

## ***Gynocladius scalpellosus* n. gen., n. sp. from Brazil (Diptera: Chironomidae: Orthoclaadiinae)**

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### **Abstract**

Diagnoses of the female, pupa, and larva of *Gynocladius* n. gen. are given. *Gynocladius scalpellosus* sp. n. from Brazil is described from the female, pupa, and larva. A preliminary phylogenetic analysis places the genus as the sister group of *Hanocladius* Wang and Sæther from China and intermediate between *Antillocladius* Sæther and *Comptosmittia* Sæther. The females are apparently parthenogenetic.

**Key words:** *Gynocladius*, Orthoclaadiinae, Chironomidae, Brazil, taxonomy

### **Introduction**

The Orthoclaadiinae fauna of the Neotropical Region is poorly known. Recently, several new species have been recorded and new species and genera have been described (Andersen & Mendes 2002; Andersen & Mendes 2004; Mendes *et al.* 2004a, 2004b). Although the number of orthoclaids recorded from Brazil has tripled in the 8 years since the last catalogue was published by Spies and Reiss (1996), many species remain to be described.

The material was collected in the Parque Estadual Intervales, São Paulo, Brazil, a strongly protected park situated in the Serra de Paranapiacaba Mountains, inside the nature reserve of the Serra do Mar mountain range. The park (24°12'–24°32'S, 48°03'–48°32'W) covers an area of 417 km<sup>2</sup> and includes parts of the municipalities of Ribeirão Grande, Eldorado, Guapiara, Iporanga, and Sete Barras (Campos 2001).

The main vegetation type is tropical Atlantic rain forest. The climate is tropical and super humid, with a dry season. The annual precipitation ranges from 1000 to 2000 mm and the mean annual temperature is about 20°C (Nimer 1989).

A new genus of Orthocladiinae, recently collected, is here described, figured, and diagnosed based on all life stages.

### Methods and terminology

The general terminology follows that of Sæther (1980). The material was mounted on slides in Euparal following the procedure outlined by Sæther (1969). The holotype will be deposited at the Museum of Zoology of the University of São Paulo (MZUSP), and 2 paratypes will be housed in the Museum of Zoology, Bergen Museum, University of Bergen, Norway (ZMBN).

The phylogenetic relationship of the genus was assessed using the same characters and states and the same data matrix as in Mendes *et al.* (2004a). The same outgroup (*Diplocladius* Kieffer, *Prosilocerus* Kieffer, and *Brillia* Kieffer) was used, the same multistate characters were ordered, and the same procedures were followed.

### *Gynocladius* new genus

*Type species: Gynocladius scalpellosus* new species, by present designation.

*Diagnostic characters:* The female imagines are separable from all other known orthoclads by the combination of hairy wings with bare squama; straight  $Cu_1$  and strongly extended costa; scutum with median group of strongly scalpellate acrostichals; gonapophysis VIII with well developed, brush-like ventrolateral lobe and large dorsomesal lobe; tergite IX undivided; and seminal capsules large with strongly sclerotised, triangular neck. The pupa is distinguished by lacking thoracic horns and anal lobe fringe; spines present posteriorly on tergites II–VIII and sternites III(IV)–VII; and subequal macrosetae on spined tubercles about half as long as the anal lobe. The larva has plumose S I; premandible with 3 apical teeth; 5-segmented antenna with blade much longer than flagellum; mentum with single median tooth, 5 pairs of lateral teeth and reduced ventromental plates; and minute procerci with reduced anal setae.

*Etymology:* From Greek *gyne*, meaning female, referring to the parthenogenesis, and “cladius”, a common ending among orthoclads.

*Female imago:* Small species; wing length about 0.9 mm.

Eye bare, rounded, no dorsomedian elongation. Antenna with 5 flagellomeres and long, simple sensilla chaeticae on each, without stiff apical seta. Palpomeres well developed; third palpomere with 1 lanceolate sensilla clavata. Temporals consisting of few inner and outer verticals and postorbitals. Tentorium very narrow. Cibarial pump with concave anterior margin and strongly diverging cornua. Clypeus broad, with numerous setae.

Anteprenotal lobes collar-like, slightly narrowed medially, with few lateral setae. About 8 short median, distinctly scalpellate acrostichals; several dorsocentrals, uni-biserial anteriorly, uniserial posteriorly; few prealars; supraalar absent. Scutellum with few transversely uniserial setae.

Wing without anal lobe; all cells with setae, with fine punctation; costa strongly extended, reaching near apex of wing;  $R_{4+5}$  ending distal to apex of  $M_{3+4}$ ;  $R_{2+3}$  ending in middle between  $R_1$  and  $R_{4+5}$ ; VR about 1.4;  $Cu_1$  straight; postcubitus ending far distal to cubital fork; anal vein ending beyond cubital fork. Brachiolum with 1 seta, subcosta bare, other veins with numerous setae. Squama bare. Sensilla campaniformia about 8 basally and 8 apically on brachiolum, 3 below setae on brachiolum; 1 present basally on subcosta, and 1 on RM.

Front leg ratio about 0.7. Spurs well developed; hind tibial comb normally developed. Pseudospurs absent, sensilla chaeticae not observed. Pulvilli absent.

Tergites with few median and lateral setae.

Female genitalia with well developed gonocoxite with several short and several long setae. Coxosternapodeme straight laterally, curved medially, connected basal of vagina. Tergite IX undivided, with several setae. Postgenital plate triangular. Cercus of moderate size. Gonapophysis VIII divided into brush-like ventrolateral lobe and large dorsomedian lobe. Apodeme lobe relatively conspicuous. Seminal capsules larger than cerci, ovoid, pale anteriorly, with very large, triangular, dark sclerotised neck. Spermathecal ducts curved close to seminal capsule and common opening. Labia without microtrichiae.

*Pupa*: Small, about 1.5 mm long. Exuviae nearly transparent with anal lobe projections slightly darkened.

Cephalothorax. Frontal setae absent. Cephalic area smooth. Ocular field apparently with two postorbitals. Two median anteprenotals and one lateral anteprenotal. Thoracic horn absent, 3 precorneals, apparently three dorsocentrals, not grouped. Wing sheath smooth, without pearls or nose.

Abdomen. Tergite I with single caudal row of weak spines, tergites II–IX and sternites III–VIII with extensive shagreen. Conjunctives with small spines. Tergite II without caudal hooklets. Tergites II–VIII with single caudal row of spines, no caudal spines on sternites. Pedes spurii A and B absent. Segments II–VIII apparently with 2 L-setae. D, V and O setae present, but weak. Anal lobe with 3 subequal macrosetae about half as long as anal lobe and situated on spined tubercles. Genital sac of female rounded, not reaching apex of anal lobe.

*Larva*: Small, about 2.6 mm long.

Antenna with 5 segments, basal segment longer than flagellum; third antennal segment much shorter than fourth. Basal antennal segment nearly 3 times as long as basal width, with ring organ situated just below middle. Lauterborn organs weak, about as long as the short third segment, style well developed. Blade much longer than flagellum, accessory blade about as long as second segment.

S I plumose. Other S setae simple. Labral lamella apparently absent. Few spinulae and chaetae. Pecten epipharyngis consisting of 3 pointed teeth. Chaetulae laterales and chaetulae basales apparently simple. Premandible with 3 apical teeth, with third about half as long as 2 apical; without brush.

Mandible with apical tooth slightly shorter than combined width of first 3 of 4 inner teeth. Fourth tooth fused with mola. Seta subdentalis slightly curved, seta interna with 4–7 branches, longer branches pectinate or plumose.

Mentum with 1 median tooth and 5 pairs of lateral teeth of which outer 2 teeth slightly smaller. Ventromental plates inconspicuous, beard absent. Setae submenti just below base of outer lateral tooth of mentum.

Maxilla and maxillary palp apparently normally developed.

Anterior and posterior parapods well developed; longer claws of anterior parapods with few apical distinct inner teeth. Procercus minute with only about 4 short anal setae, supraanal seta relatively well developed. Anal tubules well developed, digitiform, about as long as posterior parapods.

## Systematics

The imago keys to couplet 44 with *Comptosmittia* Sæther and *Parasmittia* Strenzke in Cranston *et al.* (1989), to *Antillocladius* Sæther in Sæther *et al.* (2000). The pupa will key to *Metricnemus* v. d. Wulp in Coffman *et al.* (1986) and Sæther *et al.* (2000). The larva keys to *Heleniella* Gowin in Cranston *et al.* (1983) and Sæther *et al.* (2000).

The phylogenetic analysis revealed 54 trees each with 769 steps, consistency index (CI) of 0.25, retention index (RI) of 0.44, and rescaled consistency index (RC) of 0.11. The strict consensus tree is shown in Fig. 1A, with Bremer supports given above each branch.

When the results were reweighted according to RC, a single tree with 771 steps (when the weights were reset to 1), CI of 0.37, RI of 0.62, and RC of 0.23 (Fig. 1B) was obtained. For the reweighted tree, the character weights are reset to 1, resulting in one Bremer support becoming lower than 0.5, and the supports adjusted to the shortest tree.

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**FIGURE 1.** Parsimony analysis of some genera of the Orthoclaadiinae, with *Diplocladius* Kieffer, *Propilocerus* Kieffer, and *Brillia* Kieffer combined as outgroup. Character and character states as in Table 1 of Mendes *et al.* (2004a). Data matrix for genera other than *Gynocladus* as in Mendes *et al.* (2004a) Table 2. Bremer supports for each branch are given as numbers above the branches. A, strict consensus of shortest trees; B, the single shortest tree obtained after reweighting according to the rescaled consistency index.



In the reweighted tree, *Gynocladius* forms the sister genus of *Hanocladius* Wang & Sæther known from a subtropical mountain forest area in the Hubei province of Oriental China (Wang & Sæther 2002). The thorax as well as the wing venation of the two genera are practically identical. However, *Hanocladius* has bare wings and uniquely long front metatarsi with a leg ratio of 1.15. In hypopygial features, *Hanocladius* resembles *Unniella* Sæther. Because the immatures of *Hanocladius* are unknown the sister group relationship with *Gynocladius* can at best be regarded as tentative.

Although the differences between the data matrix in Mendes *et al.* (2004a) and the one forming the basis for the present result consists only in the inclusion of *Gynocladius* and the consolidation of species into the genera *Antillocladius*, *Comptosmittia* Sæther, and *Litocladius* Mendes, Andersen & Sæther, the results appear to differ significantly. However, with a few exceptions the differences consist in some groups becoming paraphyletic instead of monophyletic. The diverse group from *Corynoneura* Winnertz to *Parakiefferiella* Thienemann, for instance, forms the sister group of *Botryocladius* Cranston & Edward to *Tvetenia* Kieffer in Mendes *et al.* (2004a), whereas the two groups form a paraphyletic group in Fig. 1B. More significant differences consist of the change in the position of *Metriocnemus* v. d. Wulp as the sister genus of *Chaetocladus* Kieffer to a position as the sister genus of the *Pseudorthocladus* group, and the change in position of *Apometriocnemus* Sæther from sister genus of *Limnophyes* Eaton to sister genus of *Gymnometriocnemus* Goetghebuer. At least the last-mentioned change appears sensible. The relationships among more basally placed genera thus should not be taken as relevant. Similar genera are not included in the analysis, being represented by only one in each group. Including all genera close to *Corynoneura* and to *Eukiefferiella* Thienemann has shown that these groups combined probably are monophyletic. Likewise, when *Onconeura* Andersen & Sæther is added, *Botryocladus* and *Unniella* are joined with this genus into a basally placed monophyletic group.

In summary, the placement of *Gynocladius* appears to be close to *Antillocladius* and perhaps related to *Hanocladius*.

#### ***Gynocladius scalpellosus* sp. n. (Figs. 2–4)**

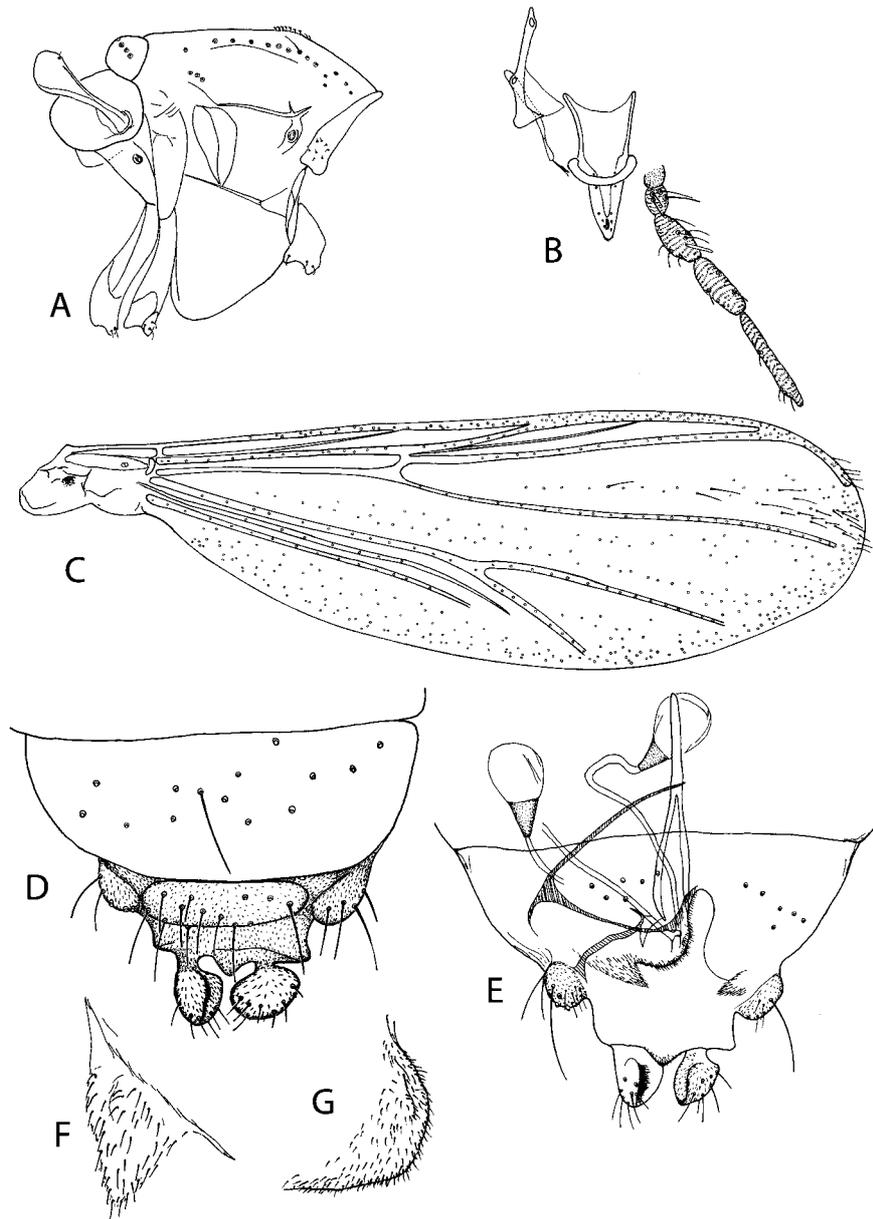
*Type material:* Holotype female with larval and pupal exuviae: BRAZIL: São Paulo State, Guapiara city, Parque Estadual Intervales, Lajeado de Cima, temporary pool, 24°16'43" S; 48°26'32" W, 820 m. a.s.l. 29.IV.2001, reared from larva, M. A. Morraye (MZUSP) Paratypes: 1 female with larval and pupal skin; 1 female with larval skin; 3 females: same data as holotype (ZMBN).

*Additional material:* 3 larvae and one female with larval and pupal skins, same data as holotype.

*Diagnostic characters:* See generic diagnosis.

*Etymology*: From Latin *scalpellum*, surgical knife, and *-osus*, full of, referring to the scalpellate acrostichals.

*Female* ( $n = 3$ , except when otherwise stated). Total length 1.29–1.34 mm. Wing length 0.82–0.91 mm. Total length/wing length 1.45–1.64. Wing length/length of profemur 2.43–2.47. Coloration: uniformly dark yellow, antennae and tarsi greyish.



**FIGURE 2.** *Gynocladius scalpellus* sp. n., female imago. A, thorax (lateral); B, cibarial pump, stipes, tentorium, and palp; C, wing; D, genitalia, dorsal view; E, genitalia, ventral view; F, ventro-lateral lobe of gonapophysis VIII; G, dorsomesal lobe of gonapophysis VIII.

Head. Flagellomeres length (in  $\mu\text{m}$ ): 64–66; 27–41; 43–46; 25–37; 55. Pedicel 34–37  $\mu\text{m}$  long, 48–50  $\mu\text{m}$  wide. Temporal setae 7–8; including 2 inner verticals; 3 outer verticals; and 2–3 postorbitals. Clypeus with 16–20 setae. Tentorium, stipes, and cibarial pump as in Fig. 2B. Tentorium 87–96  $\mu\text{m}$  long; 7–10  $\mu\text{m}$  wide. Stipes 87  $\mu\text{m}$  long; 27  $\mu\text{m}$  wide (1). Palpomere lengths (in  $\mu\text{m}$ ): 16–18; 20–25; 46–48; 48; 80–89. Third palpomere with 1–3 non-grouped sensilla clavata in apical one-third, 14–17  $\mu\text{m}$  long.

Thorax (Fig. 2A). Anteprenotum with 4–8 setae. Acrostichals 7–13 scalpellate, plus 2 anterior simple; dorsocentrals 12–26, starting close to anteprenotum; prealars 3–5. Scutellum with 6–9 setae.

Wing (Fig. 2C). VR 1.38–1.41. C extension 94–115  $\mu\text{m}$  long. Brachiolum with 1 seta; C extension with 15–25 non-marginal setae; R with 11–13 setae;  $R_1$  with 11–25;  $R_{4+5}$  with 20–22; M bare;  $M_{1+2}$  with 28–29;  $M_{3+4}$  with 14–15; Cu with 11–13;  $Cu_1$  with 7–9; Pcu 7–12 and An with 13–15. Cell  $r_{4+5}$  with 52–68 setae; m with 10–15;  $m_{1+2}$  with 106–128;  $m_{3+4}$  with 37; cu with 8–17 setae; an with 96–99.

Legs. Spur of front tibia 20–22  $\mu\text{m}$  long; spurs of middle tibia 14–16  $\mu\text{m}$  and 18–27  $\mu\text{m}$  long; spurs of hind tibia 15–16  $\mu\text{m}$  and 27–30  $\mu\text{m}$  long. Width at apex of front tibia 20–22  $\mu\text{m}$ ; of middle tibia 22–25  $\mu\text{m}$ ; of hind tibia 27–32  $\mu\text{m}$ . Comb with 8–10 setae, longest 22–27  $\mu\text{m}$  and shortest 14–20  $\mu\text{m}$ . Lengths and proportions of legs as follows ( $n = 1-2$ ):

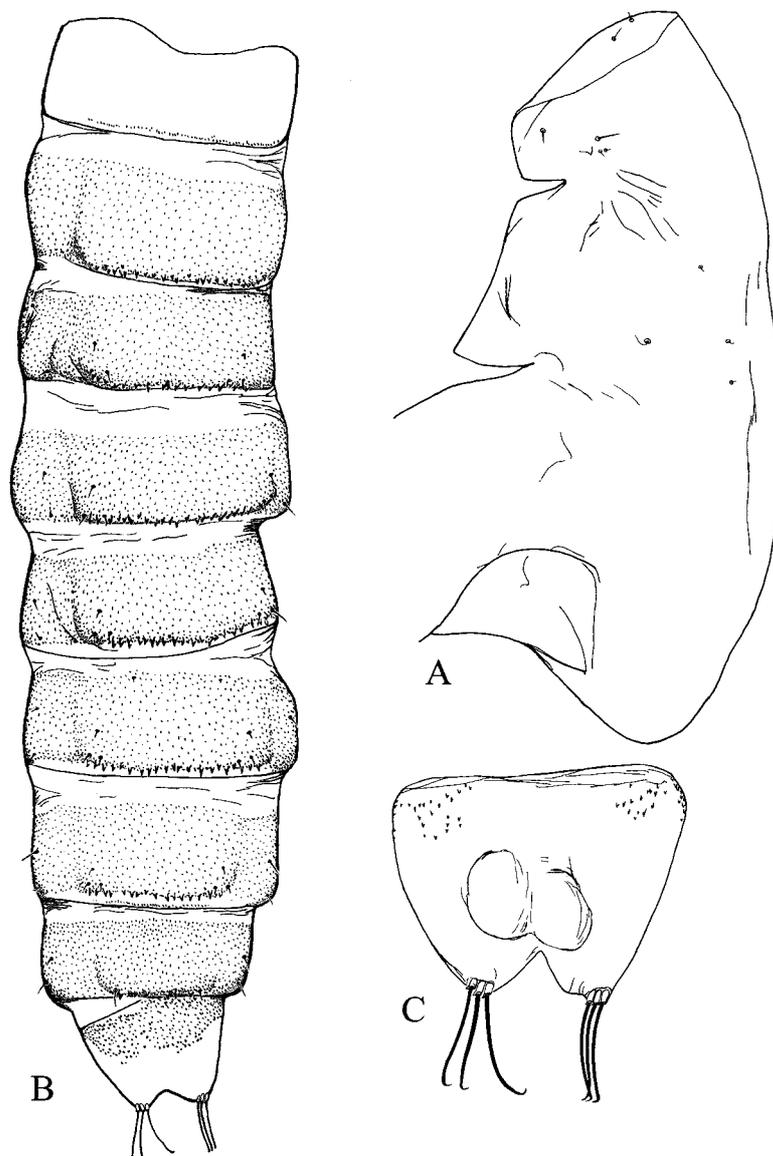
	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
P <sub>1</sub>	338–346	346–371	230–256	104–122	54–94	36–40	29	0.62–0.74	3.30–4.24	2.68–3.11	2.5–2.7
P <sub>2</sub>	371–374	302–338	169	76	50	25	25	0.53	4.50	4.11	3.7
P <sub>3</sub>	389–403	375–428	198–202	97–101	79	32	25	0.51–0.53	3.54	3.84–3.95	2.6–3.1

Genitalia (Fig. 2D–G,  $n = 1$ ). Sternite VIII with 14 setae. Gonocoxite with 12 setae. Tergite IX undivided, with about 18 setae. Cercus 37  $\mu\text{m}$  long, 16  $\mu\text{m}$  wide. Seminal capsule 59  $\mu\text{m}$  long, including 21  $\mu\text{m}$  long neck, maximum width 34  $\mu\text{m}$ . Spermathecal ducts straight for most of distance, but with loops close to seminal capsule. Notum 147  $\mu\text{m}$  long.

*Pupa* ( $n = 2$ ). Total length 2.19 mm (1). Exuviae pale, nearly transparent.

Cephalothorax (1) (Fig. 3A). Frontal apotome smooth. Ocular field apparently with 2 postorbitals, each approximately 16  $\mu\text{m}$  long. Antennal sheath smooth. Two median anteprenotals 25 and 15  $\mu\text{m}$  long, respectively, one lateral anteprenotal 35  $\mu\text{m}$  long. Pre-corneals as in Fig. 3A, each 25, 22, and 16  $\mu\text{m}$  long, respectively, all grouped together. Dorsocentrals each approximately 12  $\mu\text{m}$  long, prealar 34  $\mu\text{m}$  long.

Abdomen (Fig. 3B). Numbers of caudal spines on tergites II–VIII as follows: 13–17; 18–20; 20–23; 20–24; 21–25; 18–21; 9–15. Length (in  $\mu\text{m}$ ) of the longest caudal spine on tergites II–VIII (in  $\mu\text{m}$ ) as follows: 11–13; 9–13; 13–16; 16–14; 16; 13; 11. Anal lobe (Fig 3C) 153–157  $\mu\text{m}$  long, with 3 macrosetae, respectively 71–76, 80–82, and 89–92  $\mu\text{m}$  long. Distance from apex of genital sac to apex of anal lobe 41–46  $\mu\text{m}$ .



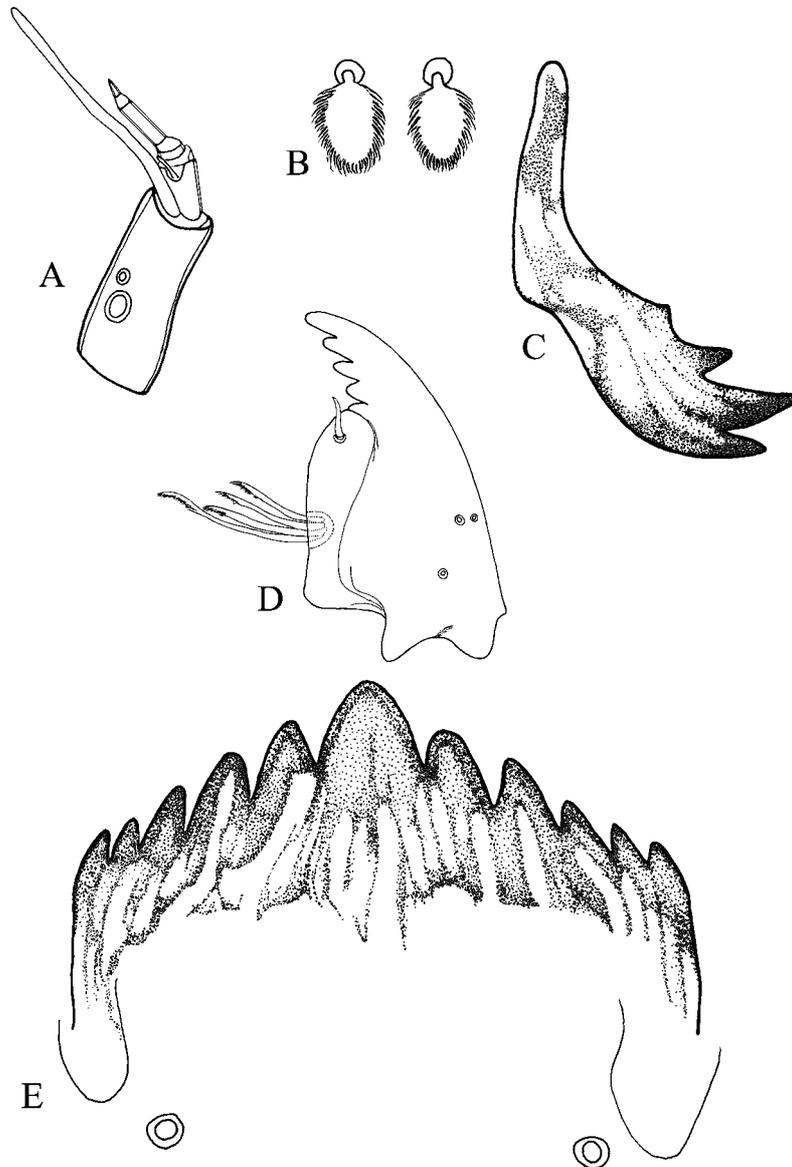
**FIGURE 3.** *Gynocladius scalpellosus* sp. n., pupa. A, cephalothorax (lateral); B, tergites (setae on segments I–II, omitted); C, anal lobe (ventral view).

*Larva* ( $n = 1-2$ ) fourth instar.

Head capsule 227–245  $\mu\text{m}$  long. Postmentum 48–53  $\mu\text{m}$  long. Colour of thoracic segments brown, head and abdomen amber yellow.

Head. Antenna as in Fig. 4A; segment lengths in  $\mu\text{m}$ : 23, 9, 3, 7, 3. Blade 34  $\mu\text{m}$  long, longer than flagellum; apical style of second segment 5  $\mu\text{m}$  long. Seta I plumose (Fig. 4B), other setae simple. Premandible as in Fig. 4C, 30–34  $\mu\text{m}$  long. Mandible (Fig. 4D) 71–74

$\mu\text{m}$  long, with apical tooth and four inner teeth, fourth tooth fused with mola; seta subdentalis slender; seta interna with four branches. Mentum (Fig. 4E) 53–55  $\mu\text{m}$  wide, with irregular, 7–9  $\mu\text{m}$  long median tooth, and five lateral teeth.



**FIGURE 4.** *Gynocladius scalpellosus* sp. n., larva. A, antenna; B, Seta I; C, premandible; D, mandible; E, mentum.

Abdomen without distinct setae. Anterior parapods fused, with numerous claws, all simple; posterior parapods not measurable. Supraanal seta approximately 46  $\mu\text{m}$  (1) long. Procerci 7  $\mu\text{m}$  wide, 7  $\mu\text{m}$  long; with 4 setae, shortest 50  $\mu\text{m}$  long, longest 71  $\mu\text{m}$  long. Anal tubules not measurable.

## Notes on biology and habitat

One larva was collected with water, mud, and clay from a small temporary pool that was nearly dried out, and transported to the laboratory of Aquatic Entomology, at Ribeirão Preto where the sample was kept wet. Rearing and transport conditions followed the procedures suggested by Mendes (2002).

A cave and sand-bottomed streams characterize the area near the sampling site; the sample, therefore, did not contain high levels of organic debris. The sampling site is located in a protected area of the Parque Estadual Intervales, São Paulo State, Brazil, where the last author carried out a post-doctoral study.

The larva kept under laboratory conditions was reared to a female, which laid about 12 small, white, and elliptical eggs inside the pupal exuviae; 10–12 additional eggs were found inside the female, but it was preserved (alcohol 70%) after laying the first half of the eggs. The material studied here originates from those eggs. From the 12 eggs, 7 completed development successfully. The others died as larvae. The time from hatching to emerging of the adults was about 22 days. The larval gut-content analysis revealed the presence of detritus, fungal hyphae, and micro-algae. All adults obtained were females, indicating a probable parthenogenetic reproductive strategy. Another parthenogenetic species has been taken in the same area, but occurs in bromeliads, and is being described by Dr. J. H. Epler (paper presented during the XVth International Symposium on Chironomidae in Minneapolis, MN, USA). Some collecting from the streams and mosses surrounding the temporary pools was carried out, but no further specimens were found.

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