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Redescription of the last instar larva and pupa of *Bezzia roldani* (Diptera: Ceratopogonidae)

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Redescripción del último estadio larval y de la pupa de *Bezzia roldani* (Diptera: Ceratopogonidae)

■ **RESUMEN.** Se redescrive e ilustra el último estadio larval y la pupa de *Bezzia roldani* Spinelli & Wirth, utilizando microscopio de contraste de fase y microscopio electrónico de barrido. Los estados inmaduros se capturaron con la ayuda de embudos Berlesse a partir de hidrófitas flotantes, de los géneros *Lemna*, *Wolfia*, *Wolffiella* y *Spirodella* (Lemnaceae) de las lagunas Chascomús y Los Talas, ambas en la provincia de Buenos Aires, Argentina. La larva presenta las características típicas de larvas carnívoras, se compara con la de *Bezzia nobilis* (Winnertz) y con una especie similar del género *Palpomyia* Meigen, *P. guarani* Lane. La pupa se compara con la de *Bezzia blantoni* Spinelli & Wirth.

PALABRAS CLAVE. Larva. Pupa. *Bezzia roldani*. MEB. Argentina.

■ **ABSTRACT.** The fourth instar larva and pupa of *Bezzia roldani* Spinelli & Wirth is redescribed and illustrated by using phase-contrast microscope and scanning electron microscope. Immatures were collected by placing floating hydrophytes of the genera *Lemna*, *Wolfia*, *Wolffiella* and *Spirodella* (Lemnaceae) in Berlesse funnels. The hydrophytes were collected in the Chascomús and Los Talas ponds, both in the province of Buenos Aires, Argentina. The larva show features typical of carnivorous larvae, and it is compared with that of *B. nobilis* (Winnertz) and with a similar species of the genus *Palpomyia* Meigen, *P. guarani* Lane. The pupa is compared with its similar congener *B. blantoni* Spinelli & Wirth.

KEY WORDS. Larva. Pupa. *Bezzia roldani*. SEM. Argentina.

INTRODUCTION

The worldwide genus *Bezzia* Kieffer, 1899 includes midges which are important predators of small invertebrates, mainly chironomid midges. The immature stages are relatively common inhabitants of different kind of wetlands, mainly streams, lakes and ponds, as well as other breeding habitats, such as sphagnum bogs, rice fields, hoofprints

in a sandy creek bed, water in tree holes, and water in bromeliads (Spinelli & Ronderos, 2001).

Borkent & Spinelli (2000), in their catalog of the ceratopogonids south of the United States of America, recorded 46 species for this area. After that, only one species, *Bezzia chilensis* Spinelli & Ronderos was described from Central Chile (Spinelli & Ronderos, 2001).

Bezzia roldani was described by Spinelli & Wirth (1981) based on adult, larva and pupa from Argentina, and subsequently redescribed by Spinelli & Wirth (1989) placing it in the *glabra* group. Although both are relatively modern descriptions, the description of the immatures was incomplete. The purpose of this paper is to redescribe the fourth instar larva and pupa of *Bezzia roldani* from specimens collected in Los Talas and Chascomús ponds in the province of Buenos Aires, Argentina, with phase-contrast microscope and with scanning electron microscope (SEM).

MATERIAL AND METHODS

Larvae and pupae were collected by placing floating hydrophytes of the genera *Lemna*, *Wolfia*, *Wolffiella* and *Spirodella* (Lemnaceae) in Berlesse funnels. The hydrophytes were collected in the Chascomús and Los Talas ponds, both in the province of Buenos Aires, Argentina, and carried to the laboratory in plastic bags. The immature midges were observed daily to record development. For detailed examination of larvae with phase-contrast microscope at oil immersion, were slide mounted in Canada balsam and placed with ventral side upward to observe internal structures in the head capsule. Pupae were slide-mounted in Canada balsam, following the technique of Borkent (2000) and examined, measured, and drawn made of the 4th segment and their tubercles using a binocular microscope with a camera lucida. Larvae and pupae were also examined using scanning electron microscopy (SEM) (JOEL 2000) by using the technique of Ronderos *et al.* (2000); measurements and ratios of the larval head capsule were taken using phase-contrast microscope.

For terminology of larvae see Ronderos *et al.* (2004) and for pupae Nevill & Dyce (1994). Studied specimens are deposited in the collection of the Museo de La Plata, Argentina.

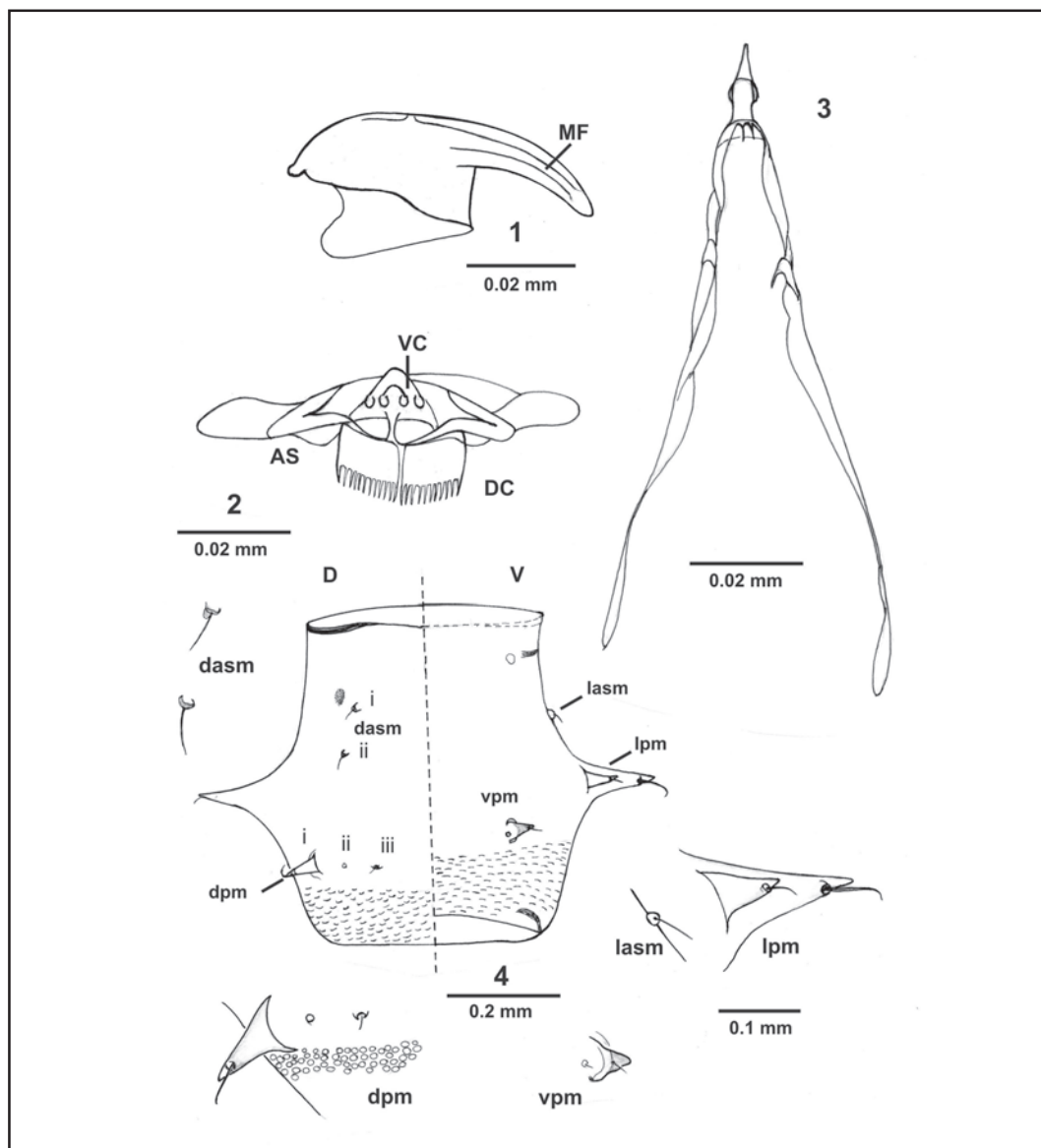
RESULTS

Bezzia roldani Spinelli & Wirth, 1981 (Figs. 1-28)

Bezzia roldani Spinelli & Wirth, 1981: 187 (female, male, pupa, larva; Argentina); Spinelli & Wirth, 1989: 769 (redescr.; Argentina); Borkent & Spinelli, 2000: 61 (Neotropical catalog).

Redescription of fourth instar larva (Figs. 1-3, 5-13)

Exuviae pale yellowish. Head capsule (Figs. 5-7) 3.4 times longer than wide; apex slightly bent ventrally, setae minute, poorly visible, chaetotaxy as in figures 5-6; HL 0.255 (0.25-0.26, n=4) mm; HW 0.08 (0.07-0.09, n=4) mm; HR 3.20 (2.88-3.57, n=4); SGR 0.055 (0.05-0.06, n=3). Labrum (Fig. 7) longer than wide, not extending beyond hypostoma, with pair anterolateral sensilla styloconica (Figs. 7-8); palatum (Figs. 7-9) with 3 pairs of closely spaced sensillae (Figs. 7-9): 2 pairs of sensillae trichoidea, one pair of sensillae campaniformia (Figs. 7, 9-10); palatal bar represented by a small, W-shaped sclerite situated immediately posterior to messors; messors (Figs. 7, 9) small, thin, gently sclerotized curved structures, situated away from mandibles. Maxilla (Figs. 7, 9-11) with pyriform sensillum, maxillary palpus long, cylindrical (Figs. 7, 9, 11), with three subapical papillae (Fig. 11); galeolacinia with stout, blunt setae (Fig. 11). Mandible (Figs. 1, 7-9) hooked, curved, tooth long, fosa mandibularis on the ectal surface (Fig. 1); ML 0.04 (0.03-0.05, n=3) mm. Hypostoma (Figs. 7, 10) finely toothed. Labium small, triangular. Epipharynx (Fig. 2) less massive, with 2 combs, ventral comb with 4-5 stout, short teeth, dorsal comb with rather long teeth on posterior edge, auxiliary sclerites located near lateral arms. LAW 0.04 mm (n=2), DCW 0.02 mm (n=2). Hypopharynx (Fig. 3) long, thin, gently sclerotized, arms slender. Thoracic pigmentation uniformly pale yellowish. Caudal segment (Figs. 12-13) about 5 times longer than wide, posterior end with 6 pairs of setae, 4 of them long, stout, pale brown, the other 2 thin, short, brown



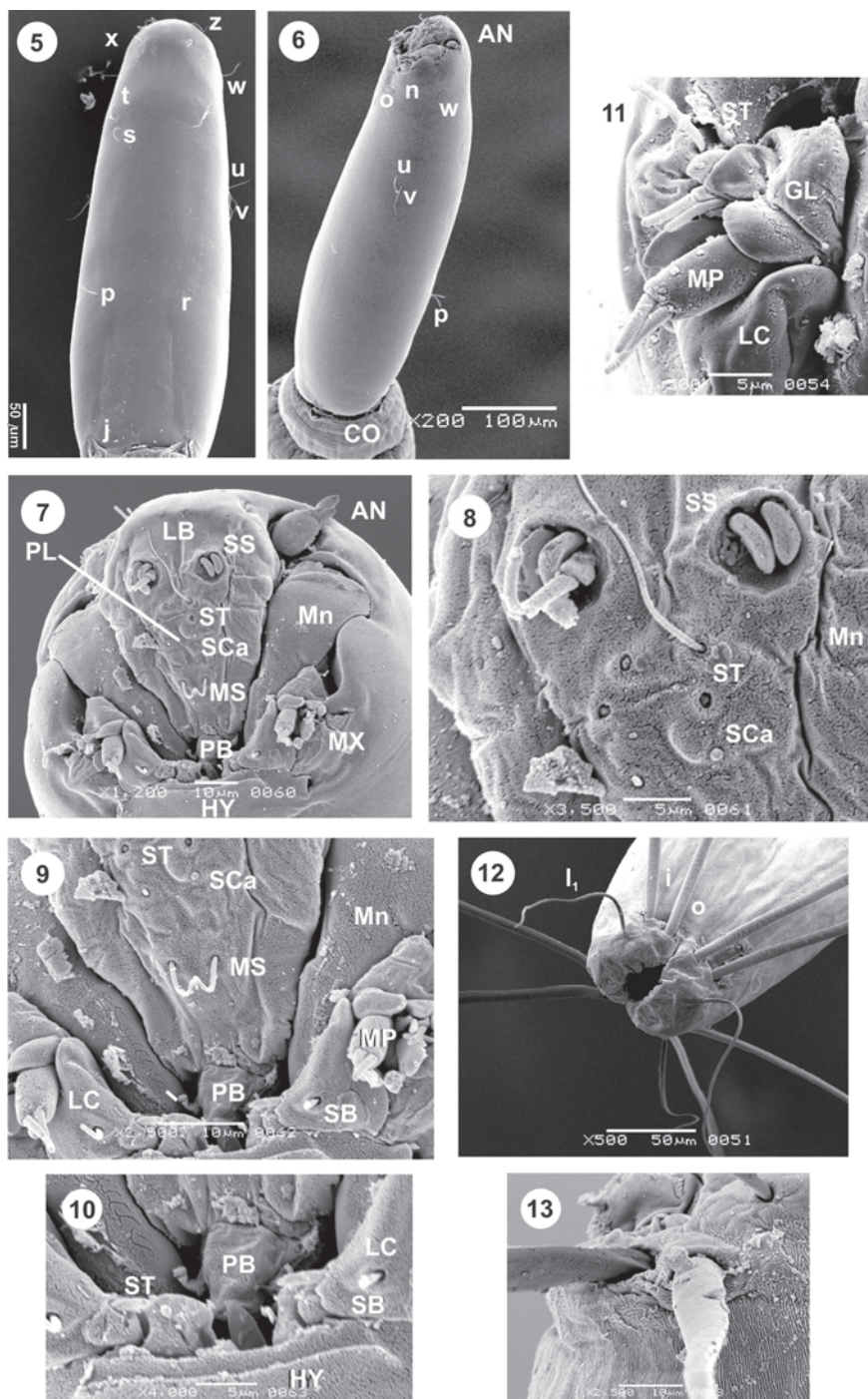
Figs. 1-4. 1-3. Larva of *Bezzia roldani*. 1, mandible; 2, epipharynx, VC: ventral comb, DC: dorsal comb, AS: auxillary sclerite, MF: fossa mandibularis; 3, hypopharynx; 4. Pupa of *Bezzia roldani*, 4th abdominal segment, abdominal tubercles: lateral anterosubmarginal tubercle (lasm); dorsal posteromarginal tubercle (dpm); dorsal anterosubmarginal tubercle (dasm); ventral posteromarginal tubercle (vpm); lateral posteromarginal tubercle (lpm).

(Fig. 13); CSL 0.47 (0.44-0.53, n=3) mm, CSW 0.086 (0.08-0.09, n=3) mm, CSR 5.42 (4.88-5.88, n=3), OL 0.55 (0.50-0.77, n=5) mm; OW 0.38 (0.35-0.50, n=5) mm.

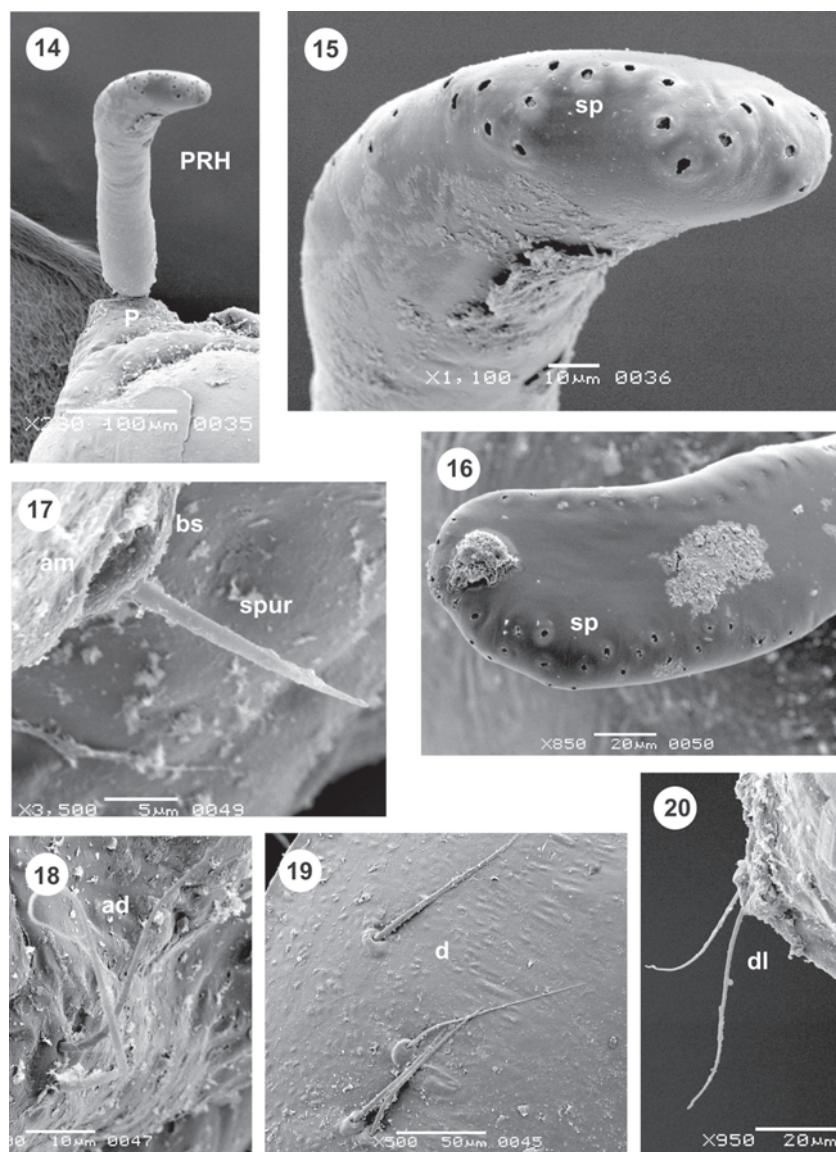
Redescription of pupa (Figs. 4, 14-28)

Length 4.69 (3.66-5.90, n=5) mm. Exuvia brownish. Length of cephalotorax 1.40 mm, wide 0.70 mm. Cephalothoracic tubercles

(Figs. 17-20) as follows: anterodorsal tubercle (ad) with 2 long, subequal, thin setae (Fig. 18); dorsolateral tubercle (dl) with 2 long, thin, subequal setae (Fig. 20); 5 dorsal tubercles (d) (Fig. 19), as follows: i, ii, with stout, subequal setae, both shorter than iii; iii with thin seta, longer than iv; iv with long stouter seta; v pore; 2 thin ventrolateral setae (vl) (Figs. 25-26); 3 stout, long ventromedian setae (vm) (Figs. 25, 27). Respiratory horn



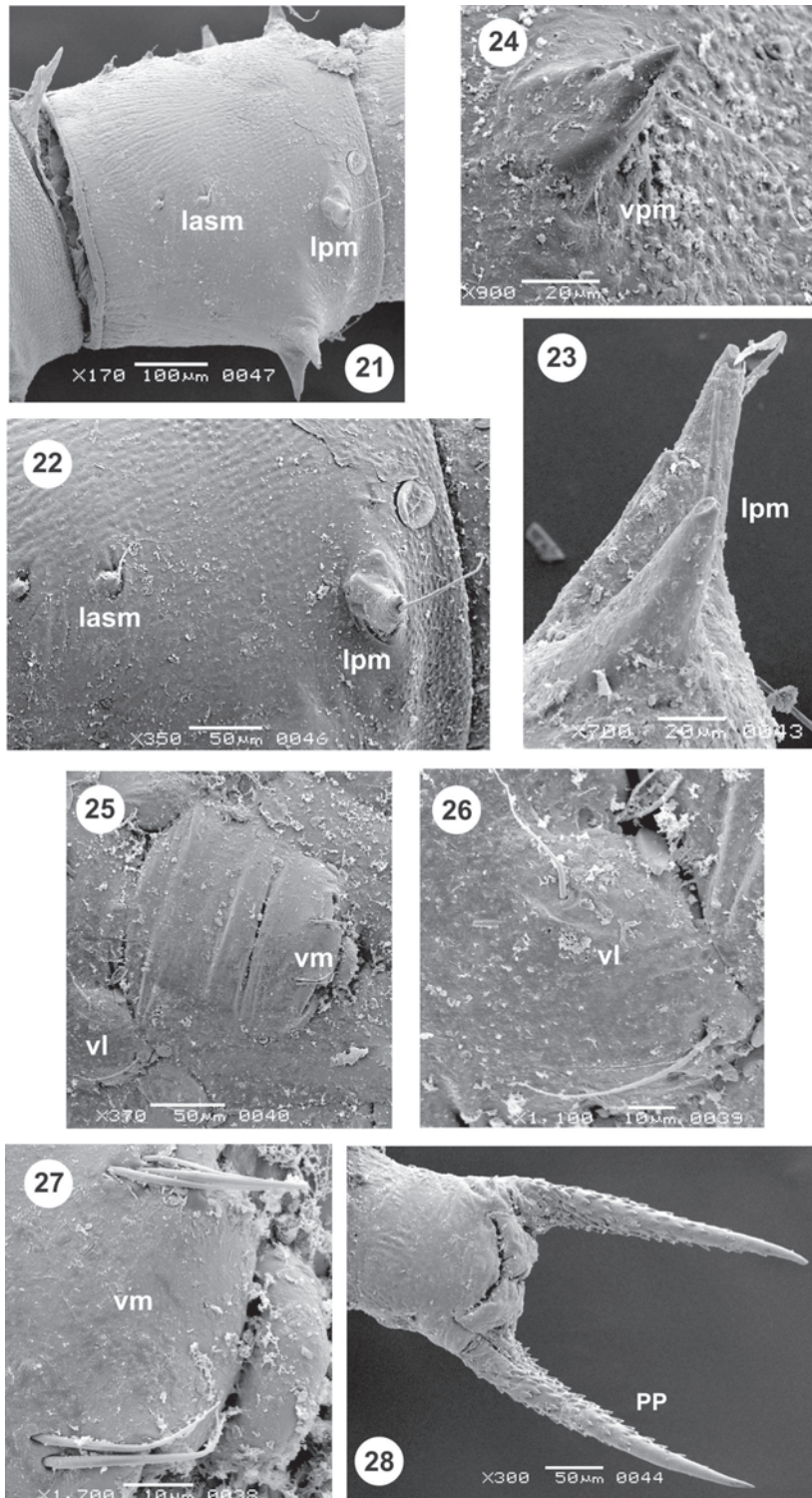
Figs. 5-13. Larva of *Bezzia roldani*. 5, head capsule, dorsal view; 6, head capsule, ventrolateral view; 7, head capsule, frontoventral view; 8, palatum anterior; 9, palatum posterior; 10, mouthpart, posterior view; 11, maxilla, lateral view; 12, caudal segment, frontal view; 13, insertion of setae of caudal segment. Head capsule chaetotaxy: j, collar pits; n, anterolateral pit; o, parahypostomal setae; p, posterior perifrontal setae; r, postnatal pits; s, anterior perifrontal setae; t, prefrontal setae; u, mesolateral setae; v, posterolateral setae; w, anterolateral setae; x, paranntenal setae; z, frontal pits; collar (CO); antennae (AN); labrum (LB); hypostoma (HY); mandible (Mn); palatum (PL); sensilla trichoidea (ST); sensilla styloconica (SS); sensilla campaniformia (SCa); messors (MS); maxilla (MX); galeolacinia (GL); maxillary palpus (MP); lacinial sclerites (LC); sensilla basiconica (SB); palatal bar (PB). Larva caudal segment chaetotaxy: «o» outer setae; «i» inner setae; l₁ first lateral setae.



Figs. 14-20. Pupa of *Bezzia roldani*. 14, respiratory horn; 15, respiratory horn, apical view; 16, respiratory horn, apical ventral view; 17, anteromarginal tubercle (am); 18, anterodorsal tubercle (ad); 19, dorsal tubercles (d); 20, dorsolateral tubercles (dl). Prothoracic respiratory horn (PRH); pedicel (P); basal sensillum (bs); spiracle (sp).

(Figs. 14-16) 4.4-4.7 times longer than broad, surface smooth, length 0.28 (0.20-0.36; $n=5$) mm, apex curved, with convoluted row of 50-60 spiracles (Figs. 14-16); pedicel (Fig. 14) stout, short; length 0.04 (0.03-0.05, $n=5$) mm; P/H 0.14 (0.10-0.17, $n=5$). Operculum 1.4 times broader than long, anterior end rounded; grooved midway on lateral margins, spiculate on midportion, with 3 pairs of tubercles: anteromarginal tubercle (am) (Fig. 17) with one single, stout, long seta, basal

sensillum (bs) present, remaining two without setae; OL 0.13 (0.12-0.14, $n=3$) mm, OW 0.23 (0.22-0.24, $n=3$) mm, OL/OW 1.76 (1.71-1.83, $n=3$). Abdominal segments with scattered small spinules. Fourth abdominal segment (Figs. 4, 21-22) with two anterosubmarginal tubercles (dasm): i-ii base rounded, with thin setae; 3 posteromarginal tubercles (dpm): i triangular, base flattened with thin seta, ii base small, seta minute, iii base small, flattened, seta thin, short; 2 ventral



Figs. 21-28. Pupa of *Bezzia roldani*. 21, 4th abdominal segment, lateral view; 22, lateral anterosubmarginal tubercle (*lasm*) and lateral posteromarginal tubercle (*lpm*); 23, base and insertion setae lateral posteromarginal tubercle (*lpm*); 24, ventral posteromarginal tubercle (*vpm*); 25, ventral setae: ventrolateral setae (*vl*), ventromedian setae (*vm*); 26, insertion ventrolateral setae (*vl*); 27, insertion ventromedian setae (*vm*); 28, female, caudal segment, ventral view, posterolateral processes (*PP*).

posteromarginal tubercles (vpm) (Figs. 4, 24): i base small, seta minute, ii triangular, base rounded, seta thin longer than i; 2 lateral posteromarginal tubercles (lpm), both triangular, base flattened (Figs. 4, 21-23), i with short, thin seta, ii with seta stouter; one lateral anterosubmarginal tubercle (lasm) with rounded, small base, medium-sized, thin seta (Figs. 4, 21-22). Caudal segment (Fig. 28) 2.53 times longer than broad, spinulose mesally, length 0.38 (0.30-0.41; n=3) mm; wide 0.15 (0.14-0.16; n=3) mm; dorsal surface with abundant posteriorly directed spinules; posterolateral processes divergent, with strong tubercles; length posterolateral processes 0.27 mm (n=3).

Distribution: Argentina (Buenos Aires and Entre Ríos provinces).

Material examined. ARGENTINA.

Buenos Aires: Chascomús pond, 20-VIII-1979, Spinelli col., 4 pupae (MLP); same data except 12-IX-1979, 3 pupae (type series) (MLP); Buenos Aires, Berisso, Los Talas pond, 30-III-1979, Fernández col., 3 larvae, 3 pupae (MLP).

For SEM: Los Talas pond, 30-III-1979, Fernández col., 4 larvae, 4 pupae (MLP).

DISCUSSION

The behavior of all animals is inseparable from their morphology (Joseph, 1979). As in other groups, mouthpart and other structures of ceratopogonid larvae often reflect their feeding habitats. Particularly important are the number, type and distribution of the sensillae in the pallatum, which are intimately related to feeding habits and searching for food (Greenwood & Chapman, 1984; Zacharuk, 1985). A similar relationship between mouthpart morphology and feeding habits also occurs in other insects (Bland, 1982, 1989).

The epipharynx and distribution of the sensillae in the pallatum of *B. roldani* is very similar to the widespread species *B. nobilis* (Winnertz, 1852), except for the presence of the palatal bar in the larva of *B. roldani*, which is absent in *B. nobilis* (Hribar &

Mullen, 1991).

Bezzia is closely related to the large, widespread genus *Palpomyia* Meigen (1818), and both genera are placed in the tribe Palpomyiini Enderlein (1936). The larvae of *Bezzia roldani* show several similarities with larvae of *Palpomyia guarani* Lane (1946), which was also described based on the SEM observations by Ronderos *et al.* (2004). The most important similarities are the shape of the epipharynx and maxillary palpus, the distribution pattern of the sensilla of pallatum and messors, and the latter situated immediately behind the last pair of sensilla campaniformia, being this particular location more similar than to other species of *Bezzia*. Larvae of *B. roldani* are therefore interpreted to be predatory-carnivorous midges, are prognathous, exhibit an elongate, narrow head, mandible hooked with a single strong tooth and a fossa mandibularis, epipharynx gently massive, hypostoma finely toothed and cylindrical maxillary palpi (Thomsen, 1937; Mullen & Hribar, 1988; Hribar, 1993; Ronderos *et al.*, 2004).

The pupae of *B. roldani*, are similar to *B. blantoni* Spinelli & Wirth (1989), known from the USA to Argentina, both species co inhabit Los Talas pond in the province of Buenos Aires. However, the respiratory horn of *B. blantoni* is more slender, bears a straight row of 36-38 spiracles and its apex is not curved. Finally, the cephalothorax of *B. blantoni* has 2 ventromedian setae and one seta in the dorsolateral tubercle.

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