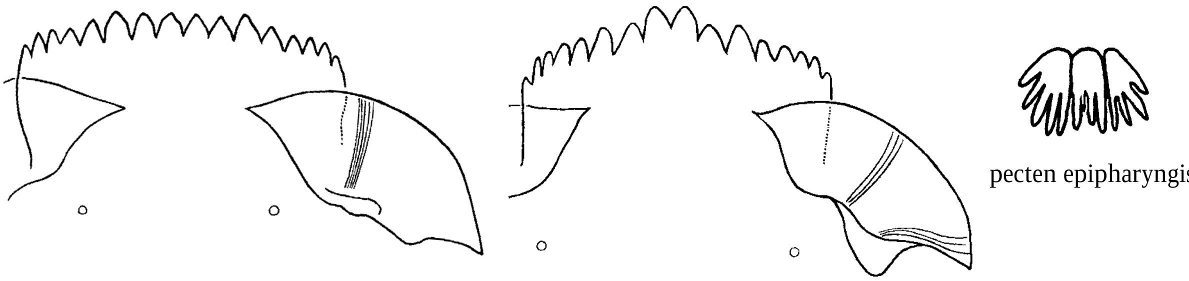
mentum from larva in *Nymphaea*

pecten epipharyngis

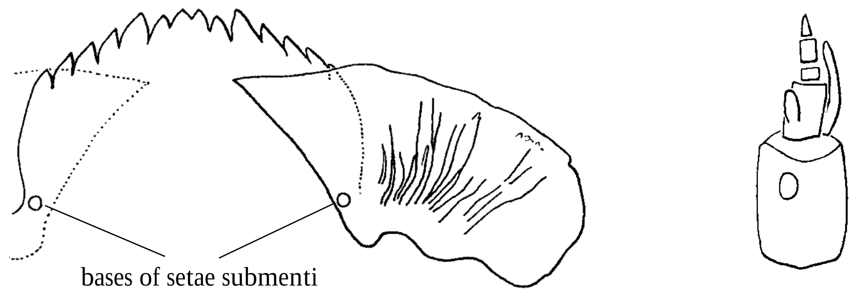


menta from larvae in *Brasenia*

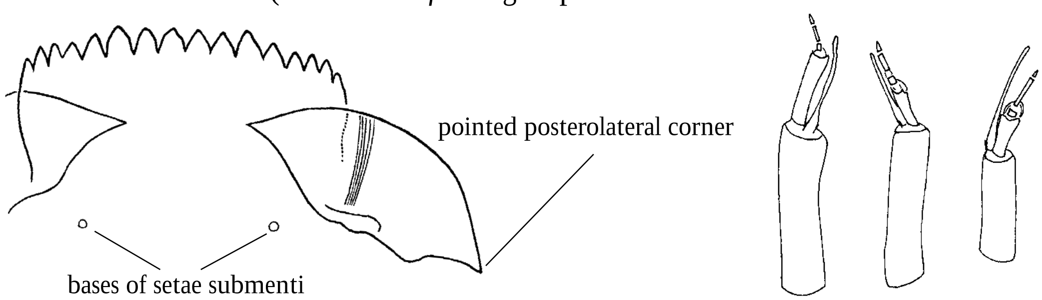
2’ Mentum with median teeth subequal to or higher than lateral teeth; pecten epipharyngis with 3 scales, with at least the outer 2 scales with apical teeth; usually not mining in *Brasenia* or *Nymphaea* leaves (but may be associated with either plant or other aquatic plants) 3



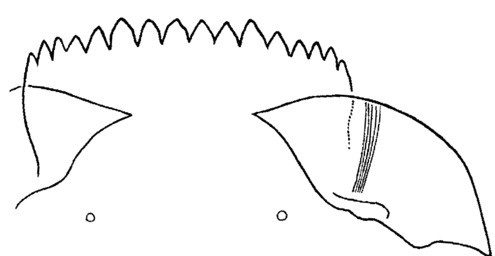
3(2’) Mentum somewhat rounded in outline; ventromental plates teardrop-shaped, with rounded posterolateral margins; setae submenti placed on ventromental plates; antenna short and squat; larvae often found in pupal cases of hydropsychid caddisflies .... ***P. ontario***



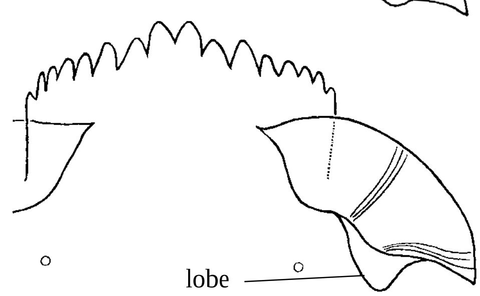
3’ Mentum more linear in outline; ventromental plates with pointed posterolateral margins; setae submenti placed adjacent to ventromental plates; antennae normal, slender; usually not found associated with caddisflies (but some *P. fallax* group larvae have been found with *Psilotreta*) 4



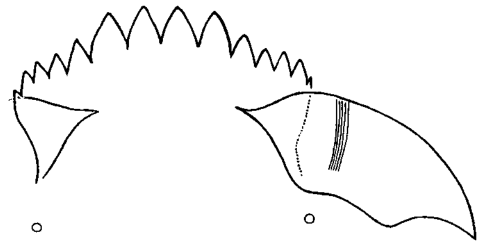
4(3’) Ventromental plate without well developed posterior lobe 5

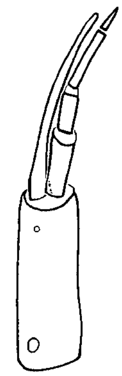


4’ Ventromental plate with well developed posterior lobe 9

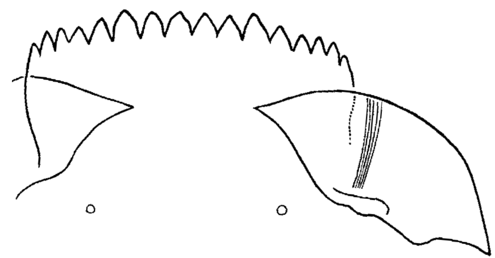


5(4) Mentum with central 4 teeth higher than remaining lateral teeth; mentum with 14 teeth or 16 teeth (if 16, outermost tooth may be very small); antenna with 4th segment longer than 3rd .... ***P. laetum***

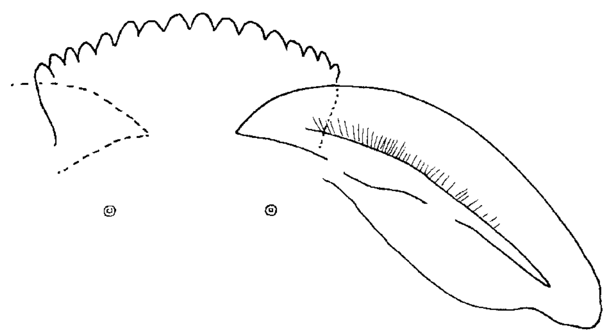




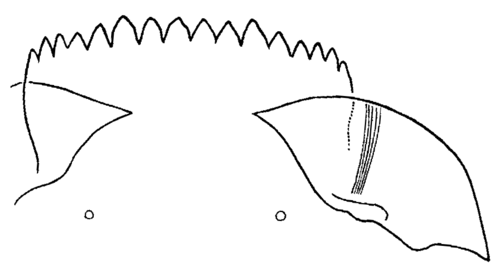
5’ Mentum with 16 teeth, with 6 central teeth slightly higher or all teeth subequal; antenna with 4th segment subequal to 3rd (figures below) 6



6(5’) Ventromental plates very wide .... ***P. beckae***
(*P. sordens* will key here; see Notes)

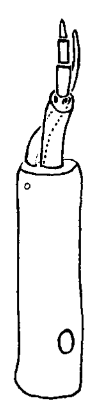


6’ Ventromental plates not as wide 7

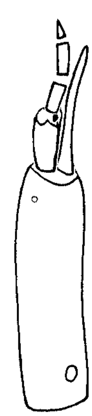


7(6’) Antennal segment 2 about as long as combined lengths of segments 3-5; head capsule often dark yellow-brown .... ***P. fallax* group**

7’ Antennal segment 2 shorter than combined lengths of segments 3-5; head capsule yellowish .... ***P.* sp. A**

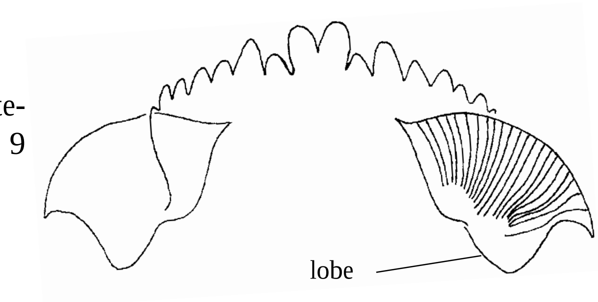


P. fallax

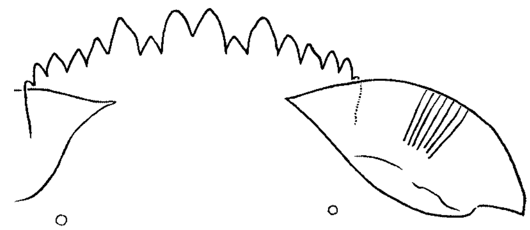


P. sp. A

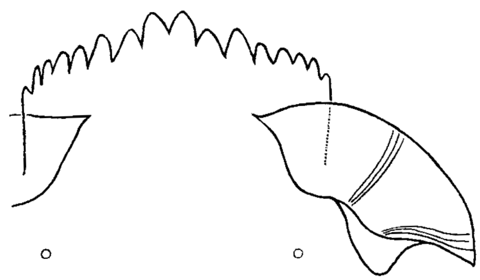
8(1') Ventromental plate with well developed posterior lobe 9



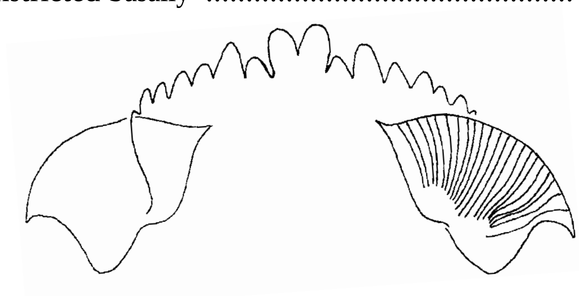
8' Ventromental plate without well developed posterior lobe 10



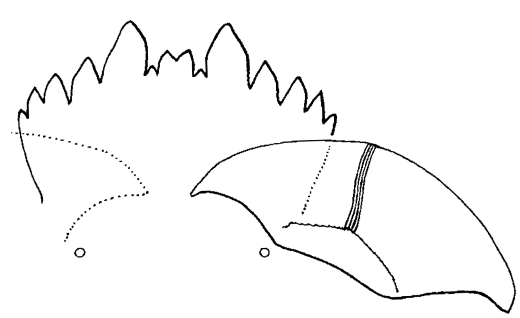
9(4', 8) Antennal segment 2 about twice as long as segments 3-5 combined; first lateral tooth of mentum may be slightly shorter than or equal to second lateral; median teeth of mentum not basally constricted .... ***P. aviceps***



9' Antennal segment 2 no more than 1.5X segments 3-5 combined; first lateral tooth of mentum always shorter than second lateral; median teeth of mentum constricted basally .... ***P. flavum***

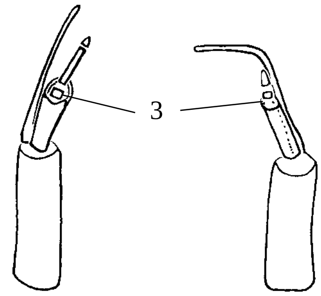


10(8') Mentum with second lateral teeth higher than median teeth .... ***P. bergi***

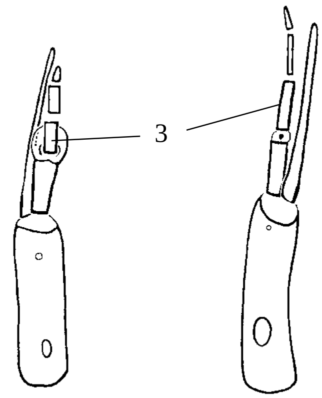


10' Mentum with second lateral teeth about as high as median teeth 11

11(10’) Third antennal segment 1/3 or less the length of the second segment 12

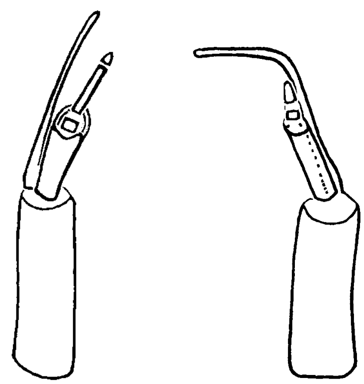


11’ Third antennal segment at least 1/2 or more the length of the second segment 13



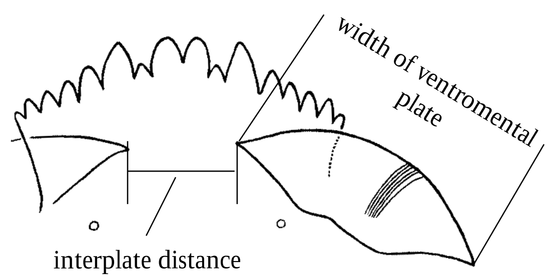
12(11) Antennal segment 4 about as long as segment 2; antennae always with 5 segments .... ***P. halterale*** **group**

12’ Antennal segment 2 much longer than 4; antennae with 4 or 5 segments .... ***P. scalaenum*** **group**

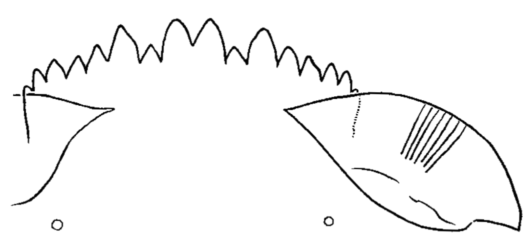


P. halterale *P. scalaenum*

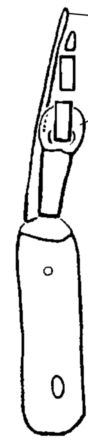
13(11’) Width of 1 ventromental plate more than 2.5X the distance between the plates 14

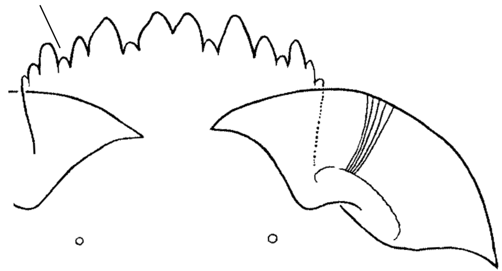


13’ Width of 1 ventromental plate 2.5X or less the distance between the plates 15

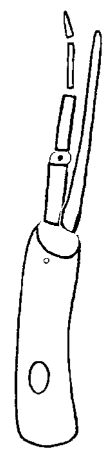


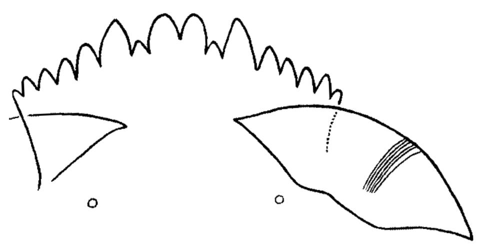
14(13) Mentum usually with 4th lateral tooth lower than 3rd and 5th; antennal segment 2 usually about twice as long as 3; antennal blade longer than flagellum; Lauterborn organs large and distinct .... ***P. trigonus***



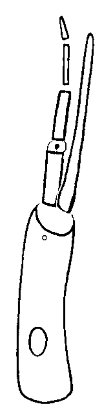


14’ Mentum with 4th lateral tooth subequal to 3rd and 5th; antennal segment 2 subequal to 3; antennal blade shorter than flagellum; Lauterborn organs minute .... ***P. tritum*** (in part)





15(13’) Lauterborn organs well developed .... ***P. illinoense* group**



15’ Lauterborn organs minute .... ***P. tritum*** (in part)

Notes on species

North American *Polypedilum* are now divided into six subgenera, which are abbreviated below as follows: *A.* = *Asheum*; *C.* = *Cerobregma*; *Pent.* = *Pentapedilum*; *P.* = *Polypedilum*; *T.* = *Tripodura*; *U.* = *Uresipedilum*. Only those species recorded from or expected to occur in the Carolinas are listed below; for a more complete listing of *Polypedilum* species of the Southeast see Caldwell et al. (1997) and Maschwitz & Cook (2000).

P. (T.) acifer - Originally described from Michigan (Townes 1945), this species is known from Florida and Alabama in the Southeast and should eventually be found in the Carolinas. The immature stages are undescribed.

P. (P.) albicorne - The immature stages of this species were described by Rossaro (1985). I have not seen any larvae from the Southeast and the species is not included in the key. It would probably key to *P. illinoense* group.

P. (T.) albinodus - The immature stages of this species are undescribed.

P. (P.) angulum - In many collections from North and South Carolina I've seen this name erroneously applied to *P. tritum*. A member of the *P. illinoense* group, *P. angulum* is not easily separable from *P. illinoense* as a larva or pupa; adult males are needed for accurate identification. In a series of Florida specimens of *P. angulum* in the FAMU collection determined by Maschwitz, none of the larvae had the long 4th antennal segment as illustrated in Maschwitz & Cook (2000: fig. 45); these larvae are impossible to separate from those of *P. illinoense*. Unless you have good male specimens associated with your larvae, you can not identify this species as a larva! I've seen adults of this species from the Savannah River Plant area in South Carolina; it is to be expected throughout the Southeast.

P. (P.) artifer - The immature stages of this species are undescribed. I've seen adults from Noland Creek in Great Smoky Mountains National Park, North Carolina.

P. (U.) aviceps - A relatively common stream and river species that is easily identified by the posterior lobe on the ventromental plates, large first lateral tooth of the mentum and the short antennal segments 3-5. It has frequently been misidentified as *P. convictum* (a name that has been incorrectly applied to *P. flavum*; see *P. flavum*).

P. (A.) beckae - This species was formerly placed in its own genus, *Asheum* (a replacement name for *Pedionomus*), but was placed as a subgenus of *Polypedilum* by Sæther & Sundal (1999). See *P. sordens*.

P. (P.) bergi - I've seen adult males from the Savannah River Plant area of South Carolina and larvae from northern Florida. Larvae have been associated with the leaves of *Potamogeton natans* in Minnesota. The species probably occurs throughout the Southeast.

P. (P.) braseniae - Larvae are usually found mining in the top surface of the floating leaves of the aquatic plants *Brasenia schreberi* and *Nymphaea odorata*. The mentum and premandibles are subject to wear. Maschwitz & Cook (2000) described the premandibles as simple, but many (unassociated) specimens I've seen have two or even three teeth on the premandible. Maschwitz & Cook (2000) also noted the differences in larvae reared from different plants, especially the mentum, but similar adults came from all their rearings.

P. (P.) calopterus - Not known from the Carolinas; recorded from Georgia in the Southeast. This species was considered a synonym of *P. fallax* by Townes, but recent authors disagree (Boesel 1985; Caldwell et al. 1997). Maschwitz & Cook (2000) could not find any differences in the immature stages of *P. calopterus* and *P. fallax*. Larvae that are not associated with adults are best called "*P. fallax* group". See also *P. fallax* and *P. walleyi* below.

P. (P.) cinctum - The immature stages of this species are undescribed.

P. (T.) digitifer - A member of the *P. halterale* group; larvae are not reliably separated from other members of this group. Soponis & Simpson (1992) described and compared the larvae, pupae and adult males of *P. digitifer* and *P. griseopunctatum*. They found differences in the number of teeth in the outer scale of the pecten epipharyngis (9 teeth for *digitifer*; 7 for *griseopunctatum*); however, reared material of *P. digitifer* from South Carolina had only 6 teeth on the outer scale. Adult males are needed for accurate identification of most species of the *P. halterale* group.

P. (P.) falciforme - Recorded from Florida in the Southeast, but this species' range extends northward to New Jersey and Minnesota. A member of the *P. illinoense* group, it is not reliably separated from the other members as a larva; a pupa or an adult male is needed for accurate identification.

P. (P.) fallax - A common species whose identification as a larva is uncertain; Maschwitz & Cook (2000) could not find any differences in the immature stages of *P. calopterus* and *P. fallax*. Larvae that are not associated with adults are best called "*P. fallax* group". I've examined larvae from the Smoky Mountains that were collected within the cases of the odontocerid caddisfly *Psilotreta*; the midge larvae were not associated with pupae or adults so it is not clear to which species they belong. See also *P. walleyi* below.

P. (U.) flavum - A very common species of streams and rivers, this species was formerly called *P. convictum* in North America. The adults of *P. flavum* and *P. convictum* are very similar, leading Townes (1945) to erroneously synonymize the two. The immature stages of the two species are quite different. It is not known if the true *P. convictum* occurs in North America. As used in this manual, *P. flavum* includes *P. obtusum* (considered a valid species by Maschwitz & Cook (2000)).

P. (T.) griseopunctatum - A member of the *P. halterale* group; larvae are not reliably separated from other members of this group. Soponis & Simpson (1992) described and compared the larvae, pupae and adult males of *P. digitifer* and *P. griseopunctatum*; see *P. digitifer* above.

P. (T.) halterale - Obviously a member of the *P. halterale* group. This group, as used in the key above, consists of *P. digitifer*, *P. griseopunctatum*, *P. halterale* and *P. simulans*. The larvae of this group can not be identified to species level without an associated adult male. Boesel (1985) considered all these species as synonyms of *P. halterale*, but his study was limited and did not make use of reared material; his synonymies have been rejected by most workers.

P. (P.) illinoense - One of the most common and ubiquitous species of the genus, but basically impossible to identify as a larva without an associated adult male because of the similarities between the larvae of the *P. illinoense* group. The *P. illinoense* group, as used in the key above, consists of *P. angulum*, *P. falciforme*, *P. illinoense*, *P. nymphaeorum* and *P. ophioides*. Maschwitz & Cook (2000: 30) offered a key to these larvae with the warning that "The following species are difficult to separate in the larval stage". In the "real world", these larvae are basically impossible to separate unless they have been associated with an adult! Note that even the adult males of this group are difficult to separate without comparative material and experience. As an example, a rearing of *P. falciforme* from Georgia (based mostly on pupal morphology) has a larva that keys to *P. nymphaeorum*, while the adult looks more like a *P. angulum*. Records in the literature may refer to any of the *illinoense* group species and in some cases refer to other species altogether. Larvae of *P. illinoense* occur under a wide range of conditions, including the high organic loading and low dissolved oxygen associated with pulp mills.

P. (P.) laetum - The larva of this species has been mistaken for a *Phaenopsectra* (*Phaenopsectra* sp. 4 in NCDENR collections), but has the typical *Polypedilum* frontoclypeal apotome; Epler (1995) referred to it as *P.* sp. C. Although I have not seen associated material of this species from the Southeast, it is obvious from the description in Maschwitz & Cook (200) and Rossaro (1985) that this distinctive larva belongs here. Apparently the mentum may have the outermost tooth worn or vestigial, so that many menta appear to have only 14 teeth.

P. (P.) nymphaeorum - A member of the *P. illinoense* group, and not reliably separated from the other members as a larva; adult males are needed. This species has not yet been recorded from the Carolinas but probably occurs there; it has been recorded from Florida, Illinois, Kentucky, Louisiana, Michigan, Minnesota, New Jersey and Ontario.

P. (C.) ontario - I've seen larvae of this species from North Carolina. Sæther & Sundal (1998) established a new subgenus, *Cerobregma*, and included *P. ontario*, the only Nearctic member of the subgenus. *Polypedilum ontario* is the only species of *Polypedilum* in North America in which the frontoclypeal apotome does not widen apically, apparently a subgeneric character state. It is also the only Nearctic *Polypedilum* known to me in which the setae submenti are placed on the ventromental plates, rather than adjacent to them. Sæther & Sundal (1998: 354) stated that the pecten epipharyngis consisted of three platelets, the lateral platelets unserrated. On a North Carolina larva, the lateral platelets of the pecten epipharyngis have two to three teeth. Bolton (1991) showed that pupal Chironomini genus C of Pinder & Reiss (1986) is this species; larvae were collected from the pupal retreats of the hydropsychid caddisfly *Cheumatopsyche*.

P. (P.) ophioides - I've seen a male from the Savannah River Plant area of South Carolina. The larva is very similar to *P. illinoense* and probably can not be reliably separated from it. Unless you have good male specimens associated with your larvae, you can not realistically identify this species as a larva!

P. (T.) parascalaenum - Originally described from Florida, but now recorded from Georgia and both Carolinas by Hudson et al. (1990). However, unless their identifications were based on adults, they must be considered dubious at best. It has been mistakenly assumed that the larval antenna of *P. parascalaenum* has 4 segments, while that of *P. scalaenum* has 5. The antennae of both species may appear to have a vestigial fifth segment; the larvae of the two species are apparently inseparable and should be referred to as "*P. scalaenum* group sp.". Judging from the numbers of adults I've seen, *P. parascalaenum* is quite rare, while *P. scalaenum* is very common. The adult of *P. parascalaenum* is unusual for a *Tripodura* in that it does not have the spine-like lateral processes at the base of the anal point, but other members of the subgenus also lack these spines (Bjørlo et al. 2000).

P. (T.) pardus - The immature stages of this species are undescribed.

P. (U.) pedatum - The immature stages of this species are undescribed.

P. (T.) scalaenum - As a larva, apparently inseparable from *P. parascalaenum* (see above). Larvae should be identified as "*P. scalaenum* group sp.". As noted above, the larval antenna usually has 4 segments, but may have a vestigial fifth segment. There is also variation in the length of the fourth segment, some appearing longer than "normal". It will take study of numerous rearings of both species to determine if it is possible to separate the larvae.

P. *(T.) simulans* - A member of the *P. halterale* group. The larvae of this group can not be identified to species level without an associated adult male. Judging from pupae and adults I've examined, *P. simulans* is one of the commoner members of the *halterale* group in the Southeast.

P. (Pent.) sordens - This species has been recorded from Florida and South Carolina in the Southeast; I have not seen any material of this species from the Southeast. Larvae are very similar to those of *P. beckae*. The larva of *P. sordens* is not included in the key. Judging from illustrations in other works (e.g. Pinder & Reiss 1983: fig. 10.63A), it ***may*** be separable from *P. beckae* by the apparently lower first lateral teeth of the mentum.

P. (P.) trigonus - A relatively common species, usually easily recognized by the reduced fourth lateral tooth on the mentum. More than one species may be included under this name in the Southeast, but extensive rearings are necessary to elucidate their identities.

P. (Pent.) tritum - A common species in the Southeast, the larvae are often misidentified as *P. illinoense* or *P. angulum*. The antenna, with the long segments 3 and 4, and vestigial Lauterborn organs, are distinctive. More than one species may be included under this name in the Southeast.

P. (P.) vibex - The immature stages of this species are undescribed. In the Southeast, recorded from Alabama, Florida and both Carolinas.

P. (P.) walleyi - Recorded for South Carolina by Hudson et al. (1990), but I've seen no material from the Southeast. I have seen reared specimens of *P. trigonus* from North Carolina misidentified as *P. walleyi*. The status of *P. walleyi* is unclear; it has been considered a synonym of *P. calopterus*, and *P. calopterus* has been considered a synonym of *P. fallax*. Caldwell et al. (1997) gave *P. calopterus* and *P. walleyi* valid species status. Maschwitz & Cook (2000) could not find any differences in the immature stages of *P. calopterus* and *P. fallax* (adult female *P. calopterus* have a broad dark band through the middle of the wing not present in *P. fallax* or *P. walleyi*). It is best to consider larvae of all three taxa not associated with adults as members of a "*P. fallax* group".

P. (Pent.) sp. A - First keyed by Epler (1992, 1995), this species has been reared and although it has a mentum very similar to *P. fallax*, is a member of the subgenus *Pentapedilum* (the adult has setae on the wing membrane). It is known from the Florida Everglades northward to at least Ohio.

P. (T.) sp. B - This taxon is based on a single male pupa with well developed pharate male genitalia from the Perdido River in northwest Florida. The superior volsella is similar to that of *P. griseopunctatum*, but has an apical extension (past the point of insertion of the medially directed setae) bearing a large, posteriorly directed seta.

Genus *Pontomyia*

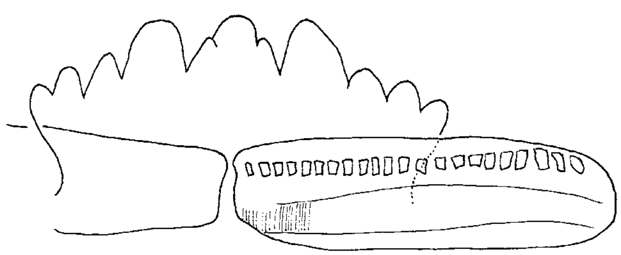
DIAGNOSIS: This tanytarsine genus is distinguished by the pecten epipharyngis of 3 scales with numerous apical teeth; antennae with sessile Lauterborn organs; premandibles with more than 3 teeth; mandible with 3 inner teeth; mentum with 4 pairs of lateral teeth; ventromental plates touching medially (or almost so); and marine habitat.

NOTES: In North America, *Pontomyia* is known only from Florida. A truly marine insect, larvae have been found at depths of 30 meters (Bretschko 1981). I've recently examined larvae that were collected from the algae-laden backs of sea turtles offshore of Puerto Rico. The Puerto Rican larvae appear to be the same species that is found in Florida, but until associated with adults, their specific identity remains unknown.

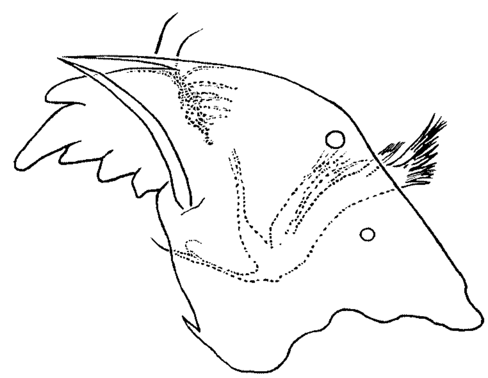
Contrary to the diagnosis in Pinder & Reiss (1983), some of the claws of the parapods are bifid.

Larvae have been found in sand, coral and algae (including those found on the backs of sea turtles).

ADDITIONAL REFERENCES: Bretschko 1981; Soong et al. 1999.

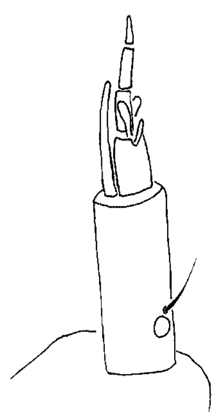


mentum

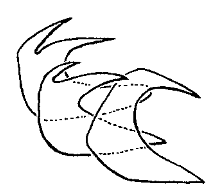


mandible

premandible



antenna and base



posterior parapod claws

Genus *Pseudochironomus*

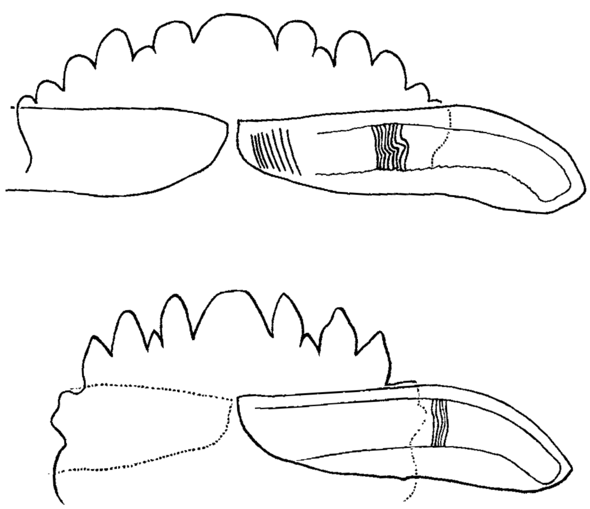
DIAGNOSIS: Distinguished by the S I setae arising from separate bases; antenna not mounted on elongate pedestal; mandible without dorsal tooth and with seta subdentalis on dorsal side; large bar-like ventromental plates that touch or almost touch medially; and procerci not fused at the base.

NOTES: Although reviewed by Sæther (1977a), the taxonomy of *Pseudochironomus* is in an unsatisfactory state. Judging from pupae and adults I've examined, *Ps. richardsoni* is common in the Southeast, but I have not seen larvae similar to that described by Sæther (1977a) for this species. Sæther's (1977a) key depends on dubious literature descriptions and a meager amount of material, and is basically unusable for southeastern larvae. Records of the Palaearctic *Ps. prasinatus* from the US must be considered with extreme skepticism; there is at least one southeastern larva that will key to *Ps. prasinatus* in Sæther's (1977a) key. However, I have a larva/pupa/pharate adult association of this taxon; it is not *Ps. prasinatus*.

Due to a paucity of material, it is not possible to construct a species key for larvae. There are two major types of larvae: those with a definite 13 toothed mentum that is basically linear, and those with an 11-13 toothed mentum that is more arcuate, with the last tooth or pair of teeth vestigial or fused. Unless accompanied by associated adults, larvae should be identified as "*Pseudochironomus* sp.".

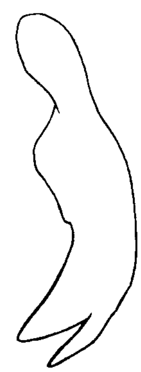
Larvae are found in sandy substrata of lakes and rivers; they may also be found in brackish/estuarine water.

ADDITIONAL REFERENCES: Sæther 1977a; Sublette 1964; Townes 1945.

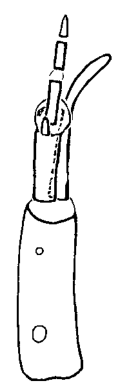


menta

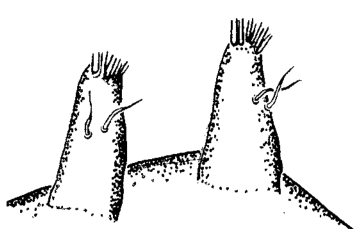
S I



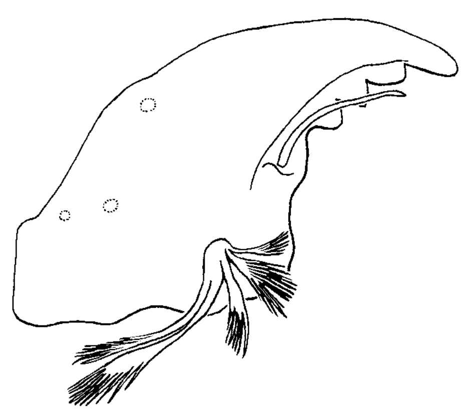
premandible



antenna



procerci (setae abbreviated)



mandible

Genus ***Rheotanytarsus***

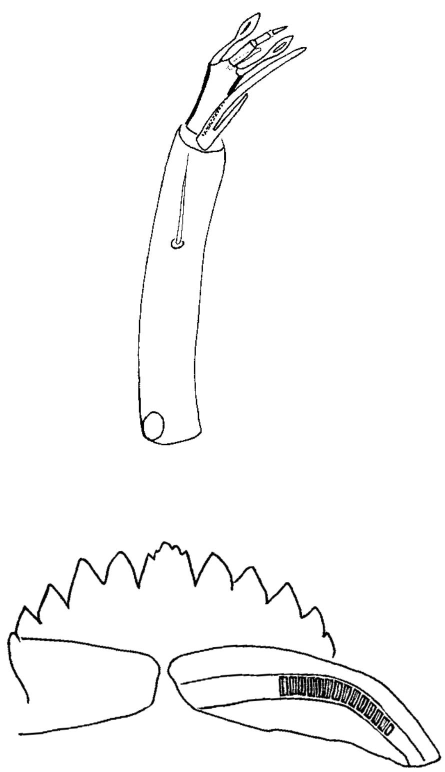
DIAGNOSIS: This tanytarsine is distinguished by the single, broad, multitoothed, comb-like pecten epipharyngis (rarely deeply trisected, but this not seen in southeastern larvae); Lauterborn organs on short pedicels; apically bifid premandible; and ventromental plates touching medially (or almost so), often with apparent block-like strial ridge markings.

NOTES: A common and often abundant midge, but poorly known on the species level. About eight species occur in the Southeast (J.E. Sublette, pers. comm.); two are described but only one, *Rh. pellucidus*, is identifiable to species as a larva. The genus has been undergoing revison by Kyerematen, but no work has been published on the Nearctic fauna.

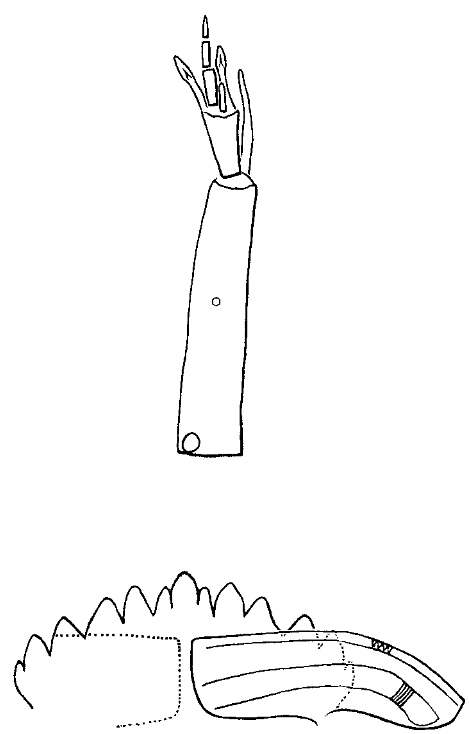
Larvae are usually found in streams and rivers, and are often associated with aquatic plant communities, where they build tubes on leaves and stems. Larvae may also be found in the littoral area of lakes, where wave action simulates flowing water conditions. Larvae attach their cases to a number of surfaces, including plants, rocks, boats and aquatic animals (in Florida, alligators, and I have found a tube on the barbel of a madtom catfish), and insects, such as dragonfly larvae (*Macromia* and *Neurocordulia*) and the megalopteran *Corydalus*.

ADDITIONAL REFERENCES: Kyerematen et al. 2000; Kullberg 1988; Lehmann 1971; Simpson & Bode 1980.

pecten epipharyngis



Rh. exiguus group antenna and mentum

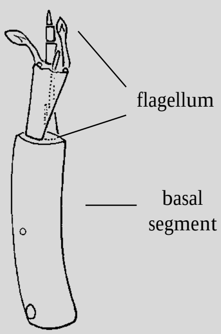


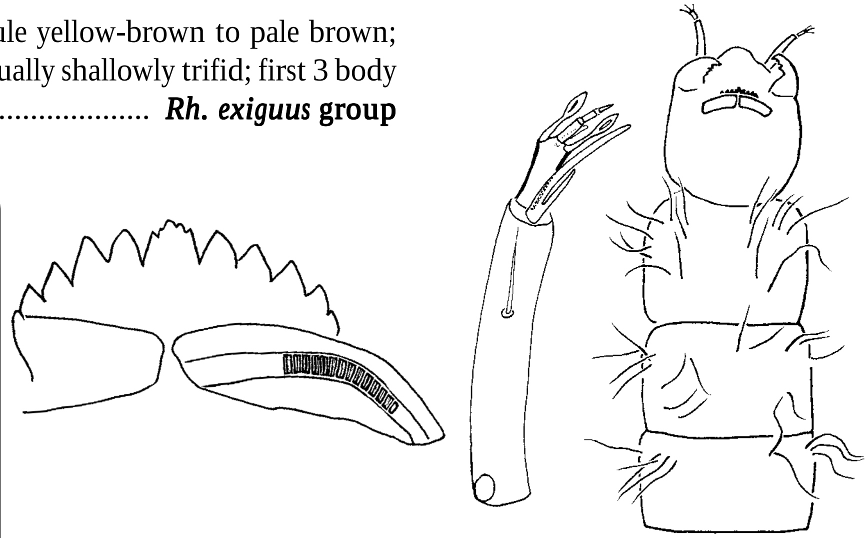
Rh. pellucidus antenna and mentum

Key to *Rheotanytarsus* larvae of the southeastern United States

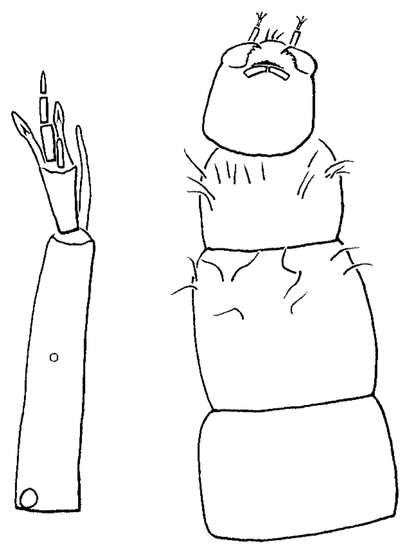
1 AR 2.0 or more; head capsule yellow-brown to pale brown; median tooth of mentum usually shallowly trifid; first 3 body segments with long setae .... ***Rh. exiguus* group**

AR = antennal ratio.
Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)

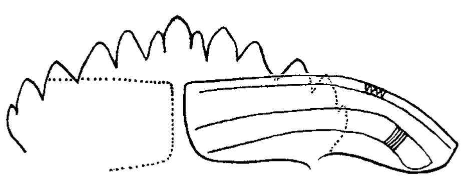


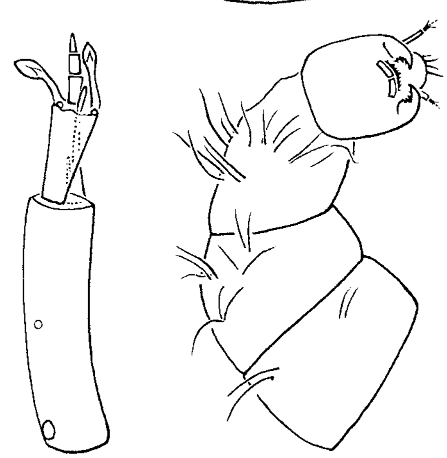


1’ AR < 2.0; head capsule pale brown to dark red-brown; median tooth of mentum shallowly to deeply trifid; first 3 body segments with long setae OR 3rd body segment with short setae 2

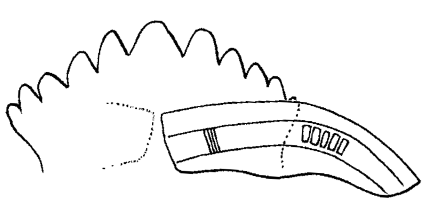


2(1’) Median tooth of mentum deeply trifid; head capsule usually pale brown; 3rd body segment with setae shorter than those on segments 1 and 2 .... ***Rh. pellucidus***





2’ Median tooth of mentum at most slightly notched; head capsule brown to dark reddish-brown; 3rd body segment with long setae .... ***Rh.* sp. A**



Notes on species

Rh. exiguus group **-** A species group that consists of several species, none of which are reliably separated as larvae (except perhaps *Rh*. sp. A; see below). The most common species of the group is the ubiquitous *Rh. exiguus*. Larvae of this group construct tubes that are attached to the substrate lengthwise along one side. Although the median tooth of the mentum is usually shallowly trifid, I have seen some larvae with a deeply trifid median tooth. Do these represent a different species or are the differences due to wear? Without associated pupae and adults this will remain a good question! Other characters that may help separate *Rh. exiguus* group larvae from those of *Rh. pellucidus* are the smaller body size (see *Rh. pellucidus* below), wider ventromental plates in most *Rh. exiguus* (3-5 times broader than long; only about 2-3 times as broad as long in *Rh. pellucidus*); the lighter head capsule color of *Rh. exiguus* group members; and the longer Lauterborn organ petioles in *Rh. exiguus* group species, in which the organs extend past the apex of antennal segment 4; in most *Rh. pellucidus* larvae the organs do not extend beyond antennal segment 4 (observation of this depends on how flat the antennae are mounted!). A good pupal character, observable on prepupal larvae with well developed pupa within, is the presence of two small posteromedian groups of spinules on a darker background on tergite II of *Rh. pellucidus*; in *Rh. exiguus* group pupae only a single posteromedian group of spinules, not on a darker background, may be present.

Rh. pellucidus - This species was formerly known as *Rh. distinctissimus*. Like the *Rh. exiguus* group, a ubiquitous species throughout the eastern US; both often occur together in samples. Larvae are small, somewhat dark headed (but not as dark as *Rh*. sp. A below), and construct tubes that are attached to the substrate using a long petiole. The short setae on body segment 3 (shorter than those present on segments 1 and 2) will usually separate this taxon easily from the *Rh. exiguus* group and *Rh*. sp. A. Mature larvae of *Rh. pellucidus* are considerably smaller than those of *Rh. exiguus* group members (length about 3 mm in *Rh. pellucidus*, over 4 mm in *Rh. exiguus* group).

Rh. sp. A - A species with a brown to dark reddish-brown head capsule, known from streams in North and South Carolina. It is probably a member of the *Rh. exiguus* group, but without full rearings and a clear definition for this group in North America its placement remains uncertain. There may be two species included in this taxon. In the small sample available to me, I noted one larva with a longest seta on the first segment that was over 230 µm long; on the other specimens, longest setae ranged in length from 105-125 µm. A different species, or just a variant? All larvae available to me were not associated with larval tubes, so the manner in which the tubes are attached to a substrate is unknown.

Genus *Robackia*

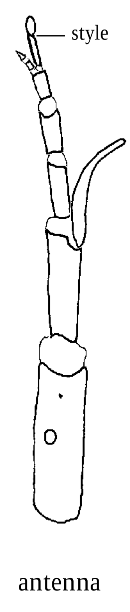
DIAGNOSIS: Distinguished by the 7 segmented antennae; mandible with modifed inner teeth and without seta interna; 14 toothed mentum; and coarsely sculptured ventromental plates.

NOTES: Based on adults, three species have been collected in the Southeast, but the third species, *R. pilicauda* Sæther, collected in Alabama and Georgia, is probably a junior synonym of *R. claviger*. Larvae of the other two species, *R. claviger* and *R. demeijerei*, are separable by their mandibles and menta (see figures below). The proximal inner mandibular teeth of *R. claviger* are enlarged and directed backwards, and in most *R. claviger* the median teeth of the mentum are somewhat truncate and distinctly lower than the lateral teeth; *R. demeijerei* has smaller proximal inner mandibular teeth and the median teeth of the mentum are more pointed and subequal to the lateral teeth. Contrary to the key in Sæther (1977a), the menta of both species have 14 teeth. Note that the mandibles of early instars may not have the modified inner teeth of 4th instar larvae. Also note that it is easy to mistake the enlarged style for an antennal segment!

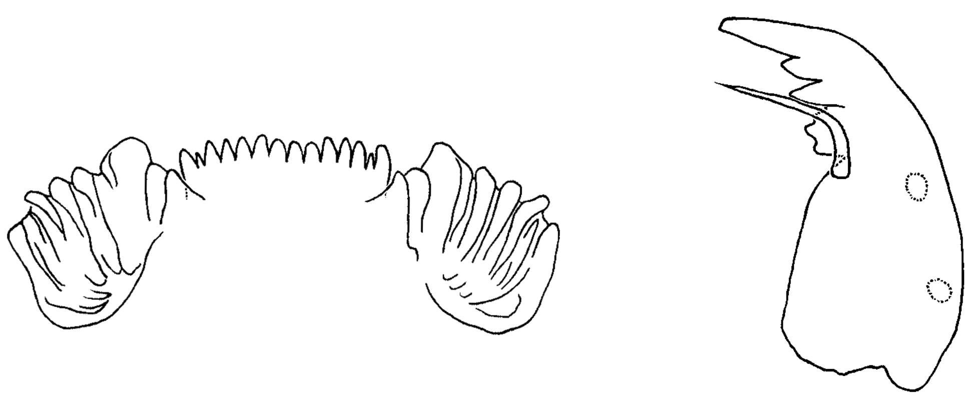
Larvae are found in sandy substrata of streams and rivers.

ADDITIONAL REFERENCES: Sæther 1977a.

R. claviger mentum and mandible



antenna



R. demeijerei mentum and mandible

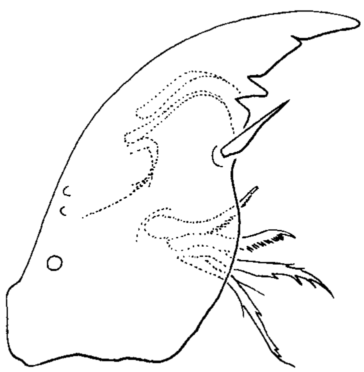
Genus *Saetheria*

DIAGNOSIS: Distinguished by the small seta-like S I and large S II; 6 segmented antennae, with second segment not as long as third and style at apex of segment 3 not exceeding apex of segment 5; mandible without dorsal tooth; premandible with 3 large inner teeth and brush present; and the coarsely striated ventromental plates.

NOTES: Three species are known from the Southeast; only two have been formerly described with complete names. *Saetheria* is very close to *Paracladopelma*, but can be distinguished by the 6 segmented antenna with the relatively shorter second segment (in *Paracladopelma* the second antennal segment is longer than the third). Contrary to the diagnoses in Jackson (1977) and Pinder & Reiss (1983), the premandible does have a brush, although it is hyaline and not easily observed.

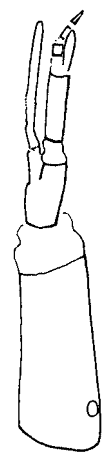
Larvae are found in sandy substrata, usually in running water.

ADDITIONAL REFERENCES: Jackson 1977; Sæther 1983a.

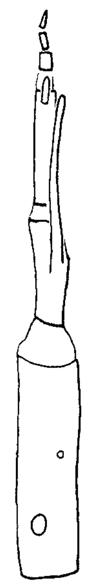


S. sp. 1 mandible

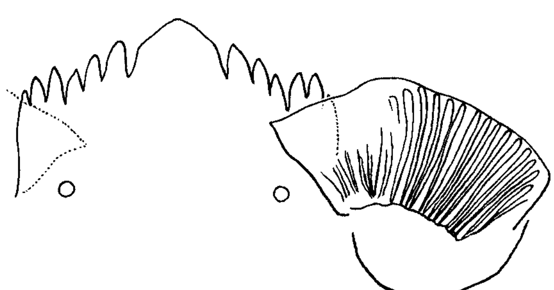
S. sp. 1 premandible



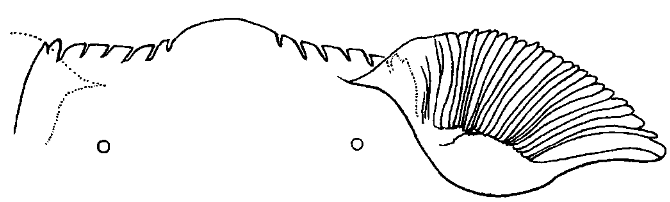
S. sp. 1 antenna



S. hirta antenna



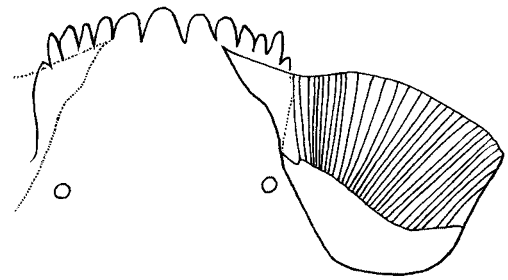
S. tylus mentum



S. sp. 1 mentum

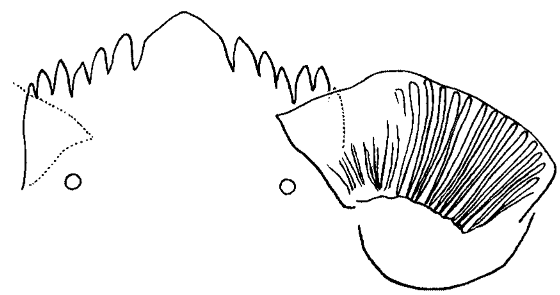
Key to *Saetheria* larvae of the southeastern United States

1 Mentum with narrow median tooth .. ***S. hirta***

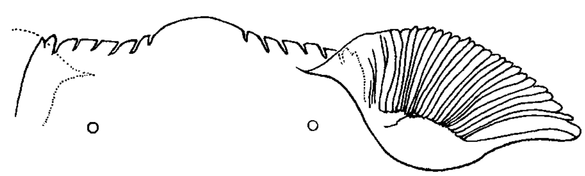


1’ Median tooth of mentum broader (figures below) 2

2(1’) Mentum more arched, with lateral teeth straight and pointing forward; ventromental plate with about 15 full length striae .... ***S. tylus***



2’ Mentum more linear, with lateral teeth lower and pointing medially; ventromental plate with about 26 full length striae .... ***S.* sp. 1**



Notes on species

S. hirta - Known only from North and South Carolina. The adult male is undescribed; Sæther (1983a) described the larva and pupa, and the female from a mature pupa. I have seen a male from the Savannah River Plant area in South Carolina that may be the male of this species or *S.* sp. 1.

S. tylus - The most commonly encountered member of the genus in the Southeast.

S. sp. 1 - Originally described from larval-pupal association from Mississippi, I have also examined material from Alabama. I have not seen material of this taxon from the Carolinas, but it probably occurs there.

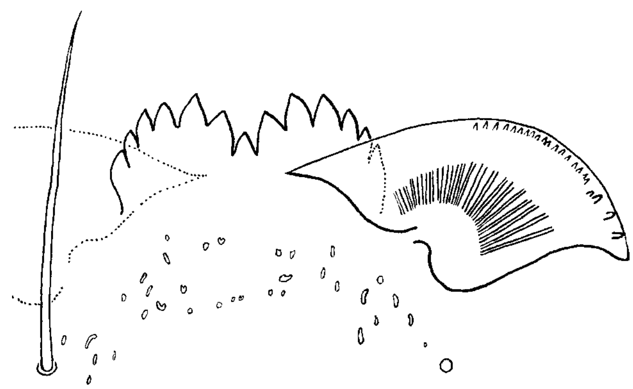
Genus *Stelechomyia*

DIAGNOSIS: Distinguished by the frontal apotome, with one median labral sclerite anterior to it (S 3 setae are not placed on the sclerite); distinctive mentum, with deeply sunken single middle tooth; long setae submenti; lack of seta interna and pecten mandibularis on mandible; and rectangular, dark yellow reddish-brown head capsule.

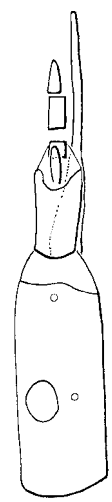
NOTES: One species, *S. perpulchra*, is known. It was formerly placed in *Lauterborniella* but given full generic status by Reiss (1982). Roback (1953) referred to this species as Tendipedini sp. A.

Larvae occur on dead wood in streams and rivers; they are often found on Hester-Dendy samplers produced from wood products.

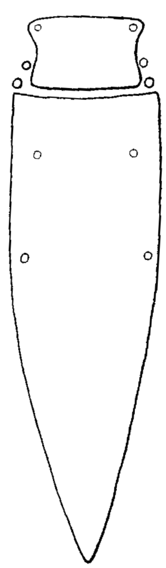
ADDITIONAL REFERENCES: Reiss 1982.



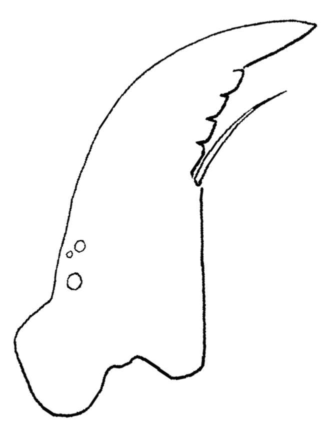
mentum



antenna



frontal apotome and labral sclerite 1



mandible

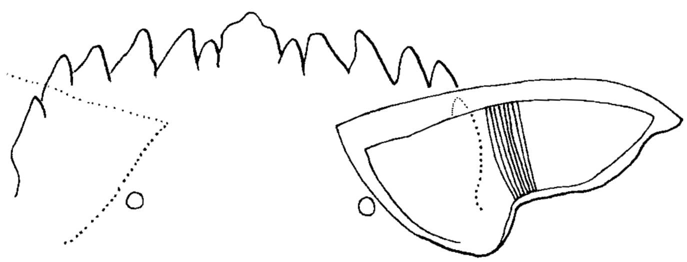
Genus *Stempellina*

DIAGNOSIS: Larvae are distinguished by the apically bifid frontoclypeal setae; granulate frontoclypeal apotome, with none to several pairs of tubercles; antennal base without apical spur but with mesal palmate process; Lauterborn organs on pedicels arising from the apex of antennal segment 2; widely separated, squat ventromental plates; procerci with dark, simple or forked apical spurs or without spurs; and portable sand case.

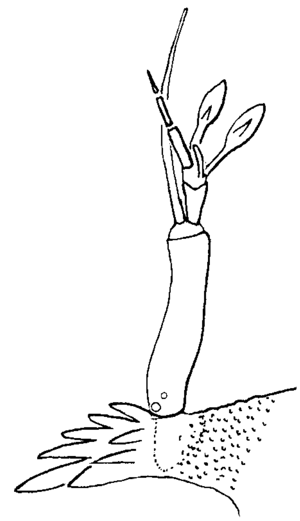
NOTES: Three described species are listed from the Carolinas by Caldwell et al. (1997); I have not seen any material of the three species listed. I have seen material of what appear to be at least 3 species based on larvae (two of these associated with pupae and adults).

Stempellina larvae live in portable cases and may occur in lotic and lentic situations.

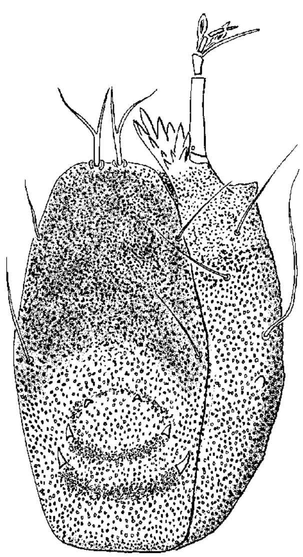
ADDITIONAL REFERENCES: Brundin 1948; Webb 1969



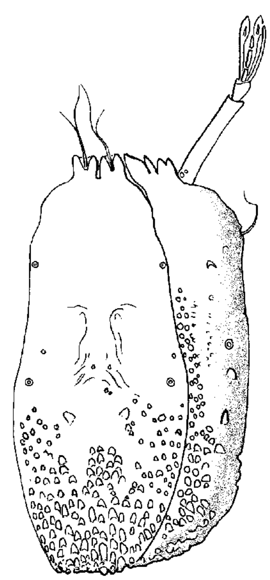
S. sp. A mentum



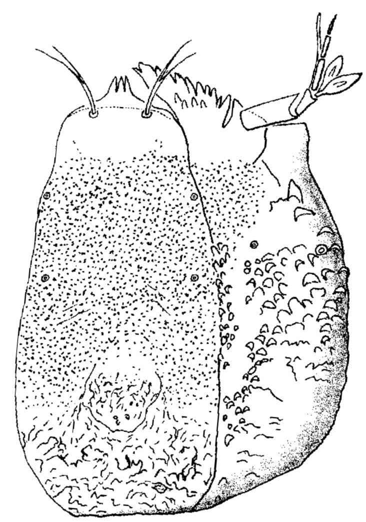
S. sp. A antenna



S. sp. A



S. sp. B

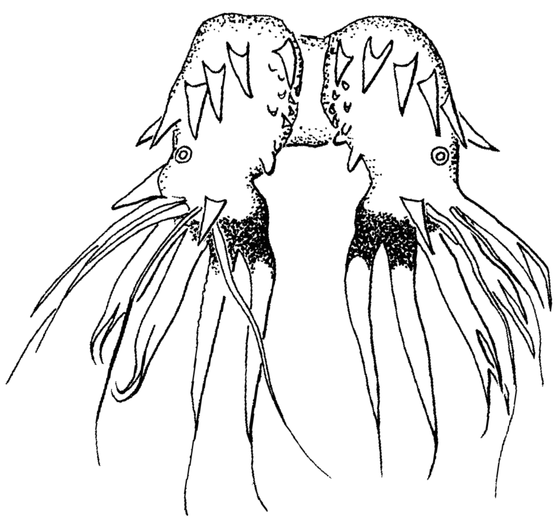


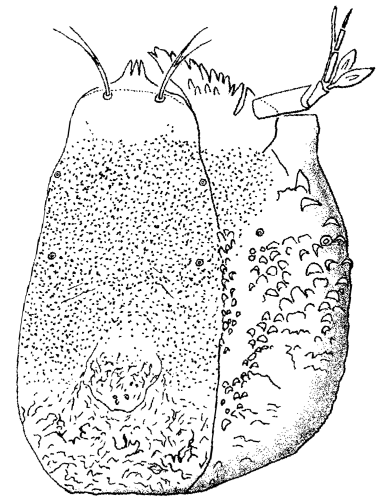
S. sp. C

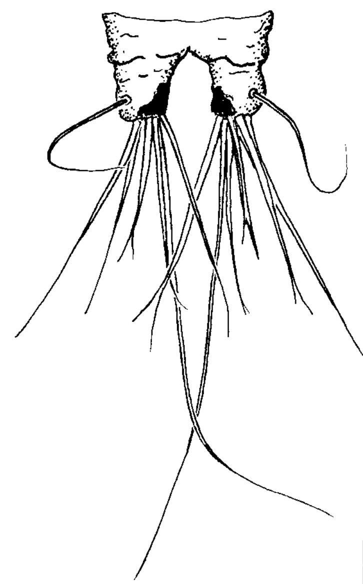
dorsal views of partial head capsules

Key to *Stempellina* larvae of the southeastern United States

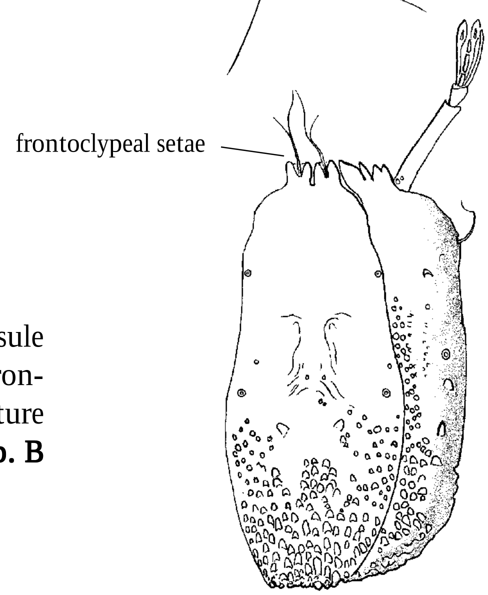
1 Procerci large, heavily sclerotized and with numerous spurs; head capsule with large tubercles laterally, none near center of head .... ***S.* sp. C**



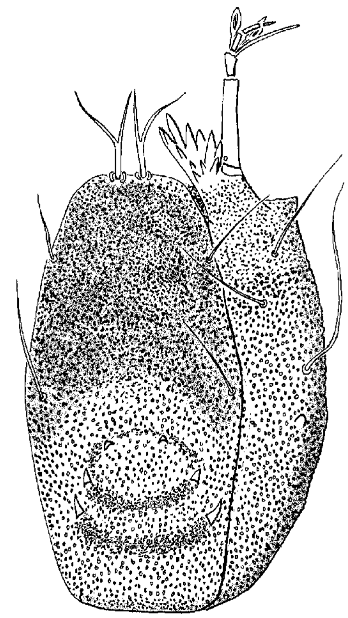




1’ Procerci not as large, without spurs or with only a few spurs; head capsule with tubercles near center of head posteriorly (figures below) 2



2(1’) Frontoclypeal setae arise from large pedicels; head capsule with numerous tubercles, mostly posteriorly on the frontoclypeal apotome and lateral to the frontoclypeal suture .... ***S.* sp. B**



2' Frontoclypeal setae not originating from large pedicels; head capsule mostly granulate dorsally, with a few tubercles near the side and 1-3 pairs of tubercles near the posterior median portion of frontoclypeal apotome .... ***S.* sp. A**

Notes on species

S. sp. A - This species is common in northern Florida; I have also seen material from the Carolinas. I have associations of this species, which appears to be undescribed. The number of sharp tubercles on the posteromedial portion of the frontoclypeal apotome varies from one pair to three pairs.

S. sp. B - I've only seen this taxon from North Carolina.

S. sp. C - I've examined material of this taxon from Alabama, Florida, North Carolina, Ohio and South Carolina. It was erroneously assigned to *Constempellina* by Epler (1995) due to the mesal process of the antennal base being obscured by detritus on the single specimen available at that time. Specimens of this species have been identified as "*Stempellina montivaga* group" or " *S.* nr. *montivaga*" by NCDENR biologists, although this taxon bears little resemblance to *S. montivaga* or, more properly, *S. bausei*. Note that the larva identified as *S. montivaga* in many previous works, such as Pinder & Reiss (1983: figs. 10.71 A, C, E and F) was misidentified; that species is actually *Neostempellina thienemanni*. See Reiss (1984) for a full listing of those publications in which *S. montivaga* was misidentified. Also note that the "real" *S. montivaga* is a junior synonym of *S. bausei* (Kieffer), a species not known to occur in the Nearctic. The larva of *S.* sp. C has procerci similar to those of *S.* sp. 3 of Oliver et al. (1978). Its placement in *Stempellina* is tentative; this species may be a *Neostempellina*. The antennal base of the larva varies from being gum drop shaped to pointed (as if it had a short spur). I have examined one larva/pupa/adult female rearing from Ohio. The pupa fits mostly *Stempellina* but lacks the characteristic, granulose median mound on the frontal apotome; the thorax is mostly smooth but with some granulation near the anterior mid-dorsal line; abdominal tergites II-VI have a basically quadrangular field of spinules; vortices are present on sternite IV; there are no spines on conjunctiva IV/V; and three lateral taeniae are present on tergite VIII. The associated adult is a female, and lacks a scutal tubercle and pulvilli (the lack of these structures would classify it as a *Neostempellina*). The Nearctic taxa assigned to *Constempellina*, *Neostempellina* and *Stempellina* are in need of revisionary work utilizing all life stages; generic limits based on European taxa may not be applicable on this side of the Atlantic.

Genus ***Stempellinella***

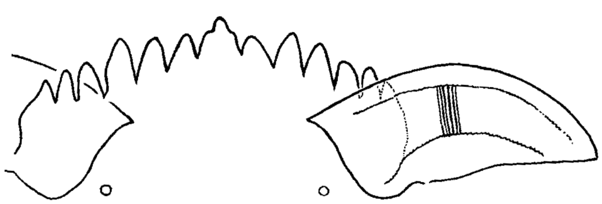
DIAGNOSIS: This tanytarsine is distinguished by the simple or apically divided S 3 (clypeal) setae; pecten epipharyngis of 3 slender spines; well developed spur on antennal base; 5 segmented antennae with one set of Lauterborn organs arising apically, the other from near the base of segment 2; premandible with 3-4 teeth; squat ventromental plates separated medially by at least the width of the 3 median mental teeth; and its portable sand case.

NOTES: At least 3 species occur in the Southeast. I've examined associations of two species (see Notes) and have seen another undescribed adult and an undescribed larva (that may be the larva of the undescribed adult).

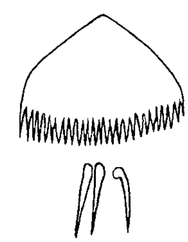
A great deal of confusion exists concerning the separation of *Stempellinella* and *Zavrelia*. Earlier works used antennal differences to separate the genera; these differences were shown to be not valid (Pinder & Reiss 1983). Pinder & Reiss (1983) used characters of the pecten epipharyngis and the premandible to separate the genera. However, *Stempellinella* sp. A has a 4 toothed premandible, unlike the 2-3 toothed premandible diagnosed for *Stempellinella* in Pinder & Reiss (1983). The larva of an undescribed *Zavrelia* species from the eastern US differs from the sole described larva of the genus, the European *Z. pentatoma*, in that the pecten epipharyngis consists of 3 slender spines, rather than the short stubby spines found in *Z. pentatoma*. At this time, only the heavier shagreen of pupal abdominal tergite II on *Zavrelia* and the hairy eyes of adult *Zavrelia* will separate the two genera. The two Nearctic taxa mentioned above blur the differences between *Stempellinella* and *Zavrelia* and make it more likely that the two genera should be combined; *Zavrelia* is the older name and would take precedence.

Stempellinella larvae are found in springs, streams and rivers; they are also recorded from lakes.

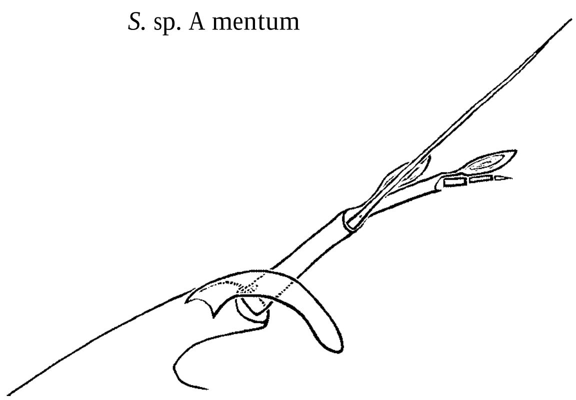
ADDITIONAL REFERENCES: Webb 1969.



S. sp. A mentum

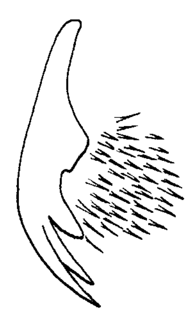


S. sp. A labral lamella
and pecten epipharyngis



S. sp. A antenna

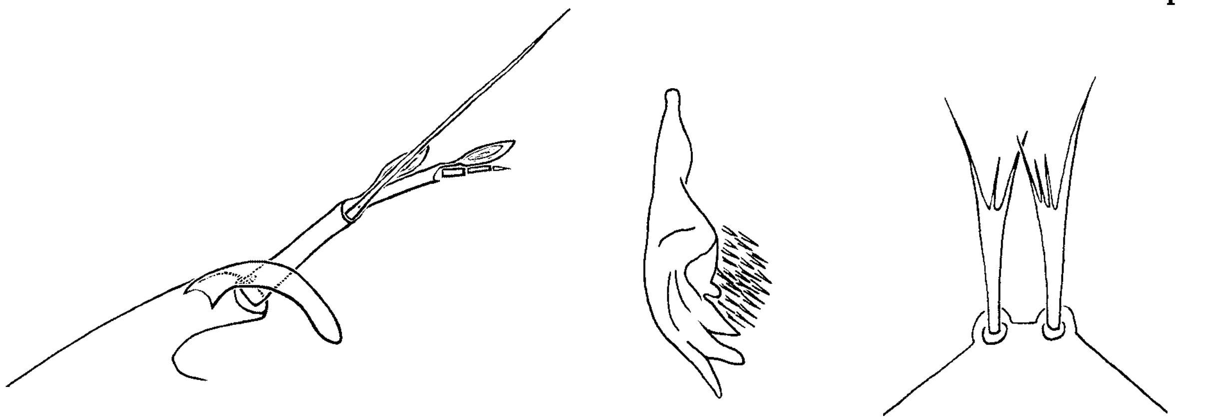
Sp. sp. A premandible



S. cf. *leptocelloides*
premandible

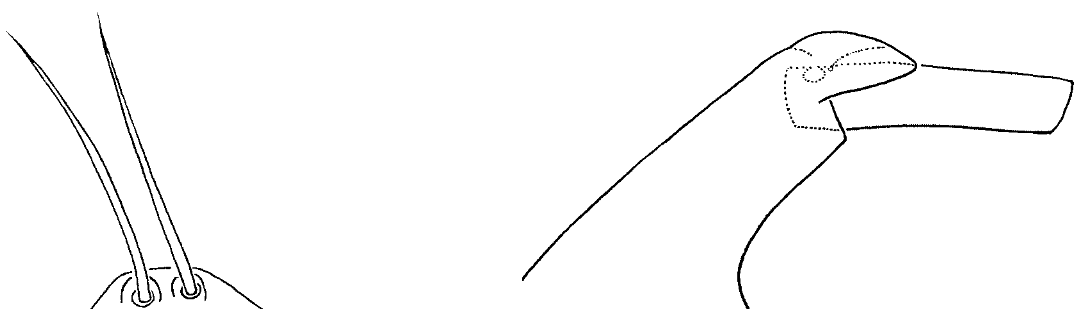
Key to *Stempellinella* larvae of the southeastern United States

1 Antennal base with long curved spur; premandible with 4 inner teeth; clypeal setae apically divided .... ***S.* sp. A**

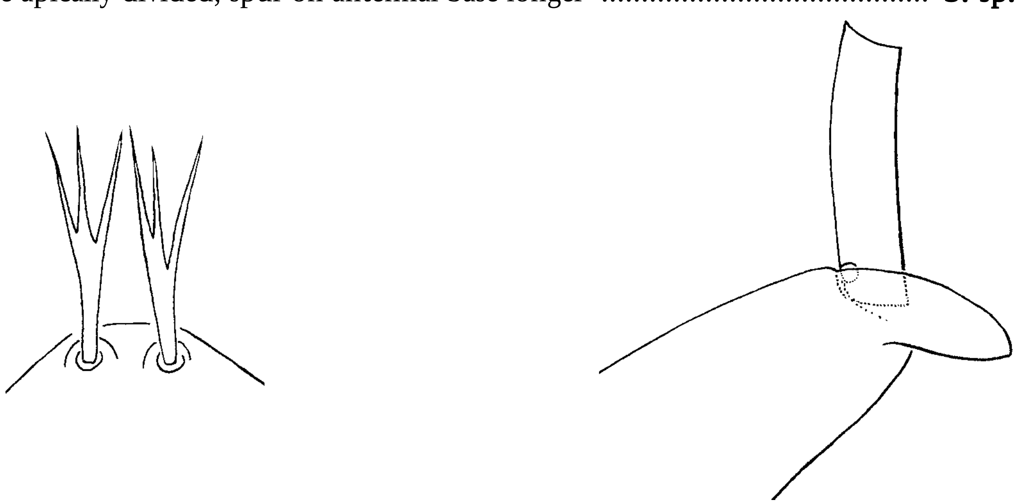


1’ Spur of antennal base not as long; premandible with 3 inner teeth; clypeal setae simple or divided 2

2(1’) Clypeal setae simple; spur on antennal base shorter .... ***S.* cf. *leptocelloides***



2’ Clypeal setae apically divided; spur on antennal base longer .... ***S.* sp. B**



Notes on species

S. cf. *leptocelloides* - I've seen reared material of this taxon from Ohio, adults from northern Florida, and larvae from Florida, North Carolina and New Jersey. The identification is uncertain because the adult male genitalia differ slightly from those figured for *S. leptocelloides* (Webb 1969: figs. 7, 8); examination of type material will be necessary.

S. sp. A - I've examined reared or associated material from Florida, North Carolina and Ohio. This taxon appears to be an undescribed species that somewhat resembles the European *S. flavidula* (Edwards), but does appear to be a different species. *Stempellinella* sp. A is the most common species of the genus that I've seen from the Southeast; I've seen larvae from Alabama, Arkansas, Florida, North Carolina, Ohio, South Carolina and Missouri. There may be more than one species included in this taxon.

S. sp. B - An undescribed species that I've seen from North Carolina, Pennsylvania and Virginia. These larvae may belong with an undescribed adult I have from Alabama.

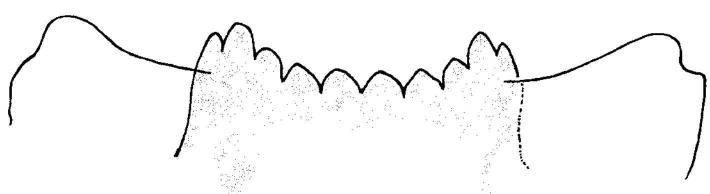
Genus *Stenochironomus*

DIAGNOSIS: Distinguished by the dorsoventrally flattened and apically tapered head capsule; antenna with blade extending only to apex of segment 2; concave mentum with 10-12 teeth; ventromental plates with striae vestigial or absent; and anal tubules with 0-2 constrictions.

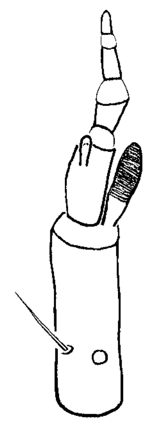
NOTES: Eight species are recorded from the Southeast. The genus was revised in an excellent monograph by Borkent (1984), who established two subgenera. He also offered a key to species for larvae. If you have perfectly mounted 4th instar larvae that are associated with adults, it may be possible to identify them. However, in the real world of benthic sampling, it is basically impossible to identify *Stenochironomus* larvae to species. Borkent (1984) noted that the putative differences between the larvae of *S. aestivalis* and *S. cinctus* described by Beck & Beck (1970) were not recognizable; the larvae are inseparable without associated adults.

Larvae mine in dead submerged leaves (subgenus *Petalopholeus*) or in submerged dead wood (subgenus *Stenochironomus*).

ADDITIONAL REFERENCES: Borkent 1984.



mentum



antenna

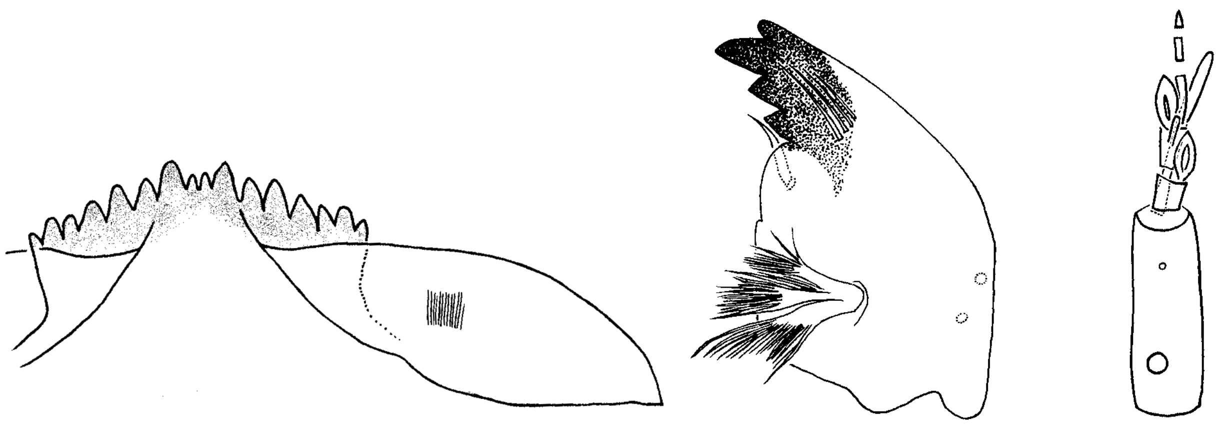
Genus *Stictochironomus*

DIAGNOSIS: Distinguished by the 6 segmented antennae, with alternate Lauterborn organs at the apex of segments 2 and 3; mandible either with 2 inner teeth and dark dorsal tooth or with 3 inner teeth and no dorsal tooth; and mentum with 4 dark median teeth, with at least the outer pair higher than the remaining lateral teeth.

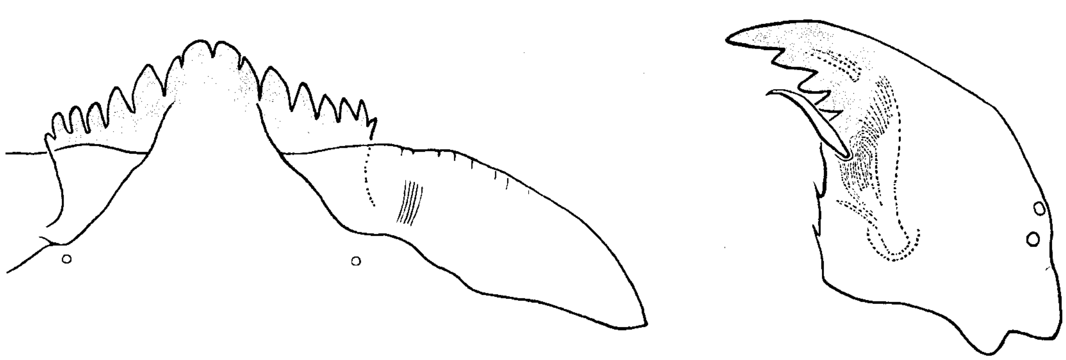
NOTES: Caldwell et al. (1997) record four *Stictochironomus* species for the Southeast. Mason (1985a) offered a key to some larvae of the genus, but it is based largely on literature descriptions (which can be notoriously inaccurate!) and does not include several species that occur here. Records of *S. devinctus* based solely on larvae should be regarded with skepticism; unless you have an associated male, you can not identify *Stictochironomus* larvae to species. The larva described as Chironomini genus B in Pinder & Reiss (1983) and pupal Chironomini genus F of Pinder & Reiss (1986) has been shown to be *S. caffrarius*, a Palaearctic and Afrotropical species not known from the US. A similar larva occurs in the Southeast with a distinctive mentum and the mandible has 3 inner teeth and no dorsal tooth; it may be the larva of *S. palliatus*. Such specimens can be called "*S. caffrarius* group sp." until an association is made and the larva identified. Other *Stictochironomus* species have the more typical mentum and a mandible with 2 inner teeth and a dark dorsal tooth.

Larvae are usually found in sandy sediments of streams, rivers and lakes; larval mouthparts are subject to abrasion from such sediments and often appear quite worn.

ADDITIONAL REFERENCES: Mason 1985a; Roback 1966d; Townes 1945.



S. devinctus mentum, mandible and antenna



S. caffrarius group sp. mentum and mandible

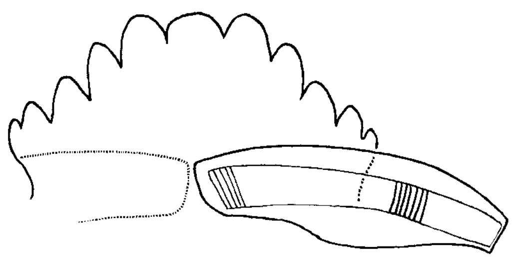
Genus *Sublettea*

DIAGNOSIS: This tanytarsine is distinguished by the simple, 3 lobed pecten epipharyngis; bifid premandible; mandible with 2 dorsal teeth and pronounced hump on outer margin; mentum with 11 teeth with 3 central teeth projecting anteriorly; ventromental plates almost touching medially; and well developed Lauterborn organs on moderately long pedicels.

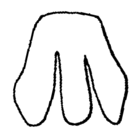
NOTES: One species, *S. coffmani*, is described from the Nearctic; it is recorded from the southeastern states with the exception of Florida. Larvae may be confused with *Neozavrelia* or *Rheotanytarsus.* Although Pinder & Reiss (1983) stated that the Lauterborn organs do not extend beyond the antennal apex, on most of the *Sublettea* specimens that I've examined the Lauterborn organs clearly extend past the apex.

Larvae are found in lotic habitats.

ADDITIONAL REFERENCES: Roback 1975.

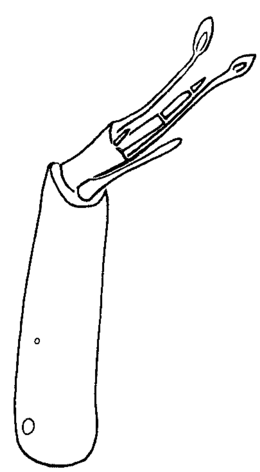


mentum



pecten epipharyngis

mandible



antenna

Genus *Tanytarsus*

DIAGNOSIS: This tanytarsine genus is distinguished by the pecten epipharyngis of 3 apically teethed scales; premandible with 3 apical teeth; antennae with small to moderate Lauterborn organs on (usually) long pedicels; and posterior parapods with simple claws.

NOTES: A speciose genus, most common on the Coastal Plain. Jim and Mary Sublette have been working with *Tanytarsus* for many years; many species are described, but the descriptions have not yet been published. With Torbjörn Ekrem as a co-author, publications are expected soon on the *T. mendax* group.

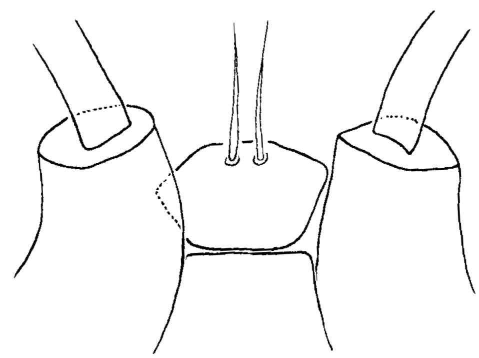
Caldwell et al. (1997) list eleven described species for the Southeast, but only one, *T. limneticus*, is associated with an identifiable larva; many undescribed species are present. The key below identifies 26 species but must be considered preliminary. Some taxa, such as *T.* spp. A, C, G, L and T, may consist of more than one species.

Larvae are found in a variety of aquatic habitats, including brackish water.

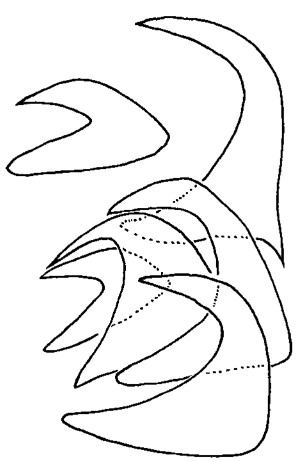
ADDITIONAL REFERENCES: Spies 1998a, 1998b; Sublette 1964.

T. sp. C labrum

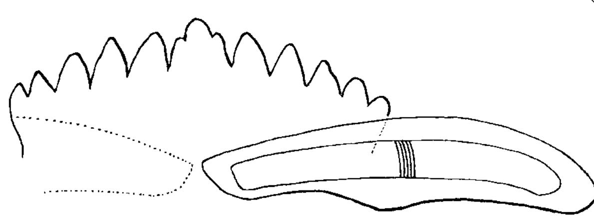
premandible



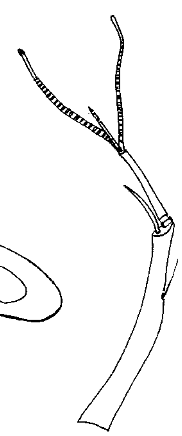
T. sp. L clypeus and antennal bases



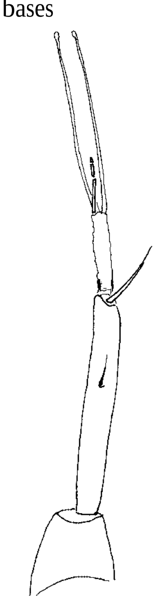
posterior parapod claws



T. sp. I mentum



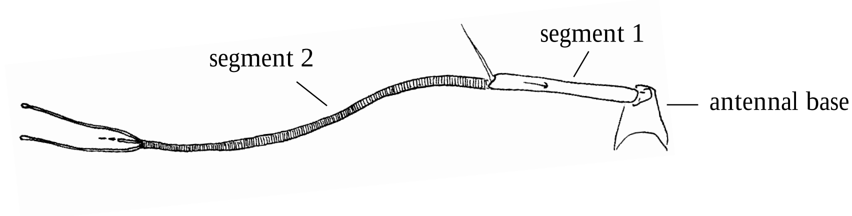
T. limneticus antenna



T. sp. L antenna

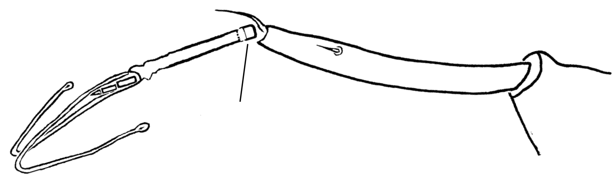
Key to *Tanytarsus* larvae of the southeastern United States

1 Antennal segment 2 long and annulated .... ***T.* sp. F**



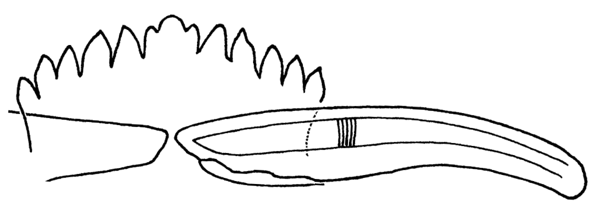
1’ Antennal segment 2 not annulated (although Lauterborn organ pedicels may be annulated) ... 2

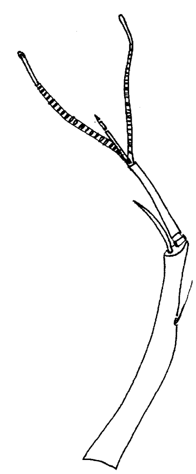
2(1’) Antennal segment 2 with a narrow ring near its base separated from the remainder of the segment by a narrow unsclerotized area 3



2’ Antennal segment 2 with base solidly sclerotized, or entire segment weakly seclerotized 5

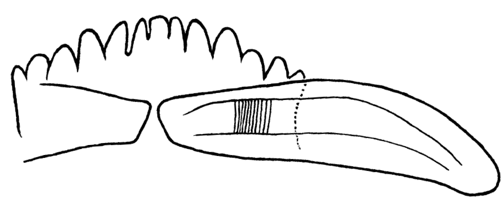
3(2’) Pedicels of Lauterborn organs annulated .... ***T. limneticus***





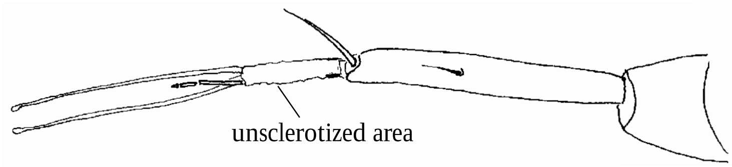
3’ Pedicels of Lauterborn organs not annulated 4

4(3’) Median tooth of mentum deeply trifid; clypeal setae thick, bifid or divided, almost coarsely serrate in some, arising from small rounded tubercle .... ***T.* sp. O**



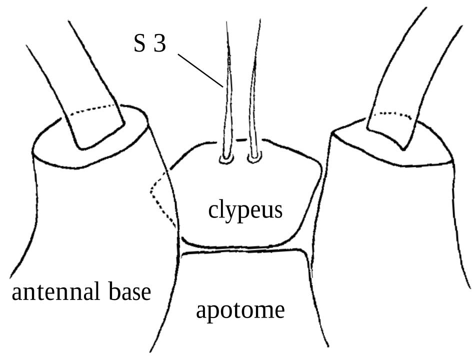
4’ Median tooth of mentum simple; clypeal setae thin, simple, not arising from small tubercle .... ***T.* sp. B**

5(2') Antennal segment 2 for the most part unsclerotized (at most a small section near the base may be weakly sclerotized) 6



5' Antennal segment 2 for the most part (at least 60%) well sclerotized 9

6(5) Clypeus (sclerite anterior to bases of antennae) with a pair of simple setae, the S 3 setae (setae may have a few fine lateral "hairs") 7

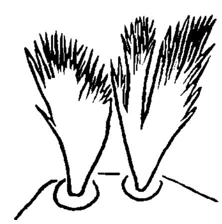


6' Clypeus with coarsely branched or plumose setae (figures below) 8

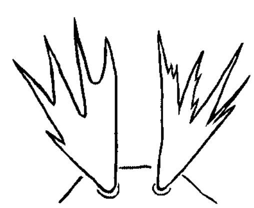
7(6) Mandible with 3 inner teeth .... ***T.* sp. L**

7' Mandible with 2 inner teeth .... ***T.* sp. V**

8(6') Clypeal (S 3) setae plumose, finely dissected .... ***T.* sp. A**



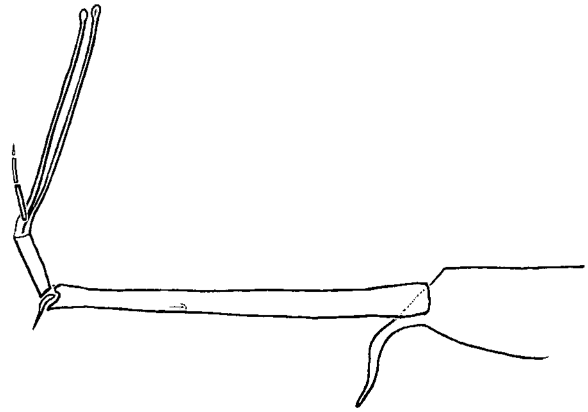
8' Clypeal setae with coarse, flattened branches .... ***T.* sp. S**



9(5') Mandible with 2 inner teeth 10

9' Mandible with 3 inner teeth 18

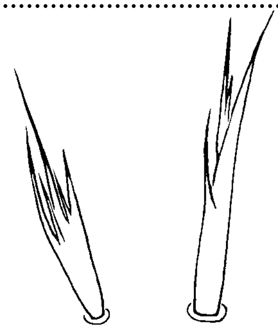
10(9) Antennal base with long spur .... ***T.* sp. M**



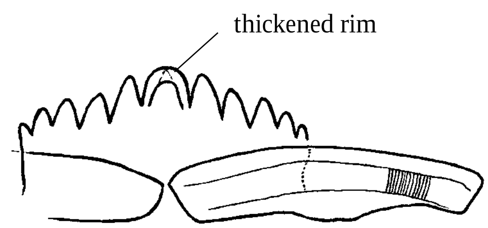
10’ Antennal base without long spur 11

11(10’) Clypeal (S 3) setae branched .... ***T.* sp. W**

11’ Clypeal setae simple 12

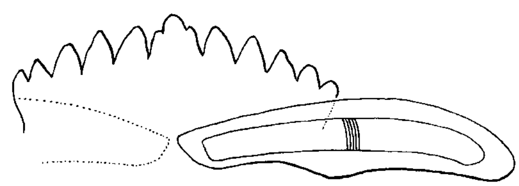


T. sp. W S 3 setae



12(11’) Median tooth of mentum with thickened rim 13

12’ Median tooth simple or weakly trifid, without thickened rim 14

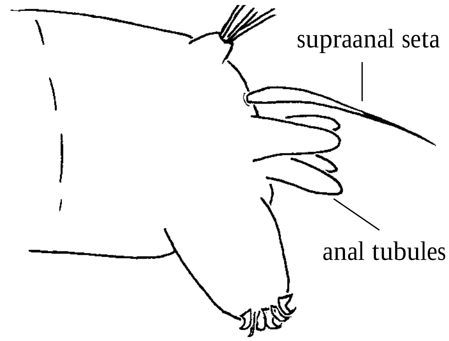


13(12) Clypeal (S 3) setae arise from pointed pedestals .... ***T.* sp. K**

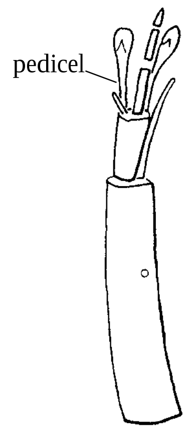
13’ Clypeal setae do not arise fom pedestals (there may be a raised area near the bases of the setae .... ***T.* sp. R**

T. sp. K S 3 setae

14(12’) Supranal setae much longer than anal tubules 15

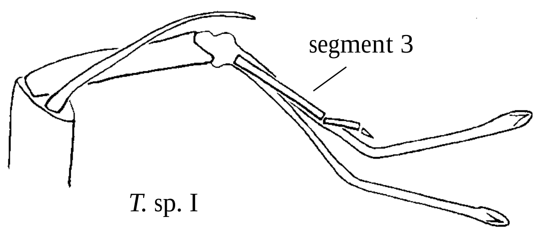


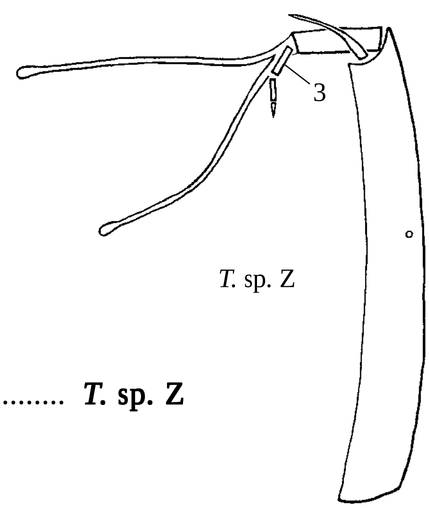
14’ Supraanal setae shorter than or subequal to anal tubules 17



15(14) Pedicels of Lauterborn organs short .... ***T.* sp. H**

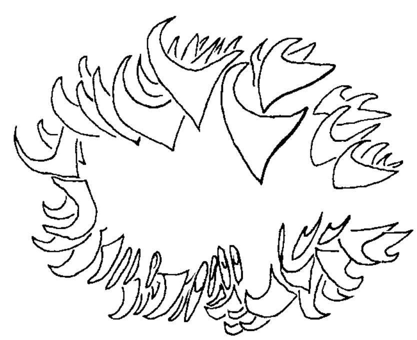
15’ Pedicels of Lauterborn organs long (figures below) 16





16(15’) Antennal segment 3 long .... ***T.* sp. I**

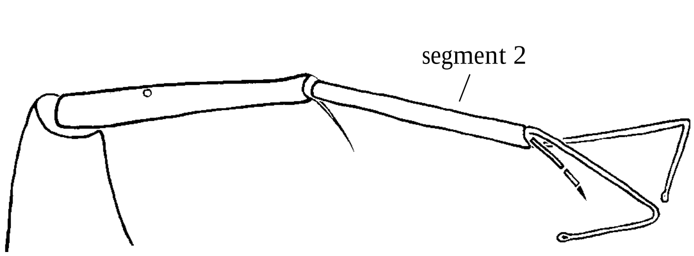
16’ Antennal segment 3 short .... ***T.* sp. Z**



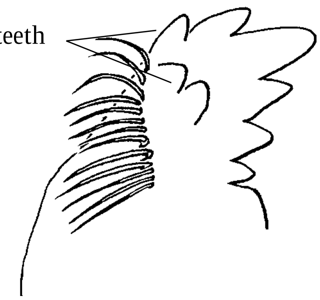
17(14’) Posterior parapods each with more than 50 claws arranged in semicircle; sclerotized length of antennal segment 2 divided by length of sgment 1 < 0.2 .... ***T.* sp. X**

17’ Posterior parapods each with fewer than 20 claws, not arranged as above; sclerotized length of antennal segment 2 divided by length of segment 1 > 0.2 .... ***T.* sp. J**

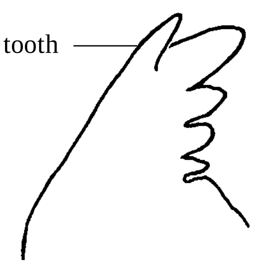
18(9’) Antennal segment 2 more than 1/2 length of segment 1; clypeal (S 3) setae with thin lateral branches .... ***T.* sp. P**



18’ Antennal segment 2 less than 1/2 length of segment 1; clypeal setae simple or branched 19



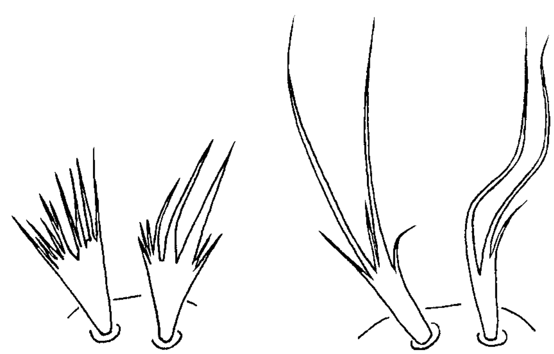
19(18’) Mandible with 1 dorsal tooth and several accessory dorsal teeth 20



19’ Mandible with a single dorsal tooth 22

20(19) Clypeal (S 3) setae simple .... ***T.* sp. C**

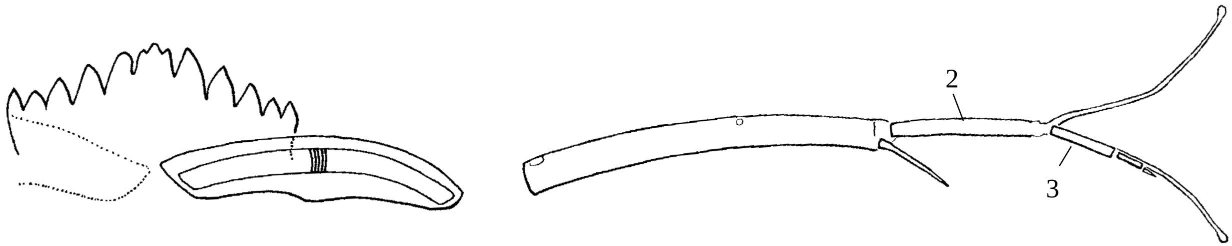
20’ Clypeal setae branched 21



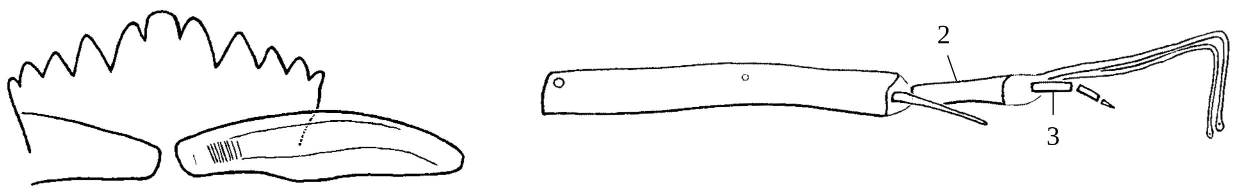
T. sp. D *T.* sp. N

branched clypeal (S 3) setae

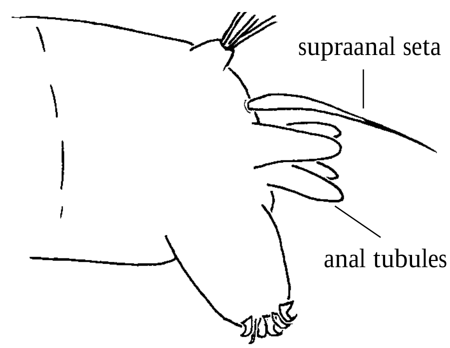
21(20') Second and third antennal segments long, second segment 0.41-0.48, mean 0.45, length of first; premandible usually apically darkened; mentum with median tooth trifid .... ***T.* sp. N**



21' Second and third antennal segments shorter, second segment 0.28-0.38, mean 0.34, length of first; premandible not darkened; mentum with 3 median teeth that are slightly fused and somewhat set apart from lateral teeth .... ***T.* sp. D**



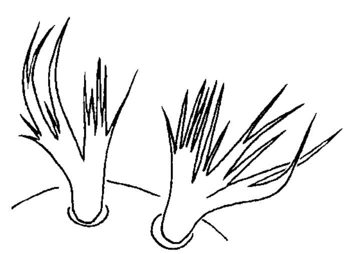
22(19') Supraanal setae much longer than anal tubules 23



22' Supraanal setae shorter than or subequal to anal tubules 25

23(22) Clypeal (S 3) setae branched .... ***T.* sp. U**

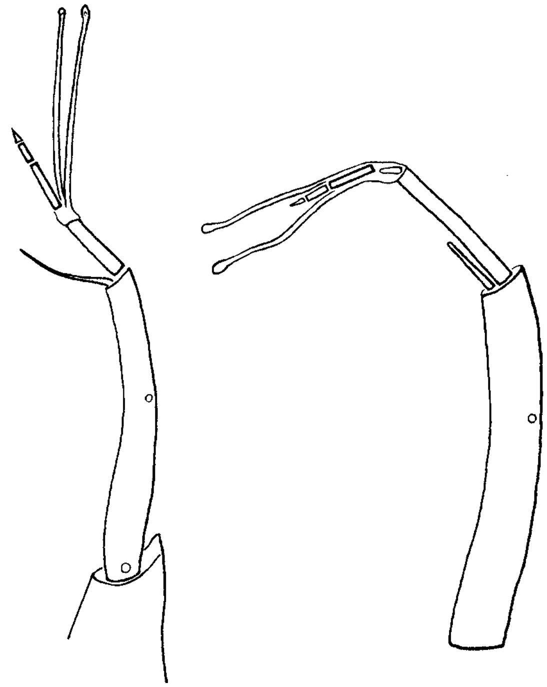
23' Clypeal (S 3) setae simple 24



T. sp. U

24(23’) Sclerotized portion of antennal segment 2 less than 0.3 length of segment 1; antennal base often with small spur .... ***T.* sp. T**

24’ Sclerotized portion of antennal segment 2 greater than 0.3 length of segment 1; antennal base without spur .... ***T.* sp. E**



T. sp. T *T.* sp. E

25(22’) Premandibles usually darkened apically; antennal segment 2 about 1/4 length of segment 1; median tooth of mentum shallowly trifid .... ***T.* sp. G**

25’ Premandibles not darkened apically; antennal segment 2 about 2/5 length of segment 1; median tooth of mentum deeply trifid .... ***T.* sp. Q**

Notes on species

T. limneticus - At this time the only *Tanytarsus* larva I feel comfortable putting a “real” name on. The distinctive annulated pedicels of the Lauterborn organs easily distinguish this species. Most larvae I’ve collected came from bottom sediments of eutrophic ponds or slowly flowing rivers. Isolated larvae were described as *Nimbocera pinderi* by Steiner & Hulbert (1982), but utilizing reared specimens, Epler (1995) showed that this species was actually *Tanytarsus limneticus*. Associations of some other *Tanytarsus* species indicate that some of the characters used to delimit *Nimbocera*, originally described from Chile by Reiss (1972), may not hold up, and that these species are best placed in *Tanytarsus*.

T. sp. A - A common species I’ve seen from Alabama, Florida, North Carolina and South Carolina. This is probably the species keyed as *Tanytarsus guerlus* group in Simpson & Bode (1980). There are many species associated with the “*guerlus* group”. Material identified as “poss. *guerla*” , “nr. *guerla*” and “nr. *guerla* sp. 2” by Roback (who described *T. guerlus*, as *Calopsectra guerla*, in 1957) in the ANSP collection was *T*. spp. C, G, L and S, with the majority being *T*. sp. L. In Florida material I’ve examined, the pupa of *T*. sp. A has anteriorly directed spines in the longitudinal spine rows on T IV, similar to those of “*Nimbocera*”, *T. limneticus* and as figured for *T. guerlus* by Roback (1957: fig. 523). I have not examined type material of *T. guerlus*.

T. sp. B - An uncommon species known to me only from Florida specimens.

T. sp. C - More than one species may be included in this taxon, which I have seen from Alabama, Florida (where it can be very common), North Carolina and South Carolina. There is variation in the length of the second antennal segment and in how deeply separated the first lateral teeth are from the median tooth, but there appears to be a continuum in these characters. A long series of reared material of all forms will be necessary to distinguish separate species, if such exist. The 3-4 accessory dorsal teeth along with the simple clypeal setae will distinguish this species from the similar *T*. sp. D.

T. sp. D - I've seen material of this taxon from Florida, North Carolina and South Carolina. Because of the similarity in the mentum, it can easily be mistaken for *T*. sp. C but note the branched S 3 setae and the single dorsal accessory tooth on the mandible of *T*. sp. D.

T. sp. E - I've seen larvae from Florida and South Carolina. Note the relatively long second antennal segment and simple clypeal setae.

T. sp. F - An unusual species with a long, annulated second antennal segment, known from Florida, Georgia and both Carolinas. Perhaps this taxon would merit separate generic status but without any associated pupae or adults such a decision would be premature. With the exception of the annulated second antennal segment it fits quite well within *Tanytarsus*. Hudson et al. (1990) and Caldwell et al. (1997) listed it as "unknown genus near *Nimbocera*" and "genus near *Nimbocera*" respectively. However, it is the second antennal segment that is annulated, not the Lauterborn pedicels as in *T. limneticus* ("*Nimbocera*"). Similar specimens have been reported from South America as *Calopsectra* sp. 13 (Roback 1966c: fig. 294) and ""*Tanytarsus*" (b)" (Nolte 1989: figs. 2.2 and 3.2).

T. sp. G - More than one taxon may be included here; I've seen larvae from Florida, Georgia, Ohio, North Carolina, South Carolina and Texas. It seems to favor more eutrophic conditions. I have seen a series of apparently worn and/or deformed *T*. sp. G larvae from Sunshine Lake in southern Florida, where a series has been collected and reared by Bob Rutter. Superficially the larvae resemble those of *Corynocera*, but the associated pupae and larvae place this species in *Tanytarsus*; and they seem to be *T*. sp. G.

T. sp. H - Known only from sites near the mouths of the Little Manatee and Suwannee Rivers on the west coast of Florida; note the short pedicels of the Lauterborn organs.

T. sp. I - Known from a series of reared specimens from a small pond in North Carolina and unassociated larvae from a lake in Florida.

T. sp. J - Known to me only from Florida specimens; it is quite common in the northern Everglades.

T. sp. K - I've only seen this species from Florida, where it occurs at least as far north as the Suwannee River. A general rule of thumb is that many species that occur in the Suwannee River basin will be found on the Coastal Plain of the Carolinas, so this taxon might be expected there.

T. sp. L - Several taxa may be included here; I've seen larvae from Florida, North Carolina and South Carolina. The clypeal setae are usually simple, but may have small lateral hair-like branches.

T. sp. M - Known to me from streams in Alabama, Florida, North Carolina and South Carolina. The long spur on the antennal base can be difficult to see if it is directed towards or from the observer. This species can also be easily confused with those *T*. sp. T specimens with a long spur on the antennal base; note that *T*. sp. M has only two inner teeth on the mandible, the median tooth of the mentum is usually lighter than the remaining teeth; and antennal segment 3 is about as long as 4.

T. sp. N - Known to me only from streams in northern Florida. The long antennal segments 2 and 3, usually apically darkened premandibles and the large supraanal setae are distinctive.

T. sp. O - I've seen material of this species from Alabama, Florida and both Carolinas. The second antennal segment is frequently weakly sclerotized, but the separate little ring–like section near the base is always evident. Note also the deeply trifid median tooth of the mentum and the thick clypeal setae that are divided (they may appear to be almost simple with only a few “split ends”) and arise from small rounded bases. The mandible usually has two inner teeth but sometimes may appear to have three.

T. sp. P - North Carolina and Alabama specimens I’ve assigned to this taxon have the posterior third of the head capsule brown. Do these represent a different species than the more “normal” individuals I’m used to seeing from northern Florida that lack this coloration? Without associated specimens showing other differences I am loathe to assign these specimens to a different “species”. Note also that the mandible of *T*. sp. P has numerous dorsal accessory teeth, similar to that of *T*. sp. C.

T. sp. Q - Known to me only from specimens in the Tampa, Florida, area.

T. sp. R - To date I’ve only seen this taxon from peninsular Florida.

T. sp. S - This species and *T*. spp. A and L appear to be closely related; they are separated mainly by the shape of the clypeal setae. I’ve seen specimens from Florida and both Carolinas.

T. sp. T - I’ve seen this taxon from Alabama, Florida (where it can be common in rivers) and North Carolina. More than one species may be included here; the size of the spur on the antennal base is variable. Perhaps those larvae with a reduced spur represent a different species, but without reared material I do not feel confident assigning species status to what merely may be variants.

T. sp. U - I’ve seen this species from Alabama, Florida and both Carolinas (it has been reared from South Carolina).

T. sp. V - I’ve seen this species from northern Florida and North Carolina

T. sp. W - To date known only from Florida.

T. sp. X - To date known only from Florida. This species has an unusual (for *Tanytarsus*) arrangement of claws on the posterior parapods. The claws are numerous (about 60 on each parapod) and arranged in a semicircle, very similar to those of some *Micropsectra* species. The mentum also has a *Micropsectra*-like appearance, but the premandible has three well defined apical teeth. Associated specimens will be necessary to determine its true generic identity.

T. sp. Z - I’ve seen larvae from Georgia and North Carolina.

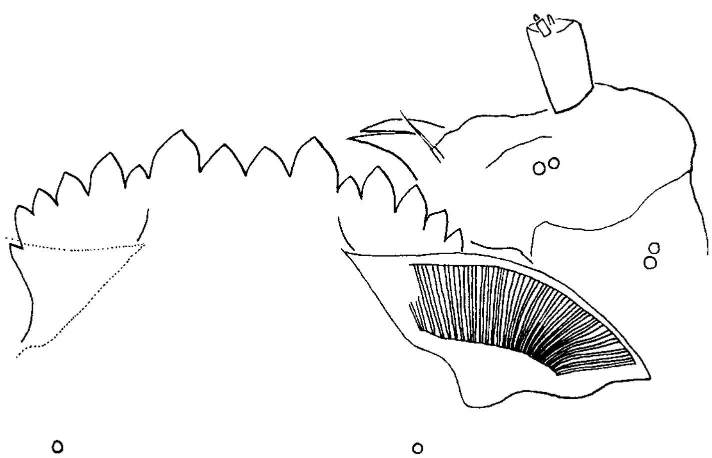
Genus ***Tribelos***

DIAGNOSIS: Distinguished by the frontal apotome with a straight anterior margin, with a clypeus (the S3 setae are on separate, thin plates lateral to it) and a medial labral sclerite anterior to the apotome; mentum with 4 median teeth higher than lateral teeth and with a thin line running from the posterior margin of the outermost median tooth to the anteromedial corner of the ventromental plate (this line usually difficult to discern); mandible with distance from basal notch of proximal inner tooth to insertion of seta subdentalis usually less than 3/4 distance from basal notch of proximal inner tooth to notch of apical tooth; and molar area of mandible with 1 or 2 serrations.

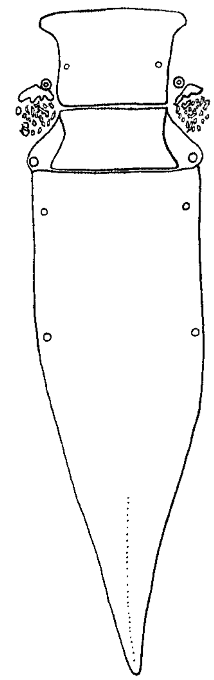
NOTES: Three species are known from the Southeast, all of which occur in the Carolinas. Hudson et al. (1990) noted two undescribed species from South Carolina but I have not seen any material of such taxa. *Tribelos* is easily confused with *Phaenopsectra*, especially earlier instar larvae. However, all southeastern *Tribelos* larvae known to me have a frontal apotome with a straight anterior margin, with two medial sclerites anterior to it; all southeastern *Phaenopsectra* larvae I've seen have a frontoclypeal apotome with a rounded anterior margin and only one medial labral sclerite anterior to it.

Larvae are found most often in streams and rivers, where they occur on vegetation and on marginal sediments; they can be abundant on Hester-Dendy samplers. Larvae appear to be tolerant of moderately enriched conditions.

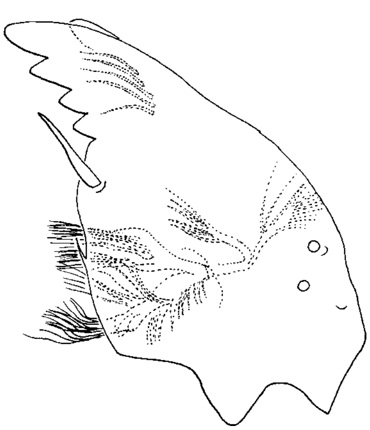
ADDITIONAL REFERENCES: Grodhaus 1987a.



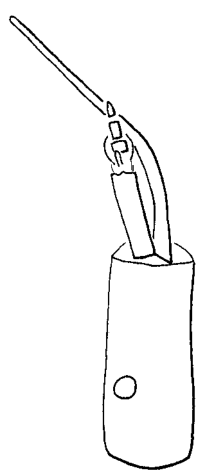
T. fuscicorne mentum and maxilla



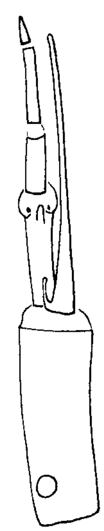
T. fuscicorne apotome and labral sclerites



T. jucundum mandible

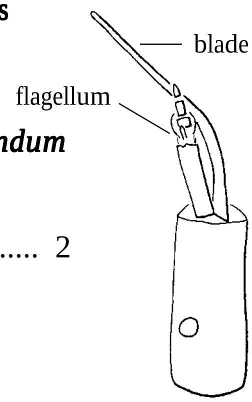


T. jucundum antenna



T. fuscicorne antenna

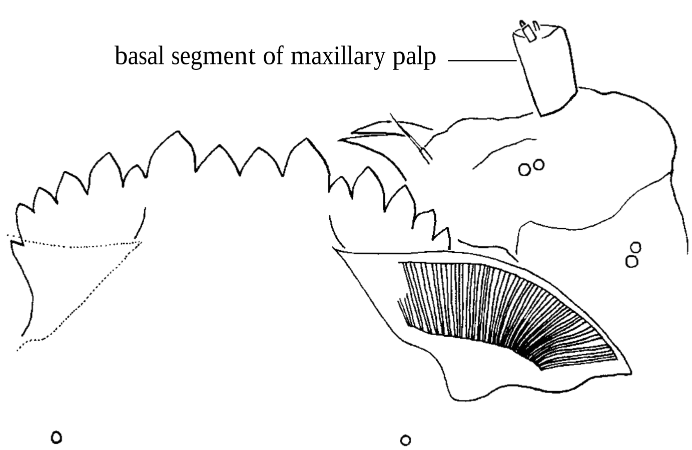
Key to *Tribelos* larvae of the southeastern United States

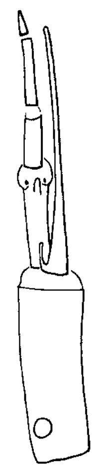


1 Blade of antenna much longer than flagellum (segments 3-5) ... ***T. jucundum***

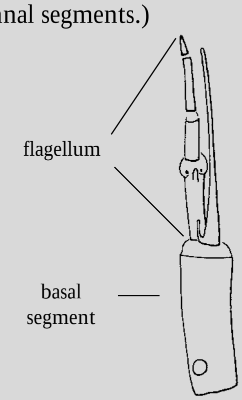
1’ Blade of antenna subequal to flagellum (figures below) 2

2(1’) Ventromental plate striae distinct across face of plate; basal segment of antenna shorter, AR 0.90-1.20; length of basal segment of maxillary palp 2 or more times width .... ***T. fuscicorne***

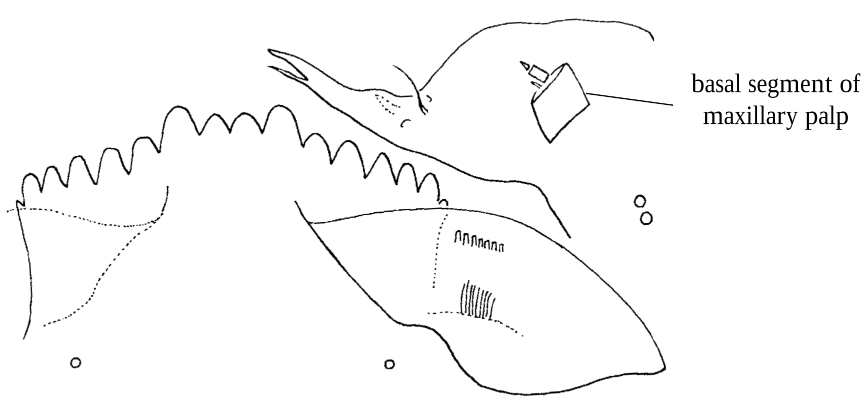


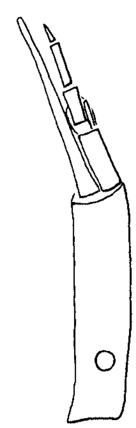


AR = antennal ratio. Calculated by dividing the length of the basal segment by the length of the flagellum (the remaining antennal segments.)



2’ Ventromental plate striae indistinct in middle of plate; basal segment of antenna longer, AR 1.4-1.6; length of basal segment of maxillary palp less than 2X width .... ***T. atrum***





Notes on species

T. atrum - The least common of the three southeastern species, early instars of *T. atrum* could be confused with early instars of *Phaenopsectra obediens* group species. See *T. jucundum* below.

T. fuscicorne - A common species on the Coastal Plain, often found in association with *T. jucundum*. With its distinct ventromental plate striae, elongate base to the maxillary palp and short basal antennal segment, *T. fuscicorne* is usually easily identified.

T. jucundum - The mentum of *T. jucundum* is similar to that of *T. atrum*, with the ventromental plate striae being indistinct in the middle of the plate. Fourth instar larvae of *T. jucundum*, with the characteristic short third antennal segment and short flagellum/elongate antennal blade, are usually easily identified. However, earlier instars of *T. jucundum* and *T. atrum* may be confused with early instars of *Phaenopsectra obediens* group species. The menta and ventromental plates of the these three taxa are similar and in some *Ph. obediens* the antennal blade extends beyond the flagellum. Note that *Phaenopsectra* has a frontoclypeal apotome, with the clypeus, bearing the S3 setae laterally, fused to the anterior portion of the apotome. On some *Phaenopsectra* specimens a thin line may be present "between" the clypeus and the apotome but this appears most often to be a fold, probably an artifact of slide mounting, rather than a line of demarcation. In *Tribelos*, the S3 setae are born on two thinner lateral plates adjacent to the medial labral sclerite 1, an intrepretation followed by Pinder & Reiss (1983). Grodhaus (1987: 172) disagreed with this interpretation of the clypeus, stating that the thinner lateral plates bearing the S3 setae were thinner portions of the clypeus. A medial labral sclerite 1 is usually not visible in *Phaenopsectra* as it easily is in *Tribelos*; in this manual I follow the interpretation of the labral sclerites as in Pinder & Reiss (1983) and thus disagree with Grodhaus (1987).

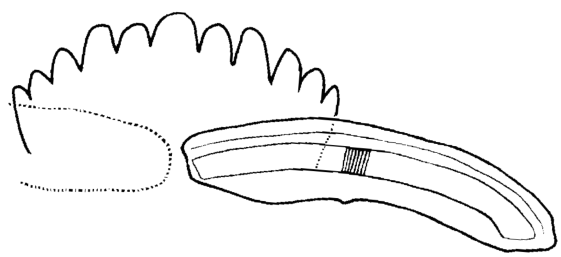
Genus *Virgatanytarsus*

DIAGNOSIS: This tanytarsine genus is distinguished by the pecten epipharyngis of 3 distally serrated scales; Lauterborn organs on moderately long pedicels; premandible with more than 3 teeth; mentum with 11 teeth; ventromental plates almost touching medially; and posterior parapods with some claws that are pad-like, with numerous small hooklets arranged in multiple rows.

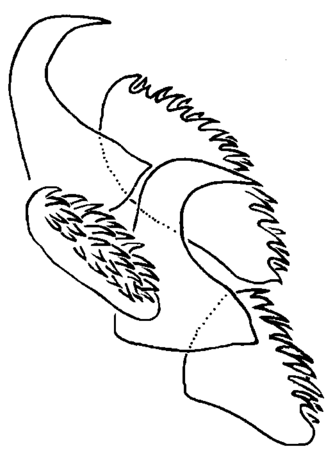
NOTES: Leeper & Taylor (1998) reported a *Virgatanytarsus* species (an adult identified by L. Ferrington) from a South Carolina temporary wetland pond, and I've examined a single adult collected from a stream in Georgia by B.A. Caldwell. I have not seen the South Carolina material and do not know if the two taxa are conspecific. I have not seen Nearctic larval material; the figures below are based on a European species.

In Europe, larvae are found in small rivers and the littoral of lakes, where they live on stony substrata and submerged macrophytes. It appears from the collection sites of the southeastern US adults mentioned above that Nearctic larvae live in similar lentic and lotic habitats.

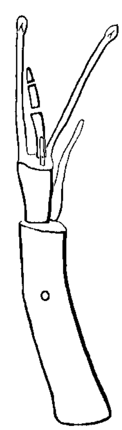
ADDITIONAL REFERENCES: Pinder 1982.



mentum



claws of posterior parapod



antenna

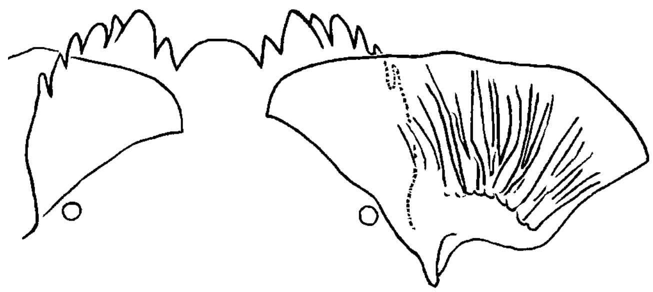
Genus ***Xenochironomus***

DIAGNOSIS: Distinguished by the dorsum of the head with 3 labral sclerites anterior to the apotome; large brush of setae on the labrum; distinctive mentum with broad sunken median tooth; and freshwater sponge mining habit.

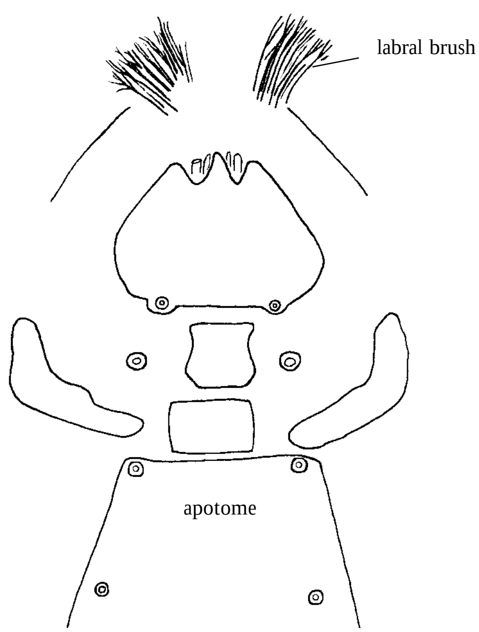
NOTES: One Holarctic species, *X. xenolabis,* is known. Other species formerly placed in the genus are now placed in *Axarus* or *Lipiniella*.

Larvae are obligate miners in freshwater sponges. The larva figured below was collected from sponge on the case of the leptocerid caddisfly *Ceraclea* in northern Florida.

ADDITIONAL REFERENCES: Roback 1963.



mentum



apotome and labral sclerites

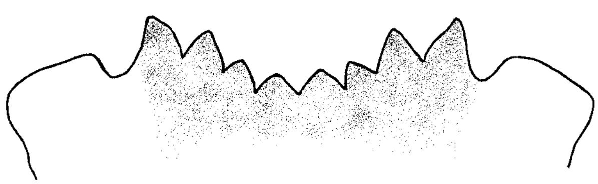
Genus *Xestochironomus*

DIAGNOSIS: Distinguished by the dorsoventrally flattened and apically tapered head capsule; antenna with blade extending past the apex of segment 3; concave mentum with 8 teeth; ventromental plates with striae vestigial or absent; and anal tubules with 4-5 constrictions.

NOTES: Borkent (1984) revised the genus and described the larva. One species, *X. subletti*, is known from the Southeast. There are many Neotropical species and the possibility that more species may occur in the US, especially in southern Florida, must be considered. Unless associated with adult males, larvae should be identified as "*Xestochironomus* sp.".

Larvae mine in dead submerged wood in lotic habitats.

ADDITIONAL REFERENCES: Borkent 1984; Sublette & Sasa 1994.



mentum

antenna

Genus *Zavrelia*

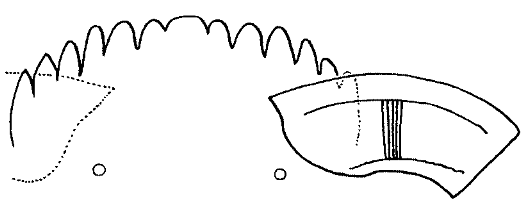
DIAGNOSIS: The sole known Nearctic representative of this tanytarsine is distinguished by the simple S 3 setae; pecten epipharyngis of 3 slender spines; short, straight spur on antennal base; 5 segmented antennae with one set of Lauterborn organs arising apically, the other from near the base of segment 2; premandible with 4 teeth; squat ventromental plates separated medially by at least the width of the 3 median mental teeth; and its portable sand case.

NOTES: There are no described species of *Zavrelia* known from the Nearctic, but at least one undescribed species occurs in the eastern US; I've seen reared material from Ohio, adults of the same species from the Smoky Mountains of North Carolina, and isolated larvae from Virginia.

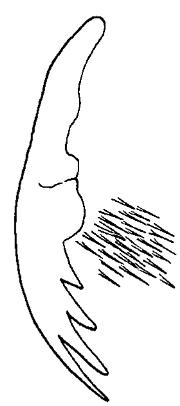
A great deal of confusion exists concerning the separation of *Zavrelia* and *Stempellinella*. Earlier works used antennal differences to separate the genera; these differences were shown to be not valid (Pinder & Reiss 1983). Pinder & Reiss (1983) used characters of the pecten epipharyngis and the premandible to separate the genera. The larva of the undescribed species from the eastern US differs from the sole described larva of the genus, the European *Z. pentatoma*, in that the pecten epipharyngis consists of 3 slender spines, rather than the short stubby spines found in *Z. pentatoma*. Also, *Stempellinella* sp. A has a 4 toothed premandible, unlike the 2-3 toothed premandible diagnosed for *Stempellinella* in Pinder & Reiss (1983). At this time, only the heavier shagreen of pupal abdominal tergite II on *Zavrelia* and the hairy eyes of adult *Zavrelia* will separate the two genera. The two Nearctic taxa mentioned above blur the differences between *Zavrelia* and *Stempellinella* and make it more likely that the two genera should be combined; *Zavrelia* is the older name and would take precedence.

Zavrelia larvae appear to be inhabitants of springs.

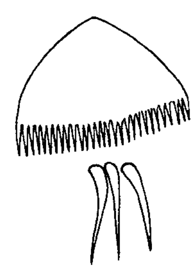
ADDITIONAL REFERENCES: None.



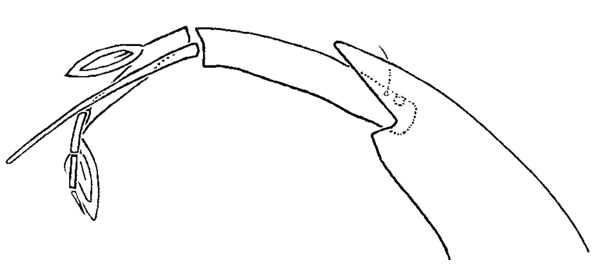
mentum



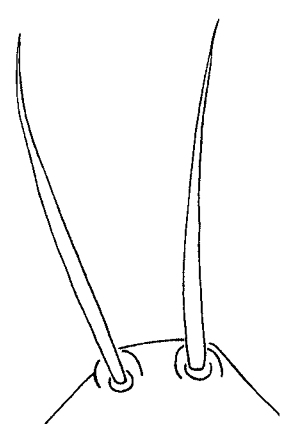
premandible



labral lamella and pecten epipharyngis



antenna and base



S 3 (clypeal) setae

Genus *Zavreliella*

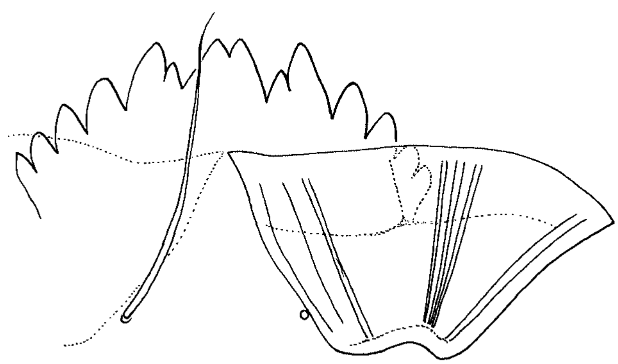
DIAGNOSIS: Distinguished by the frontoclypeal apotome, with 1 medial labral sclerite anterior to it; 6 segmented antennae with alternate Lauterborn organs at the apex of segments 2 and 3; simple setae submenti; a pair of long ventral tubules placed posterolaterally on body segment 10; and body segment 11 with anteriorly directed dorsal hump.

NOTES: One species, *Z. marmorata*, is known from the Nearctic. Reiss (1990) revised the genus; an additional 12 species are known from northern South America. *Zavreliella marmorata*, formerly known in North America as *Lauterborniella varipennis*, is found throughout most of the world; some European populations are parthenogenetic.

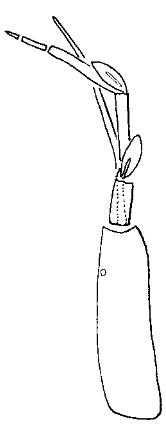
Larvae are found in marshes, vegetation-choked, eutrophic ponds and lakes, and the sluggish portions of streams and rivers, where they swim around in their hydroptilid caddisfly-like silken cases. The case of *Zavreliella* differs from that of *Lauterborniella* in that it has a circular opening; that of *Lauterborniella* has a slit-like opening.

Although the setae submenti of *Zavreliella* have been described as being on the ventromental plates, on many specimens I've examined they are placed immediately medial to the inner margin.

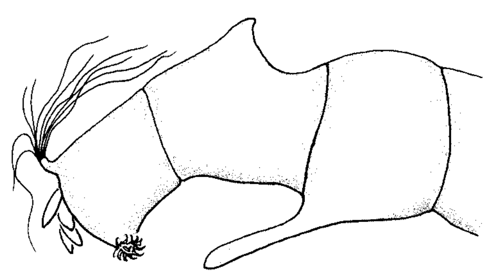
ADDITIONAL REFERENCES: Reiss 1990.



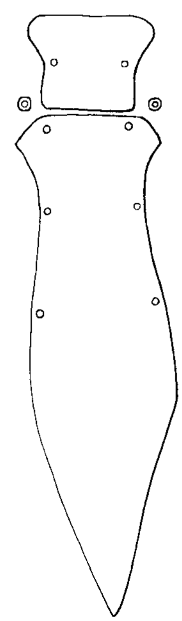
mentum



antenna



posterior body segments



apotome and labral sclerite

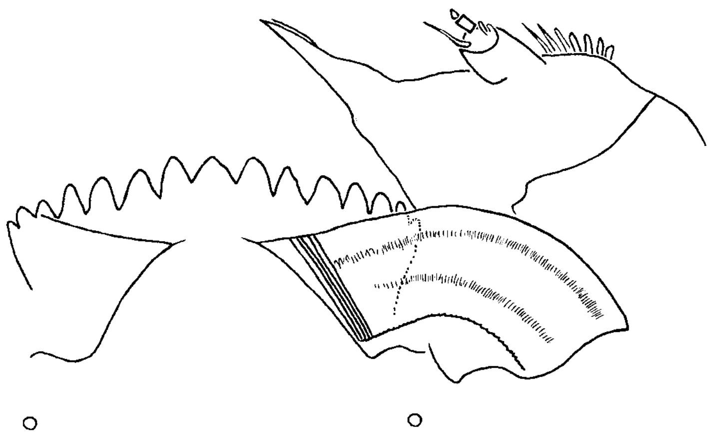
Chironomini genus III

DIAGNOSIS: Distinguished by the frontal apotome with 2 medial labral sclerites anterior to it; plumose S I setae arising from separate bases; 15 toothed mentum with median teeth subequal; apically bifid premandible, with brush; and cardo with smooth anterior margin.

NOTES: A taxon known only as a larva from Florida (several sites throughout the peninsular and northern portions of the state), southern Georgia and North Carolina (Dunahoe Bay in Robeson County); given this distribution it probably occurs throughout the Coastal Plain of the Southeast. It appears to be closely related to *Tribelos*, but without associated life stages it is not possible to accurately place this larva.

Larvae have been collected from bayheads, canals and ditches.

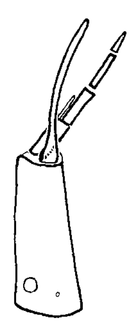
ADDITIONAL REFERENCES: None.



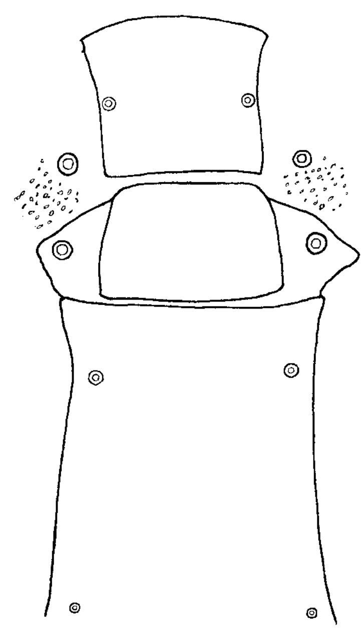
mentum and maxilla

pecten epipharyngis

mandible
(seta interna present but not shown)



antenna



apotome and labral sclerites

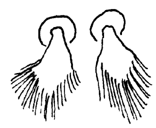
Chironomini genus IV

DIAGNOSIS: The frontal apotome apparently with clypeus and 1 medial labral sclerite anterior to it; anterior margins of apotome and clypeus straight; plumose S I on separate bases; 5 segmented antennae; premandible apically bifid, with brush; 4 median teeth of mentum separated from remainder of mentum by a line that runs posterior to the anteromedial angle of the ventromental plates; and ventromental plates with strongly crenulated anteromedian margins will distinguish this taxon.

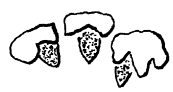
NOTES: This taxon is known from two specimens, probably third instar, collected from a pond in northern Florida in October; it is not known from the Carolinas. It may belong with *Tribelos* or *Phaenopsectra*, or may represent an undescribed genus.

ADDITIONAL REFERENCES: None.

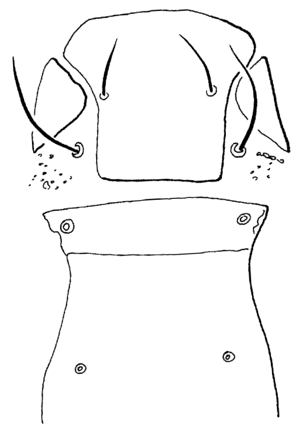
mandible



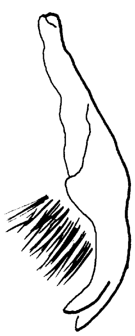
S I



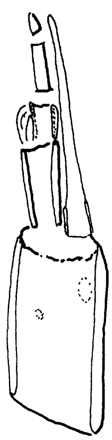
pecten epipharyngis



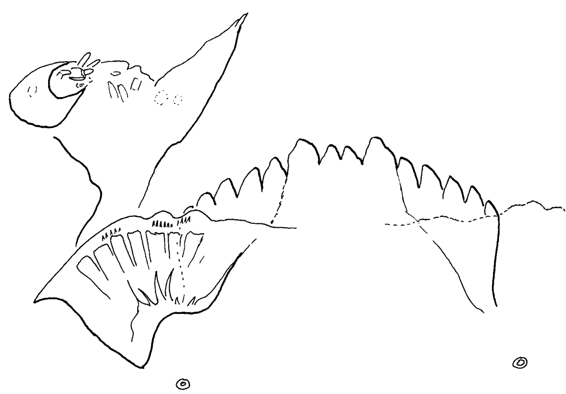
apotome and labral sclerites



premandible



antenna



mentum

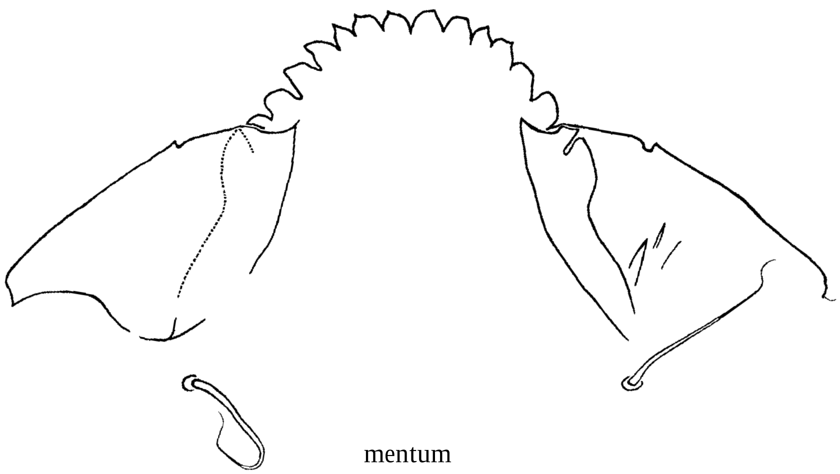
Harnischia complex genus A

DIAGNOSIS: Distinguished by the simple S I; large, blade-like S II with apical fringe; 6 segmented antenna, with alternate Lauterborn organs on segments 2 and 3; distinctive mentum with equally sized teeth arranged in a semicircle, resembling a circular saw blade; and the distinctive ventromental plates with a notch on the mid-anterior margin.

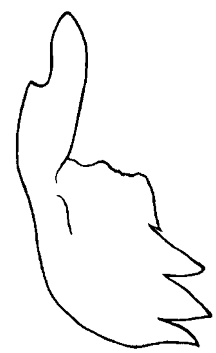
NOTES: First figured by Roback (1953: fig. 29) as “Unknown gen. & sp. near *Microtendipes*”, this taxon was listed by Hudson et al. (1990) as “Unknown genus near *Microtendipes* A”, and by Caldwell et al. (1997) as “genus near *Microtendipes* A”. Although this taxon has a 6 segmented antenna similar to that of *Microtendipes*, the structure of the S I, S II, pecten epipharyngis and mandible indicate that it may be a member of the *Harnischia* complex. It may also be closely related to *Paratendipes*, but until associated with its pupal and adult stages, its taxonomic postion will remain unclear.

Larvae are found in sandy substrata.

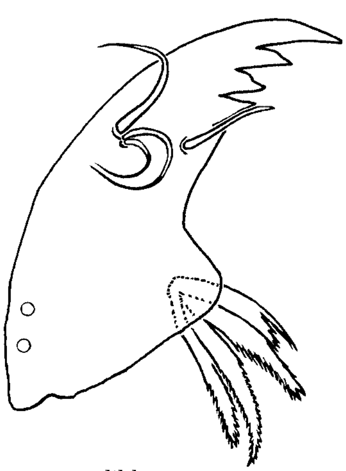
ADDITIONAL REFERENCES: None.



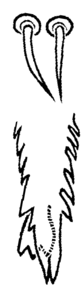
mentum



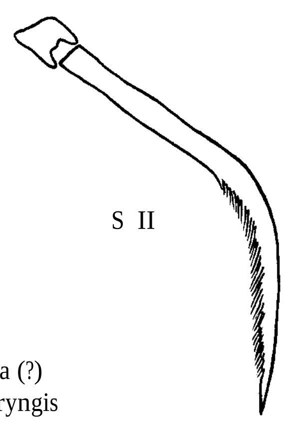
premandible



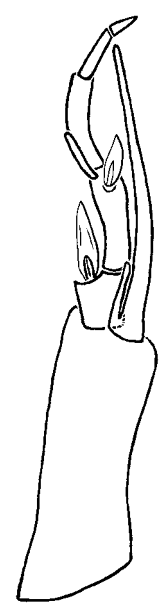
mandible



S I, labral lamella (?)
and pecten epipharyngis



S II



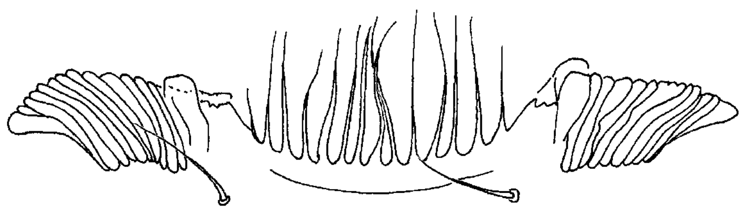
antenna

Harnischia complex genus B

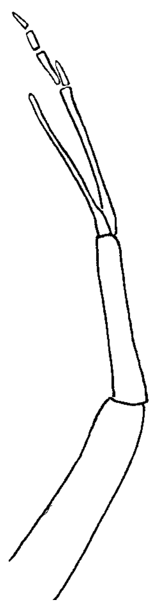
DIAGNOSIS: The 6 segmented antenna; mandible with extensive lateral fringe of setae and poorly sclerotized, lamellar teeth; and mentum with long, setae like teeth distinguish this taxon.

NOTES: This bizarre larva is known only from several sites in the panhandle of Florida; it is not known from the Carolinas. This larva may be an aberrant *Paracladopelma*. It has been found in core samples of sandy substrata.

ADDITIONAL REFERENCES: None.



mentum



antenna

mandible

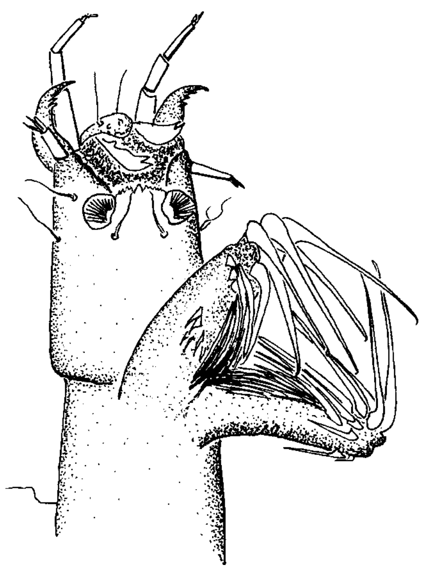
Harnischia complex genus C

DIAGNOSIS: Distinguished by the blade-like S I setae, slightly smaller than S II; 6 segmented antennae; apically bifid premandible; mentum with 5 pairs of lateral teeth; rounded ventromental plates; large claws of anterior parapods about 2/3 length of head capsule; subdivided body segments, giving appearance of about 20 body segments; and each procercus with one very long anal seta, about 4-5X as long as supraanal setae.

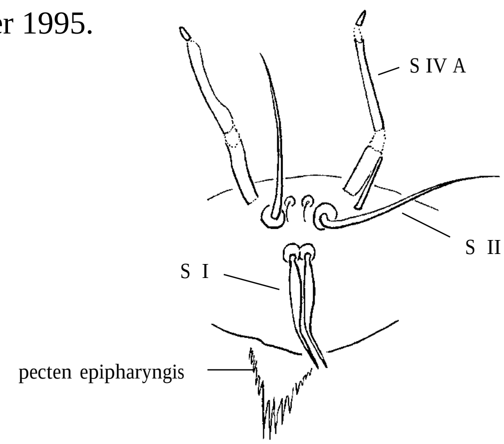
NOTES: This taxon and *Kloosia* are very similar as larvae. *Harnischia* complex genus C is not a *Kloosia*; there are also pupal and adult differences. Structures figured in Epler (1995) for *Harnischia* complex genus C were a mixture of *Kloosia* and *Harnischia* complex genus C body parts; both species may be found in the same sample (which led to the confusion by Epler (1995)). The taxon listed as "*Cryptochironomus*" nr. *macropodus* Lyakhov by Caldwell et al. (1997) is *Harnischia* complex genus C.

Larvae are found in sandy substrata of streams and rivers.

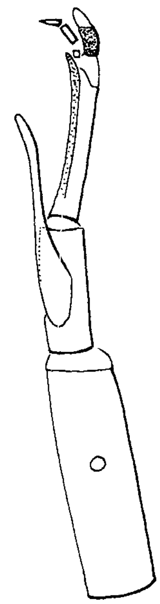
ADDITIONAL REFERENCES: Epler 1995.



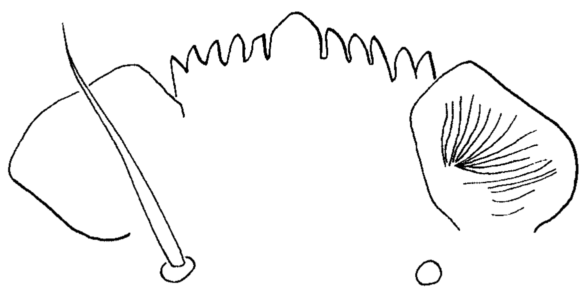
head and anterior parapods



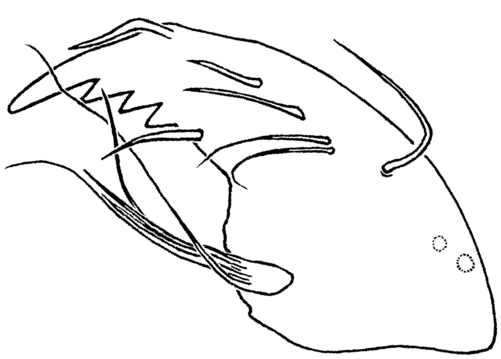
labrum



antenna

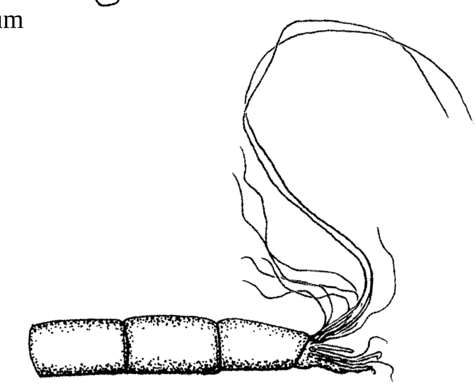


mentum



mandible

premandible



posterior end

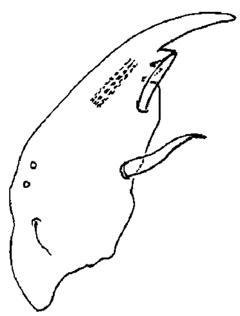
Harnischia complex genus D

DIAGNOSIS: The 5-segmented antennae with segment 3 weakly sclerotized; mandible with weak pecten mandibularis; premandible lacking a brush and with 4 teeth; and concave mentum with clear median tooth and dark lateral teeth with wide outer tooth distinguish this genus.

NOTES: This taxon is known from a single specimen from SW Florida; it is not known from the Carolinas. The specimen's S I setae and pecten epipharyngis are obscured. It superficially resembles a *Gillotia*, but that genus has a premandible with at least 6 teeth and its mandible lacks a pecten mandibularis. This specimen may belong with *Cryptochironomus*. However, antennal segment 3 is weakly sclerotized, it apparently lacks a brush on the premandible and the ventromental plates are not as laterally extended as is usual in *Cryptochironomus*.

ADDITIONAL REFERENCES: None.

antenna



mandible

premandible

mentum

NOTES

BIBLIOGRAPHY 9

Adam, J.I & O.A. Sæther. 1999. Revision of the genus *Nilothauma* Kieffer, 1921 (Diptera: Chironomidae). Ent. scand. Suppl. 56: 1-107.

Ali, A. 1991. Perspectives on management of pestiferous Chironomidae (Diptera), an emerging global problem. J. Am. Mosq. Control Assoc. 7: 260-281.

Armitage, P., P.S. Cranston & L.C.V. Pinder (eds). 1995. The Chironomidae. Biology and ecology of non-biting midges. Chapman & Hall, London. 572 pp.

Ashe, P. 1983. A catalogue of chironomid genera and subgenera of the world including synonyms (Diptera: Chironomidae). Ent. scand. Suppl. 17: 1-68.

Barton, D.R., D.R. Oliver & M.E. Dillon. 1993. The first Nearctic record of *Stackelbergina* Shilova and Zelentsov (Diptera: Chironomidae): Taxonomic and ecological observations. Aquatic Insects 15: 57-63.

Beck, E.C & W.M. Beck, Jr. 1959. A checklist of the Chironomidae (Insecta) of Florida (Diptera: Chironomidae). Bull. Fl. St. Mus. Biol. Sci. 4: 85-96.

Beck, E.C. & W.M. Beck, Jr. 1969a. The Chironomidae of Florida II. The nuisance species. Fla. Ent. 52:1-11.

Beck, E.C. & W.M. Beck, Jr. 1969b. Chironomidae (Diptera) of Florida III. The *Harnischia* complex (Chironominae). Bull. Fla. St. Mus. Biol. Sci. 13:277-313.

Beck, W.M., Jr. 1976. Biology of the larval chironomids. Fla. State Dept. Environ. Reg. Tech. Ser. 2:1-58

Beck, W.M., Jr. 1977. Environmental requirements and pollution tolerance of common freshwater Chironomidae. U.S. Environmental Protection Agency, EPA 600/4-77-024. 260 pp.

Beck, W.M., Jr. 1979. Biology of the larval chironomids. Revised edition. Fla. State Dept. Environ. Reg. Tech. Ser. 2:1-58

Beck, W.M., Jr. 1980. Interesting new chironomid records for the southern United States (Diptera: Chironomidae). J. Ga. Ent. Soc. 15:69-73.

Beck, W.M., Jr. & E.C. Beck. 1966. Chironomidae (Diptera) of Florida - I. Pentaneurini (Tanypodinae). Bull. Fla. St. Mus. Biol. Sci. 10:305-379.

Beck, W.M., Jr., & E.C. Beck. 1970. The immature stages of some Chironomini (Chironomidae). Q.J. Fla. Acad. Sci. 33:29-42.

Bilyj, B. 1984. Descriptions of two new species of Tanypodinae (Diptera: Chironomidae) from Southern Indian Lake, Canada. Can. J. Fish. Aquat. Sci. 41: 659-671.

Bilyj, B. 1985. New placement of *Tanypus pallens* Coquillett, 1902 nec *Larsia pallens* (Coq.) sensu Roback 1971 (Diptera: Chironomidae) and redescription of the holotype. Can. Ent. 117: 39-42.

Bilyj, B. 1988. A taxonomic review of *Guttipelopia* (Diptera: Chironomidae). Ent. scand. 19:1-26.

Bilyj, B. & Davies, I.J. 1989. Descriptions and ecological notes on seven new species of *Cladotanytarsus* (Chironomidae: Diptera) collected from an experimentally acidified lake. Can. J. Zool. 67:948-962.

Bjørlo, A., H. Vårdal & O.A. Sæther. 2000. A preliminary phylogenetic analysis of the subgenus *Tripodura* Townes of the genus *Polypedilum* Kieffer (Diptera: Chironomidae). pp 35-50 in Hoffrichter, O. (ed.) Late 20th Century Research on Chironomidae: an Anthology from the 13th International Symposium on Chironomidae. Shaker Verlag, Aachen, Germany.

Bode, R.W. 1983. Larvae of North American *Eukiefferiella* and *Tvetenia* (Diptera: Chironomidae). Bull. N.Y. St. Mus. No. 452:1-40.

Boesel, M.W. 1974. Observations on the Coelotanypodini of the northeastern states, with keys to the known stages. (Diptera: Chironomidae: Tanypodinae). J. Kans. Ent.

Soc. 47: 417-432.

Boesel, M.W. 1983. A review of the genus *Cricotopus* in Ohio, with a key to the adults of the northeastern United States (Diptera, Chironomidae). Ohio J. Sci. 83: 74-90.

Boesel, M.W. 1985. A brief review of the genus *Polypedilum* in Ohio, with keys to the known stages of species occurring in northeastern United States (Diptera: Chironomidae). Ohio J. Sci. 85:245-262.

Boesel, M.W. & R.W. Winner. 1980. Corynoneurinae of northeastern United States, with a key to adults and observations on their occurrence in Ohio (Diptera: Chironomidae). J. Kans. Ent. Soc. 53: 501-508.

Bolton, M.J. 1991. The identity of Chironomini Genus C (Diptera: Chironomidae) in Pinder and Reiss (1986). Ent. News 102: 125-126.

Bolton, M.J. 1992. Chironomidae (Diptera) of Cedar Bog, Champaign County, Ohio. Ohio J. Sci. 92: 147-152.

Borkent, A. 1984. The systematics and phylogeny of the *Stenochironomus* complex (*Xestochironomus*, *Harrisius*, and *Stenochironomus*). (Diptera: Chironomidae). Mem. ent. Soc. Canada 128:1-269.

Bretschko, G. 1981. *Pontomyia* Edwards (Diptera: Chironomidae), a member of the coral reef community at Carrie Bow Cay, Belize, pp. 381-385 *in* Rätzler, K. & I.G. Macintyre (eds.): The Atlantic Barrier Reef Ecosystem at Carrie Bow Cay, Belize, 1: Structure and Communities. Smithsonian Contr. Mar. Sci. 12: 539 pp.

Brundin, L. 1948. Über die Metamorphose der Sectio Tanytarsariae connectentes (Dipt. Chironomidae). Ark. Zool. 41A: 1-22 + 7 plates.

Brundin, L. 1966. Transantarctic relationships and their significance, as evidenced by chironomid midges. With a monograph of the subfamilies Podonominae and Aphroteniinae and the austral Heptagyiae. K. svenska VetenskAkad. Handl. 11: 1-472.

Caldwell, B.A. 1984. Two new species and records of other chironomids from Georgia (Diptera: Chironomidae) with some observations on ecology. Georgia J. Sci. 42: 81-96.

Caldwell, B.A. 1985. *Paracricotopus millrockensis*, a new species of Orthocladiinae (Diptera: Chironomidae) from the southeastern United States. Brimleyana 11:161-168.

Caldwell, B.A. 1986. Description of the immature stages and adult female of *Unniella multivirga* Sæther (Diptera: Chironomidae) with comments on phylogeny. Aquatic Insects 8: 217-222.

Caldwell, B.A. 1993. The immature stages of *Ablabesmyia cinctipes* (Johannsen) with comments on ecology (Insecta, Diptera, Chironomidae). Spixiana 16: 49-52.

Caldwell, B.A. 1996. Two new Nearctic species of small Orthocladiinae (Diptera: Chironomidae) with notes on ecology. Hydrobiol. 328: 1-7.

Caldwell, B.A. 1997. The American *Chaetocladius stamfordi* (Johannsen), a synonym of *C. piger* (Goetghebuer) from the Palaearctic (Diptera: Chironomidae). Aquatic Insects 19: 117-122.

Caldwell, B.A. 1999. Description of the adult male and larva of *Orthocladius (Orthocladius) vaillanti* (Diptera: Chironomidae). J. Kans. Ent. Soc. 71: 234-240.

Caldwell, B.A. 2000a. A new species of *Omisus* Townes from Georgia, USA (Diptera: Chironomidae). pp 59-67 in Hoffrichter, O. (ed.) Late 20th Century Research on Chironomidae: an Anthology from the 13th International Symposium on Chironomidae. Shaker Verlag, Aachen, Germany.

Caldwell, B.A. 2000b. First Nearctic record of *Neostempellina* Reiss, with description of a new species (Insecta, Diptera, Chironomidae). Spixiana 23: 163-166.

Caldwell, B.A., P.L. Hudson, D.R. Lenat & D.R. Smith. 1997. A revised annotated checklist of the Chironomidae (Insecta: Diptera) of the Southeastern United States. Trans. Am. ent. Soc. 123: 1-53.

Caldwell, B.A. & A.R. Soponis. 1982. *Hudsonimyia parrishi*, a new species of Tanypodinae (Diptera: Chironomidae) from Georgia. Fla. Ent. 65: 506-513.

Chernovskij, A.A. 1949. Opredelitel lichinok komarov semeistva Tendipedidae. Opred. po Faune SSSR 31: 1-189.

Coffman, W.P. & L.C. Ferrington, Jr. 1996. Chironomidae. Pp. 635-754 *in* Merritt, R.W. & K.W. Cummins (eds.). An introduction to the aquatic insects of North America. Third Edition. Kendall/Hunt Publishing Co., Dubuque, IA.

Coffman, W.P., L.C. Ferrington, Jr. & R.M. Seward. 1988. *Paraboreochlus stahli* sp. n., a new species of Podonominae (Diptera: Chironomidae) from the Nearctic. Aquatic Insects 10: 189-200.

Coffman, W.P. & S.S. Roback. 1984. *Lopescladius (Cordiella) hyporheicus*, a new subgenus and species (Diptera: Chironomidae: Orthocladiinae). Proc. Acad. Nat. Sci. Philad. 136: 130-144.

Colbo, M.H. 1996. Chironomidae from marine coastal environments near St. John's, Newfoundland, Canada. Hydrobiol. 318: 117-122.

Contreras-Lichtenberg, R. 1982. Ein Beitrag zur Kenntnis von *Goeldichironomus (Chironomus) carus* (Townes) 1945. Spixiana 5: 175-180.

Cranston, P.S. 1982. A key to the larvae of the British Orthocladiinae (Chironomidae). Scient. Publs Freshwat. biol. Ass. 45: 1-152.

Cranston, P.S. 1985. *Eretmoptera murphyi* Schaeffer (Diptera: Chironomidae), an apparently parthenogenetic antarctic midge. Br. Antarct. Surv. Bull. 66: 35-45.

Cranston, P.S. 1987. A non-biting midge (Diptera: Chironomidae) of horticultural significance. Bull. Ent. Res. 77: 661-667.

Cranston, P.S. 1999. Nearctic *Orthocladius* subgenus *Eudactylocladius* revised (Diptera: Chironomidae). J. Kansas Ent.Soc. 71: 272-295.

Cranston, P.S., M.E. Dillon, L.C.V. Pinder & F. Reiss. 1989. The adult males of the Chironominae (Diptera: Chironomidae) of the Holarctic region - Keys and diagnoses. Ent. scand. Suppl. 34: 353-502.

Cranston, P.S. & D.D. Judd. 1987. *Metriocnemus* (Diptera: Chironomidae) - an ecological survey and description of a new species. J. New York Ent. Soc. 95: 534-546.

Cranston, P.S. & R. Kitching. 1995. The Chironomidae of Austro-Oriental phytotelmata (plant-held waters): *Richea pandanafolia* Hook.f., pp. 225-231 *in* Cranston, P.S. (ed.). Chironomids - from Genes to Ecosystems. CSIRO Publications, East Melbourne, Australia.

Cranston, P.S. & U. Nolte. 1996. *Fissimentum*, a new genus of drought-tolerant Chironomini (Diptera: Chironomidae) from the Americas and Australia. Ent. News 107: 1-15.

Cranston, P.S. & D.R. Oliver. 1988a. Additions and corrections to the Nearctic Orthocladiinae (Diptera: Chironomidae). Can. Ent. 120: 425-462.

Cranston, P.S. & D.R. Oliver. 1988b. Aquatic xylophagous Orthocladiinae - systematics and ecology. Spixiana Suppl. 14:143-154.

Cranston, P.S., D.R. Oliver, & O.A. Sæther. 1983. The larvae of Orthocladiinae (Diptera: Chironomidae) of the Holarctic region. Keys and diagnoses. Ent. scand. Suppl. 19:149-291.

Cranston, P.S. & O.A. Sæther. 1982. A redefinition of *Acamptocladius* Brundin, 1956 (syn. *Phycoidella* Sæther, 1971, n. syn.) (Diptera: Chironomidae), with the description of *A. reissi* n. sp. Ent. scand. 13: 25-32.

Cranston, P.S. & O.A. Sæther. 1986. *Rheosmittia* (Diptera: Chironomidae): a generic validation and revision of the western Palaearctic species. J. nat. Hist. 20:31-51.

Curry, L.L. 1958. Larvae and pupae of the species of *Cryptochironomus* (Diptera) in Michigan. Limnol. Oceanogr. 3:427-442.

Darby, R.E. 1962. Midges associated with California rice fields, with special reference to their ecology (Diptera: Chironomidae). Hilgardia 32: 1-206.

Davis, J.R. 1992. Occurrence of *Fittkauimyia* (Diptera: Chironomidae: Tanypodinae) in Texas. Ent. News 103: 78-80.

de la Rosa, C.L. & A.J. Nastase. 1987. Larvae of *Metriocnemus* cf. *fuscipes*, *Limnophyes* sp., Pentaneurini (Diptera: Chironomidae) and

Culicoides (Diptera: Ceratopogonidae) from pitcher plants, *Sarracenia purpurea*. J. Kans. Ent. Soc. 60: 339-341.

Dendy, J.S. 1973. Predation on chironomid eggs and larvae by *Nanocladius alternantherae* Dendy and Sublette (Diptera: Chironomidae, Orthocladiinae). Ent. News 84: 91-95.

Dendy, J.S. & J.E. Sublette. 1959. The Chironomidae (=Tendipedidae: Diptera) of Alabama with descriptions of six new species. Ann. Ent. Soc. Am. 52: 506-519.

Donley, S., L.C. Ferrington, Jr. & D. Strayer. 1999. The habitat of *Paraboreochlus* larvae (Chironomidae: Podonominae). J. Kans. Ent. Soc. 71: 501-504.

Dosdall, L.M. & P.G. Mason. 1981. A chironomid (*Nanocladius (Plecopteracoluthus) branchicolus*: Diptera) phoretic on a stonefly (*Acroneuria lycorias*: Plecoptera) in Saskatchewan. Can. Ent. 113: 141-147.

Dosdall, L.M., P.G. Mason & D.M. Lehmkuhl. 1986. First records of phoretic Chironomidae (Diptera) associated with nymphs of *Pteronarcys dorsata* (Say) (Plecoptera: Pteronarcyiidae). Can. Ent. 118: 511-515.

Dosdall, L.M. & D.W. Parker. 1998. First report of a symphoretic association between *Nanocladius branchicolus* Sæther (Diptera: Chironomidae) and *Argia moesta* (Hagen) (Odonata: Coenagrionidae). Am. Midl. Nat. 139: 181-185.

Doughman, J.S. 1983. A guide to the larvae of the Nearctic Diamesinae (Diptera: Chironomidae). The genera *Boreoheptagyia*, *Protanypus*, *Diamesa* and *Pseudokiefferiella*. U.S. Geological Survey, Water-Resources Investigations Report 83-4006: 1-58.

Doughman, J.S. 1985a. Annotated keys to the genera of the tribe Diamesini (Diptera: Chironomidae), descriptions of the female and immatures of *Potthastia iberica* Tosio, and keys to the known species of *Potthastia*. Univ. Alsk. IWR (Inst. Water Resour.) Ser. IWR-107. 49 pp.

Doughman, J.S. 1985b. *Sympotthastia* Pagast (Diptera: Chironomidae), an update based on larvae from North Carolina, *S. diastena* (Sublette) comb. n., and other Nearctic species. Brimleyana 11: 39-53.

Dowling, C. & D. Murray. 1980. *Zalutschia humphriesae* sp. n., a new species of Orthocladiinae (Diptera, Chironomidae) from Ireland. Acta Univ. Carol. Biol. 1978: 49-58.

Eaton, L. 1994. A preliminary survey of benthic macroinvertebrates of Currituck Sound, North Carolina. J. Elisha Mitchell Sci. Soc. 110: 121-129.

Epler, J.H. 1986a. A novel new Neotropical *Nanocladius* (Diptera: Chironomidae), symphoretic on *Traverella* (Ephemeroptera: Leptophlebiidae). Fla. Ent. 69: 319-327.

Epler, J.H. 1986b. The larva of *Radotanypus submarginella* (Sublette) (Diptera, Chironomidae). Spixiana 9: 285-287.

Epler, J.H. 1987. Revision of the Nearctic *Dicrotendipes* Kieffer, 1913 (Diptera: Chironomidae). Evol. Monogr. 9: 102 pp + 37 plates.

Epler, J.H. 1988a. A reconsideration of the genus *Apedilum* Townes, 1945 (Diptera: Chironomidae: Chironominae). Spixiana Suppl. 14: 105-116.

Epler, J.H. 1988b. Biosystematics of the genus *Dicrotendipes* Kieffer, 1913 (Diptera: Chironomidae: Chironominae) of the world. Mem. Am. Ent. Soc. 36: 1-214.

Epler, J.H. 1992. Identification Manual for the Larval Chironomidae (Diptera) of Florida. FL Dept. Environ. Reg., Orlando, FL. 302 pp.

Epler, J.H. 1995. Identification Manual for the Larval Chironomidae (Diptera) of Florida. Revised edition. FL Dept. Environ. Protection, Tallahassee, FL. 317 pp.

Epler, J.H., J.P. Cuda & T.D. Center. 2000. Redescription of *Cricotopus lebetis* (Diptera: Chironomidae), a potential biocontrol agent of the aquatic weed hydrilla (Hydrocharitaceae). Fla. Ent. 83: 171-180.

Epler, J.H. & L.C. Ferrington, Jr. 1994. The immature stages of *Paratendipes basidens* Townes (Diptera: Chironomidae: Chironominae). J. Kans. Ent. Soc. 67: 311-317.

Epler, J.H., A.D. Harrison & L. Hare. 1999. *Acinoretracus*, a new Afrotropical genus for some species previously placed in *Dicrotendipes* (Diptera: Chironomidae: Chironominae). Tijd. voor Ent. 141: 209-220.

Epler, J.H. & W.J. Janetzky. 1999. A new species of *Monopelopia* (Diptera: Chironomidae) from phytotelmata in Jamaica, with preliminary ecological notes. J. Kans. Ent. Soc. 71: 216-225.

Fagnani, J.P. , & A.R. Soponis. 1988. The occurrence of setal tufts on larvae of *Orthocladius* (*Orthocladius*) *annectens* Sæther. Spixiana Suppl. 14: 139-142.

Ferrington, L.C., Jr. 1984. Evidence for the hyporheic zone as a microhabitat of *Krenosmittia* spp. larvae (Diptera: Chironomidae). J. Freshwater Ecol. 2: 353-358.

Ferrington, L.C., Jr. 1987. Microhabitat preferences of larvae of three Orthocladiinae species (Diptera: Chironomidae) in Big Springs, a sandbottom spring in the high plains of western Kansas. Ent. scand. Suppl. 29: 361-368.

Ferrington, L.C., Jr. 1992. Habitat and sediment preferences of *Axarus festivus* larvae. Neth. J. Aquat. Ecol. 26: 347-354.

Ferrington, L.C., Jr. 1995. Utilization of anterior headcapsule structures in locomotion by larvae of *Constempellina* sp. (Diptera: Chironomidae). Pp. 305-315 *in* Cranston, P.S. (ed.). Chironomids - from Genes to Ecosystems. CSIRO Publications, East Melbourne, Australia. 482 pp.

Ferrington, L.C., Jr. & O.A. Sæther. 1987. Male, female, pupa and biology of *Oliveridia hugginsi* n. sp. (Chironomidae: Diptera) from Kansas. J. Kans. Ent. Soc. 60: 451-461.

Fittkau, E.J. 1962. Die Tanypodinae (Diptera: Chironomidae). (Die Tribus Anatopyniini, Macropelopiini und Pentaneurini). Abh. Larval-syst. Insekten 6: 1-453.

Fiottkau, E.J. 1963. *Manoa*, eine neue Gattung der Chironomidae (Diptera) aus Zentralamazonien. Arch. Hydrobiol. 59: 373-390.

Fittkau, E.J. & J. Lehmann. 1970. Revision der Gattung *Microcricotopus* Thien. u. Harn. (Dipt., Chironomidae). Int. Rev. ges. Hydrobiol. 55: 391-402.

Fittkau, E.J. & D.A. Murray. 1985. *Radotanypus* a new genus of Tanypodinae from the Nearctic (Diptera, Chironomidae). Spixiana Suppl. 11: 209-213.

Fittkau, E.J., & D.A. Murray. 1986. The pupae of Tanypodinae (Diptera: Chironomidae) of the Holarctic region: Keys and Diagnoses. Ent. scand. Suppl. 28: 31-113.

Fittkau, E.J. & D.A. Murray. 1988. *Bethbilbeckia floridensis*: a new genus and species of Macropelopiini from the South Eastern Nearctic. Spixiana Suppl. 14: 253-259.

Fittkau, E.J., F. Reiss & O. Hoffrichter. 1976. A bibliography of the Chironomidae. Gunneria 26: 1-177.

Fittkau, E.J. & S.S. Roback. 1983. The larvae of Tanypodinae (Diptera: Chironomidae) of the Holarctic region: Keys and diagnoses. Ent. scand. Suppl. 19:33-110.

Giberson, D.J., A.J. MacInnes & M. Blanchard. 1996. Seasonal frequency and positioning of parasitic midges (Chironomidae) on *Pteronarcys biloba* nymphs (Plecoptera: Pteronarcyidae). J. N. Am. Benth. Soc. 15: 529-536.

Gonser, T. & M. Spies. 1997. Southern Hemisphere *Symbiocladius* (Diptera, Chironomidae) and their mayfly hosts (Ephemeroptera, Leptophlebiidae). Pp. 455-466 *in* Landolt, P. & M. Sartori (eds.). Ephemeroptera & Plecoptera: Biology-Ecology-Systematics. MTL, Fribourg.

Gordon, M.J., B.K. Swan & C.G. Paterson. 1978. *Baeoctenus bicolor* (Diptera: Chironomidae) parasitic in unionid bivalve molluscs, and notes on other chironomid-bivalve associations. J. Fish. Res. Bd. Can. 35: 154-157.

Gotceitas, V. & R.J. MacKay. 1980. The phoretic association of *Nanocladius (Nanocladius) rectinervis* (Kieffer) (Diptera: Chironomidae) on *Nigronia serricornis* Say (Megaloptera: Corydalidae). Can. J. Zool. 58: 2260-2263.

Gouin, F. 1936. Métamorphosis de quelques Chironomides d”Alsace et de Lorraine avec la description de trois espèces nouvelles par

M. Goetghebuer. Rev. Fr. Ent. 3: 151-173.

Grodhaus, G. 1976. Two species of *Phaenopsectra* with drought-resistant larvae (Diptera: Chiro nomidae). J. Kans. Ent. Soc. 49: 405-418.

Grodhaus, G. 1987a. *Endochironomus* Kieffer, *Tribelos* Townes, *Synendotendipes*, n. gen., and *Endotribelos*, n. gen. (Diptera: Chironomidae) of the Nearctic region. J. Kansas Ent. Soc. 60:167-247.

Grodhaus, G. 1987b. *Phaenopsectra mortensoni* n. sp. and its relationship to other Chironomidae (Diptera) of temporary pools. Ent. scand. Suppl. 29:137-145.

Halvorsen, G.A. 1982. *Saetheriella amplicristata* gen. n., sp. n., a new Orthocladiinae (Diptera: Chironomidae) from Tennessee. Aquatic Insects 4: 131-136.

Halvorsen, G.A. & O.A. Sæther. 1987. Redefinition and revision of the genus *Tokunagaia* Sæther, 1973 (Diptera: Chironomidae). Ent. scand. Suppl. 29: 173-188.

Hamilton, A.L. 1965. An analysis of a freshwater benthic community with special reference to the Chironomidae. Ph.D. thesis, Univ. of British Columbia. 94 + 216 pp.

Hansen, D.C. & E.F. Cook. 1976. The systematics and morphology of the Nearctic species of *Diamesa* Meigen, 1835 (Diptera: Chironomidae). Mem. Am. Ent. Soc. 30:1-203.

Hashimoto, H. 1976. Non-biting midges of marine habitats (Diptera: Chironomidae), pp. 377-414 *in* Cheng, L. Marine Insects. North-Holland Pub.Co., Amsterdam. 581 pp.

Hauber, U.A. 1944. Life histories and ecology of Iowa midges (Tendipedidae). I. The genus *Tanytarsus*. Proc. Iowa Acad. Sci. 51:451-461.

Hestenes, T.C. & O.A. Sæther. 2000. Three new Nearctic *Thienemanniella* Kieffer species with a review of the Nearctic species, pp. 103-127 *in* Hoffrichter, O. (ed.) Late 20th Century Research on Chironomidae: an Anthology from the 13th International Symposium on Chironomidae. Shaker Verlag, Aachen, Germany.

Heyn, M.W. 1992. A review of the systematic position of the North American species of the genus *Glyptotendipes*. Neth. J. Aquat. Ecol. 26: 129-137.

Hirvenoja, M. 1973. Revision der Gattung *Cricotopus* van der Wulp und ihrer Verwandten (Diptera, Chironomidae). Ann. Zool. Fennici 10:1-363.

Hirvenoja, M. & E. Hirvenoja. 1988. *Corynoneura brundini* spec. nov. Ein Beitrag zur Systematik der Gattung *Corynoneura*. Spixiana Suppl. 14:213-238.

Hoffrichter, O. & F. Reiss. 1981. Supplement 1 to a Bibliography of the Chironomidae. Gunneria 37: 1-68.

Hudson, P.L., D.R. Lenat, B.A. Caldwell & D. Smith. 1990. Chironomidae of the Southeastern United States: A checklist of species and notes on biology, distribution, and habitat. U.S. Fish Wildl. Ser., Fish. Wildl. Res. 7:1-46.

International Commission on Zoological Nomenclature. 1999. International Code of Zoological Nomenclature. Fourth edition adopted by the International Union of Biological Sciences. International Trust for Zoological Nomenclature, London. 306 pp.

Jackson, G.A. 1977. Nearctic and Palaearctic *Paracladopelma* Harnisch and *Saetheria* n. gen. (Diptera: Chironomidae). J. Fish. Res. Bd. Canada 34:1321-1359.

Jacobsen, R.E. 1992. Descriptions of the larvae of four Nearctic species of *Epoicocladius* (Diptera: Chironomidae) with a redescription of *Epoicocladius ephemerae* (Kieffer). Neth. J. Aquat. Ecol. 26: 145-155.

Jacobsen, R.E. 1998. Taxonomy of the genus *Platysmittia* (Diptera: Chironomidae), with comments on its ecology and phylogenetic position. Aquatic Insects 20 (4): 239-256.

Jacobsen, R.E. & S.A. Perry. 2000. A review of *Beardius* Reiss & Sublette, with description of a new species from Everglades National Park, Florida. Spixiana 23: 129-144.

Jacobsen, R.E. & S.A. Perry (in press). A new species of *Manoa* (Diptera: Chironomidae) from Everglades National Park. J. N. Am. Benth. Soc.

Johannsen, O.A. 1937a. Aquatic Diptera. Part III.

Chironomidae: Subfamilies Tanypodinae, Diamesinae, and Orthocladiinae. Mem. Cornell Univ. Agric. Exp. Stn. 205: 3-84 + plates I-XVIII.

Johannsen, O.A. 1937b. Aquatic Diptera. Part IV. Chironomidae: Subfamily Chironominae. Mem. Cornell Univ. Agric. Exp. Stn. 210: 3-56 + plates I-IX.

Kyerematen, R.A.K., O.A. Sæther & T. Andersen. 2000. A revision of the *Rheotanytarsus pellucidus* group (Diptera: Chironomidae). pp 147-170 in Hoffrichter, O. (ed.) Late 20th Century Research on Chironomidae: an Anthology from the 13th International Symposium on Chironomidae. Shaker Verlag, Aachen, Germany.

Kullberg, A. 1988. The case, mouthparts, silk and silk formation of *Rheotanytarsus muscicola* Kieffer (Chironomidae: Tanytarsini). Aquatic Insects 10: 249-255.

Langton, P.H. 1980. The genus *Psectrocladius* Kieffer (Diptera: Chironomidae) in Britain. Ent. Gaz. 31: 75-88.

Langton, P.H. 1985. Review of type specimens of the *limbatellus* group, with a provisional key to known females of *Psectrocladius* Kieffer (Diptera: Chironomidae). Ent. scand. 15: 477-485.

Langton, P.H. 1991. A key to pupal exuviae of West Palaearctic Chironomidae. P.H. Langton, Huntington, Cambridgeshire, England. 386 pp.

Langton, P.H. & P.S. Cranston. 1991. Pupae in nomenclature and identification: West Palaearctic *Orthocladius* s.str. (Diptera: Chironomidae) revised. Sys. Ent. 16: 239-252.

Langton, P.H., P.S. Cranston & P. Armitage. 1988. The parthenogenetic midge of water supply systems, *Paratanytarsus grimmii* (Schneider) (Diptera: Chironomidae). Bull. Ent. Res. 78: 317-328.

Langton, P.H. & Z. Moubayed. 1990. Redescription of the pupal exuviae of *Potthastia montium* Edwards (=*iberica* Serra-Tosio syn. nov.) (Diptera; Chironomidae). Br. J. Nat. Hist. 3: 135-137.

Lehmann, J. 1970a. Revision der europäischen Arten (Imagines ♂♂) der Gattung *Parachironomus* Lenz (Diptera, Chironomidae). Hydrobiol. 33: 129-158.

Lehmann, J. 1970b. Revision der europäischen Arten (Imagines ♂♂ und Puppen ♂♂) der Gattung *Rheotanytarsus* Bause (Diptera, Chironomidae). Zool. Anz. 185: 344-378.

Lehmann, J. 1972. Revision der europäischen Arten (Puppen ♂♂ und Imagines ♂♂) der Gattung *Eukiefferiella* Thienemann. Beitr. Ent. 22: 347-405.

Lehman, J. 1973. Systematische und phylogenetische Studie über die Gattungen *Thienemanniola* Kieffer und *Corynocera* Zetterstedt (Diptera, Chironomidae). Hydrobiologia 43: 381-414.

Lenat, D.R. 1993a. Using mentum deformities of *Chironomus* larvae to evaluate the effects of toxicity and organic loading in streams. J.N. Am. Benth. Soc. 12: 265-269.

Lenat, D.R. 1993b. A biotic index for the southeastern United States: derivation and list of tolerance values, with criteria for assigning water-quality ratings. J. N. Am. Benth. Soc. 12: 279-290.

Lenat, D.R. & D.R. Folley. 1983. Lotic chironomids of the North Carolina mountains. Mem. Am. Ent. Soc. 34: 145-164.

Lenz, F. 1921. Chironomidenpuppen und -larven. Bestimmungstabellen. Dt. ent. Zt. 3: 148-162.

LeSage, L. & A.D. Harrison. 1980. Taxonomy of *Cricotopus* species (Diptera: Chironomidae) from Salem Creek, Ontario. Proc. Ent. Soc. Ont. 111:57-114.

Lindeberg, B. & T. Wiederholm. 1979. Notes on the taxonomy of European species of *Chironomus* (Diptera: Chironomidae). Ent. scand. Suppl. 10:99-116.

Magy, H.I., G. Grodhaus, J.D. Gates & J.Montez. 1970. Pondweed - a substrate for chironomids, especially *Paralauterborniella subcincta*. Calif. Mosq. Control. Assoc. 37: 115-119.

Makarchenko, E.A. 1986. *Diamesa subletti* sp. n., a new species of chironomid (Diptera, Chironomidae) from Canada. Aquatic Insects 8: 155-157.

Makarchenko, E.A. 1995. New species of *Lappodiamesa* Serra-Tosio and *Arctodiamesa* Makartshenko (Diptera, Chironomidae) from the east Palaearctic. Aquatic Insects 17: 83-93.

Makarchenko, E.A & M.A. Makarchenko. 2000. Revision of *Pagastia* Oliver, 1959 (Diptera, Chironomidae) of the Holartcic region. pp 171-176 in Hoffrichter, O. (ed.) Late 20th Century Research on Chironomidae: an Anthology from the 13th International Symposium on Chironomidae. Shaker Verlag, Aachen, Germany.

Malloch, J.R. 1915. The Chironomidae, or midges, of Illinois, with particular reference to the species occurring in the Illinois River. Bull. Illinois St. Lab. Nat. Hist. 10: 275-543.

Manuel, K.L. 1976. Description of immature stages of *Glyptotendipes (Phytotendipes) meridionalis* Dendy and Sublette (Diptera: Chironomidae). Unpublished M.S. thesis, Auburn Univ., Auburn, AL. 37 pp.

Maschwitz, D.E. & E.F. Cook. 2000. Revision of the Nearctic species of the genus *Polypedilum* Kieffer (Diptera: Chironomidae) in the subgenera *P. (Polypedilum)* Kieffer and *P. (Uresipedilum)* Oyewo and Sæther. Ohio Biological Survey Bulletin New Series Volume 12 Number 3. vii + 135 pp.

Mason, P.G. 1985a. The larvae and pupae of *Stictochironomus marmoreus* and *S. quagga* (Diptera: Chironomidae). Can. Ent. 117: 43-48.

Mason, P.G. 1985b. Four new species of the *Cryptochironomus fulvus* (Johannsen) species complex (Diptera: Chironomidae). Ent. scand. 16: 399-413.

Mason, P.G. 1985c. The larva of *Tvetenia vitracies* (Sæther) (Diptera: Chironomidae). Proc. Ent. Soc. Wash. 87: 418-420.

Mason, W.T., Jr. 1973. An introduction to the identification of chironomid larvae (revised edition). Analytical Quality Control Lab., National Environmental Research Center, U.S.E.P.A., Cincinnati, OH, 90 pp.

Morley, R.L. & R.A. Ring. 1972a. The intertidal Chironomidae (Diptera) of British Columbia. I. Keys to their life stages. Can. Ent. 104: 1093-1098.

Morley, R.L. & R.A. Ring. 1972b. The intertidal Chironomidae (Diptera) of British Columbia. II. Life history and population dynamics. Can. Ent. 104: 1099-1121.

Mozley, S.C. 1980. Biological indicators of water quality in North Carolina. I. Guide to identification of orthocladiine Chironomidae (Diptera). Unpublished report, North Carolina Department of Natural Resources and Community Development, Division of Environmental Management. (with minor revisions added November 1981.)

Murray, D.A. & E.J. Fittkau. 1985. *Hayesomyia*, a new genus of Tanypodinae from the Holarctic (Diptera: Chironomidae). Spixiana Suppl. 11: 195-207.

Niitsuma, H. 1985. A new species of the genus *Nilothauma* (Diptera: Chironomidae) from Japan. Kontyu 53: 229-232.

Niitsuma, H. & E.A. Makarchenko. 1997. The first record of *Compteromesa* Sæther (Diptera, Chironomidae) from the Palaearctic region, with description of a new species. Jap. J. Ent. 65: 612-620.

Nolte, U. 1989. Observations on Neotropical rainpools (Bolivia) with emphasis on Chironomidae (Diptera). Stud. Neotrop. Fauna and Environ. 24: 105-120.

Nolte, U. 1993. Egg masses of Chironomidae (Diptera). A review, including new observations and a preliminary key. Ent. scand. Suppl. 43: 1-75.

Nolte, U. 1995. From egg to imago in less than seven days: *Apedilum elachistus* (Chironomidae). Pp. 177-184 *in* Cranston, P.S. (ed.). Chironomids - from Genes to Ecosystems. CSIRO Publications, East Melbourne, Australia.

Oliver, D.R. 1959. Some Diamesini (Chironomidae) from the Nearctic and Palaearctic. Ent. Tidskr. 90: 48-64.

Oliver, D.R. 1971. Description of *Einfeldia synchrona* n. sp. (Diptera: Chironomidae). Can. Ent. 103: 1591-1595.

Oliver, D.R. 1976. Chironomidae (Diptera) of

Char Lake, Cornwallis Island, N.W.T., with descriptions of two new species. Can. Ent. 108: 1053-1064.

Oliver, D.R. 1977. *Bicinctus*-group of the genus *Cricotopus* van der Wulp (Diptera: Chironomidae) in the Nearctic with a description of a new species. J. Fish. Res. Bd. Can. 34: 98-104.

Oliver, D.R. 1981a. Chironomidae. Pp 423-458 *in* McAlpine, J.F., et. al. (coordinators): Manual of Nearctic Diptera, Vol. 1. Agric. Can. Monogr. 27, 674 pp.

Oliver, D.R. 1981b. Redescription and systematic placement of *Oreadomyia albertae* Kevan and Cutten-Al-Khan (Diptera: Chironomidae). Quaest. ent. 17: 121-128.

Oliver, D.R. 1981c. Description of *Euryhapsis* new genus including three new species (Diptera; Chironomidae). Can. Ent. 113: 711-722.

Oliver, D.R. 1982. *Xylotopus*, a new genus of Orthocladiinae (Diptera: Chironomidae). Can. Ent. 114:167-168.

Oliver, D.R. 1983. The larvae of Diamesinae (Diptera: Chironomidae) of the Holarctic region. Keys and diagnoses. Ent. scand. Suppl. 19:115-138.

Oliver, D.R. 1984. Description of a new species of *Cricotopus* van der Wulp (Diptera: Chironomidae) associated with *Myriophyllum spicatum*. Can. Ent. 116: 1287-1292.

Oliver, D.R. 1985. Review of *Xylotopus* Oliver and description of *Irisobrillia* n. gen. (Diptera: Chironomidae). Can. Ent. 117: 1093-1110.

Oliver, D.R. & R.W. Bode. 1985. Description of the larva and pupa of *Cardiocladius albiplumus* Sæther (Diptera: Chironomidae). Can. Ent. 117:803-809.

Oliver, D.R. & M.E. Dillon. 1988. Review of *Cricotopus* (Diptera: Chironomidae) of the Nearctic Arctic zone with description of two new species. Can. Ent. 120: 463-496.

Oliver, D.R. & M.E. Dillon. 1994a. Systematics of some species of *Micropsectra* (Diptera: Chironomidae) living in low-order streams in southern Ontario, Canada. Can. Ent. 126: 199-217.

Oliver, D.R. & M.E. Dillon. 1994b. Corrections and additions to "A catalog of Nearctic Chironomidae". Proc. Ent. Soc. Wash. 96: 8-10.

Oliver, D.R., M.E. Dillon & P.S. Cranston. 1990. A catalog of Nearctic Chironomidae. Research Branch Agriculture Can. Pub. 1857/ B. 89 pp.

Oliver, D.R., D. McClymont & M.E. Roussel. 1978. A key to some larvae of Chironomidae (Diptera) from the Mackenzie and Porcupine River watersheds. Fish. Mar. Serv. Tch. Report No. 791: 1-73.

Oliver, D.R. & M.E. Roussel. 1982. The larvae of *Pagastia* Oliver (Diptera: Chironomidae) with descriptions of three Nearctic species. Can. Ent. 114:849-854.

Oliver, D.R. & M.E. Roussel. 1983a. Redescription of *Brillia* Kieffer (Diptera: Chironomidae) with descriptions of Nearctic species. Can. Ent. 115:257-279.

Oliver, D.R & M.E. Roussel. 1983b. The genera of larval midges of Canada (Diptera: Chironomidae). Part 11. The insects and arachnids of Canada. Biosys. Res. Inst., Ottawa. 263 pp.

Oliver, D.R. & B.J. Sinclair. 1989. Madicolous Chironomidae (Diptera), with a review of *Metriocnemus hygropetricus* Kieffer. Acta Biol. Debricina Oecol. Hung. 2: 285-293.

Oyewo, E.A. & O.A. Sæther. 1998. Revision of Afrotropical *Polypedilum* Kieffer subgen. *Uresipedilum* Sasa et Kikuchi, 1995 (Diptera: Chironomidae), with a review of the subgenus. Annls. Limnol. 34: 315-362.

Pankratova, V. Ya. 1970. Lichinki i kukolki komarov podsemeistva Orthocladiinae fauny SSSR (Diptera, Chironomidae = Tendipedidae). Opred. po. Faune SSSR 31: 1-344.

Pennuto, C.M. 1997. Incidence of chironomid phoretics on hellgrammites in streams of southern Maine. Northeastern Naturalist 4: 285-292.

Pennuto, C.M. 1998. Seasonal position patterns and fate of a commensal chironomid on fishfly host. J. Freshw. Ecol. 13: 323-332.

Picado, C. 1913. Les Broméliacées épiphytes considerées comme milieu biologique. Bull.

Sci. Fr. Belg. (Ser. 7) 47:215-360 + 24 plates.

Parker, C.R. & J.R. Voshell, Jr. 1979. *Cardiocladius* (Diptera: Chironomidae) larvae ectoparasitic on pupae of Hydropsychidae (Trichoptera). Environ. Ent. 8: 808-809.

Pescador, M.L., D.R. Lenat & M.L. Hubbard. 1999. Mayflies (Ephemeroptera) of North Carolina and South Carolina: an update. Fla. Ent. 82: 316-332.

Pinder, L.C.V. 1976. Morphology of the adult and juvenile stages of *Microtendipes rydalensis* (Edw.) comb. nov. (Diptera: Chironomidae). Hydrobiologia 48: 179-184.

Pinder, L.C.V. 1978. A key to the adult males of the British Chironomidae (Diptera). Scient. Publs Freshwat. biol. Ass. 37:1-169, 189 figs.

Pinder, L.C.V. 1982. *Virgatanytarsus* new genus for the "*triangularis*" group of the genus *Tanytarsus* van der Wulp. Spixiana 5:31-34.

Pinder, L.C.V., & F. Reiss. 1983. The larvae of Chironominae (Diptera: Chironomidae) of the Holarctic region. Keys and diagnoses. Ent. scand. Suppl. 19:293-435.

Pinder, L.C.V. & F. Reiss. 1986. The pupae of Chironominae (Diptera: Chironomidae) of the Holarctic region. Keys and diagnoses. Ent. scand. Suppl. 28:299-456.

Reiss, F. 1969. Die neue, europäisch verbreitete Chironomidengattung *Parapsectra* mit einem brachypteren Artvertreter aus Mooren (Diptera). Arch. Hydrobiol. 66: 192-211.

Reiss, F. 1972. Die Tanytarsini (Chironomidae, Diptera) Südchiles und Westpatagoniens. Mit Hinweisen auf die Tanytarsini-Fauna der Neotropis. Stud. Neotrop. Fauna 7: 49-94.

Reiss, F. 1974. Die in stehenden Gewässern der Neotropis verbreitete Chironomidengattung *Goeldichironomus* Fittkau (Diptera, Insecta). Stud. neotrop. Fauna 9:95-122.

Reiss, F. 1982. *Hyporhygma* n. gen. und *Stelechomyia* n. gen. aus Nordamerika (Diptera, Chironomidae). Spixiana 5:289-302.

Reiss, F. 1984. *Neostempellina thienemanni* n. gen., n. sp., eine europäische Chironomide mit gehäusetragenden Larven (Diptera, Insecta). Spixiana 7: 203-210.

Reiss, F. 1985. Die panamerikanisch verbreitete Tanytarsini-Gattung *Skutzia* gen. nov. (Diptera, Chironomidae). Spixiana Suppl. 11: 173-178.

Reiss, F. 1988a. *Irmakia*, ein neues Subgenus von *Demicryptochironomus* Lenz, 1941, mit der Beschreibung von vier neuen Arten. Spixiana 11: 1-12.

Reiss, F. 1988b. Die Gattung *Kloosia* Kruseman, 1933 mit der Neubeschreibung zweier Arten. Spixiana Suppl. 14:35-44.

Reiss, F. 1990. Revision der Gattung *Zavreliella* Kieffer, 1920. (Diptera, Chironomidae). Spixiana 13: 83-115.

Reiss, F. & E.J. Fittkau. 1971. Taxonomie und Ökologie europäische verbreiteter *Tanytarsus*-Arten (Chironomidae, Diptera). Arch. Hydrobiol. Suppl. 40: 75-200.

Reiss, F. & L. Säwedal. 1981. Keys to males and pupae of the Palaearctic (excl. Japan) *Paratanytarsus* Thienemann & Bause, 1913, n. comb., with descriptions of three new species (Diptera: Chironomidae). Ent. scand. Suppl. 15: 73-104.

Reiss, F. & J.E. Sublette. 1985. *Beardius* new genus with notes on additional Pan-American taxa. (Diptera: Chironomidae). Spixiana Suppl. 11:179-193.

Rempel, J.G. 1937. Notes on the genus *Chasmatonotus* with descriptions of three new species (Diptera, Chironomidae). Can. Ent. 69: 250-255.

Roback, S.S. 1953. Savannah River tendipedid larvae (Diptera: Tendipedidae (= Chironomidae)). Proc. Acad. Nat. Sci. Philad. 105:91-132.

Roback, S.S. 1957. The immature tendipedids of the Philadelphia area (Diptera: Tendipedidae). Monogr. Acad. nat. Sci. Philad. 9:1-152.

Roback, S.S. 1963. The genus *Xenochironomus* (Diptera: Tendipedidae) Kieffer, taxonomy and immature stages. Trans. Am. ent. Soc. 88: 235-245.

Roback, S.S. 1966a. A new *Procladius* species with description of the immature stages. Ent. News 77: 177-184.

Roback, S.S. 1966b. A new record of *Symbiocladius* *equitans* (Claassen) (Diptera: Tendipedidae, Orthocladiinae). Ent. News 77: 254.

Roback, S.S. 1966c. The Catherwood Foundation Peruvian-Amazon Expedition. XII. Diptera, with some observations on the salivary glands of the Tendipedidae. Monogr. Acad. Nat. Sci. Philad. 14: 305-375.

Roback, S.S. 1969. The immature stages of the genus *Tanypus* Meigen (Diptera: Chironomidae: Tanypodinae). Trans. Am. Ent. Soc. 94: 407-428.

Roback, S.S. 1971. The adults of the subfamily Tanypodinae (= Pelopiinae) in North America (Diptera: Chironomidae). Monogr. Acad. Nat. Sci. Philad. 17:1-410.

Roback, S.S. 1972. The immature stages of *Paramerina smithae* (Sublette) (Diptera: Chironomidae: Tanypodinae). Proc. Acad. Nat. Sci. Philad. 124: 11-15.

Roback, S.S. 1974a. The immature stages of the genus *Coelotanypus* (Chironomidae: Tanypodinae: Coelotanypodinae) in North America. Proc. Acad. Nat. Sci. Philad. 126: 9-19.

Roback, S.S. 1974b. Insects (Arthropoda: Insecta). Pp 313-376 *in* Hart, C.W. & S.L.H. Fuller (eds.): Pollution Ecology of Freshwater Invertebrates. Academic Press, New York.

Roback, S.S. 1975. A new subgenus and species of the genus *Tanytarsus* Chironomidae: Chironominae: Tanytarsini). Proc. Acad. Nat. Sci. Philad. 127:71-80.

Roback, S.S. 1976. The immature chironomids of the eastern United States I. Introduction and Tanypodinae-Coelotanypodinae. Proc. Acad. Nat. Sci. Philad. 127:147-201.

Roback, S.S. 1977. The immature chironomids of the eastern United States II. Tanypodinae - Tanypodini. Proc. Acad. Nat. Sci. Philad. 128:55-87.

Roback, S.S. 1978a. The immature chironomids of the eastern United States III. Tanypodinae-Anatopyniini, Macropelopiini, and Natarsiini. Proc. Acad. Nat. Sci. Philad. 129:151-202.

Roback, S.S. 1978b. New name for *Brundinia* Roback nec *Brundinia* Tottenham. Ent. News 89: 141.

Roback, S.S. 1979a. *Hudsonimyia karelena*, a new genus and species of Tanypodinae, Pentaneurini. Proc. Acad. Nat. Sci. Philad. 131: 1-8.

Roback, S.S. 1979b. New record and hosts for genus nr. *Phycoidella* Sæther (Diptera: Chironomidae: Orthocladiinae). Ent. News 90: 239-240.

Roback, S.S. 1980. The immature chironomids of the eastern United States IV. Tanypodinae-Procladiini. Proc. Acad. Nat. Sci. Philad. 132:1-63.

Roback, S.S. 1981. The immature chironomids of the eastern United States V. Pentaneurini-*Thienemannimyia* group. Proc. Acad. Nat. Sci. Philad. 133:73-128.

Roback, S.S. 1982a. Identity of *Ablabesmyia* sp., Roback, Bereza and Vidrine (1980) (Diptera: Chironomidae). Ent. News 93:13-15.

Roback, S.S. 1982b. The Tanypodinae (Diptera: Chironomidae) of Australia II. Proc. Acad. Nat. Sci. Philad. 134: 80-112.

Roback, S.S. 1983. *Krenopelopia hudsoni*: a new species from the eastern United States (Diptera: Chironomidae: Tanypodinae). Proc. Acad. Nat. Sci. Philad. 135:254-260.

Roback, S.S. 1984. Tanypodinae (Diptera: Chironomidae) from Afognak and Kodiak Islands, Alaska. Proc. Acad. Nat. Sci. Philad. 136: 12-23.

Roback, S.S. 1985. The immature chironomids of the eastern United States VI. Pentaneurini-Genus *Ablabesmyia*. Proc. Acad. Nat. Sci. Philad. 137:153-212.

Roback, S.S. 1986a. The immature chironomids of the eastern United States VII. Pentaneurini-Genus *Monopelopia*, with redescription of the male adults and description of some Neotropical material. Proc. Acad. Nat. Sci. Philad. 138:350-365.

Roback, S.S. 1986b. The immature chironomids of the eastern United States VIII. Pentaneurini-Genus *Nilotanypus*, with the description of a new species from Kansas. Proc. Acad. Nat. Sci. Philad. 138:443-465.

Roback, S.S. 1986c. *Reomyia* a new genus of Tanypodinae-Pentaneurini (Diptera, Chironomidae). Spixiana 9: 283-284.

Roback, S.S. 1987a. The immature chironomids of the eastern United States. IX. Pentaneurini - Genus *Labrundinia* with the description of some Neotropical material. Proc. Acad. Nat. Sci. Philad. 139: 159-209.

Roback, S.S. 1966d. The immature stages of *Stictochironomus annulicrus* (Townes) (Diptera, Tendipedidae). Ent. News. 77: 169-173.

Roback, S.S. 1987b. The immature stages and female adult of *Alotanypus aris* Roback with a redescription of the male adult (Diptera: Chironomidae: Macropelopiini). Not. Nat. 466: 1-8.

Roback, S.S. 1987c. The larval stage of *Monopelopia tillandsia* Beck and Beck (Diptera: Chironomidae: Tanypodinae). Not. Nat. 467: 1-3.

Roback, S.S. 1989. The larval development of *Djalmabatista pulcher* (Joh.) (Diptera: Chironomidae: Tanypodinae). Proc. Acad. Nat. Sci. Philad. 141: 73-74.

Roback, S.S., D.J. Bereza & M.F. Vidrine. 1980. Description of an *Ablabesmyia* [Diptera: Chironomidae: Tanypodinae] symbiont of unionid fresh-water mussels [Mollusca: Bivalvia: Unionacea], with notes on its biology and zoogeography. Trans. Am. Ent. Soc. 105: 577-619.

Roback, S.S. & W.P. Coffman. 1977. New records of probable *Djalmabatista* species from eastern North America and Venezuela (Chironomidae: Tanypodinae). Proc. Acad. Nat. Sci. Philad. 128: 49-54.

Roback, S.S. & L.C. Ferrington, Jr. 1983. The immature stages of *Thienemannimyia barberi* (Coquillett) (Diptera: Chironomidae: Tanypodinae). Freshwat. Invertebr. Biol. 2: 107-111.

Roback, S.S. & R.P. Rutter. 1988. *Denopelopia atria*, a new genus and species of Pentaneurini (Diptera: Chironomidae: Tanypodinae) from Florida. Spixiana Suppl. 14:117-127.

Roback, S.S. & K.J. Tennessen. 1978. The immature stages of *Djalmabatista pulcher* [= *Procladius (Calotanypus) pulcher* (Joh.)]. Proc. Acad. Nat. Sci. Philad. 130: 11-20.

Rosenberg, D.M., A.P. Wiens & O.A. Sæther. 1977. Responses to crude oil contamination by *Cricotopus (Cricotopus) bicinctus* and *C. (C.) mackenziensis* (Diptera: Chironomidae) in the Fort Simpson area, Northwest Territories. J. Fish. Res. Bd. Can. 34: 254-261.

Rossaro, B. 1979. Description of the larva of *Paratrichocladius rufiventris* (Diptera: Chironomidae). Not. Ent. 59: 75-78.

Rossaro, B. 1984. *Stilocladius* Rossaro, 1979 reconsidered, with descriptions of the female and larva of *S. montanus* Rossaro (Diptera: Chironomidae, Orthocladiinae). Ent. scand. 15: 185-191.

Rossaro, B. 1985. Revision of the genus *Polypedilum* Kieffer, 1912. I. Key to adults, pupae and larvae of the species known to occur in Italy (Diptera, Chironomidae). Mem. Soc. Ent. Ital. 62/63: 3-23.

Rossaro, B. 1990. Revision of the genus *Paratrichocladius* Santos-Abreu. 2nd Note: Description of 4 new species (Diptera Chironomidae Orthocladiinae). Boll. Soc. Ent. Ital., Gen., 122: 58-66.

Ryser, H.M., W. Wülker & A. Scholl. Revision der Gattung *Chironomus* Meigen (Diptera). X. *Lobochironomus* n. subg. (*C. montuosus* n. sp., *C. storai* Goetgh., *C. mendax* Storå). Rev. Suisse Zool. 92: 385-404.

Sæther, O.A. 1969. Some Nearctic Podonominae, Diamesinae, and Orthocladiinae (Diptera: Chironomidae). Bull. Fish. Res. Bd. Can. 170: 1-154.

Sæther, O.A. 1971. Four new and unusual Chironomidae (Diptera). Can Ent. 103: 1799-1827.

Sæther, O.A. 1973a. Four species of *Bryophaenocladius* Thien., with notes on other Orthocladiinae (Diptera: Chironomidae). Can. Ent. 105: 51-60.

Sæther, O.A. 1973b. Taxonomy and ecology of three new species of *Monodiamesa* Kieffer, with keys to Nearctic and Palaearctic species of the genus (Diptera: Chironomidae). J. Fish. Res. Bd. Can. 30: 665-679.

Sæther, O.A. 1975a. Nearctic and Palaearctic *Heterotrissocladius* (Diptera: Chironomidae).

Bull. Fish. Res. Bd. Can. 193: 1-67.

Sæther, O.A. 1975b. Two new species of *Protanypus* Kieffer, with keys to Nearctic and Palaearctic species of the genus (Diptera: Chironomidae). J. Fish. Res. Bd. Can. 32: 367-388.

Sæther, O.A. 1975c. Two new species of *Heterotanytarsus* Spärck, with keys to Nearctic and Palaearctic males and pupae of the genus (Diptera: Chironomidae). J. Fish. Res. Bd. Can. 32: 259-270.

Sæther, O.A. 1975d. Twelve new species of *Limnophyes* Eaton, with keys to Nearctic males of the genus (Diptera: Chironomidae). Can. Ent. 107: 1029-1056.

Sæther, O.A. 1976. Revision of *Hydrobaenus*, *Trissocladius*, *Zalutschia*, *Paratrissocladius*, and some related genera. Bull. Fish. Res. Bd. Can. 195:1-287.

Sæther, O.A. 1977a. Taxonomic studies on Chironomidae: *Nanocladius*, *Pseudochironomus*, and the *Harnischia* complex. Bull. Fish. Res. Bd. Can. 196:1-143.

Sæther, O.A. 1977b. *Habrobaenus hudsoni* n. gen., n. sp. and the immatures of *Baeoctenus bicolor* Sæther (Diptera: Chironomidae). J. Fish. Res. Bd. Can. 34: 2354-2361.

Sæther, O.A. 1980a. Glossary of chironomid morphology terminology (Diptera: Chironomidae). Ent. scand. Suppl. 14:1-51.

Sæther, O.A. 1980b. The females and immatures of *Paracricotopus* Thienemann and Harnisch, 1932, with the description of a new species. Aquatic Insects 2: 129-145.

Sæther, O.A. 1980c. New name for *Oliveria* Sæther, 1976 (Diptera: Chironomidae) nec *Oliveria* Sutherland, 1965 († Cnidaria: Anthozoa), with a first record for the European continent. Ent. scand. 11: 399-400.

Sæther, O.A. 1981a. *Doncricotopus bicaudatus* n. gen., n. sp. (Diptera: Chironomidae, Orthocladiinae) from the Northwest Territories, Canada. Ent. scand. 12:223-229.

Sæther, O.A. 1981b. Orthocladiinae (Chironomidae: Diptera) from the British West Indies with descriptions of *Antillocladius* n. gen., *Lipurometriocnemus* n. gen., *Compterosmittia* n. gen. and *Diplosmittia* n. gen. Ent. scand. Suppl. 16: 1-46.

Sæther, O.A. 1981c. *Compteromesa oconeensis* gen. n., sp.n., a new Prodiamesinae (Diptera: Chironomidae) from South Carolina. Aquatic Insects 3: 193-198.

Sæther, O.A. 1982. Orthocladiinae (Diptera: Chironomidae) from SE U.S.A., with descriptions of *Plhudsonia*, *Unniella* and *Platysmittia* n. genera and *Atelopodella* n. subgen. Ent. scand. 13: 465-510.

Sæther, O.A. 1983a. *Oschia dorsenna* n. gen. n. sp. and *Saetheria hirta* n. sp., two members of the *Harnischia* complex (Diptera: Chironomidae). Ent. scand. 14: 395-404.

Sæther, O.A. 1983b. Three new species of *Lopescladius* Oliveira, 1967 (syn. "*Cordites*" Brundin, 1966, n. syn.), with a phylogeny of the *Parakiefferiella* group. Mem. Am. Ent. Soc. 34: 279-298.

Sæther, O.A. 1983c. The larvae of Prodiamesinae (Diptera: Chironomidae) of the Holarctic region - Keys and diagnoses. Ent. scand. Suppl. 19: 141-147.

Sæther, O.A. 1983d. A review of Holarctic *Gymnometriocnemus* Goetghebuer, 1932, with the description of *Rhaphidocladius* subgen. n. and *Sublettiella* gen. n. (Diptera: Chironomidae). Aquatic Insects 5: 209-226.

Sæther, O.A. 1984. The immatures of *Antillocladius* Sæther, 1981 (Diptera: Chironomidae). Aquatic Insects 6:1-6.

Sæther, O.A. 1985a. A review of *Odontomesa* Pagast, 1947 (Diptera, Chironomidae, Prodiamesinae). Spixiana Suppl. 11:15-29.

Sæther, O.A. 1985b. A review of the genus *Rheocricotopus* Thienemann & Harnisch, 1932, with the description of three new species (Diptera, Chironomidae). Spixiana Suppl. 11:59-108.

Sæther, O.A. 1985c. The imagines of *Mesosmittia* Brundin, 1956, with description of seven new species. Spixiana 11:37-54.

Sæther, O.A. 1985d. The females of *Compteromesa oconeensis* Sæther, 1981, and *Prodiamesa olivacea* (Meigen, 1818) (syn. *Trichodiamesa autumnalis* Goetghebuer, 1926, n. syn.) (Diptera, Chironomidae, Prodiamesinae).

Spixiana Suppl. 11: 7-13.

Sæther, O.A. 1985e. *Apometriocnemus fontinalis* n. gen., n. sp. (Diptera: Chironomidae) from Tennessee. Ent. scand. 15: 536-539.

Sæther, O.A. 1985f. *Diplosmittia carinata* sp. n. (Diptera: Chironomidae) from Minnesota. Spixiana Suppl. 11: 55-57.

Sæther, O.A. 1985g. *Heleniella parva* n. sp. (Diptera: Chironomidae) from South Carolina. Ent. scand. 15: 532-535.

Sæther, O.A. 1985h. A redefinition of *Thienemannia* Kieffer, 1909 (Diptera: Chironomidae), with the description of *T. pilinucha* sp. n. Aquatic Insects 7: 111-131.

Sæther, O.A. 1985i. *Trichochilus*, a new genus of Orthocladiinae (Diptera: Chironomidae). Spixiana Suppl. 11: 31-36.

Sæther, O.A. 1985j. Male and female imagines of *Platysmittia bilyji* sp. n. (Diptera: Chironomidae) from Manitoba, Canada. Ent. scand. 15: 527-531.

Sæther, O.A. 1989a. *Metriocnemus* van der Wulp: a new species and revision of species described by Meigen, Zetterstedt, Stæger, Holmgren, Lundström and Strenzke (Diptera: Chironomidae). Ent. scand. 19: 393-430.

Sæther, O.A. 1989b. Two new species of *Hydrobaenus* Fries from Massachusetts, U.S.A., and Japan (Diptera: Chironomidae). Ent. scand. 20: 55-63.

Sæther, O.A. 1990. A review of the genus *Limnophyes* Eaton from the Holarctic and Afrotropical regions (Diptera: Chironomidae, Orthocladiinae). Ent. scand. Suppl. 35:1-139.

Sæther, O.A. 1992a. First Nearctic record of the orthoclad genus *Tavastia* Tuiskunen (Diptera: Chironomidae). Ent. scand. 22: 385-388.

Sæther, O.A. 1992b. *Heterotrissocladius boltoni* sp. n., a new orthoclad from vernal pools and streams in Ohio, U.S.A. (Diptera: Chironomidae). Neth. J. Aquat. Ecol. 26: 191-196.

Sæther, O.A. 1997. First description of the imagines and pupa of *Propsilocerus jacuticus* (Zvereva) (Diptera: Chironomidae). Acta Zool. Hung. 43: 241-249.

Sæther, O.A., P. Ashe & D.A. Murray. 2000. Family Chironomidae. pp 113-334 *in* Papp, L. & B. Darvas (eds.) Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance). Appendix. Science Herald, Budapest. 604 pp.

Sæther, O.A. & G.A. Halvorsen. 1981. Diagnoses of *Tvetenia* Kieff. emend., *Dratnalia* n. gen., and *Eukiefferiella* Thien. emend., with a phylogeny of the *Cardiocladius* group (Diptera: Chironomidae). Ent. scand. Suppl. 15: 269-285.

Sæther, O.A. & Ø. Schnell. 1988. Two new species of the *Rheocricotopus (R.) effusus* group (Diptera, Chironomidae). Spixiana Suppl. 14: 65-74.

Sæther, O.A. & J.E. Sublette. 1983. A review of the genera *Doithrix* n. gen., *Georthocladius* Strenzke, *Parachaetocladius* Wülker, and *Pseudorthocladius* Goetghebuer (Diptera: Chironomidae, Orthocladiinae). Ent. scand. Suppl. 20:1-100.

Sæther, O.A. & A. Sundal. 1999. *Cerobregma*, a new subgenus of *Polypedilum* Kieffer, with a tentative phylogeny of subgenera and species groups within *Polypedilum* Diptera: Chironomidae). J. Kansas Ent. Soc. 71: 315-382.

Sæther, O.A. & X. Wang. 1995. Revision of the genus *Paraphaenocladius* Thienemann, 1924 of the world (Diptera: Chironomidae, Orthocladiinae). Ent. scand. Suppl. 48: 3-69.

Sæther, O.A. & X. Wang. 1996. Revision of the orthoclad genus *Propsilocerus* Kieffer (=*Tokunagayusurika* Sasa) (Diptera: Chironomidae). Ent. scand. 27:441-479.

Sæther, O.A. & E. Willassen. 1985. The first record of *Protanypus pseudomorio* Makarchenko (Diptera: Chironomidae) from the Nearctic, with description of the female and a revised key to males of the genus. Aquatic Insects 7: 141-148.

Sæther, O.A. & E. Willassen. 1988. A review of *Lappodiamesa* Serra Tosio, with the description of *L. boltoni* spec. nov. from Ohio, USA (Diptera, Chironomidae). Spixiana Suppl. 14: 75-84.

Säwedal, L. 1981. Amazonian Tanytarsini II. *Caladomyia* n. gen. and eight new species (Diptera: Chironomidae). Ent. scand. 12: 123-143.

Säwedal, L. 1982. Taxonomy, morphology, phylogenetic relationships and distribution of *Micropsectra* Kieffer, 1909 (Diptera: Chironomidae). Ent. scand. 13: 371-400.

Sasa, M. & M. Kikuchi. 1995. Chironomidae (Diptera) of Japan. University of Tokyo Press. 333 pp.

Schlee, D. 1968. Vergleichende Merkmalsanalyze zur Morphologie und Phylogenie der *Corynoneura* -Gruppe (Diptera: Chironomidae). Zugleich eine allgemeine Morphologie der Chironomiden-Imago. Stuttg. Beitr. Naturk. 180:1-150.

Schmid, P.E. 1993. A key to the larval Chironomidae and their instars from Austrian Danube region streams and rivers with particular reference to a numerical taxonomic approach. Part I. Diamesinae, Prodiamesinae and Orthocladiinae. Wasser und Abwasser Suppl. 3: 1-514.

Schnell, Ø. 1991. New records of Chironomidae (Diptera) from Norway (II), with two new species synonyms. Fauna Norv., Ser. B: 38: 5-10.

Schnell, Ø. & O.A. Sæther. 1988. *Vivacricotopus*, a new genus of Orthocladiinae (Diptera, Chironomidae) from Norway. Spixiana Suppl. 14: 49-55.

Serra-Tosio, B. 1989. Révision des espècies ouest-paléarctiques et néarctiques de *Boreoheptagyia* Brundin avec des clés pour les larves, les nymphes et les imagos (Diptera, Chironomidae). Spixiana 11: 133-173.

Shilova, A.I. 1961. Novyi rod i vid tendipedid (Diptera, Tendipedidae) *Lipiniella* Shilova, gen. n. (A new genus and species of tendipedid (Diptera, Tendipedidae) *Lipiniella* Shilova, gen. n.). Byull. Inst. Biol. Vodokhran. 11: 19-23.

Shilova, A.I. 1963. Metamorfoz *Lipiniella arenicola* Shilova (Diptera, Tendipedidae). (The metamorphosis of *Lipiniella arenicola* Shilova (Diptera, Tendipedidae)). Trudy Inst. Biol. Vodokhran. 5: 71-80.

Shilova, A.I. 1966. Lichinka *Odontomesa fulva* Kieff. (Diptera, Chironomidae, Orthocladiinae) [The larva of *Odontomesa fulva* Kieff. (Diptera, Chironomidae, Orthocladiinae)]. Trudy Inst. Biol. vnutrenn. Vod 12:239-250.

Shilova, A.I., I.E. Kerkis & I.I. Kiknadze. 1992. *Lipiniella prima* sp. nov. (Diptera, Chironomidae), larva and karyotype. Neth. J. Aquat. Ecol. 26: 197-201.

Shobanov, N.A., I.I. Kiknadze & M.G. Butler. 1999. Palaearctic and Nearctic *Chironomus (Camptochironomus) tentans* (Fabricius) are different species (Diptera: Chironomidae). Ent. scand. 30: 311-322.

Simpson, K.W. 1982. A guide to basic chironomid literature for the genera of North American Chironomidae (Diptera) - adults, pupae, and larvae. Bull. N.Y. State Mus. No. 447.

Simpson, K.W. & R.W. Bode. 1980. Common larvae of Chironomidae (Diptera) from New York State streams and rivers with particular reference to the fauna of artificial substrates. Bull. N.Y. St. Mus. No. 439:1-105 pp.

Simpson, K.W., R.W. Bode & P. Albu. 1982. Keys for the genus *Cricotopus* adapted from "Revision der Gattung *Cricotopus* van der Wulp und ihrer Verwandten (Diptera, Chironomidae)" by M. Hirvenoja. Bull. N.Y. St. Mus. 450:1-133.

Soong, K., G-F. Chen & J-R. Cao. 1999. Life history studies of the flightless marine midges *Pontomyia* spp. (Diptera: Chironomidae). Zool. Stud. 38: 466-473.

Soponis, A.R. 1977. A revision of the Nearctic species of *Orthocladius (Orthocladius)* van der Wulp (Diptera: Chironomidae). Mem. Ent. Soc. Canada 102:1-187.

Soponis, A.R. 1979. *Zalutschia briani* n. sp. from Florida (Diptera: Chironomidae). Ent. scand. Suppl. 10:125-131.

Soponis, A.R. 1980a. Taxonomic composition of Chironomidae (Diptera) in a sand-bottomed stream of northern Florida. Pp 163-169 *in*

Murray, D.A. (ed.): Chironomidae - Ecology, Systematics, Cytology and Physiology. Pergamon Press, Oxford & New York.

Soponis, A.R. 1980b. *Pseudorthocladius macrostomus*, a new species of chironomid (Diptera) with a long proboscis. Fla. Ent. 63:486-490.

Soponis, A.R. 1983. Emergence of *Polypedilum* (Chironomidae) in a sand-bottomed stream of northern Florida. Mem. Am. Ent. Soc. 34:309-313.

Soponis, A.R. 1987. Notes on *Orthocladius (Orthocladius) frigidus* (Zetterstedt) with a redescription of the species (Diptera: Chironomidae). Ent. scand. Suppl. 29: 123-131.

Soponis, A.R. 1990. A revision of the Holarctic species of *Orthocladius (Euorthocladius)* (Diptera: Chironomidae). Spixiana Suppl. 13:1-56.

Soponis, A.R. & C.L. Russell. 1982. Identification of instars and species in some larval *Polypedilum (Polypedilum)* (Diptera: Chironomidae). Hydrobiol. 94: 25-32.

Soponis, A.R. & C.L. Russell. 1984. Larval drift of Chironomidae (Diptera) in a North Florida stream. Aquatic Insects 6: 191-199.

Soponis, A.R. & K.W. Simpson. 1992. *Polypedilum digitifer* Townes and *Polypedilum griseopunctatum* (Malloch) (Diptera: Chironomidae): redescription of adult males with a description and separation of the immature stages. Neth. J. Aquat. Ecol. 26: 203-213.

Spies, M. 1998a. Three species of *Tanytarsus* involved in California midge nuisance problems: descriptions, ecology, and faunal relations (Insecta, Diptera, Chironomidae). Spixiana 21: 253-270.

Spies, M. 1998b. Resolution of *Tanytarsus mendax* Kieffer, 1925, *T. dibranchius* Kieffer in Zavrel, 1926, and associated names (Diptera: Chironomidae). Studia dipterologica 5: 195-210.

Spies, M. 1999. *Cricotopus (Isocladius) subletteorum*, a new species of Chironomidae (Diptera) from the southwestern United States. J. Kans. Ent. Soc. 71: 199-207.

Spies, M. 2000. A contribution to the knowledge of Holarctic *Parachironomus* Lenz (Diptera: Chironomidae), with two new species and a provisional key to Nearctic adult males. Tijd. voor Ent. 143: 125-143.

Spies, M., E.J Fittkau & F. Reiss. 1994. The adult males of *Parachironomus* Lenz, 1921, from the Neotropical faunal region (Insecta, Diptera, Chironomidae). Spixiana Suppl. 20: 61-98.

Spies, M. & F. Reiss. 1996. Catalog and bibliography of Neotropical and Mexican Chironomidae. Spixiana Suppl. 22: 61-119.

Steffan, A.W. 1965. *Plecopteracoluthus downesi* gen. et sp. nov. (Diptera: Chironomidae), a species whose larvae live phoretically on larvae of Plecoptera. Can. Ent. 97: 1323-1344.

Steiner, B. 1983. *Paracricotopus mozleyi* n. sp. from Georgia (Diptera: Chironomidae). Mem. Am. Ent. Soc. 34:329-335.

Steiner, J.W., J.S. Doughman & C.R. Moore. 1982. A generic guide to the larvae of the Nearctic Tanytarsini. U.S. Geological Survey Open File Report 82-768. 40 pp.

Steiner, J.W. & J.L. Hulbert. 1982. *Nimbocera pinderi*, a new species (Diptera: Chironomidae) from the southeastern United States. Fla. Ent. 65: 228-233.

Stone, A. & W.W. Wirth. 1947. On the marine midges of the genus *Clunio* Haliday (Diptera, Tendipedidae). Proc. Ent. Soc. Wash. 49: 201-224.

Strenzke, K. 1940. Terrestrische Chironomiden V. *Camptocladius stercorarius* De Geer. Zool. Anz. 132: 115-123.

Strenzke, K. 1950a. Systematik, Morphologie und Ökologie der terrestrischen Chironomiden. Arch. Hydrobiol. Suppl. 18:207-414.

Strenzke, K. 1950b. Terrestrische Chironomiden XIV. "*Limnophyes*" *flexuellus* Edw. Zool. Anz. 145:101-111.

Strenzke, K. 1960. Metamorphose und Verwandtschaftsbeziehungen der Gattung *Clunio* Hal. (Dipt.) (Terrestrische Chironomiden XXIV). Suol. eläin-ja kasvit. Seur. Van. kasvit. Julk. 22: 1-30.

Strixino, S.T. & G. Strixino. 1991. Nova espécie de

Goeldichironomus Fittkau (Diptera, Chironomidae) do Brasil. Rev. Bras. Ent. 35: 593-602.

Sublette, J.E. 1960. Chironomid midges of California. I. Chironominae, exclusive of Tanytarsini (= Calopsectrini). Proc. U.S. Nat. Mus. 112: 197-226.

Sublette, J.E. 1964. Chironomidae (Diptera) of Louisiana. I. Systematics and immature stages of some lentic chironomids of west-central Louisiana. Tulane Stud. Zool. 11:109-150.

Sublette, J.E. 1967. Type specimens of Chironomidae (Diptera) in the Cornell University collection. J. Kans. Ent. Soc. 4: 477-564.

Sublette, J.E. & M. Sasa. 1994. Chironomidae collected in Onchocerciasis endemic areas of Guatemala (Insecta, Diptera). Spixiana Suppl. 20: 1-60.

Sublette, J.E., L.E. Stevens & J.P. Shannon. 1998. Chironomidae (Diptera) of the Colorado River, Grand Canyon, Arizona, USA, I: Systematics and ecology. Great Basin Naturalist 58: 97-146.

Sublette, J.S. & M.F. Sublette. 1973. The morphology of *Glyptotendipes barbipes* (Staeger) (Diptera: Chironomidae). Stud. Nat. Sci. 6: 1-80.

Sublette, J.E. & M.F. Sublette. 1974a. A review of the genus *Chironomus* (Diptera: Chironomidae) V. The *maturus*-complex. Stud. Nat. Sci. 8: 1-41.

Sublette, J.E. & M.F. Sublette. 1974b. A review of the genus *Chironomus* (Diptera: Chironomidae) VII. The morphology of *Chironomus stigmaterus* Say. Stud. Nat. Sci. 10: 1-65.

Sublette, J.E. & M. Sublette. 1979. A synopsis of the Chironomidae of New Mexico. Pp. 53-128 *in* Sublette, J.E (P.I.): Evaluation of long term effects of thermal effluents on stream biota. Technical Report: "Utilization of Chironomidae (Diptera) as a water quality indicator group in New Mexico". New Mexico Energy Institute 32, 172 pp.

Sublette, J.E. & W.W. Wirth. 1972. New genera and species of West Indian Chironomidae (Diptera). Fla. Ent. 55: 1-17.

Tennessen, K.J. & P.K. Gottfried. 1983. Variation in structure of ligula of Tanypodinae larvae (Diptera: Chironomidae). Ent. News 94: 109-116.

Thienemann, A. 1942. Larve und systematische Stellung von *Neozavrelia luteola* Goetgh. Chironomiden aus dem Lunzer Seengebiet II. Arch. Hydrobiol. 38: 581-585.

Thienemann, A. 1949. Die Metamorphose von *Stempellina montivaga* Goetgh. (Chironomiden aus dem Lunzer Seengebiet IX.) Ent. Tidskr. 70: 12-18.

Tokunaga, M. 1935. Chironomidae from Japan (Diptera). IV. The early stages of a marine midge, *Telmatogeton japonicus* Tokunaga. Philipp. J. Sci. 57: 491-511.

Townes, H.K. 1945. The nearctic species of Tendipedini (Diptera: Tendipedidae (=Chironomidae)). Am. Midl. Nat. 34:1-206.

Trivinho-Strixino, S. & G. Strixino. 1991. Duas novas espécies de *Nimbocera* Reiss (Diptera, Chironomidae) do Estado de São Paulo, Brasil. Rev. Bras. Ent. 35: 173-178.

Tuiskunen, J. 1983. A description of *Corynocera gynocera* sp. n. (Diptera, Chironomidae) from Finland. Ant. Ent. Fenn. 49: 100-102.

Tuiskunen, J. 1986a. A new northern species of *Sympotthastia* (Diptera, Chironomide, Diamesinae). Ann. Ent. Fenn. 52: 78-80.

Tuiskunen, J. 1986b. The Fennoscandian species of *Parakiefferiella* Thienemann (Diptera, Chironomidae, Orthocladiinae). Ann. Zool. Fenn. 23: 175-196.

Tuiskunen, J. & B. Lindeberg. 1986. Chironomidae (Diptera) from Fennoscandia north of 68° N, with a description of ten new species and two new genera. Ann. Zool. Fenn. 23: 361-393.

Walker, I.R., D.R. Oliver & M.E. Dillon. 1992. The larva and habitat of *Parakiefferiella nigra* Brundin (Diptera: Chironomidae). Neth. J. Aquat. Ecol. 26: 527-531.

Warwick, W.F. 1989. Morphological deformities in larvae of *Procladius* Skuse (Diptera: Chironomidae) and their biomonitoring potential. Can. J. Fish. Aquat. Sci. 46: 1255- 1270.

Warwick, W.F. 1990. Morphological deformities in Chironomidae (Diptera) larvae from the Lac St. Louise and Laprairie basins of the St. Lawrence River. J. Great Lakes Res. 16: 185-208.

Watson, C. 1999. Description of the larva of *Apsectrotanypus algens* (Coquillett) with a review of the generic placement of the species (Diptera: Chironomidae). J. Kans. Ent. Soc. 71: 241-246.

Webb, C. J. & A. Scholl. 1985. Identification of larvae of European species of *Chironomus* Meigen (Diptera: Chironomidae) by morphological characters. Sys. Ent. 10: 353-372.

Webb, D.W. 1969. New species of chironomids from Costello Lake, Ontario (Diptera: Chironomidae). J. Kans. Ent. Soc. 42:91-108.

Webb, D.W. 1972. The immature stages of *Chironomus aethiops* (Townes) with keys to the species of the known immature stages of the subgenus *Dicrotendipes* (Diptera: Chironomidae). Trans. Illinois St. Acad. Sci. 65: 74-76.

Webb, D.W. 1981. Redescription of *Micropsectra polita* (Diptera: Chironomidae) with the female and immature stages. Great Lakes Ent. 14:185-190.

Webb, D.W. 1982. *Smittia lasiops* (Malloch): a redescription of the adults with a description of the immature stages (Diptera: Chironomidae). Proc. Ent. Soc. Wash. 84: 468-474.

Webb, D.W. & W.U. Brigham. 1982. Aquatic Diptera. Pp. 11.1-11.111 *in* Brigham, A.R., W.U. Brigham & A. Gnilka (eds.). Aquatic Insects and Oligochaetes of North and South Carolina. Midwest Aquatic Enterprises, Mahomet, IL. 837 pp.

Wiederholm, T. (ed.) 1983. Chironomidae of the Holarctic region. Keys and diagnoses. Part 1. Larvae. Ent. scand. Suppl. 19:1-457.

Wiederholm, T. (ed.) 1986. Chironomidae of the Holarctic region. Keys and diagnoses. Part 2. Pupae. Ent. scand. Suppl. 28:1-482.

Wiederholm, T. (ed.) 1989. Chironomidae of the Holarctic region. Keys and diagnoses. Part 3. Adult males. Ent. scand. Suppl. 34: 1-524.

Wirth, W.W. 1949. A revision of the clunionine midges with descriptions of a new genus and four new species (Diptera: Tendipedidae). Univ. Calif. Publs. Ent. 8:151-182.

Wirth, W.W. 1952. Notes on marine midges from the eastern United States (Diptera, Tendipedidae [= Chironomidae]). Bull. Mar. Sci. Gulf Caribb. 2:307-312.

Wirth, W.W. 1979. *Siolimyia amazonica* Fittkau, an aquatic midge new to Florida with nuisance potential. Fla. Ent. 62: 134-135.

Wülker, W.F. & M.G. Butler. 1983. Karyosystematics and morphology of northern *Chironomus* (Diptera: Chironomidae): Freshwater species with larvae of the *salinarius* type. Ent. scand. 14: 121-136.

Wülker, W.F. & E. Morath. 1989. South American *Chironomus* (Dipt.) - Karyotypes and their relations to North America. Acta Biol. Debr. Oecol. Hung. 2: 389-397.

Wülker, W.F., J.E. Sublette, E. Morath & J. Martin. 1989. *Chironomus columbiensis* n.sp. in South America and *Chironomus anonymus* Williston in North America - closely related species. Stud. Neotrop. Fauna Environ. 3: 121-136.

Wülker, W.F., J.E. Sublette, M.F. Sublette & J. Martin. 1971. A review of the genus *Chironomus* (Diptera: Chironomidae) I. The *staegeri* group. Stud. Nat. Sci. 1: 1-89.

Yamamoto, M. 1980. Discovery of the Nearctic genus *Chasmatonotus* Loew (Diptera, Chironomidae) from Japan, with descriptions of three new species. Esakia 15: 79-96.

Yamamoto. M. 1985. Two new species of the genus *Chasmatonotus* from Japan (Diptera, Chironomidae). Esakia 23: 93-98.

CHECKLIST OF THE CHIRONOMIDAE OF NORTH AND SOUTH CAROLINA 10

This checklist registers species known to occur in North and South Carolina, based on literature citations and material examined by the author. It also includes species which may occur in the Carolinas; many of these species occur in the Southeast U.S. but have not been positively identified from North or South Carolina. Note also that some literature records can be considered doubtful; some species recorded in earlier literature but misidentified are not listed. Also note that some larval species group names may also be represented by adult records; i.e., there could be some duplication. Only important synonyms pertaining to Carolinas Chironomidae are listed. Genera and species are arranged in alphabetical order; for tribes and subgenera see Oliver et al. (1990), Caldwell et al. (1997) or text.

KEY: **[ ]** = synonym ***** = may occur in North or South Carolina **¿** = recorded from North or South Carolina, but identification doubtful, not confirmed or incorrect **N** = recorded from North Carolina **S** = recorded from South Carolina **L** = larva known **A** = species-level identification only with adult or pupa, or larva unknown **P** = species known only as pupa **LU** = larva cannot be identified to a described species without associated life stages

TELMATOGETONINAE		
Telmatogeton Schiner		
japonicus Tokunaga	N	L
PODONOMINAE		
Boreochlus Edwards		
persimilis (Johannsen)	NS	LU
Paraboreochlus Thienemann		
cf. *stahli* Coffman	N	LU
TANYPODINAE		
Ablabesmyia Johannsen		
annulata (Say)	NS	L
aspera (Roback)	S	L
cinctipes (Johannsen)	NS	L
hauberi Beck & Beck	NS	L
idei (Walley)	S	L
¿ *illinoensis* (Malloch)	¿NS	LU
janta (Roback)	NS	LU
mallochi (Walley)	NS	L
[*auriensis* Roback]		
[*ornata* Beck & Beck]		
[*tarella* Roback]		
monilis (Linnaeus)	NS	L
[*americana* Fittkau]		
[*basalis* Walley]		
parajanta Roback	NS	LU
peleensis (Walley)	NS	L
philosphagnos Beck & Beck	N	L
rhamphe Sublette	NS	LU
simpsoni Roback	NS	L
Alotanypus Roback		
aris Roback	NS	L
Apsectrotanypus Fittkau		
johnsoni (Coquillett)	NS	L
Bethbilbeckia Fittkau & Murray		
floridensis Fittkau & Murray	S	L
Brundiniella Roback		
eumorpha (Sublette)	NS	L
Cantopelopia Roback		
gesta Roback	S	L

Clinotanypus Kieffer		
pinguis (Loew)	NS	LU
[*thoracicus* (Loew)]		
Coelotanypus Kieffer		
concinnus (Coquillett)	NS	L
scapularis (Loew)	NS	L
tricolor (Loew)	NS	L
Conchapelopia Fittkau		
aleta Roback	NS	LU
* *currani* Walley	*	LU
fasciata Beck & Beck	NS	LU
[*dusena* Roback]		
pallens (Coquillett)	NS	LU
rurika (Roback)	NS	LU
telema Roback	N	LU
* *Denopelopia* Roback & Rutter		
* *atria* Roback & Rutter	*	L
Djalmabatista Fittkau		
pulchra (Johannsen)	NS	L
[*maculatus* Roback]		
Fittkauimyia Karunakaran		
serta (Roback)	N	LU
Guttipelopia Fittkau		
guttipennis (Wulp)	NS	L
[*currani* Beck & Beck]		
Hayesomyia Murray & Fittkau		
senata (Walley)	NS	L
Helopelopia Roback		
cornuticaudata (Walley)	NS	LU
[*gigas* (Beck & Beck)]		
pilicaudata (Walley)	NS	LU
Hudsonimyia Roback		
karelena Roback	NS	L
* *parrishi* Caldwell & Soponis	*	L
Krenopelopia Fittkau		
hudsoni Roback	NS	LU
Labrundinia Fittkau		
becki Roback	NS	L
johannseni Beck & Beck	N	L

maculata Roback	N	L
neopilosella Beck & Beck	NS	L
pilosella (Loew)	NS	L
[*floridana* Beck & Beck]		
virescens Beck & Beck	N	L
sp. 3 nr. *virescens* Roback	NS	LU
[sp. 4 Roback]		
sp. 6 Roback	N	LU
* sp. A Epler	*	LU
* sp. B Epler	*	LU
Larsia Fittkau		
berneri Beck & Beck	N	L
canadensis Bilyj	S	L
decolorata (Malloch)	NS	L
[*lurida* Beck & Beck]		
* *indistincta* Beck & Beck	*	L
sp. A Epler	S	L
sp. B Epler	S	L
Macropelopia Thienemann		
decedens (Walker)	N	LU
Meropelopia Roback		
americana (Fittkau)	NS	LU
flavifrons (Johannsen)	NS	LU
[*fittkaui* Beck & Beck]		
Monopelopia Fittkau		
boliekae Beck & Beck	N	L
* *tenuicalcar* (Kieffer)	*	L
¿ *tillandsia* Beck & Beck	¿ N	L
Natarsia Fittkau		
baltimorea (Macquart)	NS	L
sp. A Roback	NS	L
Nilotanypus Kieffer		
americanus Beck & Beck	NS	L
fimbriatus (Walker)	NS	L
Paramerina Fittkau		
anomala Beck & Beck	N	LU
fragilis (Walley)	S	LU
* *testa* Roback	*	LU
Pentaneura Philippi		
inconspicua (Malloch)	NS	L
[*inculta* Beck & Beck]		
Procladius Skuse		
bellus (Loew)	NS	L
[*pusillus* Loew]		
denticulatus Sublette	S	LU
freemani Sublette	NS	LU
sublettei Roback	NS	LU
Psectrotanypus Kieffer		
dyari (Coquillett)	NS	L
sp. A Epler	NS	LU
Reomyia Roback		
sp. A Epler	N	LU
Rheopelopia Fittkau		
acra (Roback)	NS	LU
cf. *paramaculipennis* (Roback)	N	LU
* *perda* (Roback)	*	LU
sp. 3 Roback	N	LU
* sp. A Epler	*	LU
Tanypus Meigen		
carinatus Sublette	NS	L
clavatus Beck	N	L
concavus Roback	NS	LU
neopunctipennis Sublette	NS	L
punctipennis Meigen	NS	L
stellatus Coquillet	NS	L
Trissopelopia Kieffer		
ogemawi Roback	NS	L
Zavrelimyia Fittkau		
bifasciata (Coquillet)	S	L
sinuosa (Coquillett) complex	NS	LU
[*carneosa* Fittkau]		
thryptica (Sublette) complex	S	LU
sp. A Epler	N	L
DIAMESINAE		
Diamesa Meigen		
nivoriunda (Fitch)	NS	LU
sp. A Epler	N	LU
sp. B Epler [prob. *nivoriunda*]	N	LU
sp. C Epler	N	LU
Pagastia Oliver		
orthogonia Oliver	N	L
Potthastia Kieffer		
cf. *gaedii* (Meigen)	N	LU
longimana Kieffer	NS	L
cf. *montium* (Edwards)	N	LU
Sympotthastia Pagast		
cf. *zavreli* Pagast	N	LU
Diamesinae genus P Doughman	N	LU
PRODIAMESINAE		
Compteromesa Sæther		
oconeensis Sæther	S	LU
Monodiamesa Kieffer		
cf. *depectinata* Sæther	N	LU
Odontomesa Pagast		
fulva (Kieffer)	NS	L
Prodiamesa Kieffer		
olivacea (Meigen)	NS	L
ORTHOCLADIINAE		
* *Acamptocladius* Brundin	*	LU
Acricotopus Kieffer	NS	LU
Antillocladius Sæther		
arcuatus Sæther	S	LU
pluspilalus Sæther	S	LU
* *Apometriocnemus* Sæther	′	LU
Brillia Kieffer		
flavifrons (Johannsen)	NS	L
parva Johannsen	NS	L
sera Roback	NS	L
Bryophaenocladius Thienemann		
digitatus Sæther	NS	LU
flavoscutellatus (Malloch)	N	LU
fuminosus (Curran)	S	LU
impectinus Sæther	NS	LU
psilacrus Sæther	S	LU

sp. 1 Epler	N	A
sp. 2 Epler	N	A
sp. 3 Epler	S	A
* *Camptocladius* Wulp		
* *stercorarius* (De Geer)	*	L
Cardiocladius Kieffer		
albiplumus Sæther	NS	L
obscurus (Johannsen)	NS	L
Chaetocladius Kieffer		
ligni Cranston & Oliver	N	L
piger (Goetghebuer)	NS	LU
Chasmatonotus Loew		
* *bicolor* Rempel	*	LU
* *bimaculatus* Osten Sacken	*	LU
unimaculatus Loew	NS	LU
Clunio Haliday		
marshalli Stone & Wirth	N	L
Compterosmittia Sæther		
nerius (Curran)	NS	LU
Corynoneura Winnertz		
¿ *fittkaui* Schlee	NS	LU
¿ *lacustris* Edwards	S	LU
lobata Edwards	NS	L
[*taris* Roback]		
cf. *oxfordana* Boesel & Winner	S	A
sp. B Epler	S	LU
* sp. C Epler	*	LU
* sp. D Epler	*	LU
sp. E Epler	S	LU
Cricotopus Wulp		
* *absurdus* Johannsen	*	L
albiforceps (Kieffer)	N	LU
¿ *annulator* Goetghebuer	S	LU
* *belkini* Sublette	*	A
bicinctus Meigen	NS	L
cf. *cylindraceus* (Kieffer)	N	LU
elegans Johannsen	N	L
festivellus (Kieffer)	NS	LU
fugax (Johannsen)	N	LU
cf. *fuscus* (Kieffer)	N	LU
* *infuscatus* (Malloch)	*	L
intersectus (Staeger)	N	L
* *lebetis* Sublette	*	L
luciae LeSage & Harrison	NS	L
nostocicola Wirth	NS	L
cf. *patens* Hirvenoja	N	LU
politus (Coquillett)	NS	LU
slossonae Malloch	NS	LU
sylvestris (Fabricius)	NS	L
tremulus (Linnaeus)	N	LU
triannulatus (Macquart)	NS	LU
[*exilis* Johannsen]		
* *tricinctus* (Meigen)	*	LU
trifascia Edwards	N	L
* *trifasciatus* Meigen	*	L
[*remus* Sublette]		
varipes Coquillett	NS	LU
vierriensis Goetghebuer	NS	L
sp. 2 Epler	N	A
* sp. "Ozarks" Epler	*	LU
* sp. "Santa Fe" Epler	*	LU
Diplocladius Kieffer		
cultriger Kieffer	NS	L
* *Diplosmittia* Sæther	*	A
Doithrix Sæther & Sublette		
dillonae Cranston & Oliver	N	LU
parcivillosa Sæther & Sublette	NS	LU
villosa Sæther & Sublette	NS	LU
Epoicocladius Zavrel		
flavens (Malloch)	N	L
sp. #3 Jacobsen	N	L
Eukiefferiella Thienemann		
brehmi Gowin group	NS	LU
brevicalcar (Kieffer) group	NS	LU
brevinervis (Malloch)	NS	LU
claripennis (Lundbeck) group	NS	LU
coerulescens (Kieffer)	S	LU
devonica (Edwards) group sp. A Epler	NS	LU
devonica (Edwards) group sp. B Epler	N	LU
gracei (Edwards) group	N	LU
ilkleyensis (Edwards)	NS	LU
¿ *lobifera* Goetghebuer	S	LU
pseudomontana Goetghebuer group	N	LU
tirolensis (Goetghebuer)	NS	L
Euryhapsis Oliver		
sp. 1 Epler	N	A
Georthocladius Strenzke		
curticornus Sæther	NS	LU
fimbriosus Sæther & Sublette	NS	LU
triquetrus Sæther & Sublette	S	LU
Gymnometriocnemus Goetghebuer		
brumalis (Edwards)	NS	LU
subnudus (Edwards)	N	LU
sp. 1 Epler	N	A
Heleniella Gowin		
hirta Sæther	N	LU
parva Sæther	NS	LU
Heterotrissocladius Spärck		
marcidus (Walker)	NS	LU
sp. C Sæther	N	LU
* sp. "Caldwell" Epler	*	LU
Hydrobaenus Fries		
johannseni (Sublette)	NS	L
pilipes (Malloch)	NS	L
Krenosmittia Thienemann & Krüger	N	LU
Limnophyes Eaton		
asquamatus (Andersen)	S	LU
brachytomus (Kieffer)	NS	LU
carolinensis Sæther	NS	LU
fumosus (Johannsen)	NS	LU
minimus (Meigen)	NS	LU
natalensis (Kieffer)	N	LU

cf. *pilicistulus* Sæther	N	LU
pumilio (Holmgren)	N	LU
sp. 1 Epler	N	A
Lipurometriocnemus Sæther		
vixlobatus Sæther	NS	A
Lopescladius Oliveira		
¿ *hyporheicus* Coffman & Roback	S	LU
sp. 1 Coffman & Roback	S	LU
Mesocricotopus Brundin		
loticus Caldwell	S	L
sp. 1 Epler	N	A
Mesosmittia Brundin		
* *mina* Sæther	*	A
patrihortae Sæther	S	A
* *prolixa* Sæther	*	A
Metriocnemus Wulp		
eurynotus (Holmgren)	NS	L
fuscipes (Meigen)	NS	L
knabi Coquillet	N	L
Nanocladius Kieffer		
alternantherae Dendy & Sublette	NS	L
balticus (Palmén)	NS	L
branchicolus Sæther	N	L
crassicornus Sæther	S	LU
distinctus (Malloch)	NS	L
downesi (Steffan)	N	L
incomptus Sæther	NS	L
minimus Sæther	NS	LU
¿ *parvulus* (Kieffer)	S	LU
cf. *rectinervis* (Kieffer)	NS	LU
spiniplenus Sæther	NS	LU
* sp. D Epler	*	LU
* sp. #1 Jacobsen	*	LU
* sp. #3 Jacobsen	*	LU
sp. #5 Jacobsen	N	LU
Orthocladius Wulp		
annectens Sæther	NS	L
carlatus (Roback)	NS	L
dentifer Brundin	NS	L
dorenus Roback	NS	L
dubitatus Johannsen	NS	L
frigidus (Zetterstedt)	NS	L
* *hellenthali* Soponis	*	LU
lignicola (Kieffer)	NS	L
luteipes Goetghebuer	N	L
mallochi Kieffer	S	L
nigritus Malloch	NS	L
obumbratus Johannsen	NS	L
oliveri Soponis	NS	L
rivicola Kieffer	NS	L
rivulorum Kieffer	NS	L
robacki Soponis	N	L
rubicundus (Meigen)	S	L
saxosus (Tokunaga)	N	L
subletti Soponis	S	L
thienemanni Kieffer	S	L
vaillanti Langton & Cranston	N	L
sp. "Jacobsen"	N	L
Parachaetocladius Wülker		
abnobaeus (Wülker)	NS	L
sp. B Sæther & Sublette	S	LU
Paracricotopus Thienemann & Harnisch		
glaber Sæther	NS	LU
millrockensis Caldwell	NS	LU
* *mozleyi* Steiner	*	LU
Parakiefferiella Thienemann		
cf. *bathophila* (Goetghebuer)	S	A
coronata (Edwards)	NS	L
sp. A Epler	N	LU
sp. B Epler	N	LU
sp. C Epler	N	LU
sp. D Epler	N	LU
sp. E Epler	N	LU
* sp. F Epler	*	LU
sp. G Mozley	N	LU
Parametriocnemus Goetghebuer		
eoclivus Sæther	N	LU
hamatus (Johannsen)	NS	A
lundbeckii (Johannsen)	NS	LU
cf. *vespertinus* Sæther	N	A
sp. 1 Epler	N	A
sp. F Epler	N	LU
Paraphaenocladius Thienemann		
exagitans (Johannsen)	NS	L
innasus Sæther & Wang	S	L
pseudirritus Strenzke	S	L
pusillus Sæther & Wang	N	L
Parasmittia Strenzke		
cf. *carinata* Strenzke	N	A
Paratrichocladius Santos Abreu		
rufiventris (Meigen)	NS	LU
Platysmittia Sæther		
fimbriata Sæther	N	A
* *Plhudsonia* Sæther		
* *partita* Sæther	*	AP
Psectrocladius Kieffer		
* cf. *calcaratus* (Edwards)	*	LU
elatus Roback	NS	L
* *flavus* (Johannsen)	*	LU
limbatellus (Holmgren) group	S	LU
cf. *octomaculatus* Walker	N	LU
* *pilosus* Roback	*	LU
psilopterus (Kieffer) group sp. 1 Epler	N	LU
* *psilopterus* (Kieffer) group sp. 2 Epler	*	LU
simulans (Johannsen)	NS	LU
sordidellus (Zetterstedt) group	N	LU
vernalis (Malloch)	NS	L
sp. 1 Epler	S	A
Pseudorthocladius Goetghebuer		
amplicaudus Sæther & Sublette	S	A
clavatosus Sæther & Sublette	S	A
curticornus Sæther & Sublette	S	A
destitutus Sæther & Sublette	S	A
dumicaudus Sæther	S	A

macrovirgatus Sæther & Sublette	S	A
morsei Sæther & Sublette	NS	A
rectangilobus Caspars & Siebert	NS	A
rectilobus Sæther & Sublette	S	A
tricanthus Sæther & Sublette	NS	A
uniserratus Sæther & Sublette	S	A
wingoi Sæther & Sublette	NS	A
sp. B Sæther & Sublette	S	P
Pseudosmittia Goetghebuer		
forcipata (Goetghebuer)	NS	A
Psilometriocnemus Sæther		
triannulatus Sæther	NS	LU
Rheocricotopus Thien. & Harnisch		
amplicristatus Sæther	S	A
conflusirus Sæther	S	A
effusus (Walker)	NS	L
eminellobus Sæther	NS	L
glabricollis (Meigen)	NS	L
¿ *pauciseta* Sæther	N	L
robacki (Beck & Beck)	NS	L
tuberculatus Caldwell	NS	L
unidentatus Sæther & Schnell	N	L
* sp. VA Epler	*	LU
Rheosmittia Brundin		
arcuata Caldwell	NS	LU
* *Saetheriella* Halvorsen		
* *amplicristata* Halvorsen	*	LU
Smittia Holmgren		
aterrima (Meigen)	NS	LU
* *lasiops* (Malloch)	*	LU
sp. 1 Epler	N	A
sp. 2 Epler	S	A
Stilocladius Rossaro		
clinopecten Sæther	NS	L
Sublettiella Sæther		
calvata Sæther	S	A
Symbiocladius Kieffer		
¿ *equitans* (Claassen)	N	LU
Synorthocladius Thienemann		
semivirens (Kieffer)	NS	LU
sp. 1 Epler	S	A
Tavastia Tuiskunen		
cristicauda Sæther	N	A
* *Thienemannia* Kieffer		
* *pilinucha* Sæther	*	LU
Thienemanniella Kieffer		
boltoni Hestenes & Sæther	N	L
lobapodema Hestenes & Sæther	NS	L
¿ *obscura* Brundin	S	LU
¿ *partita* Schlee	S	L
similis (Malloch)	NS	L
taurocapita Hestenes & Sæther	N	L
xena (Roback)	NS	L
* sp. B Epler	*	LU
Tokunagaia Sæther	N	LU
* *Trichochilus* Sæther		
* *lacteipennis* (Johannsen)	*	L
Tvetenia Kieffer		
¿ *bavarica* (Goetghebuer)	NS	LU
paucunca (Sæther)	NS	LU
¿ *verralli* Edwards	N	LU
vitracies (Sæther)	NS	LU
* sp. GA Epler	*	LU
sp. NC Epler	N	LU
Unniella Sæther		
multivirga Sæther	NS	L
Xylotopus Oliver		
par (Coquillett)	NS	L
Zalutschia Lipina		
briani Soponis	NS	LU
cf. *zalutschicola* Lipina	NS	LU
sp. A Epler	NS	LU
Orthocladiinae sp. A Sæther	S	P
Orthocladiinae sp. B Sæther	S	P
Orthocladiinae sp. C Sæther	NS	LU
* Orthocladiinae genus E Epler	*	LU
Orthocladiinae genus I Epler	N	LU
Orthocladiinae genus 2 Epler	N	A
CHIRONOMINAE		
Apedilum Townes		
elachistum Townes	N	L
subcinctum Townes	N	L
Axarus Roback		
festivus (Say)	NS	LU
rogersi (Beck & Beck)	NS	LU
taenionotus (Say)	S	LU
* *Beardius* Reiss & Sublette		
* *truncatus* Reiss & Sublette	*	L
Beckidia Sæther	S	LU
Chernovskiia Sæther		
orbicus (Townes)	NS	LU
Chironomus Meigen		
austini Beck & Beck	N	L
crassicaudatus Malloch	NS	L
decorus Johannsen	NS	LU
[*attenuatus* Walker]		
longipes Staeger	NS	LU
[*dorsalis* auct.]		
* *major* Wülker & Butler	*	L
ochreatus (Townes)	S	L
plumosus (Linnaeus)	N	L
riparius Meigen	NS	L
staegeri Lundbeck	NS	L
stigmaterus Say	N	L
tuxis Curran	S	A
Cladopelma Kieffer		
amachaerum (Townes)	S	LU
collator (Townes)	NS	LU
edwardsi (Kruseman)	NS	LU
forcipis (Rempel)	NS	LU
[*boydi* Beck]		
galeator (Townes)	NS	LU
spectabile (Townes)	S	LU
virudulum (Linnaeus)	NS	LU

Cladotanytarsus Kieffer		
* *aeiparthenus* Bilyj	*	LU
cf. *daviesi* Bilyj	NS	LU
viridiventris (Malloch)	NS	LU
sp. A Epler	NS	LU
sp. B Epler	NS	LU
sp. D Epler	N	LU
sp. E Epler	NS	LU
sp. F Epler	N	LU
sp. H Epler	NS	LU
sp. I Epler	N	LU
Constempellina Brundin		
brevicosta (Edwards)	NS	LU
[*ranota* Webb]		
sp. A Epler	N	LU
Cryptochironomus Kieffer		
argus Roback	N	LU
blarina Townes	NS	LU
* *digitatus* (Malloch)	*	LU
fulvus (Johannsen)	NS	LU
* *parafulvus* (Beck & Beck)	*	LU
ponderosus (Sublette)	NS	LU
* *psittacinus* (Meigen)	*	A
[*styliferus* (Johannsen)]		
scimitarus Townes	NS	A
sorex Townes	NS	LU
Cryptotendipes Beck & Beck		
casuarius (Townes)	N	LU
emorsus (Townes)	NS	LU
pseudotener (Goetghebuer)	S	LU
Demeijerea Kruseman		
atrimana (Coquillett)	NS	A
brachialis (Coquillett)	N	A
obrepta (Townes)	NS	A
Demicryptochironomus Lenz		
cuneatus (Townes)	NS	LU
sp. A Epler	N	LU
sp. B Epler	N	LU
sp. C Epler	N	LU
Dicrotendipes Kieffer		
fumidus (Johannsen)	NS	L
leucoscelis (Townes)	NS	L
lobus (Beck)	NS	L
lucifer (Johannsen)	NS	L
modestus (Say)	NS	L
neomodestus (Malloch)	NS	L
nervosus (Staeger)	NS	L
simpsoni Epler	NS	L
thanatogratus Epler	S	L
tritomus (Kieffer)	NS	L
[*incurvus* Sublette]		
* sp. A Epler	*	L
Einfeldia Kieffer		
brunneipennis (Johannsen)	N	A
natchitocheae (Sublette)	NS	L
pagana (Meigen)	N	LU
sp. A Epler	N	LU
Endochironomus Kieffer		
nigricans (Johannsen)	NS	L
subtendens (Townes)	S	L
sp. A Epler	N	LU
Endotribelos Grodhaus		
hesperium (Sublette)	S	L
Fissimentum Cranston & Nolte		
sp. A Epler	S	L
Gillotia Kieffer		
alboviridis (Malloch)	S	A
Glyptotendipes Kieffer		
amplus Townes	N	L
barbipes (Staeger)	NS	L
¿ *dreisbachi* Townes	S	LU
¿ *lobiferus* (Say)	NS	LU
meridionalis Dendy & Sublette	NS	LU
paripes Edwards	NS	L
* *seminole* Townes	*	L
testaceus	NS	L
* sp. B Epler	*	LU
* sp. F Epler	*	LU
* sp. G Epler	*	LU
Goeldichironomus Fittkau		
* *amazonicus* (Fittkau)	*	L
carus (Townes)	N	L
devineyae (Beck & Beck)	N	L
fluctuans Reiss	S	L
holoprasinus (Goeldi)	NS	L
[*fulvipilus* (Rempel)]		
* cf. *natans* Reiss	*	LU
Harnischia Kieffer		
curtilamellata (Malloch)	NS	LU
* *incidata* Townes	*	LU
Hyporhygma Reiss		
quadripunctatum (Malloch)	N	L
Kiefferulus Goetghebuer		
dux (Johannsen)	NS	LU
pungens (Townes)	N	LU
* sp. B Epler	*	LU
Kloosia Kruseman		
dorsenna (Sæther)	NS	L
Lauterborniella Thienemann & Bause		
agrayloides (Kieffer)	NS	L
Lipiniella Shilova	NS	LU
Microchironomus Kieffer		
nigrovittatus (Malloch)	N	LU
Micropsectra Kieffer		
dives (Johannsen)	N	LU
geminata Oliver & Dillon	NS	LU
polita (Malloch)	S	L
recurvata Goetghebuer	NS	LU
xantha (Roback)	N	LU
sp. A Epler	N	LU
sp. B Epler	N	LU
sp. C Epler	N	LU
sp. D Epler	N	LU

sp. E Epler	S	LU
sp. 1 Epler	N	A
sp. 6 Epler	N	A
sp. 7 Epler	S	A
Microtendipes Kieffer		
caducus Townes	N	LU
caelum Townes	NS	LU
pedellus (De Geer)	NS	LU
sp. 1 Epler	N	A
* *Neostempellina* Reiss	*	LU
Neozavrelia Goetghebuer	N	LU
Nilothauma Kieffer		
babiyi (Rempel)	S	LU
bicorne (Townes)	NS	LU
mirabile (Townes)	S	LU
sp. A Epler	N	A
Omisus Townes		
browni Caldwell	S	LU
pica Townes	NS	LU
Pagastiella Brundin		
orophila (Edwards)?	S	LU
ostansa (Webb)	NS	LU
Parachironomus Lenz		
¿ *abortivus* (Malloch)	NS	LU
alatus (Beck)	NS	L
carinatus (Townes)	NS	L
chaetoalus (Sublette)	NS	LU
digitalus (Edwards)	S	A
directus (Dendy & Sublette)	N	L
frequens (Johannsen)	NS	L
hazelriggi Spies	NS	LU
* *hirtalatus* (Beck & Beck)	*	LU
pectinatellae (Dendy & Sublette)	NS	L
potamogeti (Townes)	NS	L
[sp. B Epler]		
schneideri Beck & Beck	N	L
* *sublettei* (Beck)	*	L
* *supparilis* (Edwards)	*	L
[sp. A Epler]		
tenuicaudatus (Malloch)	NS	LU
Paracladopelma Harnisch		
doris (Townes)	NS	L
loganae Beck & Beck	NS	L
nereis (Townes)	NS	L
undine (Townes)	NS	L
sp. 1 Jackson	N	LU
sp. 2 Jackson	N	LU
sp. A Epler	N	LU
Paralauterborniella Lenz		
nigrohalteralis (Malloch)	NS	L
Parapsectra Reiss		
sp. 1 Epler	N	A
Paratanytarsus Thienemann & Bause		
dissimilis (Johannsen)	NS	L
[sp. A Epler]		
dubius (Malloch)	N	A
cf. *laccophilus* (Edwards)	N	LU
quadratus (Sublette)	N	LU
[sp. C Epler]		
recens (Sublette)	NS	A
sp. 2 Epler	S	A
sp. D Epler	N	LU
Paratendipes Kieffer		
albimanus (Meigen)	NS	L
basidens Townes	N	L
¿ *duplicatus* (Johannsen)	NS	LU
nitidulus (Coquillett)	S	LU
subaequalis (Malloch)	N	L
Phaenopsectra Kieffer		
flavipes (Meigen)	NS	LU
obediens (Johannsen)	NS	LU
punctipes (Wiedemann)	NS	LU
vittata (Townes)	NS	A
Polypedilum Kieffer		
* *acifer* Townes	*	A
albicorne (Meigen)	NS	A
albinodus Townes	NS	A
angulum Maschwitz	S	LU
angustum Townes	S	A
artifer (Curran)	N	A
aviceps Townes	NS	L
beckae (Sublette)	NS	L
bergi Maschwitz	S	L
braseniae (Leathers)	NS	L
* *calopterus* (Mitchell	*	LU
cinctum Townes	NS	A
digitifer Townes	NS	LU
* *falciforme* Maschwitz	*	LU
fallax (Johannsen)	NS	L
flavum (Johannsen)	NS	L
[*convictum* auct.]		
[*obtusum* Townes]		
gomphus Townes	NS	A
griseopunctatum (Malloch)	NS	LU
halterale (Coquillett)	NS	LU
illinoense (Malloch)	NS	LU
laetum (Meigen)	NS	L
* *nymphaeorum* Maschwitz	*	LU
ontario (Walley)	N	L
ophioides Townes	S	LU
¿ *parascalaenum* Beck	NS	LU
pardus Townes	S	LU
* *parvum* Townes	*	A
pedatum Townes	S	A
scalaenum (Schrank)	NS	LU
simulans Townes	NS	LU
¿ *sordens* (Wulp)	S	LU
¿ *sulaceps* Townes	S	A
trigonus Townes	N	L
tritum (Walker)	NS	L
vibex Townes	NS	A
¿ *walleyi* Townes	S	A
* sp. A Epler	*	LU

Pseudochironomus Malloch		
fulviventris (Johannsen)	NS	LU
julia (Curran)	NS	A
* *middlekaufi* Townes	*	A
rex (Hauber)	N	A
richardsoni Malloch	N	LU
Rheotanytarsus Thienemann & Bause		
exiguus (Johannsen)	NS	LU
pellucidus (Walker)	NS	L
sp. 4 Epler	S	A
sp. A Epler	N	LU
Robackia Sæther		
claviger (Townes)	NS	L
demeijerei (Kruseman)	NS	L
Saetheria Jackson		
hirta Sæther	NS	L
tylus (Townes)	NS	L
Skutzia Reiss		
sp. 1 Epler	N	A
Stelechomyia Reiss		
perpulchra (Mitchell)	NS	L
Stempellina Thienemann & Bause		
almi Brundin	NS	A
rodesta Webb	S	A
subglabripennis (Brundin)	N	A
sp. B Epler	N	LU
sp. C Epler	NS	LU
Stempellinella Brundin		
brevis Edwards	S	A
leptocelloides (Webb)	S	A
sp. A Epler	NS	LU
sp. B Epler	N	LU
Stenochironomus Kieffer		
aestivalis Townes	NS	LU
cinctus Townes	NS	LU
hilaris (Walker)	NS	LU
macateei (Malloch)	NS	LU
poecilopterus (Mitchell)	NS	LU
unictus Townes	NS	LU
Stictochironomus Kieffer		
annulicris (Townes)	N	A
caffrarius group sp.	NS	LU
[Chironomini genus B Pinder & Reiss]		
devinctus (Say)	NS	LU
palliatus (Coquillett)	N	A
Sublettea Roback		
coffmani (Roback)	NS	L
Tanytarsus Wulp		
cf. *allicis* Sublette	S	A
cf. *brundini* Lindeberg	NS	A
buckleyi Sublette	NS	A
confusus Malloch	NS	A
debilis (Meigen)	N	A
dendyi Sublette	NS	A
guerlus (Roback)	S	A
limneticus Sublette	NS	L
[*pinderi* Steiner & Hulbert]		
mendax Kieffer	NS	A
[*xanthus* Sublette]		
neoflavellus Malloch	NS	A
recurvatus Brundin	NS	A
tibialis Webb	S	A
sp. 3 Epler	S	A
sp. 7 Epler	N	A
sp. 8 Epler	S	A
sp. 9 Epler	S	A
sp. 10 Epler	S	A
sp. 11 Epler	S	A
sp. 13 Epler	S	A
sp. 14 Epler	S	A
sp. A Epler	NS	LU
sp. C Epler	NS	LU
sp. D Epler	NS	LU
sp. E Epler	S	LU
sp. F Epler	NS	LU
sp. G Epler	NS	LU
sp. I Epler	N	LU
sp. L Epler	NS	LU
sp. M Epler	NS	LU
sp. O Epler	NS	LU
sp. P Epler	N	LU
sp. S Epler	NS	LU
sp. T Epler	N	LU
sp. U Epler	NS	LU
sp. V Epler	N	LU
sp. Z Epler	N	LU
Tribelos Townes		
atrum (Townes)	NS	L
fuscicorne (Malloch)	NS	L
jucundum (Walker)	NS	L
Virgatanytarsus Pinder	S	A
Xenochironomus Kieffer		
xenolabis (Kieffer)	NS	L
Xestochironomus Sublette & Wirth		
subletti Borkent	NS	L
Zavrelia Kieffer		
sp. 1 Epler	N	A
Zavreliella Kieffer		
marmorata (Wulp)	NS	L
[*varipennis* Coquillet]		
Chironomini genus III Epler	N	LU
* Chironomini genus IV Epler	*	LU
Harnischia complex genus A Epler	NS	LU
* *Harnischia* complex genus B Epler	*	LU
Harnischia complex genus C Epler	N	LU