



Description of the immatures of the predaceous midge *Bezzia blantoni* Spinelli & Wirth (Diptera: Ceratopogonidae)

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Abstract

The fourth instar larva and pupa of *Bezzia blantoni* Spinelli & Wirth (1989) are described, illustrated and photomicrographed by using phase-contrast microscopy and Scanning Electron Microscope (SEM). The larva, which shows features typical to carnivorous larvae, is compared with that of *B. roldani* Spinelli & Wirth. The species is recorded for the first time from the Martín García island, located in the La Plata river between Argentina and Uruguay. Details of the biology traits, breeding location and feeding behavior are given.

Key words: Larva, Pupa, *Bezzia blantoni*, SEM, Martín García island, Argentina

Introduction

The genus *Bezzia* Kieffer includes relatively large-sized, predaceous midges represented in the Neotropics by 46 species, of which the egg of one, the larva of four and the pupa of eight species are known (Borkent & Spinelli, 2007). The adults are important predators of small invertebrates, mainly chironomid midges. The immatures are relatively common inhabitants of different kind of wetlands, mainly streams, lakes and ponds, as well as other habitats, such as sphagnum bogs, rice fields, hoofprints in a sandy creek bed, water in tree holes, and water in bromeliads (Ronderos *et al.*, 2007).

The widespread species *Bezzia blantoni*, known from Belize to Argentina, was originally described by Spinelli & Wirth (1989) based on adult and pupa. Although these are relatively modern descriptions, the one of the pupa is incomplete. This species was not been mentioned again in the literature, except in catalogs in reference to the original description.

During a recent entomological survey carried out in Martín García island, located in La Plata River between Argentina and Uruguay, larvae and pupae of *Bezzia blantoni* were collected. The purpose of this paper is to describe the fourth instar larva and redescribe the pupa of this species on the basis of observations carried out with Phase-Contrast Microscopy (PCM) and with Scanning Electron Microscopy (SEM).

Material and methods

Larvae and pupae were collected with micropipetae by placing in a plastic tray floating hydrophytes from a pond located in the Martín García island. Immatures were carried to the laboratory in vials containing water of the environment, transferred individually in Petri dishes and observed daily to record development. This water contained some small, unidentified microorganisms, upon which the larvae likely fed. All immatures were examined under both dissecting and compound microscope. For the observation of larvae with PCM at oil immersion, they were slide mounted in Canada balsam, placed with their ventral side upward in order to

observe internal structures within the head capsule. Pupae were slide-mounted in Canada balsam following the technique of Borkent & Spinelli (2007), and examined, measured, and drawn the 4th segment and their tubercles using binocular microscope with camera lucida. Larvae and pupae were also examined using SEM (JOEL 2000) by using the technique of Ronderos *et al.*, (2000); measurements and ratios of the larval head capsule and measurements of pupa were taken using SEM and given in the first place, and using Binocular Compound Microscope (BCM), given in the second place; remaining measurements were taken only using BCM.

Specific terms for structures follow Ronderos *et al.* (2007). Studied specimens are deposited in the collection of the Museo de La Plata, Argentina.

Abbreviations of measurements:

Larva: **Head Capsule: HL**, head length; **HW**, head width; **HR**, head ratio = HL/HW; **SGW**, subgenal width; **SGR**, subgenal ratio = HW/SWG; **Epipharynx: LAW**: the wide across the lateral arms of the epipharynx; **DCW**: wide across each of the paired dorsal comb sclerites of the epipharynx. **Mandible: MDL**, mandible length. **Caudal Segment: CSL**, caudal segment length; **CSW**, caudal segment width; **CSR**, caudal segment ratio = CSL/CSW; **OL**, length of caudal setae; **OD**, distance between bases of caudal setae "o"; **OLODR**, ratio OL/OD.

Pupa: **Operculum: OL**, operculum length; **OW**, operculum width; **OW/OL**, ratio.

Prothoracic Respiratory Horn: PRH, respiratory horn length; **P**, pedicel length; **P/PRH**, ratio.

Caudal Segment: CSL, caudal segment length; **CSW**, caudal segment width.

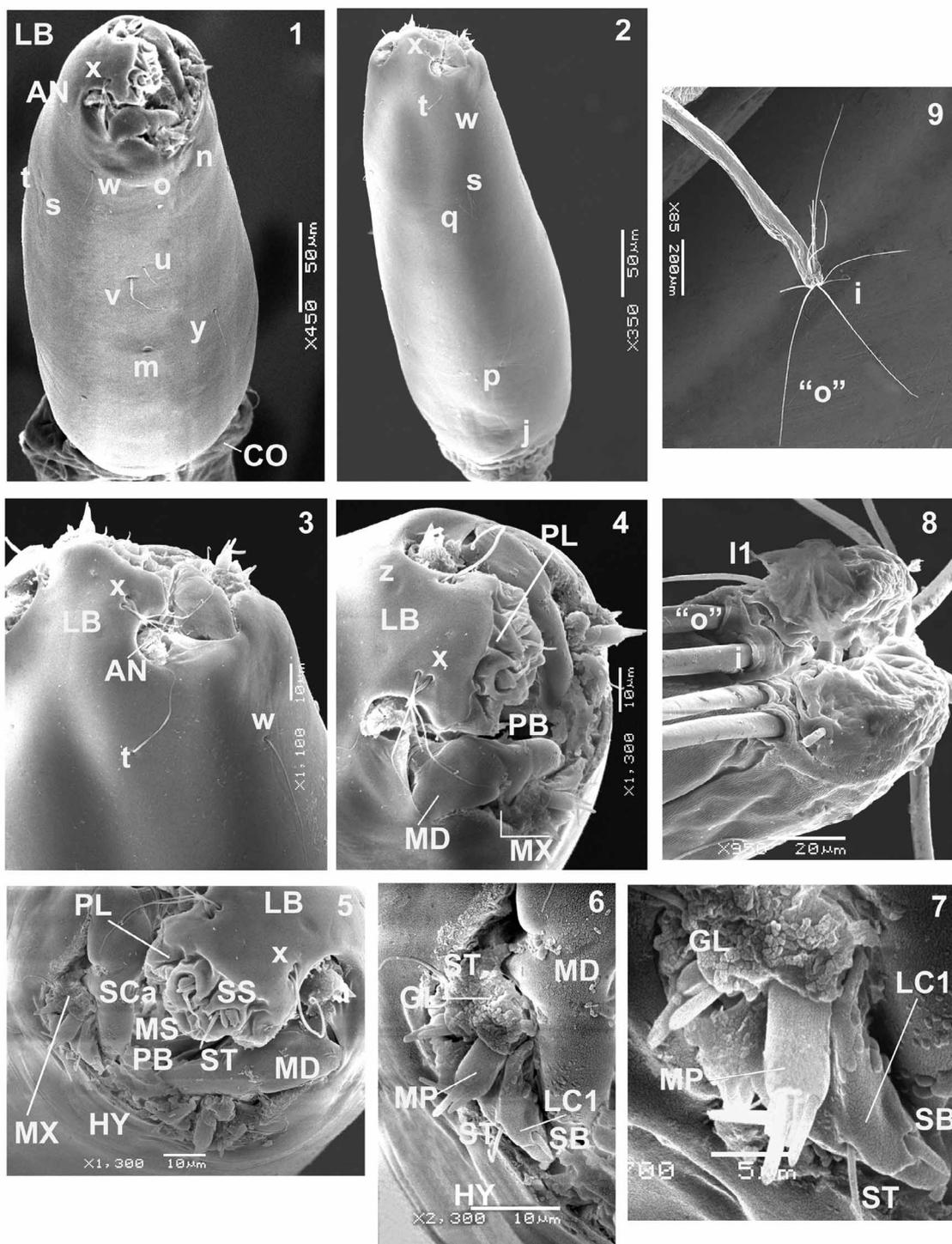
Results

Bezzia blantoni Spinelli & Wirth, 1989

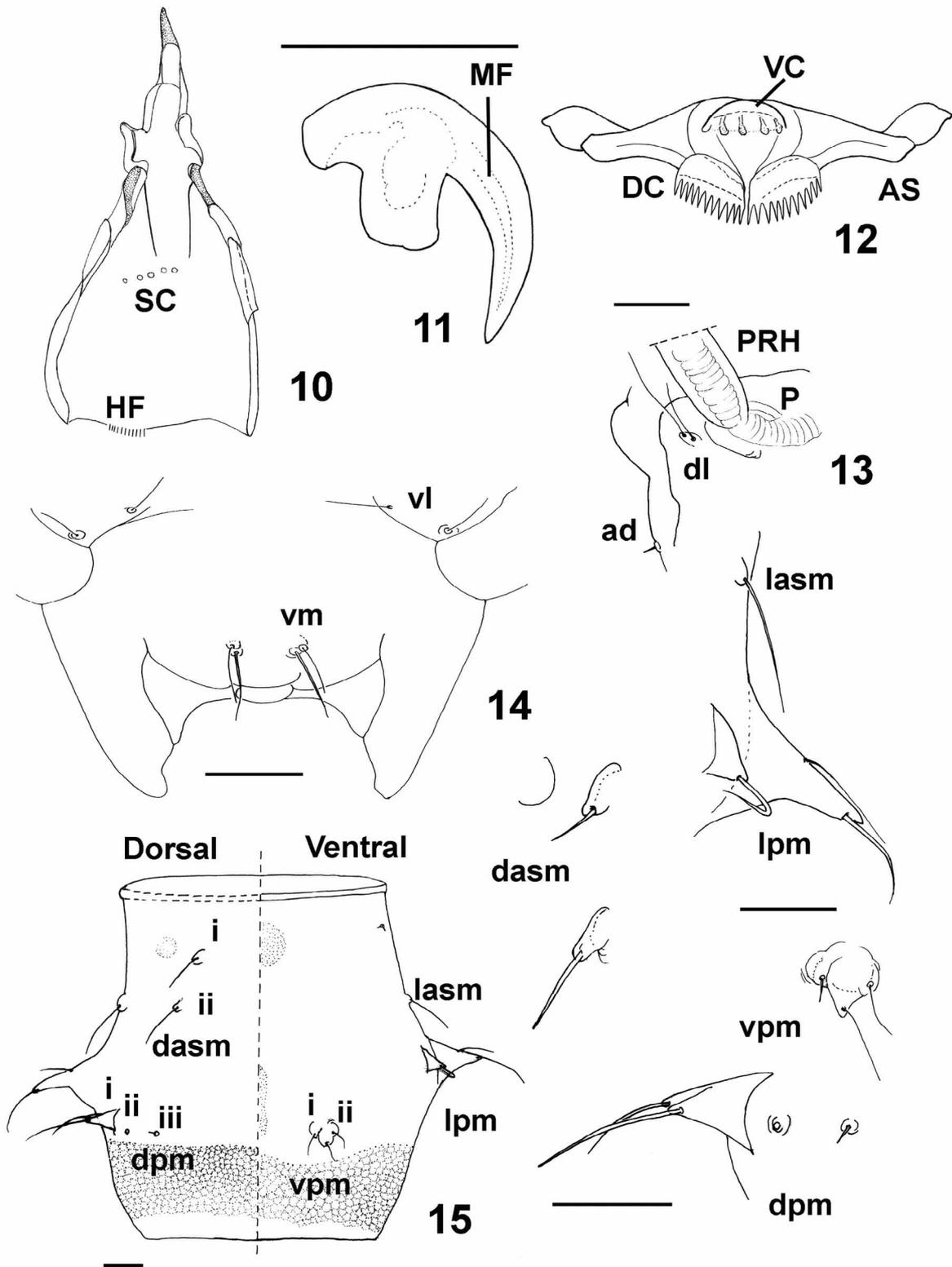
(Figs. 1–29)

Bezzia blantoni Spinelli & Wirth 1989: 771 (male, female, pupa; distribution); Spinelli & Wirth, 1993: 63 (in list Argentinean species); Arnaud & Arnaud, 1996: 17; Borkent & Wirth, 1997: 125 (Catalog World species); Borkent & Spinelli, 2000: 61 (Catalog south USA species); Borkent & Spinelli, 2007: 93 (Neotropical catalog); Borkent, 2009: 157 (online Catalog).

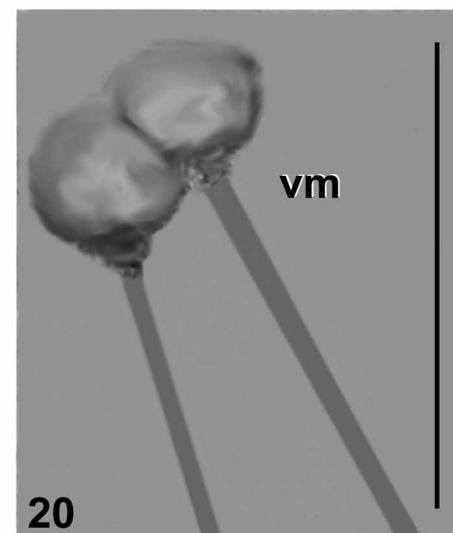
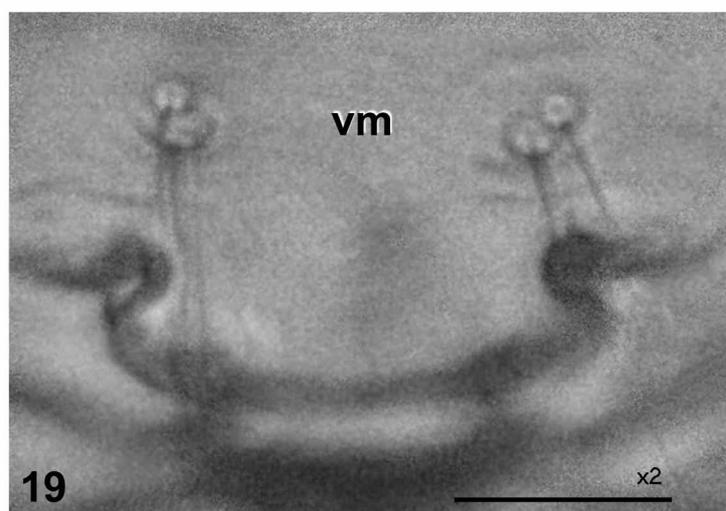
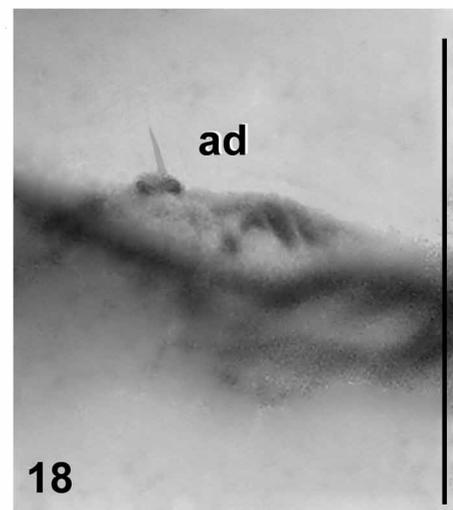
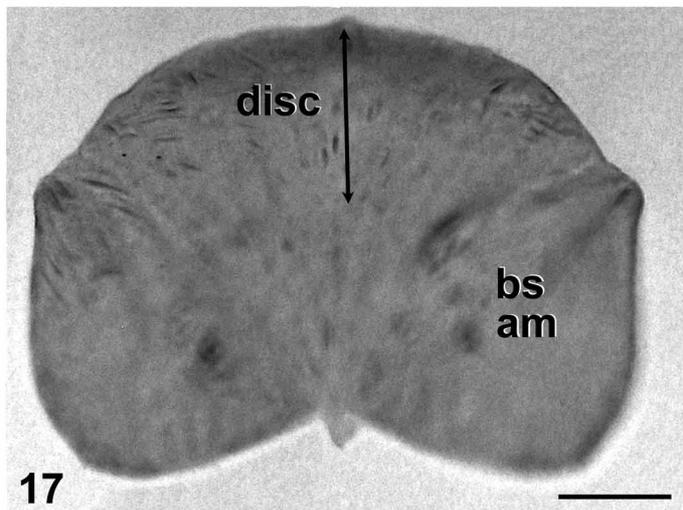
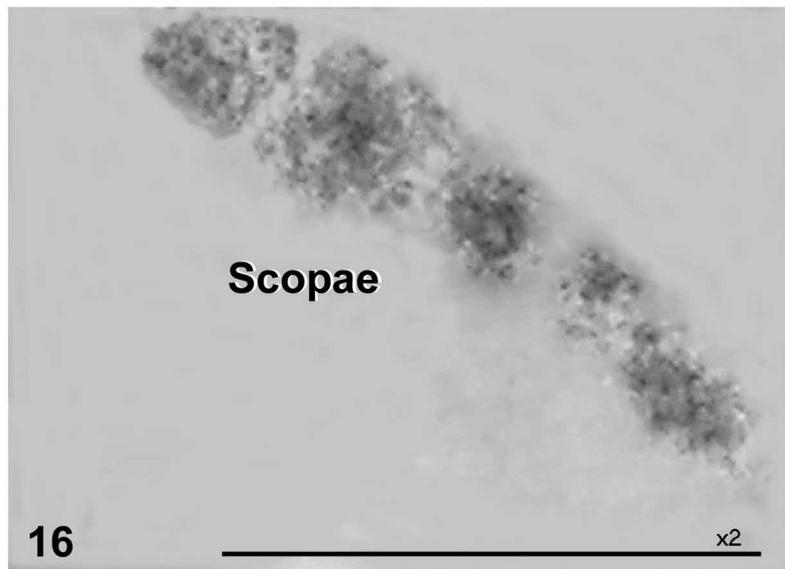
Description of fourth instar larva (Figs. 1–12, 16). Exuviae pale yellowish. Head capsule (Figs. 1–5) elongate; apex slightly bent ventrally, setae minute, poorly visible, chaetotaxy as in Figs. 1–2; HL 0.30 mm (0.28–0.33, n=2), 0.41 mm (0.38–0.45, n=5); HW 0.126 mm (0.12–0.13; n=2), 0.12 mm (0.11–0.13, n=5); HR 2.62 (2.52–2.73; n=2), 3.36 (3.15–3.46, n=5); SGW 0.082 mm (0.076–0.089; n=2), 0.07 mm (0.07–0.08, n=5); SGR 1.52 (1.47–1.57; n=2), 1.64 (1.57–1.71, n=5). Labrum (Figs. 1, 3–5) longer than wide, not extending beyond hypostoma, with pair anterolateral sensilla styloconica (Fig. 5); palatum (Figs. 4–5) with 3 pairs of closely spaced sensillae, 2 trichoidea, one campaniformia (Fig. 5); palatal bar small, situated immediately posterior to messors; messors (Fig. 5) small, thin, curved, gently sclerotized, situated away from mandibles, 5 small scopae (Figs. 10, 16). Maxilla (Figs. 4–7) with blunt sensillum, maxillary palpus long, cylindrical (Fig. 6–7), with 2–3 subapical papillae; galeolacinia with stout, blunt setae (Figs. 6–7). Mandible (Figs. 4–6, 11) hooked, curved, tooth long, fosa mandibularis on ectal surface; MDL 0.05 mm (0.04–0.06, n=5). Hypostoma (Figs. 5–6) simple, finely toothed. Labium small, triangular. Epipharynx (Fig. 12) less massive, with 2 combs: ventral comb with 4–6 stout, short teeth, apical margin concave; dorsal comb with rather long teeth on posterior edge, auxiliary sclerites located near lateral arms; LAW 0.06 mm (n=3); DCW 0.03 mm (n=2). Hypopharynx (Fig. 10) long, thin, gently sclerotized, arms slender, hypopharyngeal fringe (Fig. 10) present. Thoracic pigmentation uniformly pale yellowish. Caudal segment (Figs. 8–9) about 4 times longer than wide, posterior end with 6 pairs of setae, 4 of them long, stout, pale brown, the other 2 thin, short,



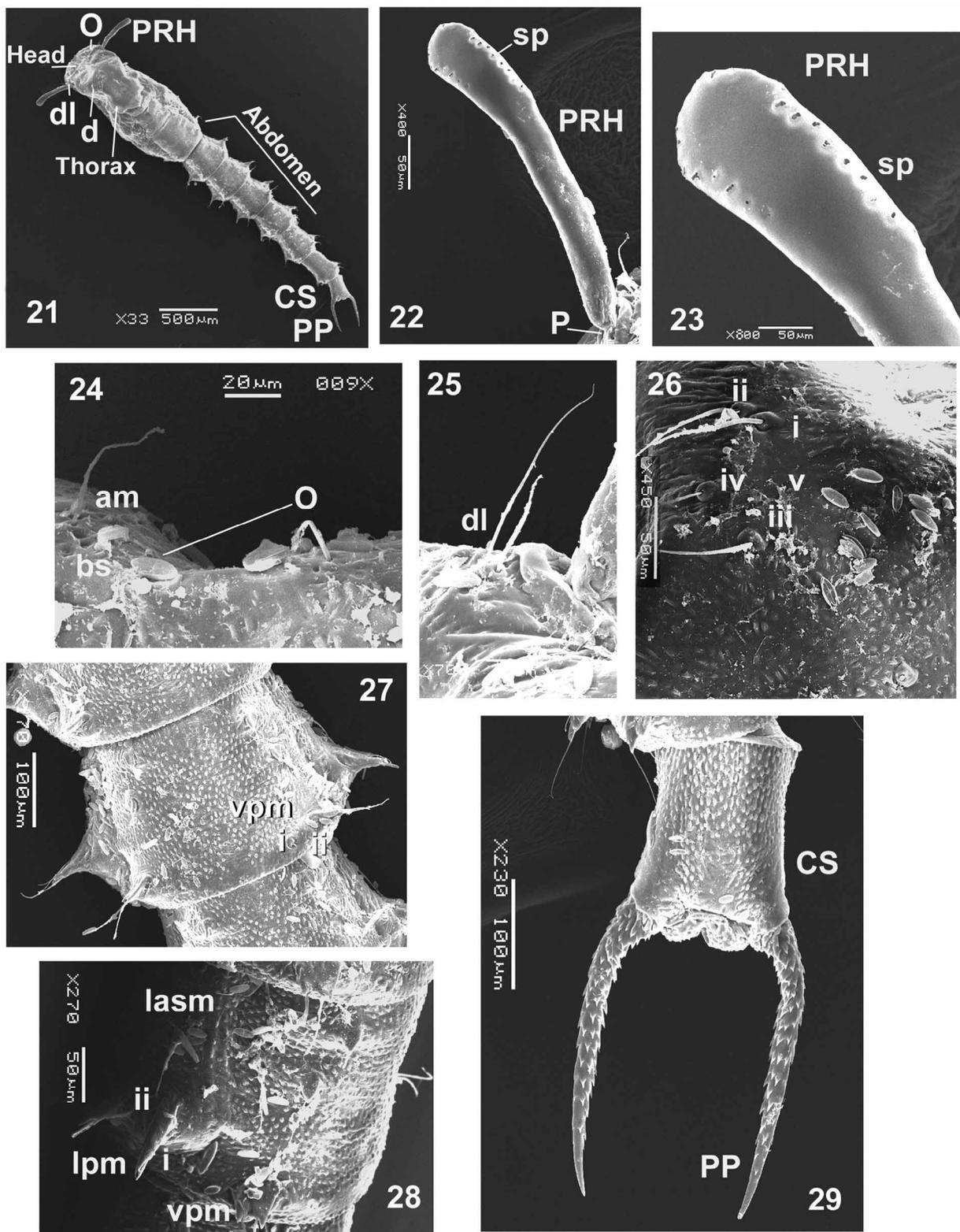
FIGURES 1–9. *Bezzia blantonii*, larva; 1, head capsule, ventrolateral view; 2, head capsule, dorsolateral view; 3, head capsule, anterolateral view; 4, head capsule, anterolateral view (palatum anterior); 5, head capsule, frontal view (palatum); 6, mouthpart; 7, maxilla, lateral view; 8, insertion of setae of caudal segment; 9, caudal segment, frontal view. Head capsule chaetotaxy: j, collar pits; m, posterolateral pits; n, anterolateral pit; o, parahypostomal setae; p, posterior perifrontal setae; q, postfrontal setae; s, anterior perifrontal setae; t, prefrontal setae; u, mesolateral setae; v, posterolateral setae; w, anterolateral setae; x, paranntenae setae; y, ventral setae; z, frontal pits; collar (CO); antennae (AN); labrum (LB); hypostoma (HY); mandible (MD); palatum (PL); sensilla trichoidea (ST); sensilla styloconica (SS); sensilla campaniformia (SCa); messors (MS); maxilla (MX); galeolacinia (GL); maxillary palp (MP); lacinial sclerite 1 (LC1); sensilla basiconica (SB); palatal bar (PB). Larva caudal segment chaetotaxy: “o” outer setae; “i” inner setae; l₁, first lateral setae.



FIGURES 10–15. *Bezzia blantoni*, larva; 10–12. 10, hypopharynx, dorsal view; 11, mandible, lateral view; 12, epipharynx. Pupa, 13–15. 13, dorsolateral and anterodorsal tubercles; 14, ventral setae; 15, 4th abdominal segment and details. Auxillary sclerite (AS); dorsal comb (DC); fossa mandibularis (MF); hypopharyngeal fringe (HF); ventral comb (VC); scopae (SC). Head, thoracic and 4th abdominal tubercles pupa: dorsolateral (dl) and anterodorsal (ad) tubercles; ventromedian setae (vm), ventrolateral setae (vl); abdominal tubercles: lateral anterosubmarginal tubercle (lasm); dorsal posteromarginal tubercle (dpm); dorsal anterosubmarginal tubercle (dasm); ventral posteromarginal tubercle (vpm); lateral posteromarginal tubercle (lpm); prothoracic respiratory horn (PRH); pedicel (P). Scales: 0.05 mm.



FIGURES 16–20. *Bezzia blantoni*, larva; 16, scopae; 17–20, Pupa, 17, operculum, dorsal view; 18, anterodorsal tubercle (ad), lateral view; 19, ventral setae; 20, detail of ventromedian setae. anteromarginal tubercle (am); anterodorsal tubercle (ad); basal sensillum (bs); ventromedian setae (vm). Scale 0.05 mm



FIGURES 21–29. *Bezzia blantoni*, pupa; 21, entire pupa, dorsal view; 22, prothoracic respiratory horn; 23, prothoracic respiratory horn, anteroventral view; 24, head, dorsolateral view operculum; 25, dorsolateral tubercle detail; 26, dorsal tubercles; 27, 4th abdominal segment, ventral view; 28, 4th abdominal segment, lateroventral view; 29, female, caudal segment, ventral view. Anteromarginal tubercle (am); caudal segment (CS); dorsal tubercles (d); dorsolateral tubercles (dl); posterolateral processes (PP); prothoracic respiratory horn (PRH); pedicel (P); basal sensillum (bs); operculum (O); spiracle (sp); lateral anterosubmarginal tubercle (lasm) and lateral posteromarginal tubercle (lpm); ventral posteromarginal tubercle (vpm).

brown; CSL 0.69 mm (0.62–0.73, n=4), CSW 0.12 mm (0.09–0.18, n=4), CSR 6.01 (4.00–7.10, n=4), OD 0.04 (0.03–0.06, n=5), OL 0.546 mm (0.53–0.55 mm; n=2), 0.60mm (0.57–0.66, n=4), OLODR 15.7 (10.00–22.00, n=4).

Description of pupa (Figs. 13–15, 17–29) Length with SEM 3.35 mm. Exuviae brownish. Cephalothorax length 1.29 mm, width 0.60 mm. Operculum (Figs. 17, 21, 24) anterior margin rounded, grooved midway on lateral margins, midportion spiculate, with 3 pairs of tubercles: anteromarginal tubercle (am) with one single, thin, medium-sized seta, basal sensillum (bs) present; remaining two without setae; OL 0.12 mm (n=3), OW 0.24 mm (0.23–0.25, n=3), OW/OL 2.02 (1.91–2.08, n=3), anterior margin rounded, grooved midway on lateral margins, midportion spiculate, with 3 pairs of tubercles: anteromarginal tubercle (am) with one single, thin, medium-sized seta, basal sensillum (bs) present; remaining two without setae. Ventral setae (Figs. 14, 19–20) in tubercles with base rounded: 2 thin, medium-sized ventrolateral setae (vl), 2 stout, long ventromedian setae (vm). Abdominal segments with scattered small spinules. Thoracic tubercles and sensilla as follows: anterodorsal tubercle (ad) with one short, stout seta, base rounded (Fig.18); dorsolateral tubercle (dl) with 2 long, thin setae, one long, one medium-sized (Figs. 13, 21, 25); 5 rounded dorsal tubercles (Figs. 21, 26), as follows: i–iv with stout, subequal, long, thin setae, v pore. Prothoracic respiratory horn (Figs. 13, 21, 22–23) PRH 0.31 mm (n=1), 0.31 mm (0.26–0.35, n=3); 4.7–5.0 times longer than wide, surface smooth, apex curved, with convoluted row of 40–50 apical spiracles (Figs. 22–23); pedicel stout, short, P 0.019 mm (n=1), 0.03 mm (0.02–0.04, n=3); P/PRH 0.06 (n=1), 0.09 (0.07–0.11, n=3) (Figs. 13, 22). Abdominal segments with scattered small spinules. Fourth abdominal segment (Figs. 15, 27–28) with 2 dorsal anterosubmarginal tubercles (dasm): i–ii base cylindrical, with medium-sized, thin seta; 3 dorsal posteromarginal tubercles (dpm): i base triangular, with 2 long, stout setae, ii pore, iii base rounded, seta minute; 2 ventral posteromarginal tubercles (vpm): i base small, short seta, ii triangular, base rounded, with 2 thin setae longer than i; 2 lateral posteromarginal tubercles (lpm), both triangular, base flattened, i with medium-sized, stout seta, ii with 2 long setae, one stout, other thin; one lateral anterosubmarginal tubercle (lasm) with base rounded, small, one long, thin seta. Caudal segment (Figs. 21, 29) 2.83 times longer than wide, dorsal surface with abundant posteriorly directed spinules; posterolateral processes slightly curved mesad in posterior end, with strong tubercles; posterolateral processes length 0.263 mm (0.25–0.27, n=3). Male CSL 0.43 mm (0.41–0.45, n=3), CSW 0.15 mm (0.14–0.16, n=3). Female CSL 0.044 mm (n=1), 0.41 mm (n=1); CSW 0.13 mm (n=1), 0.15 mm (n=1).

Distribution: Belize, Honduras, Costa Rica, Puerto Rico, Argentina (Buenos Aires and Corrientes provinces).

Specimens examined. Argentina, Buenos Aires prov., isla Martín García, Arenal Chico, 20.vii.2006, M. Ronderos – F. Díaz col., 4 larvae, 2 pupae; same data except 14.ix.2006, 1 pupa, same data except 11.x.2006, 1 larva, 1 pupa.

For SEM: same data, 3 larvae, 1 female pupa.

Physicochemical variables of the water in the pond: temperature: 21.25 (16.0–23.6 °C); conductivity: 19 µs; total dissolved solids (TSD): 13 mg/l; PH: 5.59 (5.54–5.68)

Discussion

One of the less known aspects of Ceratopogonidae larvae is the nature of their food and feeding behavior. Direct feeding observations have been made for only a few representative species of the most commonly collected genera, e.g. *Bezzia*, among others. In this sense, the morphology of the larva of *B. blantoni* indicates that it feeds on microorganisms carried in the standing water and organic matter of their natural environment, showing structures typical of carnivorous species (Thomsen, 1937; Mullen & Hribar, 1988), such as head elongated and narrow mouthparts directed anteriorly, sclerotized labium, mandible broad with pointed hooks, weak pharynx and finely serrate hypostoma. The sensilla of pallatum, messors and palatal bar are probably used during feeding (Becker, 1958), and Hribar (1993) stated their intimate relationship with the feeding

habits; the distribution of the pallatum sensilla and shape of messors of *B. blantoni* resembles those illustrated by Hribar & Mullen (1991: figs. 84–85) for *Bezzia* sp., and by Ronderos *et al.*, (2007) for *Bezzia roldani* Spinelli & Wirth.

With regard to the relation between larval morphology and habitat, Mullen & Hribar (1988) suggested that the long caudal setae may function to amplify the body oscillation and to increase the larval speed in water, enabling to capture prey and/or to avoid predators. They also suggested that the setae may have tactile function, providing information on the approach of predators. The length of the seta “o” and “i” setae of the caudal segment of the larvae of *Bezzia blantoni* could represent a good adaptation to the environment where it was captured. Glukhova (1977) has indicated that *Bezzia* and *Palpomyia* include both swimming and non swimming species in the European USSR fauna. In this case, *B. blantoni* larvae move very rapidly.

Ronderos *et al.*, (2007) fully redescribed the immatures of *B. roldani* through observations made with SEM. Due to similarities of the morphology and habitat preference, they compared the pupa of this species with that of *B. blantoni*, although the later was described by Spinelli & Wirth (1989) based on observations carried out with compound microscope. The most important morphological differences between larvae of the two species, both noted on the basis of observations with SEM are: *B. roldani* has only the palatal bar and lacks scopae, the hypostoma is double, the hypopharynx lacks fringe, and the ventral epipharyngeal comb is conical-shaped. Finally, the head capsule and the caudal segment are distinctly shorter.

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