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Tempisquitoneura, a new genus of Neotropical Orthocladiinae (Diptera:Chironomidae) symphoretic on *Corydalus* (Megaloptera:Corydalidae)

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Abstract. The adult male, adult female, pupa, and larva of a new genus (*Tempisquitoneura*) of midge (Diptera:Chironomidae) are described and illustrated from specimens collected and reared from *Corydalus* (Megaloptera:Corydalidae) in northwestern Costa Rica. Larvae and pupae of the midge live attached to the *Corydalus* larvae. The genus belongs in the *Corynoneura* group of the subfamily Orthocladiinae, but its relationship to the two other described genera in the group (*Corynoneura* and *Thienemanniella*) will remain unclear until more Neotropical members of this group are described and analyzed in all life stages.

Key words: Diptera, Chironomidae, *Tempisquitoneura merrillorum*, new genus, new species, Costa Rica, symphoresy, Megaloptera.

De la Rosa (1992) described phoretic relationships between several insect species and *Corydalus* (Megaloptera:Corydalidae) in northwestern Costa Rica. Among these was a midge (Diptera:Chironomidae) larva designated as "*Thienemanniella* sp. nov.". Examination of all three life stages of this chironomid indicates that establishment of a new genus is necessary to accommodate this taxon.

Corydalus larvae were collected in the field and taken to the laboratory in individual glass vials half filled with stream water. Larvae were then placed in small closed aquaria through which stream water flowed (piped into the artificial stream system in the laboratory directly from the Río Tempisquito). A clean rock was provided as a substratum. Larvae were fed caddisfly and stonefly larvae daily; the small aquaria were checked twice a day for emerged chironomids. When one was found, the pupal exuviae and, when possible, the larval case (still attached to the *Corydalus* larva) were collected as well. Several hours were allowed for hardening of the adult structures before preservation in 70–75% ethanol.

Morphological terminology and methodology follow Epler (1987), Oliver and Dillon (1989), and Sæther (1980). All measurements are in μm except where noted, and consist of the range and, for samples with four or more specimens, the mean.

Tempisquitoneura Epler, new genus

Type species: *Tempisquitoneura merrillorum* Epler, by monotypy.

Diagnosis

Adult male.—Small, brightly patterned species; wing length about 1 mm.

Eyes bare, small, reniform, without dorsomesal extension. Temporal setae few, with 1 inner vertical and several outer vertical/postorbital setae. Tentorium long, narrow, tapering to point; cibarial pump broad, with small cornua (Fig. 1F). Antenna with 13 flagellomeres and well developed plume; sensilla trichoidea ("sensillum chaetica" of Oliver and Dillon 1989) present on flagellomeres 2, 3 and subapically on last segment; apex clubbed, pointed, without rosette of short setae (Fig. 1E). Palp well developed; dorsum of palpomere 3 (Fig. 1G) with numerous setae, with 5–8 shorter, stouter setae apically and 2 sensilla clavata ventrally near attachment point of palpomere 4, no pit present.

Thorax (Fig. 2D) with bright orange vittae in life. Antepronotal lobes well developed, slight-

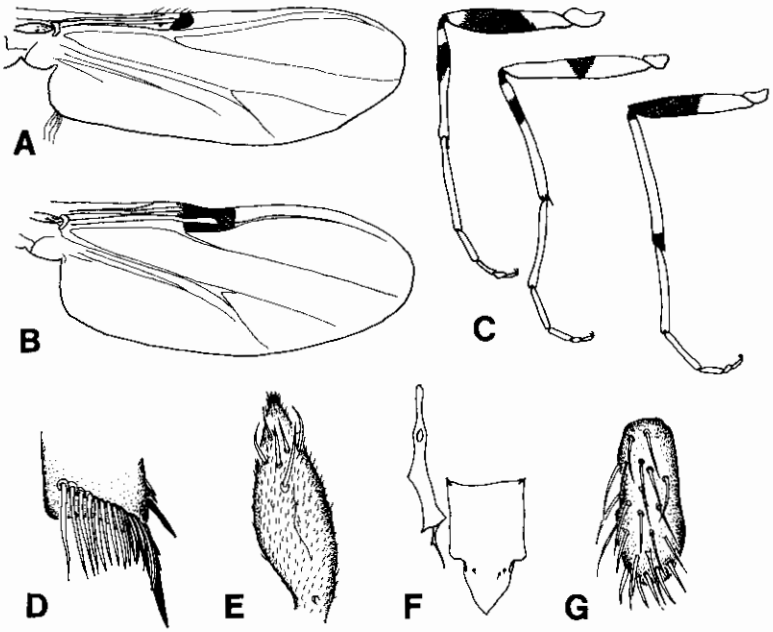

FIG. 1. *Tempisquitoneura merrillorum* adult structures: A.—Wing, male (setal fringe partially drawn). B.—Wing, female. C.—Legs, male; left to right: fore, mid, hind. D.—Apex of hind tibia. E.—Apex of antenna. F.—Cibarial pump and stipes. G.—Third palpal segment, dorsal.

ly narrowed dorsally; narrowly separated or touching medially; with lateral setae. Acrostichal setae absent; dorsocentral setae bi- or triserial, becoming uniserial posteriad; prealar setae in one group; 1 supraalar seta present; scutellar setae in transverse row, uniserial.

Wing membrane without setae, with fine punctuation. Anal lobe well developed (Fig. 1A). Brachiolum with 1 seta; sensilla campaniformia: 3 anterior to seta and 7 at distal tip. Costa apically fused with R_1 and R_{4+5}, forming a thick clavus slightly proximal to wing midpoint; a weak false vein of variable width and development runs from RM to near apex; Cu_1 slightly sinuous; FCu distal to RM; postcubitus (vannal fold of Sæther [1980]) and anal vein end near FCu. Veins, except costa, without setae; squama bare. Wing with complete fringe of simple setae; anterior margin of wing from costa to apex with single length setae, near apex setae become finer and alternate in length. Wing margin slightly sinuate at clavus.

Fore leg trochanter with moderately developed dorsal keel. Fore tibia with single spur; mid tibia with 2 unequal spurs; hind tibial apex (Fig. 1D) scarcely widened and without modified setae; with comb and two unequal spurs. Hind margin of tarsomeres 1–3 with double row of shorter, thicker, bluntly tipped setae; most distal of these setae on each tarsomere larger; this double row best developed on mid and hind legs. Legs with tarsomere 4 weakly cordiform. Sensilla chaetica present on tarsomere 1 of mid leg; pulvilli absent.

Abdomen (Fig. 2E) with distinctive dorsal pattern; with a few scattered setae on tergite I; tergites II–V with a raised, median circular group of setae and few lateral setae; tergites VI–VIII with transverse rows of setae.

Hypopygium (Fig. 2C) without well developed anal point, but posterior margin of tergite IX with slight medial protrusion. Superior volsella vestigial; inferior volsella well developed. Gonostylus without crista dorsalis; with simple megaseta. Transverse sternapodeme straight, with strong anterolateral projections; phallapodeme broad, strongly curved posteriad. Virga absent.

Adult female.—Generally similar to male except for usual sexual differences, with following exceptions:

Head with several inner vertical and outer

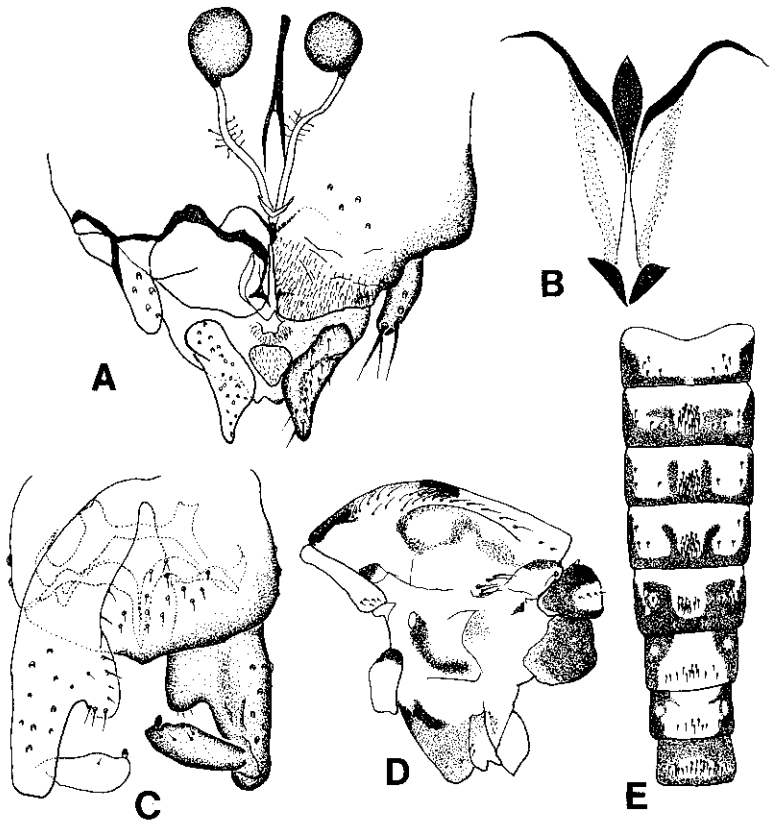

FIG. 2. *Tempisquitoneura merrillorum* adult structures: A.—Female genitalia. B.—Female dorsomesal and ventrolateral lobes. C.—Male hypopygium, dorsal view at right, ventral view at left. D.—Thorax, lateral. E.—Abdominal tergites I-VIII, dorsal.

vertical/postorbital setae. Antenna with 5 flagellomeres; pedicel with 1-2 setae; apical club more pointed and with numerous sensilla trichoidea.

Wing with sinuate margin at clavus; clavus longer than in male, extending to midpoint of wing (Fig. 1B).

Tarsomere 1 of mid leg with double row of sensilla chaetica; tarsomere 1 of hind leg with single row.

Genitalia (Fig. 2A) with gonocoxite IX well developed. Two seminal capsules present: large, dark, spherical with well developed neck; spermathecal ducts essentially straight, with special secretory cells. Labia fused basally and medially, split into two triangular processes caudally. Dorsomesal lobes sclerotized, separate, with a well sclerotized, spatulate structure between them; apodeme lobe well sclerotized (Fig. 2B).

Pupa.—Small, length less than 3 mm. Exuviae infuscate.

Frontal setae absent. Ocular field with 2 postorbital setae, vertical setae absent. Thorax with 2 median antepronotal setae; 3 unequal precorneal setae (Fig. 3C); 4 dorsocentral setae arranged in two pairs. Thoracic horn absent. Humeral callus with broad spine (Fig. 3C). Dorsum of thorax with small, sharply pointed tubercles along eclosion line. Wing sheath usually with weak pearl row, without nose (pearl rows are not apparent on some specimens; this might be due to variation or partial decomposition of the exuviae).

Tergite I without shagreen, T II-VIII and anterior portion of anal lobe with shagreen of fine spinules (Fig. 3D). Sternite I without shagreen, S II-VIII with shagreen of fine spinules. Posterior margin of T II-VIII with transverse row(s) of 1 to many pointed tubercles (T II sometimes lacks this row); posterior margin of S IV-VII with transverse row(s) of smaller pointed tubercles. Conjunctives II/III-VI/VII with trans-

verse row of anteriorly curved hooklets. Pedes spurii A and B absent. Dorsal conjunctives V/VI-VI/VII with pair of 0-setae; ventral conjunctives II/III-VI/VII with pair of 0-setae. Tergites I and VIII with 4 pairs of D setae; T II-VII with 5 pairs of D setae. Sternite I with 3 pairs of V setae; S II-VII with 4 pairs of V setae; S VIII with 1 pair of V setae. Tergites I and VIII with 2 L setae, T II-VII with 4 L setae; all lateral setae reduced, L_2 longest on T II-VII. Anal lobe with uniserial fringe confined to posterior third of lobe. Anal macrosetae absent; no filamentous seta on inner margin of anal lobe. Genital sacs of male and female not extending to apex of anal lobe; male lobes longer than female.

Larva.—Small, length about 4–7 mm.

Head capsule about 1½ times as long as wide (Fig. 4B). Dorsum with frontoclypeal apotome. Antenna about ¼ length of head capsule; 5 segmented, with ring organ on proximal third and 2 antennal "setae" on distal third of first segment; antennal blade slightly longer than flagellum; small Lauterborn organs and well developed style present at apex of segment 2 (Fig. 4F). Labrum (Fig. 4A) with scalloped anteromedian margin; S I bifid; S II large, rising from small pedestal; S III thin, situated posterolaterad to S I and anteriad to S II; S IVA present adjacent to S II, S IVB apparently absent or vestigial. Pecten epipharyngis consists of 3 spines; adjacent first pair of chaetulae laterales of similar shape; one pair of chaetulae laterales with widely expanded base and pectinate margin with one apical blade darker than others; 2 additional smaller, broadly pectinate pairs of chaetulae laterales. Chaetulae basales absent. Premandible with simple apex, with well developed brush near midpoint. Mandible with 4 inner teeth and with apical tooth usually longer than inner teeth; seta subdentalis extends forward to apex of proximal inner tooth; seta interna with 6–7 plumose branches (Fig. 4D). Mentum (Fig. 4E) with 3 median teeth and 5 pairs of lateral teeth, first pair of lateral teeth closely appressed to outer median teeth; ventromental plates vestigial, without beard beneath; seta submenti slightly shorter than mentum length. Maxilla with lacinial chaetae bladelike, with smooth or fringed inner margins; setae maxillaris simple; galea with group of short setae, without pecten galearis.

Anterior parapods separate, longer than wide, each with some long claws bearing one to several inner spines/teeth, some shorter, stouter, curved claws with inner teeth, and a pair of dark, well sclerotized, hooked claws with expanded bases (Fig. 4C); a single longer seta near base of each parapod. Body with second and third segments fused. Salivary/silk glands large (280+ μm long). Procerci small, bearing 4 large apical setae and 2 weak basal setae. Posterior parapods separate, longer than wide, bearing a strong, simple subbasal seta; with simple hooked claws. Anal tubules shorter than posterior parapods. Body segments with 0–2 pairs of longer (70–90 μm) setae, setae longer on posterior segments.

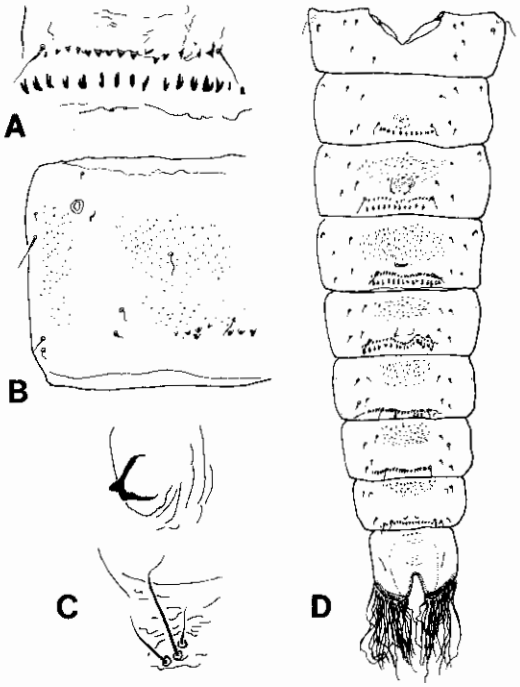

FIG. 3. *Tempisquitoneura merrillorum* pupal structures: A.—Detail of posteromedian portion of tergite III. B.—Right lateral half of sternite VI. C.—Spine of humeral callus and precorneal setae. D.—Abdomen, dorsal.

Remarks

Tempisquitoneura features several adult and pupal characters previously ascribed to either *Corynoneura* or *Thienemanniella* (the *Corynoneura* group, also referred to by some authors as the "Corynoneurini"). The genus also possesses several characters unique for the group. In the adult these include: wings with well developed anal lobe, setae present on female antennal ped-

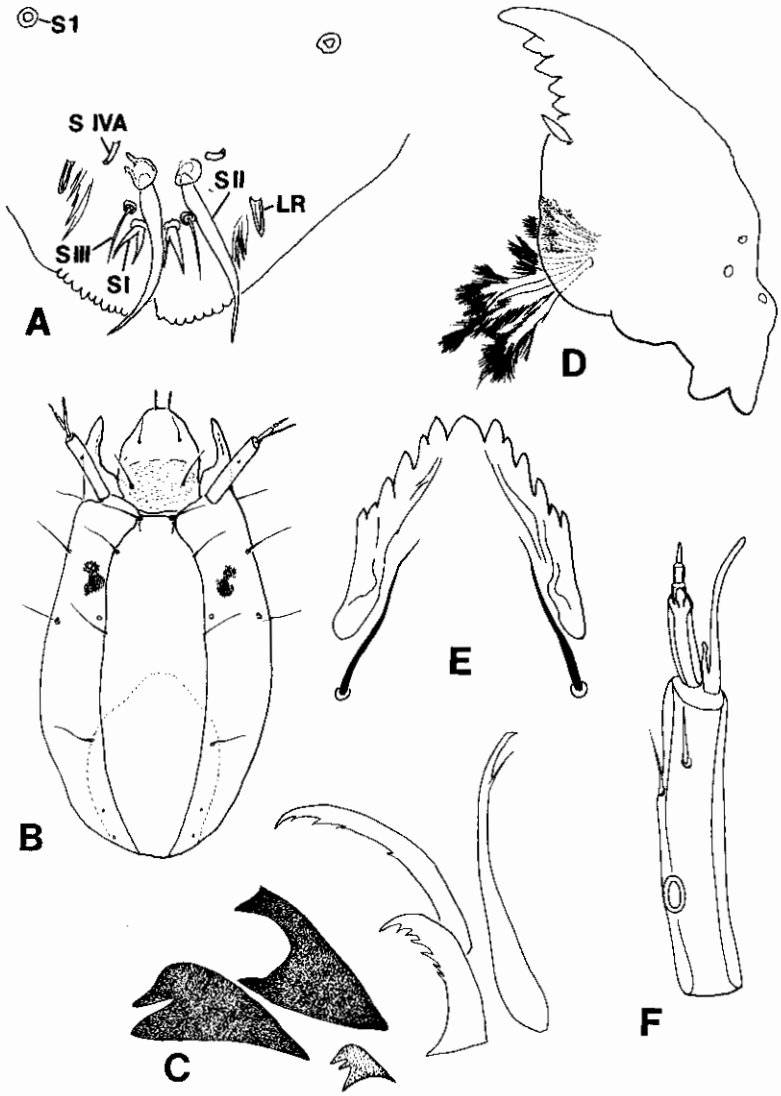

FIG. 4. *Tempisquitoneura merrillorum* larval structures: A.—Palatal surface of labrum; LR = labral rod; S 1 = labral (cephalic) seta 1; S I = seta anteriores, S II = seta posteriores; S III = seta minuscula; S IVA = bisensillum A of labrum. B.—Head capsule, dorsal. C.—Claws of anterior parapod. D.—Mandible. E.—Mentum. F.—Antenna.

icel, palpomere 3 with numerous dorsal setae, abdominal tergites II–V with a raised, median circular group of setae, male sternapodeme transverse, with strong anterolateral projections (sternapodeme transverse with weak anterolateral projections in *Thienemanniella*; in *Corynoneura* the sternapodeme is an inverted U- or V-shape and without anterolateral projections), female genitalia with sclerotized spatulate structure between dorsomesal lobes; pupa: frontal setae absent, humeral callus with broad spine, abdomen with reduced lateral setae, none of which are lamelliform, anal macrosetae and setae of inner margin of anal lobe absent; larva: S I bifid, antennae short and anterior parapods with two well sclerotized large hook-like claws. Some of these characters, such as the broad spine on the humeral callus and reduced lateral setae of the pupa, the modified anterior parapod claws, and (perhaps) the short antennae of the larva,

are probably related to the symphoretic life style of the immature stages and would be regarded as autapomorphies.

Characters shared with *Thienemanniella* include: adult: transverse portion of sternapodeme of male genitalia straight, hind tibial apex not widened; pupa: dorsocentral setae arranged in two pairs; larva: antennae five-segmented, simple subbasal seta at posterior parapod. Following the analysis of Schlee (1968), these characters are symplesiomorphies. The arrangement of the pupal dorsocentral setae, which were not included in Schlee's analysis, would also be considered a plesiomorphic character state. In *Corynoneura*, the anteriormost dorsocentral seta is displaced ventrally. Characters shared with *Corynoneura* include: adult: dorsal keel present on fore trochanter; bare eyes; pupa: weak pearl rows present (however, one species assigned to *Thienemanniella* has pearl rows; see below). The fore trochanter keel was considered by Schlee (1968) to be a derived character state. The wings of *Tempisquitoneura* bear a well developed anal lobe. Reduction of this lobe was considered apomorphic by Schlee (1968); the anal lobe is most reduced in *Corynoneura*. With the exception of the fore trochanter keel, the adults of *Tempisquitoneura* are morphologically plesiomorphic members of the *Corynoneura* group.

Ferrington and Sæther (1995) describe a new Neotropical genus, including two species, which they tentatively place in the *Corynoneura* group. This genus possesses a dorsal keel on the trochanters and wing venation somewhat similar to the other members of the *Corynoneura* group (R_1 and R_{2+3} are apically inflated). The wing lacks an anal lobe and the sternapodeme is transverse, without oral projections. However, unlike *Corynoneura*, *Tempisquitoneura*, or *Thienemanniella*, the genus has a weak, rounded anal point, a phallapodeme with a rounded, blunt aedeagal lobe (other *Corynoneura* group genera have a pointed, recurved aedeagal lobe), the ventromedial margin of the gonocoxite bears a line of strong setae not found in other members of the group, and the fourth tarsomeres are not cordiform. Because only the males are known, it is not possible to accurately assess this taxon's position. It may not belong in the *Corynoneura* group.

Numerous pupal types occur in Neotropical members of the *Corynoneura* group which may represent new genera (W. P. Coffman, University of Pittsburgh, personal communication). Note that Coffman et al. (1992) found 37 species, based on pupal exuviae, of "Corynoneurini" from streams in the Guanacaste area of Costa Rica. *Tempisquitoneura* appears most similar to *Thienemanniella semifimbriata* Sæther, described from the British West Indies (Sæther 1981) and since recorded from Costa Rica (Watson and Heyn 1992) and Guatemala (Sublette and Sasa 1994). The pupa of that species also has two pairs of dorsocentral setae, wing sheath pearl rows (as in *Tempisquitoneura*, these are much weaker than those in *Corynoneura*) and caudal hooklets on conjunctives II/III–VI/VII, and the larva has elongated posterior parapods. However, on the generic level, the adult and larva of *T. semifimbriata* are not clearly different from other described species of *Thienemanniella*. Sæther (1981:37) noted that it would be "most appropriate not to name a new genus for this species until the apparent synapomorphies can be checked on a larger number of species".

Schlee (1968) considered five trends for the larvae, all of them involving progressive elongation of certain body structures, with the longer structures considered apomorphic. These included: 1) elongation of the head capsule. Schlee (1968) gave head capsule length/width values of about 1.3 for *Thienemanniella* and about 2 for *Corynoneura*. *Tempisquitoneura* lies in between with a value of about 1.7. 2) Elongation of the antennae. Here *Tempisquitoneura* falls at the bottom of the gradient with its short antennae; *Corynoneura* has the longest antennae. 3) Elongation of the anterior parapods and 4) posterior parapods. The anterior and posterior parapods are elongated in *Tempisquitoneura* to a point intermediate between those of most *Corynoneura* and *Thienemanniella*; larvae of *Corynoneura* have the longest parapods. 5) Elongation of the procerci. Schlee (1968) gave values of length 2–3 times the width for *Thienemanniella* and about 6 times for *Corynoneura*. In *Tempisquitoneura* this value is about 2. Thus, in three of the five trends, *Tempisquitoneura* occupies an intermediate state; in the other two, it lies at the plesiomorphic end of the gradient.

Tempisquitoneura and *Thienemanniella* appear to form a plesiomorphic sister group to *Corynoneura*. However, given the mix of characters present in *Tempisquitoneura*, the phylogenetic relationship between that genus and *Corynoneura–Thienemanniella* is uncertain and will remain so until further taxa in the Neotropical *Corynoneura* group are described in all life stages.

Tempisquitoneura larvae bear noticeably large salivary/silk glands. Many (most?) Nearctic *Corynoneura* and *Thienemanniella* also have large glands, but not as large as those observed in *Tempisquitoneura*.

The labral setae of the larva have been difficult to interpret in the *Corynoneura* group. Cranston et al. (1983) stated for *Thienemanniella*: "well developed seta on tubercle may be either labral seta S I or S IVa". For *Corynoneura* they stated: "strongly developed seta arising from socket may be either S III or S I setae". Apparently the authors meant to state labral (cephalic) seta S 1, not S I. Sæther (1981:35), in his description of the larva of *Thienemanniella semifimbriata*, stated "labral seta S 1 visible ventrally and appearing as a strong S I seta on a tubercle". It is clear that the enlarged seta is not labral (cephalic) seta S 1 (Figs. 4A, B), nor is it S I. Our interpretation of the labral setae of *Tempisquitoneura* (and Nearctic *Thienemanniella* prob. *xena* (Roback) used for comparative purposes) follows fig. 67 in Sæther (1980), where this large seta should be interpreted as S II. It appears that S IV B is absent or vestigial, or may be what we have called the labral rod. A similar situation is apparent in *Corynoneura*, as can be seen in fig. 9.3 in Hirvenoja and Hirvenoja (1988). *Tempisquitoneura* is the only member of the *Corynoneura* group with a bifid S I (the S I was not observed on specimens of *Thienemanniella semifimbriata*).

Etymology

Named for the Río Tempisquito in northwestern Costa Rica, where most of the specimens were collected.

Tempisquitoneura merillorum Epler, new species

Theinemanneilla sp. nov. de la Rosa 1992:316.

Type locality: **COSTA RICA**: **Guanacaste**: Quebrada Pedregal, 2 km south of Estación Cerro El Hacha; 10°58'55"N, 85°32'30"W, elevation 300 m.

Description

As in the generic diagnosis, with the following additions:

Adult male (n = 5).—Thorax length 0.77–0.92, 0.82 mm; abdomen length 0.99–1.19, 1.12 mm; total length 1.80–2.10, 1.94 mm.

Color (in alcohol): Apex of antenna and pedicel dark brown, palps light brown except palpomere 5 white; occiput with brown band, remainder of head pale brown. Wing with arculus and clavus dark brown, remainder clear; haltere with base brown, apical knob light. Legs (Fig. 1C) stramineous with following brown markings: fore leg—base of trochanter, apical ⅔ of femur except for small pale preapical area; proximal tibial apex and band at about ⅓ length; apices of tarsomeres 1, 2, and entire tarsomeres 3–5 with pale brown; mid leg—trochanter; band at mid-femur; proximal apex of tibia; with slight darkening at distal tibial apex and apices of tarsomeres 1, 2, and entire tarsomeres 3–5; hind leg—base of trochanter; distal ½ of femur; tibial apices; apices of tarsomeres 1, 2, and entire tarsomeres 3–5 with pale brown. Thorax and abdomen patterned as in Figures 2D, E; sternites IV–VII with anterior brown band, VIII mostly brown; hypopygium pale.

Head: inner vertical setae 1–2, 1, outer vertical/postorbital setae 2–5, 3; clypeal setae 17–24, 21; cibarial setae 1–3, 2. Tentorium length 130–140, 136. Length of palpomeres 1–5 (n = 4): 25–38, 33; 40–45, 43; 72–88, 79; 90–100 (n = 3); 165 (n = 1). AR 0.38–0.55 (n = 3).

Thorax: Antepronotal setae 5–8, 6; dorsocentral setae 15–21, 18; prealar setae 3–5, 4; scutellar setae 7–11, 9. Anapleural suture length 108–182, 155, about ½ as long as preepisternum.

Wing: Length 880–980, 916; width 360–400, 375. C 330–375, 352, M 265–295, 283, Cu 440–525, 475; VR 1.57–1.78, 1.68; C/wing length 0.37–0.40, 0.38, Cu/wing length 0.49–0.54, 0.52.

Legs: Lengths and proportions of legs are shown in Table 1. Length of tibial spurs: fore 33–40, 37; mid 15–17, 16 and 25–30, 28; hind 15–23, 19 and 38–50, 43. Hind tibial comb with 12–13, 12 setae. Numbers of blunt tipped setae on hind margin of tarsomeres 1–3: fore 11–13, 12; 10–12, 11; 2–6, 4; mid 22–29, 26; 14–21, 18; 6–11, 9; hind 37–46, 42; 17–24, 21; 8–10, 9. Mid leg tarsomere 1 with 2–3, 2 sensilla chaetica.

Abdomen: Number of setae in circular groups on tergites II–V: 13–22, 17; 10–19, 16; 13–18, 16; 8–20, 14; 5–8, 7. Hypopygium (Fig. 2C) with 22–28, 25 dorsomedial setae. Transverse sternapodeme width 53–75, 64. Gonocoxite length 158–175, 166; gonostylus length 50–68, 56.

TABLE 1. Leg measurements (μm) and ratios for *Tempisquitoneura merrillorum*. LR = leg ratio (tarsomere$_1$/tibia); BV = Beinverhältnis (femur + tibia + tarsomere$_1$/tarsomeres$_{2-5}$); SV = Schenkel-Schiene-Verhältnis (femur + tibia/tarsomere$_1$).

	Fore	Mid	Hind
Male			
Femur	420–480, 442	470–580, 504	390–450, 414
Tibia	385–455, 415	435–520, 468	450–525, 481
Tarsomere$_1$	305–355, 324	280–325, 300	290–330, 304
Tarsomere$_2$	100–120, 110	135–155, 144	150–185, 164
Tarsomere$_3$	60–70, 64	70–80, 78	70–85, 76
Tarsomere$_4$	25–35, 30	25–30, 29	25–35, 31
Tarsomere$_5$	40–50, 43	45–50, 47	40–50, 44
LR	0.76–0.82, 0.78	0.62–0.66, 0.64	0.62–0.64, 0.63
BV	4.53–5.26, 4.80	4.02–4.52, 4.27	3.68–3.88, 3.82
SV	2.56–2.69, 2.65	3.09–3.38, 3.24	2.89–3.02, 2.94
Female			
Femur	435–495, 458	490–550, 523	410–455, 437
Tibia	395–445, 415	470–520, 486	475–540, 502
Tarsomere$_1$	300–335, 313	300–330, 310	300–340, 310
Tarsomere$_2$	95–115, 105	140–160, 149	160–190, 171
Tarsomere$_3$	55–65, 62	65–85, 76	75–85, 79
Tarsomere$_4$	30	25–30, 28	25–30, 28
Tarsomere$_5$	40–50, 47	40–50, 47	40–50, 48
LR	0.74–0.78, 0.75	0.63–0.65, 0.64	0.60–0.63, 0.62
BV	4.58–5.16, 4.87	4.23–4.67, 4.40	3.76–3.95, 3.83
SV	2.69–2.84, 2.79	3.20–3.33, 3.25	2.95–3.12, 3.03

Adult female (n = 5).—Thorax length 0.72–0.93, 0.84 mm; abdomen length 0.95–1.28, 1.11 mm; total length 1.67–2.18, 1.95 mm.

Color (in alcohol): similar to male.

Head: Inner vertical setae 2–5, 3, outer vertical/postorbital setae 5–10, 6; clypeal setae (n = 4) 27–39, 30; cibarial setae (n = 3) 2–3. Tentorium length (n = 4) 103–130, 123. Length of palpomeres 1–5 (n = 3): 38–40; 40–45; 80–95; 88–103; 152–170. AR 0.39–0.49, 0.45.

Thorax: Antepronotal setae 7–14, 9; dorsocentral setae 16–24, 22; prealar setae 3–5, 4; scutellar setae 11–12, 11. Anapleural suture length (n = 3) 160–170.

Wing: Length 940–1120, 998; width 410–460, 441. C 445–505, 480, M 285–315, 302, Cu 450–510, 476; VR 1.50–1.62, 1.58; C/wing length 0.45–0.50, 0.48, Cu/wing length 0.46–0.49, 0.48.

Legs: Lengths and proportions of legs are shown in Table 1. Length of tibial spurs: fore 35–40, 38; mid 15–20, 18 and 23–30, 28; hind 20–25, 21 and 43–50, 46. Hind tibial comb with 11–13, 12 setae. Mid leg tarsomere 1 with 28–40, 31 sensilla chaetica; hind leg tarsomere 1 with 6–15, 10 sensilla chaetica. Numbers of blunt tipped setae on hind margin of tarsomeres 1–3: fore 12–16, 14; 11–17, 14; 5–8, 7; mid 24–34, 28; 19–23, 21; 9–11, 10; hind 42–55, 47; 21–24, 22; 10–12, 10.

Abdomen: Number of setae in raised circular groups on tergites II–V: 17–26, 21; 17–23, 19; 15–21, 17; 11–18, 15; 7–12, 9. Tergite IX with 23–29, 26 setae; gonocoxite IX with 8–11, 10 setae. Seminal capsule diameter 38–43, 40. Notum length (measured from anteriormost point to bifurcation) 43–68, 61; cercus length (n = 4) 75–88, 80.

Pupa (n = 10).—Cephalothorax length (n = 7) 0.78–0.85, 0.83 mm; abdomen length (n = 8) 1.60–1.90, 1.76 mm; total length 2.53–2.68, 2.61 mm.

Color: Light brown with darker brown infuscation at base and around margin of wing sheaths; T V–II darker anteriorly and along lateral muscle mark line, genital sacs darker brown.

Cephalothorax (n = 2): Lengths of precorneal setae: anterior 12–22; median 40–49; posterior 10–15. Lengths of dorsocentral setae: Dc$_1$ 13–15;

Dc_2 24–33; Dc_3 8–10; Dc_4 38–50. Distance from Dc_1–Dc_2 19–40; Dc_2–Dc_3 228–238; Dc_3–Dc_4 13–15.

Abdomen: Number of hooklets on conjunctives II/III–VI/VII: 8–19, 14; 16–27, 20; 16–25, 19; 11–21, 16; 4–19, 9. Number of stronger caudal pointed spinules on T II–VIII: 0–2, 1; 15–38, 23; 16–50, 24; 19–55, 32; 29–63, 40; 26–59, 38; 16–51, 31. Number of stronger caudal pointed spinules on S IV–VII: 11–29, 18; 7–33, 20; 9–30, 22; 12–22, 16. Anal fringe with 24–32, 28 setae on each lobe.

Larva (n = 8).—Head capsule length (n = 2) 435–440; width 255–260; head capsule length/width 1.67–1.73; total length (n = 6) 4.3–6.5, 5.5 mm.

Color: Head capsule light brown with dark brown postoccipital margin; body cream colored in alcohol.

Head: Postmentum length 190–215, 197. Antennae (n = 7): lengths of segments 1–5: 80–86, 83; 19–23, 20; 4–5, 5; 4; 5; antennal blade 30–48, 39 long. Premandible length (n = 5) 59–67, 62. Mandible length (n = 8) 105–133, 115; seta subdentalis length (n = 6) 7–9, 8. Mentum (n = 7–8) length 63–70, 66; width 80–93, 87.

Body: Anterior parapod (n = 2) length 275–475; median width 150–225. Seta at base of parapod length (n = 7) 113–120, 116. Salivary/silk gland (n = 6) length 288–450, 373; width 93–200, 152. Procercus (n = 8) length 8–10, 8; width 15; length of procercal setae 153–188, 162. Posterior parapod (n = 6) length 175–225, 203; median width 95–120, 109; subbasal seta length 70–90, 79. Anal tubules (n = 5) 65–75, 72 long; 43–50, 45 wide.

Type material

Holotype.—**COSTA RICA. Guanacaste:** Quebrada Pedregal, 2 km south of Estación Cerro El Hacha; 10°58'55"N, 85°32'30"W, elevation (el.) 300 meters, on *Corydalus*, ♂ with pupal exuviae (Pex) and larval exuviae (Lex), collected 21.ii.1992, emerged 27.ii.1992, leg. C.L. de la Rosa.

Allotype.—♀ with pupal and larval exuviae, same locality and collection data, emerged 23.ii.1992.

Paratypes.—(All specimens taken from *Corydalus* larvae collected in Costa Rica, Guanacaste, by C.L. de la Rosa)—same locality as holotype, 1 ♂/Pex/Lex, 1 ♀/Pex, collected (coll.) 21.ii.1992, emerged (em.) 25.ii.1992; same locality, 1 ♀/Pex, coll. 21.ii.1992, em. 28.ii.1992; same locality, 1 ♀ pupa/Lex, 2 larvae, 2.vii.1989. Río Tempisquito at Hacienda Tempisquito, 10°50'45"N, 85°33'40"W, el. 100 m, 1 ♂/Pex/Lex, coll. 6.ii.1992, em. 2.iii.1992; same locality, 1 ♂/Pex, coll. 6.ii.1992, em. 7–16.ii.1992; same locality, 1 ♂/Pex, coll. 6.ii.1992, em. 17–19.ii.1992; same locality, 1 ♀/Pex, coll. 6.ii.1992, em. 5.iii.1992; same locality, 1 ♂/Pex/Lex, coll. 14.vii.1988, em. 18.vii.1988; same locality, 1 ♀/Pex/Lex; coll. 6.ii.1992, em. 20.ii.1992; same locality, 1 ♀/Pex/Lex, coll. 14.vii.1988, em. 2.viii.1988; same locality, 1 larva, coll. 14.vii.1989. Río Tempisquito, Hacienda Tempisquito, by highway, el. 100 m, 1 ♀ pupa/Lex, 1 pupa, 3.iii.1989. Confluence of Quebrada Jorco and Quebrada Bolaños, 10°58'35"N, 85°32'55"W, el. 330 m, 3 ♀/Pex, coll. 21.ii.1992, em. 25.ii.1992. Quebrada Bolaños, El Hacha Vieja, Cerro El Hacha sector, 10°58'45"N, 85°32'30"W, el. 300 m, 1 ♀ pupa, 2 larvae, coll. 2.ii.1989. Río Sapoá, Hacienda Ceferino, Cerro El Hacha sector, 11°01'N, 85°36'W (approximate location), el. 235 m, 1 ♀ pupa/Lex, 9.iv.1989. Río Azufrado, Potrerillos, by highway, el. 100 m, 1 ♂ pupa/Lex, 19.vi.1989. Quebrada Las Yegüitas, on road to Maritza, Orosí sector, 10°57'30"N, 85°32'50"W, el. 300 m, 1 ♂ pupa/Lex, 3 larvae, 20.vi.1989; same locality, 1 ♂ pupa/Lex, 19.vii.1989. Holotype, allotype, and some paratypes are deposited in the Chironomidae collection at Florida A & M University (Florida State Collection of Arthropods). Other paratypes will be placed in the Instituto Nacional de Biodiversidad (INBIO), the Academy of Natural Sciences of Philadelphia, the Canadian National Collection, and the senior author's collection. In addition, several *Corydalus* with numerous attached larvae remain in the authors' collections.

Etymology

We take great pleasure in naming this species for Judy and Barry Merrill of Dallas, Texas. Their generous contributions of computer hardware, laboratory equipment, and funds for publication have made possible this paper and others dealing with chironomid systematics.

Ecology and behavior

Phoresy is the interrelationship between two insects in which one is carried on the body of the other (Torre-Bueno 1978); this relationship does not necessarily imply an interdependency between the two, but that one is merely transported by the other. Symphoresy implies a symbiotic relationship between the two organisms. Sæther (1977) and Epler (1986) described species of *Nanocladius* (*Plecopteracoluthus*) that had symphoretic relationships with Plecoptera and Ephemeroptera. Because *Tempisquitoneura* apparently lives its entire immature life in a de-

pendent association with *Corydalus*, this phoretic relationship can be more precisely defined as symphoretic.

In northwestern Costa Rica, *Tempisquitoneura merrillorum* is very common in most streams that support a healthy population of *Corydalus*, although few pupal exuviae of the chironomid were found in foam samples. A black-light sheet trap operated at the Río Tempisquito at Hacienda Tempisquito on 6 June 1988 produced large numbers of Chironomidae, but no *Tempisquitoneura* adults. Streams with high sediment and suspended organic matter loads tended to support lower populations of *Tempisquitoneura*. Also, colder streams (~20°C) at high elevations (~700 m a.s.l. and above) supported smaller populations of *Tempisquitoneura* than warmer streams in the same drainage system.

Tempisquitoneura larvae preferred corydalid larvae with head widths greater than 3 mm; the larger the larva, the greater the number of *Tempisquitoneura* it supported (de la Rosa 1992). Small *Tempisquitoneura* larvae were usually found embedded in the abdominal gills of the host, while larger larvae preferred positions on the thorax (ventrally between the legs, and dorsally) and the first abdominal segments. Late-instar larvae built a short tube (<⅓ length of the larvae) of sand particles and detritus. A thin silk case was constructed for pupation, which occurred on the host. Preferred locations for pupation were laterally on the thorax and first and second abdominal segments. Emergence occurred year round, with a peak number of pupae found in June and July.

Tempisquitoneura larvae feed on substrate particles or detritus (determined by examination of gut contents) reached by hanging down onto the substrate while attached to the host by the rear prolegs. Upon disturbance to the host, larvae retreated to a position close to the host's body, sometimes turning inside their tubes. Larvae also examine the surface of the host for food particles (de la Rosa 1992).

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