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Detailed description of larvae and pupae of two Neotropical species of *Alluaudomyia* Kieffer (Culicomorpha: Ceratopogonidae)

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ABSTRACT

The first description of the larva and pupa of *Alluaudomyia amazonica* Spinelli & Wirth and a detailed redescription of the larva and pupa of *A. schnacki* Spinelli are provided. Studied specimens were collected in the Corrientes and Buenos Aires provinces, Argentina, from habitats associated with aquatic ferns, those of *A. amazonica* with *Salvinia biloba* Raddi emend. De la Sota and *A. schnacki* with *Azolla filiculoides* Lam. The larvae were examined using a Scanning Electron Microscope (SEM) and a Compound Microscope (CM), while the pupae by the CM only. Data on the bionomics of both species are provided.

1. Introduction

The predaceous midges of the genus *Alluaudomyia* Kieffer are well represented in all biogeographic regions of the World (Spinelli and Wirth, 1984; Borkent, 2015). The larvae of these small, brightly patterned midges inhabit ponds, lakes and streams, and they are unique in swimming on the surface film (Borkent and Spinelli, 2007)

Although, there are 19 species of *Alluaudomyia* described from the Neotropical region (Borkent 2015), the immatures are known for only five of them: *A. bella* (Coquillett), *A. biestroi* Spinelli, *A. caribbeana* Spinelli & Wirth, *A. distispinulosa* Spinelli & Wirth and *A. schnacki* Spinelli. The descriptions of larvae and/or pupae of all above-mentioned species are rather inadequate and should be revised.

The purpose of this paper is to provide the first description of larva and pupa of *A. amazonica* Spinelli & Wirth and a detailed redescription of larva and pupa of *A. schnacki*, from material recently collected in Corrientes and Buenos Aires provinces, Argentina.

2. Material and methods

Larvae and pupae of *A. schnacki* were collected with a pipette from *Azolla filiculoides* Lam. (Azollaceae) in Napostá Grande stream in Buenos Aires province and in Vega stream in Corrientes province, while immatures of *A. amazonica* were collected associated to the aquatic fern *Salvinia biloba* Raddi emend. De la Sota (Salviniaceae) in temporary ponds in Corrientes province. Specimens were carried to the laboratory, larvae placed individually in Petri dishes and pupae isolated in a vial with a drop of water and observed daily until adult emergence. Adults were allowed to harden for 24 h before being preserved in ethanol to ensure their pigmentation complete. Larval and pupal exuviae and adults were mounted in Canada balsam following the technique described by Borkent and Spinelli (2007).

For Scanning Electron Microscope (SEM), the larvae were prepared following the technique of Ronderos et al. (2000, 2008). The photomicroghaphs were taken with JSM6360LV. Ink illustrations were made using CM an attached camera lucida. Photographs were taken with a digital camera micrometrics SE Premium, through a Nikon Eclipse E200 microscope. Measurements were taken using SEM and Compound Microscope (CM) when possible.

For larval terminology see Ronderos et al. (2012) and for pupal terminology see Borkent (2012), with addition of the following abbreviations of measurements: DAL, dorsal apotome length and DAW, dorsal apotome width.

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The studied specimens are deposited in the collection of the División Entomología, Museo de La Plata (MLPA), Argentina.

3. Results

Alluaudomyia amazonica Spinelli & Wirth
(Figs. 1A–F, 2A–K, 3A–E)

Alluaudomyia amazonica Spinelli and Wirth, 1984 (female, male; Brazil); Spinelli, 1987: 160 (records; Argentina, Uruguay); Spinelli and Wirth, 1993: 38 (check-list; Argentina); Borkent and Wirth, 1997: 90 (in World catalog); Spinelli, 1998: 325 (check-list; Argentina); Borkent and Spinelli, 2000: 43 (in New World catalog south of USA); Borkent and Spinelli, 2007: 76 (in Neotropical catalog); Borkent, 2015: 110 (in online Word catalog).

Description fourth instar larva (Figs. 1A–F, 2A and B, 3A–C). Color in life uniformly bluish; exuvium uniformly pale brown. Head capsule (Figs. 1A and B, 2A) 1.8× longer than broad, yellowish brown; chaetotaxy as shown in Fig. 1A and B. HL 0.25 (n = 2) mm (CM), 0.23 mm (SEM), HW 0.14 (n = 2) mm (CM), 0.12 mm (SEM); HR 1.80 (n = 2) (CM), 1.91 mm (SEM), SGW 0.09–0.11 (0.10, n = 2), SGR 1.40–1.55 (1.47, n = 2). Labrum (Figs. 1B and C, 2A) as long as its greatest basal width; palatum (Fig. 1B, D) with three pairs of anterolateral sensilla styloconica on anterior edge and three pairs of trichoidea sensilla (two of them immediately underneath the row of styloconica sensilla, the remaining one situated posteriorly) (Fig. 1C–E); messors well developed, long and club-shaped, length 0.018–0.020 (0.019, n = 2) mm (Figs. 1D, 2A); scopae well developed with 5–6 short teeth (Fig. 1D); palatar bar present, Y-shaped (Figs. 1D, 2A). Mandible (Figs. 2A, 3A) hooked, with two teeth, submedian tooth stout, apical tooth with blunt tip, with single short seta on basal portion near the hypocondyle, one pore anteriorly, fossa mandibularis on ectal surface (Fig. 3A) MDL 0.037–0.042 (0.040, n = 2) mm, MDW 0.01 (n = 2) mm. Maxilla (Fig. 1B) sclerotized, with quadrangular, spiculate basal sclerite, galeolacinia (Fig. 1C, E) with lacineal sclerite 1 with long, thin seta (Fig. 1C), lacineal sclerite 2 with short, stout seta (Fig. 1C and D); maxillary palpus long, cylindrical, with apical and subapical bunches of 5–6 papillae each (Fig. 1B–E). Hypostoma (Fig. 1B–E) finely crenulated. Epipharynx (Figs. 2A, 3B) less massive, dorsal comb with 12 teeth, median teeth stouter; ventral comb (comb 4) massive with 6 pointed teeth, median teeth shorter than lateral ones, comb 3 absent, comb 2 with 14–16 fine teeth; lateral arms stout with medial sclerite comb underneath. Hypopharynx (Figs. 2A, 3C) long, thin with slender arms; labium small, triangular; LAW 0.02–0.06 (0.05, n = 2) mm, DCW 0.02 (n = 2). Caudal segment as shown in Figs. 1F, 2B; one pair of subequal, long, stout setae "o", one pair of subapical, long, thin setae "i", one pair of short, thin setae "l_1" and one pair of short, thin seta "l_2". CSL 0.30 mm, CSW 0.10 mm, CSR 3.00, OL 0.46 mm, OD 0.025 mm.

Description female pupa (Figs. 2C–I, 3D and E). Total length 1.82–2.37 (2.14, n = 10) mm. Exuviae pale brown (Fig. 2C), except cephalothorax brown. Dorsal apotome (Fig. 2D) with disk 1.5× broader than long, disk surface covered with stout knob-like tubercles, more evident on lateral margins, anterior margin rounded with subapical tubercle; posterior margin straight, posterolateral margin with broad raised areas; bearing two dorsal apotome sensilla, DA-1-H minute seta, DA-2-H campaniform sensillum (Fig. 2D); DAL 0.10–0.12 (0.11, n = 8) mm; DAW 0.12–0.18 (016, n = 8) mm; DAW/DAL 1.19–1.70 (1.50, n = 8). Cephalothorax (Fig. 2C) with very small rounded tubercles on dorsal surface, length 0.83–0.95 (0.90, n = 10) mm, width 0.53–0.65 (0.59, n = 10) mm. Cephalothoracic sensilla as follows: two dorsolateral cephalic sclerite sensilla (Fig. 2E), DL-1-H minute seta, DL-2-H campaniform sensillum; three anterolateral sensilla (Fig. 2E), AL-1-T long, thin seta, AL-2-T, AL-3-T short, stout setae; two anteromedial sensilla (Fig. 2E), AM-1-T medium-sized, thin seta, AM-2-T minute seta; dorsals (Fig. 2F): D-1-T, D-2-T, D-5-T minute setae, D-3-T campaniform sensillum, D-4-T long, thin seta, supraalar (SA-2-T) campaniform sensillum. Respiratory organ (Fig. 2C, G) brown, 7 X longer than broad, surface covered with scale-like spicules, with double row of 12–14 distal pores, 2–3 lateral ones; RO length 0.157–0.175 (0.170, n = 10) mm, RO width 0.022–0.025 (0.023, n = 10) mm; pedicel (P) (Fig. 2G) smooth, short, pedicel length 0.017–0.022 (0.019, n = 10) mm, P/RO 0.10–0.13 (0.11, n = 10) mm. Clypeal/labral sensilla absent; four ocular sensilla present: O-1-H long, thin seta, O-2-H, O-4-H campaniform sensilla, O-3-H short, thin seta (Fig. 3D). Abdominal segments covered with small spinules. First abdominal segment (Fig. 2H) with sensilla as follows: D-2-I short, stout seta, D-3-I medium-sized, thin seta; D-4-I, D-7-I pores, D-5-I minute seta, D-8-I short, stout seta, D-9-I long, thin seta; three lateral sensilla, L-1-I long, thin seta, L-2-I minute seta, L-3-I short, thin seta on stout, triangular tubercle. Second abdominal segment similar to the first one. Segment 4 with sensillar pattern (Fig. 3E) as follows: D-2-IV short, stout seta, D-3-IV long, thin seta; D-4-IV, D7-IV pores, D-5-IV minute seta, D-8-IV short, stout seta, D-9-IV long, thin seta, all located on small, bifid tubercles; L-1-IV, L-2-IV, L-4-IV short, stout setae, L-3-IV, medium-sized, thin seta, all located on triangular tubercles; three ventral sensilla, V-5-IV short, stout seta, V-6-IV long, thin seta, V-7-IV medium-sized, stout seta, all located on small, bifid tubercles. Segment 9 (Fig. 2C, I) 1.9× longer than width, surface with anterior band of scattered spicules, dorsal surface with two small rounded tubercles, ventral surface with pore at mesal portion; length 0.19–0.23 (0.21, n = 10) mm, width 0.13–0.15 (0.14, n = 10) mm. Terminal process (Fig. 2I) 0.4 length of segment 9, nearly straight, spiculated with campaniform sensillum on base (D-5-IX), darker tip pointed; length 0.070–0.085 (0.076, n = 10) mm.

Description male pupa (Fig. 2J and K). Similar to female with usual sexual differences: total length 1.97–2.15 (2.03, n = 5) mm. Dorsal apotome (Fig. 2J) with anterior margin slightly concave, DAL 0.10–0.11 (0.105, n = 3) mm; DAW 0.160–0.175 (0.165, n = 3) mm, DAW/DAL 1.45–1.66 (1.57, n = 3). Respiratory organ with RO length 0.160–0.175 (0.167, n = 7) mm, RO width 0.025 (n = 7); pedicel length 0.017–0.020 (0.018, n = 7) mm, P/RO 0.100–0.121 (0.109, n = 7). Cephalothorax length 0.75–0.81 (0.78, n = 6) mm, width 0.50–0.60 (0.53, n = 6) mm. Segment 9 (Fig. 2K) length 0.195–0.230 (0.220, n = 7) mm, width 0.11–0.16 (0.135, n = 7) mm; dorsal surface with two rounded tubercles; genital lobe extending beyond of posterior margin of segment; terminal process (Fig. 2K) length 0.–095-0.110 (0.102, n = 7) mm.

Distribution. Brazil (Amazonas, Mato Grosso), Argentina (Formosa, Corrientes, Entre Ríos).

Material examined: Argentina: Corrientes prov., Departamento Corrientes, Estación Biológica Corrientes, 27°32′51.8″ S, 58°40′44.8″ W, 52 m, 29-XI-2010, P. Marino, 1 male (with pupal exuvium), 2 females (with pupal exuviae); same data except 9-XI-2011, Díaz-Marino, 5 males (with pupal exuviae), 6 females (with pupal exuviae); same data except 10-XI-2011, 1 females (with pupal exuviae), 2 females (with larval and pupal exuviae); same data except 30-IV-2012, 2 males (with pupal exuviae), 1 female (with pupal exuvium).

Material examined with SEM, Estación Biológica Corrientes, estero, 27°32′51.8″ S, 58°40′44.8″ W, 52 m, 29-XI-2010, P. Marino, 2 larvae.

Remarks. The wing pattern of the specimens that have reached the adult stage during the present study have very small dark spots at the apices of the veins M_1, M_2 and CuA_1 that are absent in the specimens from the type series. All other extraalar characters, including the female genital sclerotization and the male genitalia are identical those in *A. amazonica*, as they

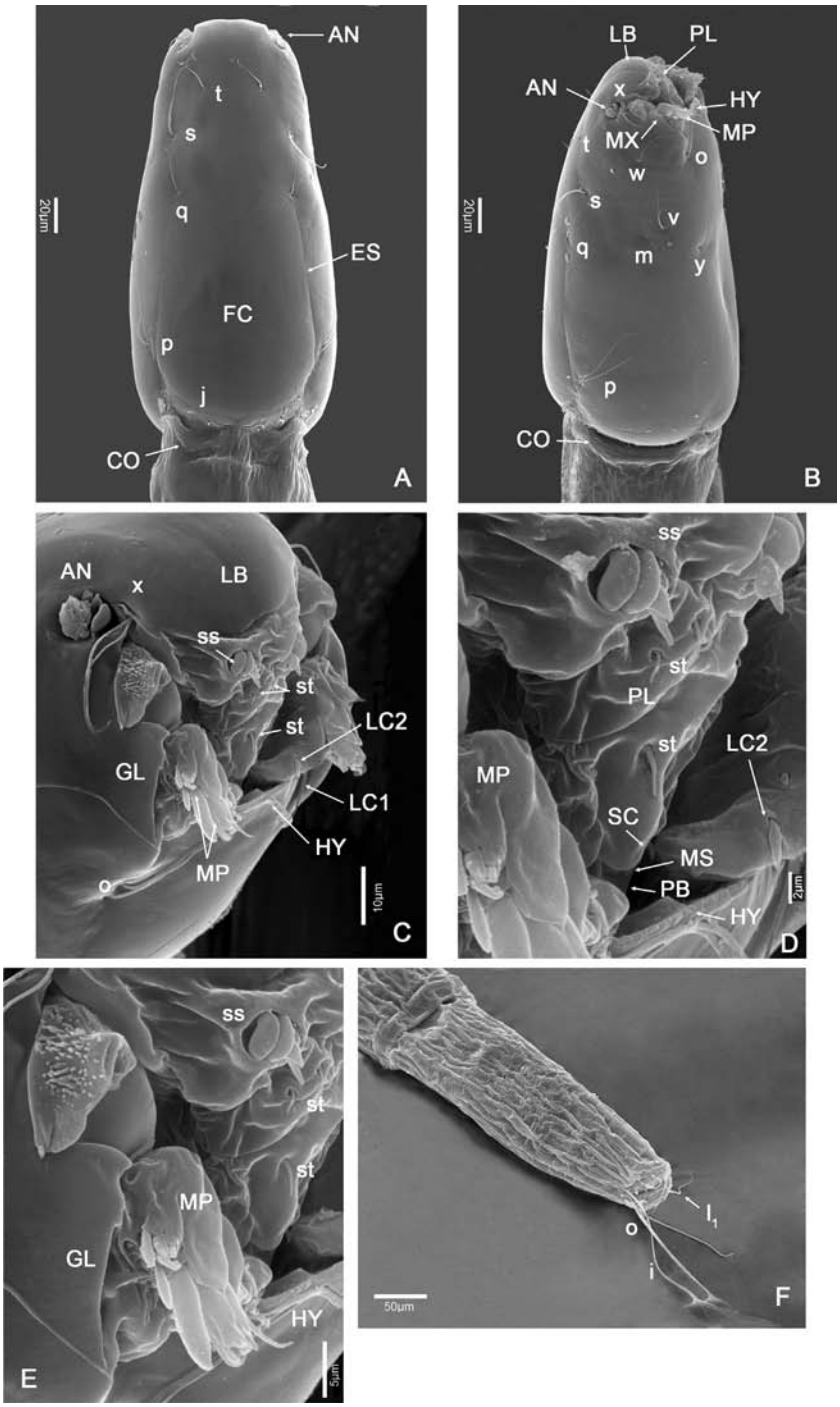

Fig. 1. SEM photomicrographs of *Alluaudomyia amazonica* Spinelli & Wirth, larva. (A) Head capsule chaetotaxy, dorsal view. (B) Head capsule chaetotaxy, ventrolateral view. (C) Head capsule, detail of frontal view. (D) Head capsule, detail of palatum. (E) Head capsule, detail of maxilla. (F) Caudal segment.
Antennae (AN); collar (CO); epicranial suture (ES); frontoclypeus (FC); galeolacinia (GL); hypostoma (HY); labrum (LB); lacinial sclerite 1 (LC1); lacinial sclerite 2 (LC2); maxilla (MX); maxillary palpus (MP); messors (MS); palatar bar (PB); palatum (PL); sensilla styloconica (ss); sensilla trichoidea (st); scopae (SC). Head capsule and caudal segment chaetotaxy are indicated by single letters: j, collar pits; m, posterolateral pits; o, parahypostomal setae; p, posterior perifrontal setae; q, postfrontal setae; s, anterior perifrontal setae; t, prefrontal setae; v, posterolateral setae; w, anterolateral setae; x, paranntenal setae; y, ventral setae; "o" outer setae; "i" inner setae, "l_1" first lateral setae.

were described in the original description by Spinelli and Wirth (1984).

Alluaudomyia schnacki Spinelli
(Figs. 4A–K, 5, 6A–E)

Alluaudomyia schnacki Spinelli, 1983: 403 (female, male, larva, pupa; Argentina); Spinelli, 1987: 160 (records; Argentina, Uruguay); Spinelli and Wirth, 1993: 38 (check-list; Argentina); Borkent and Wirth, 1997: 90 (in World catalog); Spinelli, 1998: 325 (check-list; Argentina); Borkent and Spinelli, 2000: 44 (in New World catalog south of USA); Borkent and Spinelli, 2007: 77 (in Neotropical catalog); Spinelli et al., 2010: 131 (records; Argentina, Chile); Marino et al., 2011: 203 (check-list of Ventania hills, Argentina); Borkent, 2015: 113 (in online World catalog).

Redescription fourth instar larva (Figs. 4A–K, 5A and B, 6A–C). Color in life uniformly brownish, exuvium slightly paler. Head capsule (Figs. 4A and B, 5A) 1.7× longer than broad, yellowish

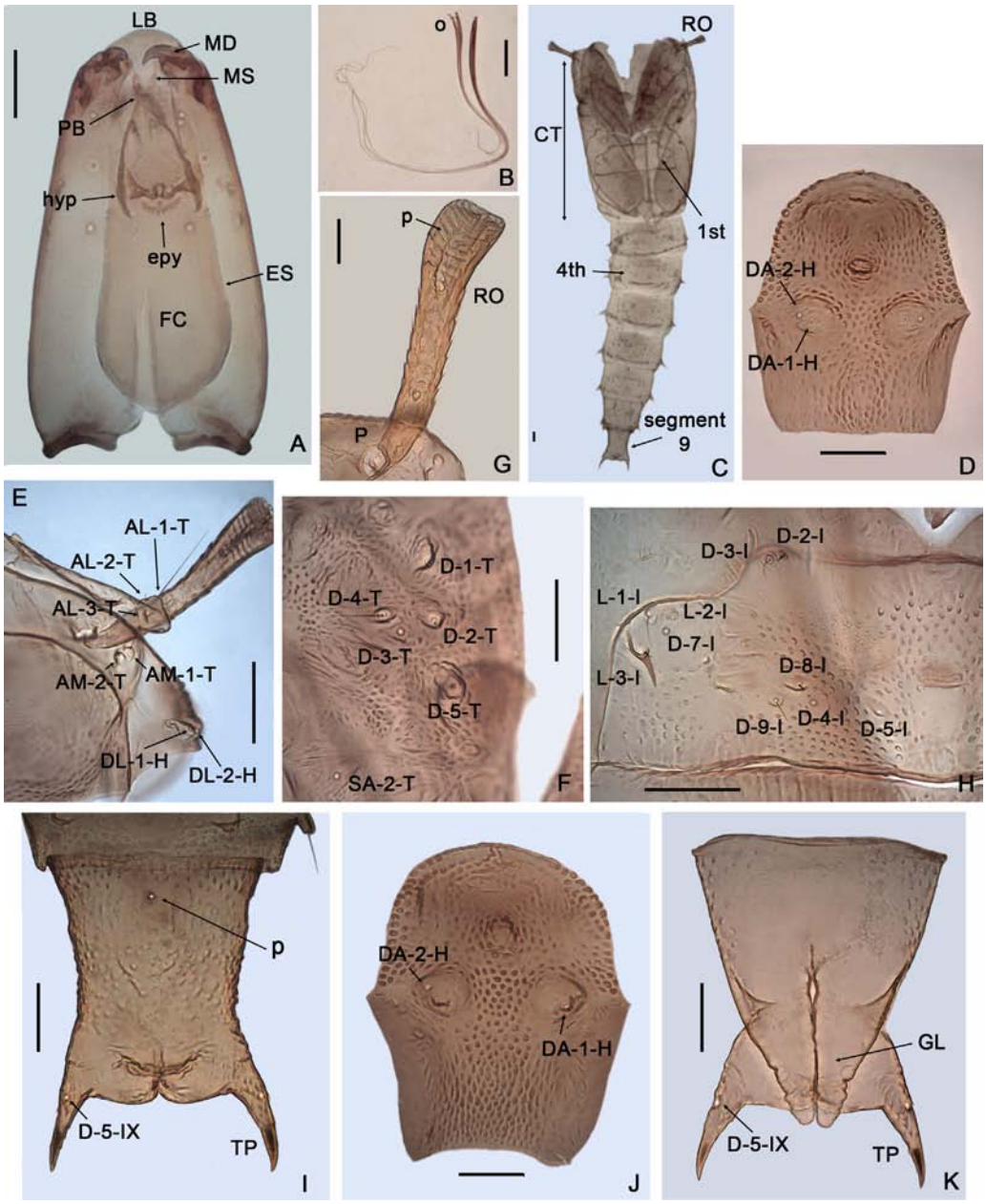

Fig. 2. *Alluaudomyia amazonica* Spinelli & Wirth, (A and B) larva, (C–I) female pupa, (J and K) male pupa. (A) Head capsule, ventral view. (B) Caudal segment insertion of setae. (C) Entire pupa. (D, J) Dorsal apotome. (E) Cephalothoracic chaetotaxy. (F) Dorsal sensilla and supraalar sensillum. (G) Respiratory organ. (H) First abdominal segment chaetotaxy. (I, K) Segment 9, ventral view.
Anterolateral sensilla (AL-1-T, AL-2-T, AL-3-T); anteromedial sensilla (AM-1-T, AM-2-T); cephalothorax (CT); dorsal apotome (DA); dorsal apotome sensilla (DA-1-H, DA-2-H); dorsolateral cephalic sclerite sensilla (DL-1-H, DL-2-H); dorsal sensilla (D-1-T, D-2-T, D-3-T, D-4-T, D-5-T); dorsal sensilla of segment 1 (D-2-I, D-3-I, D-4-I, D-7-I, D-8-I, D-9-I); epipharynx (epy); genital lobe (GL); hypopharynx (hyp); labrum (LB); lateral sensilla of segment 1 (L-1-I, L-2-I, L-3-I, L-4-I); mandible (MD); messors (MS); "o" outer setae; palatar bar (PB); pedicel (P); pore (p); respiratory organ (RO); supraalar sensillum (SA-2-T); terminal processes (TP).

brown; chaetotaxy as shown in Fig. 4A and B. HL 0.23–0.25 (0.24, $n = 2$) mm, HW 013–0.15 (0.14, $n = 2$) mm; HR 1.66–1.77 (1.72, $n = 2$), SGW 0.09–0.10 (0.095, $n = 2$), SGR 1.40–1.55 (1.47, $n = 2$). Labrum (Fig. 4A, C–F) as long as its greatest basal width; palatum (Fig. 4B, D and E) with three pairs of anterolateral sensilla styloconica on anterior edge, two pairs of trichoidea sensilla immediately underneath and three pairs of campaniform sensilla situated posteriorly (Fig. 4B–D, F–I); messors well developed, long, club-shaped, length 0.026 mm (Figs. 4D, 5A), scopae well developed with 4–5 short teeth (Fig. 4D); palatar bar present (Fig. 4G). Mandible (Figs. 4D–I, 5A) hooked with two teeth, submedian tooth stout, apical tooth elongate, tip pointed, with single short seta on basal portion near the hypocondyle, one pore anteriorly, fossa mandibularis on ectal surface, MDL 0.037–0.042 (0.040, $n = 2$) mm, MDW 0.012 ($n = 2$) mm. Maxilla (Fig. 4B, E) sclerotized, galeolacinia (Fig. 4C, G and H) with lacineal sclerite 1 with long, thin seta (Fig. 4C, G and H); lacineal sclerite 2 (Fig. 4G–I) with short, stout seta; maxillary palpus long, cylindrical, with apical and subapical bunches of 4 papillae each (Fig. 4B and C, G and H). Hypostoma (Fig. 4B and C, E, G, I) uniformly smooth. Epipharynx (Figs. 5A, 6B) less massive, dorsal comb with 9 pointed teeth, median tooth longer; ventral comb (comb 4) massive with 3 strong teeth, each tridentate, comb 3 absent, comb 2 with 20–22 fine teeth; lateral arms stout with medial sclerite comb underneath. Hypopharynx (Figs. 5A, 6C) long, thin, with slender arms; labium small, triangular; LAW 0.05–0.06 (0.055, $n = 2$) mm, DCW 0.025–0.027 (0.026, $n = 2$). Caudal segment as in

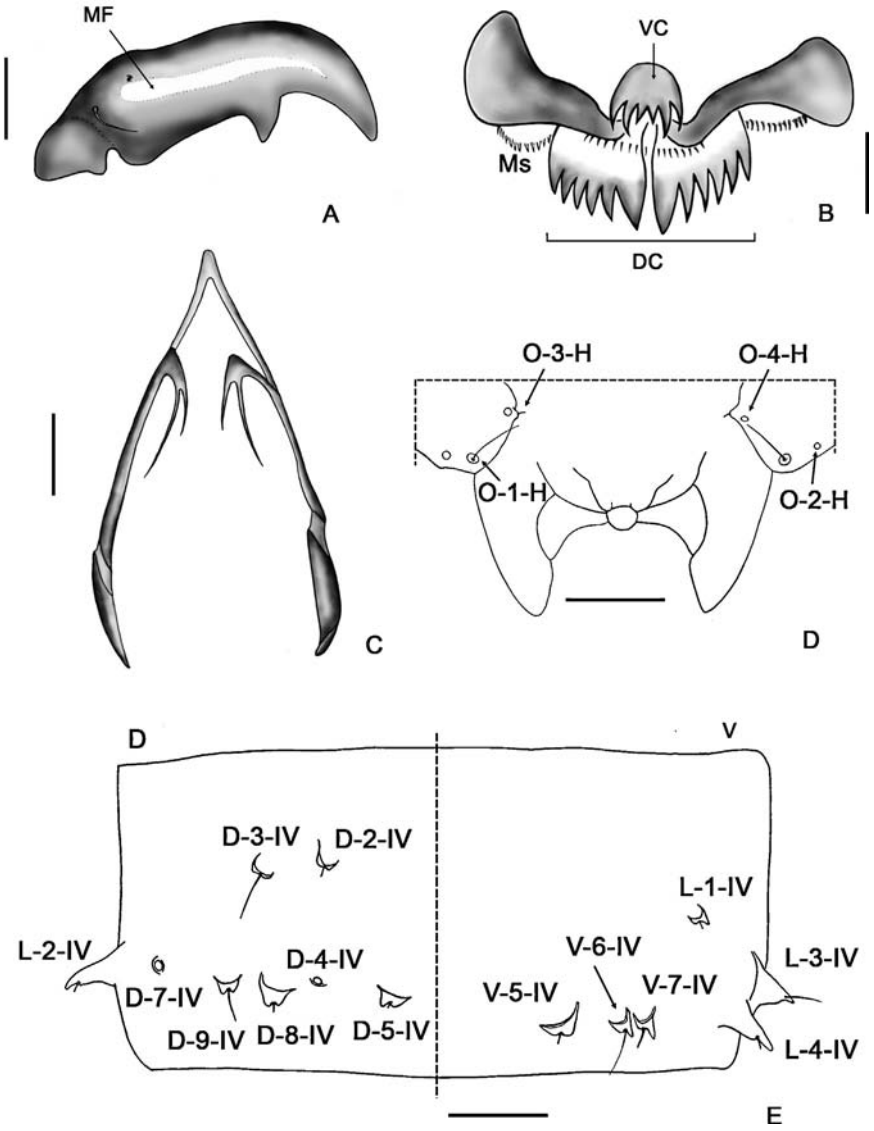

Fig. 3. *Alluaudomyia amazonica* Spinelli & Wirth, (A–C) larva, (D and E) female pupa. (A) Mandible. (B) Epipharynx. (C) Hypopharynx. (D) Ocular sensilla. (E) Fourth abdominal segment chaetotaxy.
Dorsal comb (DC); dorsal sensilla of segment 4 (D-2-IV, D-3-IV, D-4-VI, D-5-IV, D-7-IV, D-8-IV, D-9-VI); fossa mandibularis (MF); lateral sensilla of segment 4 (L-1-IV, L-2-IV, L-3-IV, L-4-IV); medial sclerite (Ms); ocular sensilla (O-1-H, O-2-H, O-3-H, O-4-H); ventral comb (VC); ventral sensilla of segment 4 (V-5-IV, V-6-IV, V-7-IV)

Figs. 4J and K, 5B; one pairs of subequal, long, thin setae "d", one pair of subequal, long, stout setae "o", one pair of subapical, long, thin setae "i", one pair of short, thin setae "l_1 " and one pair of long, thin seta "v". CSL 0.20 mm, CSW 0.06 mm, CSR 3.33, OL 0.60 mm, OD 0.025 mm.

Redescription female pupa (Fig. 5C–E, G–I). Total length 1.97–2.25 (2.13, $n = 10$) mm. Exuviae brownish (Fig. 5C). Dorsal apotome (Fig. 5D) with disk 1.7× broader than long, disk surface smooth, anterior margin rounded, lateral margins wrinkled, posterior margin slightly concave; bearing two dorsal apotome sensilla, DA-1-H short, stout seta, DA-2-H campaniformia sensillum (Fig. 5D); DAL 0.095–0.105 (0.100, $n = 9$) mm; DAW 0.16–0.18 (0.17, $n = 9$) mm; DAW/DAL 1.60–1.85 (1.68, $n = 9$). Cephalothorax (Fig. 5C) brownish, surface smooth, length 0.77–0.90 (0.85, $n = 10$) mm, width 0.52–0.63 (0.58, $n = 10$) mm. Cephalothoracic sensilla as follows: two dorsolateral cephalic sclerite sensilla (Fig. 5E), DL-1-H minute seta, DL-2-H campaniform sensillum; three anterolateral sensilla (Fig. 5E), AL-1-T long, thin seta, AL-2-T, AL-3-T short, stout setae; two anteromedial sensilla (Fig. 5E), AM-1-T medium-sized, thin seta; AM-2-T short, stout seta; dorsals: D-1-T, D-5-T minute, stout setae, D-2-T medium-sized, thin seta, D-3-T campaniform sensillum, D-4-T absent, supraalar (SA-2-T) campaniform sensillum. Respiratory organ (Fig. 5C, G) dark brown, 3.4 X longer than broad, expanded distally, surface smooth on basal half, with double row of 23–26 pairs of distal pores forming a shallow gutter-like structure; RO length 0.17–0.21 (0.19, $n = 10$) mm, RO width 0.050–0.062 (0.056, $n = 10$) mm; pedicel (P) (Fig. 5G) pale brown, smooth, short, pedicel length 0.0125–0.0150 (0.0140, $n = 10$) mm, P/RO 0.06–0.08 (0.07, $n = 10$). Clypeal/labral sensilla absent; three ocular sensilla present: O-1-H, O-3-H long, thin setae, O-2-H campaniform sensillum. Abdominal segments covered with small spinules. First abdominal segment (Fig. 5H) with sensilla as follows: D-2-I short, stout seta, D-3-I long, thin seta; D-4-I pore; D-5-I, D-7-I absent, D-8-I short, stout seta; D-9-I medium-sized, thin seta; three lateral sensilla, L-1-I medium-sized, thin seta, L-2-I short, thin seta on rounded tubercle, L-3-I medium-sized, thin seta on triangular tubercle. Second abdominal segment similar to the first one. Segment 4 with sensillar pattern as follows: D-2-IV short, stout seta; D-3-IV long, thin seta, D-4-IV, D-7-IV pores, D-5-IV minute seta on bifid tubercle, D-8-IV short, stout

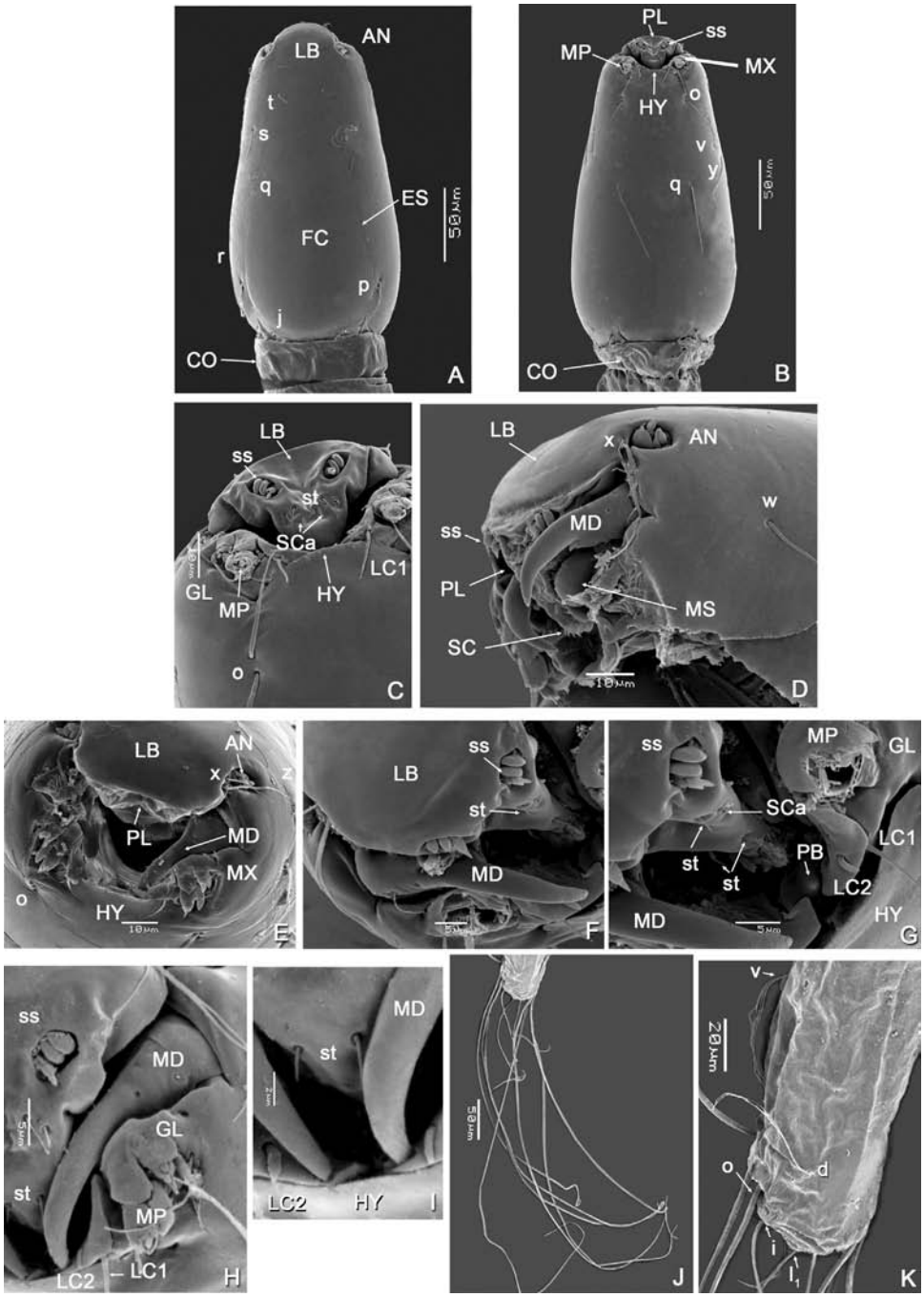

Fig. 4. SEM photomicrographs of *Alluaudomyia schnacki* Spinelli larva. (A) Head capsule chaetotaxy, dorsal view. (B) Head capsule chaetotaxy, ventral view. (C) Head capsule, anteroventral view. (D) Head capsule, anterolateral view. (E) Head capsule, frontal view. (F) Head capsule, detail of frontal view. (G) Detail of palatum. (H) Detail of maxilla. (I) Detail of hypostoma. (J) Caudal segment. (K) Caudal segment insertion of setae.
Antennae (AN); collar (CO); epicranial suture (ES); frontclypeus (FC); galeolacinia (GL); hypostoma (HY); labrum (LB); lacinial sclerite 1 (LC1); lacinial sclerite 2 (LC2); mandibule (MD); maxilla (MX); maxillary palpus (MP); messors (MS); palatar bar (PB); palatum (PL); sensilla campaniformia (SCa); sensilla styloconica (ss); scopae (SC). Head capsule and caudal segment chaetotaxy are indicated by single letters: j, collar pits; o, parahypostomal setae; p, posterior perifrontal setae; q, postfrontal setae; r, postnatal pits; t, prefrontal setae; v, posterolateral setae; w, anterolateral setae; x, paranntenal setae; y, ventral setae; "d", dorsal setae; "o" outer setae; "i" inner setae; "l_1" first lateral setae.

seta on prominent triangular tubercle; D-9-IV long, thin seta on bifid tubercle; L-1-IV, L-2-IV, L-4-IV short, stout setae, all located on prominent triangular tubercles, L-3-IV medium-sized, thin seta on rounded tubercle; three ventral sensilla, V-5-IV minute seta, V-6-IV medium-sized, thin seta, V-7-IV short, stout seta, all located on bifid tubercles. Segment 9 (Fig. 5I) two X longer than width, surface with anterior band of a few spicules, dorsal surface with two rounded tubercles, ventral surface with pore at mesal portion; length 0.174–0.225 (0.204, $n = 10$) mm, width 0.105–0.140 (0.120, $n = 10$) mm. Terminal process (Fig. 5I) 0.5 length of segment 9, divergent, spiculated with two campaniform sensilla at base (D-5-IX, D-6-IX), tip dark, recurved, pointed; length 0.06–0.08 (0.07, $n = 10$) mm.

Redescription male pupa (Figs. 5F, J and K, 6 D and E). Similar to female with usual sexual differences: Total length 1.87–2.30 (2.10, $n = 7$) mm. Dorsal apotome (Fig. 5J) with DAL 0.045–0.055

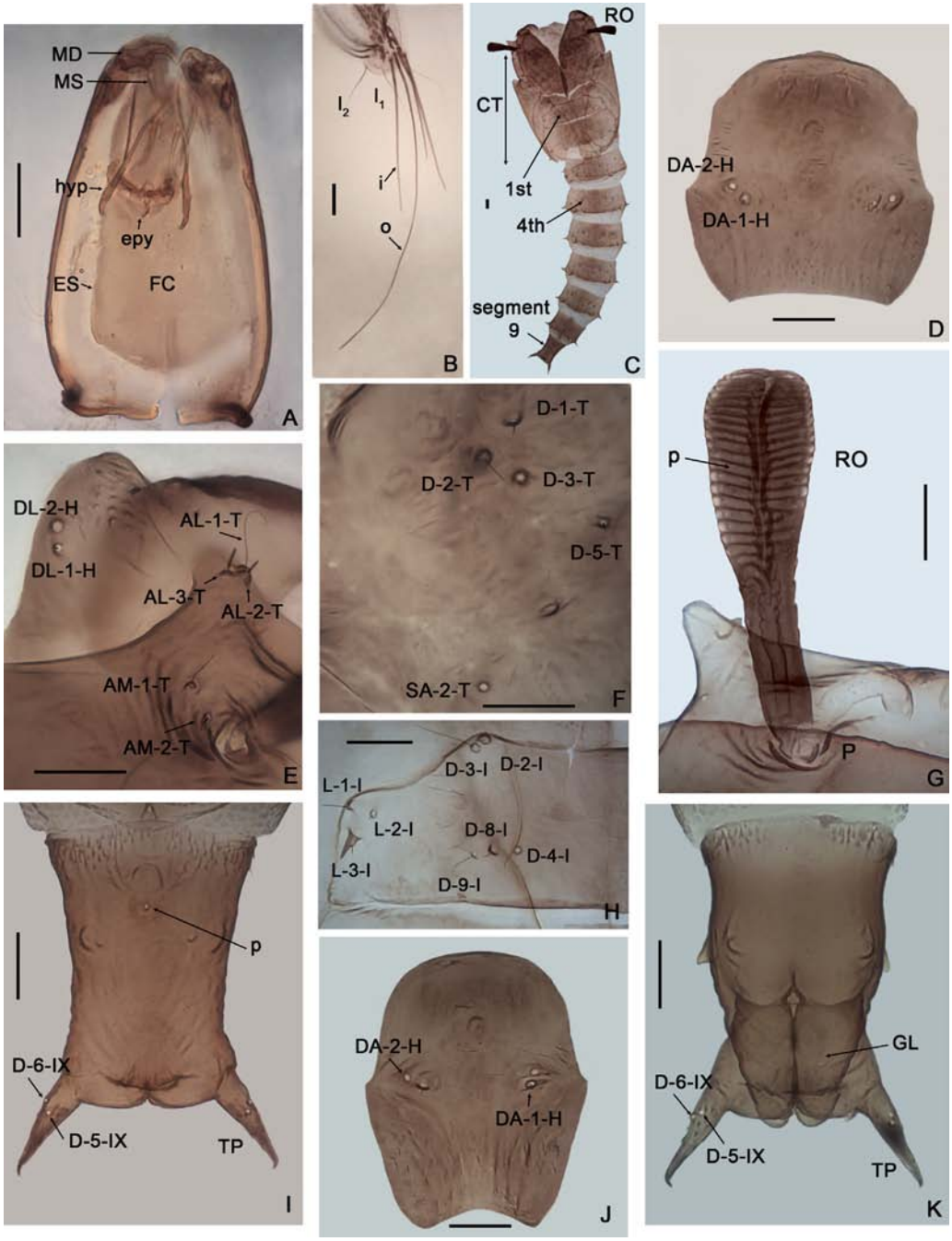

Fig. 5. *Alluaudomyia schnacki* Spinelli, (A and B) larva, (C–E, G–I) female pupa, (F, J and K) male pupa. (A) Head capsule, ventral view. (B) Caudal segment insertion of setae. (C) Entire pupa. (D, J) Dorsal apotome. (E) Cephalothoracic chaetotaxy. (F) Dorsal sensilla and supraalar sensillum. (G) Respiratory organ. (H) First abdominal segment chaetotaxy. (I, K) Segment 9.

Anterolateral sensilla (AL-1-T, AL-2-T, AL-3-T); anteromedial sensilla (AM-1-T, AM-2-T); cephalothorax (CT); dorsal apotome (DA); dorsal apotome sensilla (DA-1-H, DA-2-H); dorsolateral cephalic sclerite sensilla (DL-1-H, DL-2-H); dorsal sensilla (D-1-T, D-2-T, D-3-T, D-4-T, D-5-T); dorsal sensilla of segment 1 (D-2-I, D-3-I, D-4-I, D-7-I, D-8-I, D-9-I); epipharynx (epy); genital lobe (GL); hypopharynx (hyp); labrum (LB); lateral sensilla of segment 1 (L-1-I, L-2-I, L-3-I, L-4-I); mandible (MD); messors (MS); "o" outer setae; palatar bar (PB); pedicel (P); pore (p); respiratory organ (RO); supraalar sensillum (SA-2-T); terminal processes (TP). Caudal segment chaetotaxy are indicated by single letters: "o" outer setae, "i" inner setae, "l_1" first lateral setae, "l_2" second lateral setae.

(0.490, $n = 7$) mm; DAW 0.077–0.087 (0.081, $n = 8$) mm, DAW/DAL 1.45–1.84 (1.66, $n = 7$). Dorsals as in Fig. 5F. Respiratory organ dark brown, RO length 0.180–0.202 (0.186, $n = 7$) mm, RO width 0.050–0.062 (0.055, $n = 8$); pedicel length 0.012–0.015 (0.013, $n = 7$) mm, P/RO 0.061–0.088 (0.070, $n = 7$). Oculars as in Fig. 6D. Cephalothorax length 0.75–0.90 (0.82, $n = 7$) mm, width 0.53–0.65 (0.56, $n = 7$) mm. Segment 4 with sensillar pattern as in Fig. 6E. Segment 9 (Fig. 5K) length 0.18–0.23 (0.21, $n = 7$) mm, width 0.11–0.15 (0.13, $n = 7$) mm; dorsal surface with two rounded tubercles; genital lobe reaching or extending beyond of posterior margin of segment; terminal process (Fig. 5K) length 0.085–0.105 (0.097, $n = 7$) mm.

Distribution. Chile (Santiago), Argentina (Formosa, Corrientes, Entre Ríos, Buenos Aires, Chubut), Uruguay (Artigas, Tacuarembó).

Material examined: Argentina: Buenos Aires prov., Sierra de la Ventana, arroyo Napostá Grande, 38°08′44.2″ S, 62°05′32.7″ W, 300 m, 17-XI-2006, Marino-Díaz, 1 female (with larval and pupal exuviae); same data except 7-II-2007, F. Díaz, 1 female (with pupal exuvium), 1 larva. Corrientes prov., Partido Bella Vista, ruta Prov.

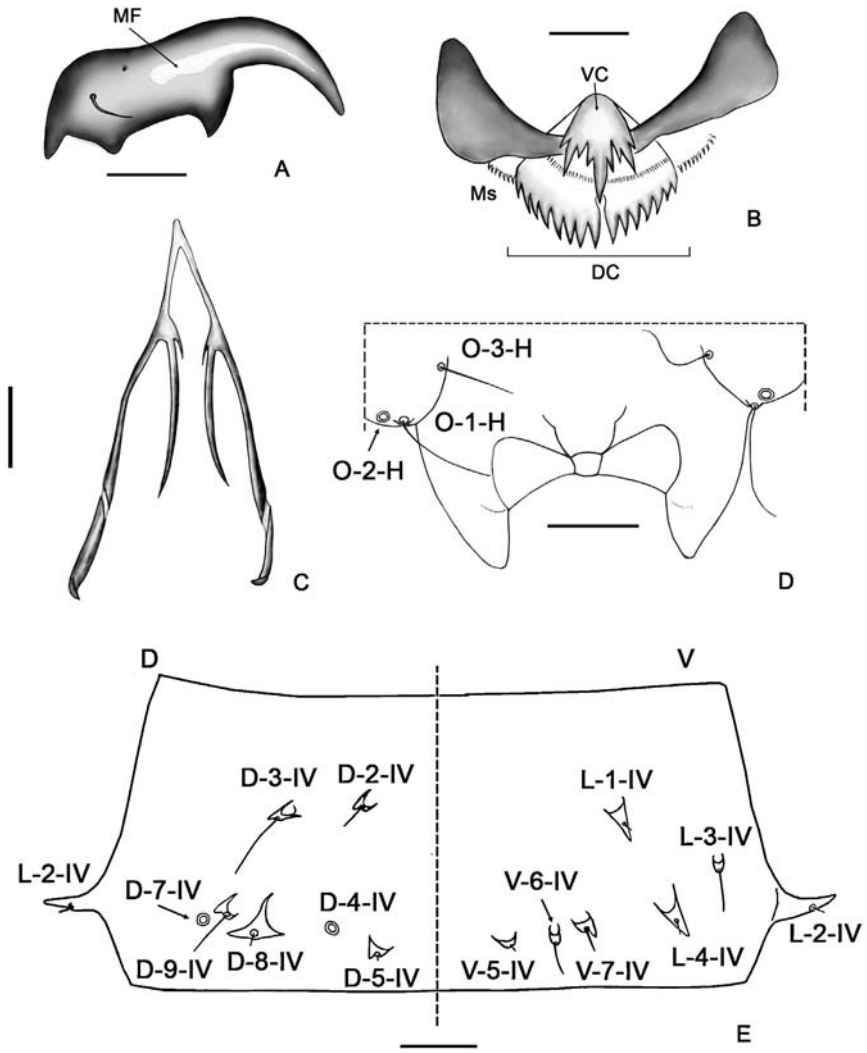

Fig. 6. *Alluaudomyia schnacki* Spinelli, (A–C) larva, (D and E) male pupa. (A) Mandible. (B) Epipharynx. (C) Hypopharynx. (D) Ocular sensilla. (E) Fourth abdominal segment chaetotaxy.
Dorsal comb (DC); dorsal sensilla of segment 4 (D-2-IV, D-3-IV, D-4-VI, D-5.IV, D-7-IV, D-8-IV, D-9-VI); fossa mandibularis (MF); lateral sensilla of segment 4 (L-1-IV, L-2-IV, L-3-IV, L-4-IV); medial sclerite (Ms); ocular sensilla (O-1-H, O-2-H, O-3-H); ventral comb (VC); ventral sensilla of segment 4 (V-5-IV, V-6-IV, V-7-IV).

27 e/Km 54-55, 16-IX-2010, Díaz-Marino, 4 males (with pupal exuviae), 5 females (with pupal exuviae); ruta Nac. 12, arroyo Vega, 30°06′40.6″ S, 59°31′56.9″ W, 20 m, 18-IX-2010, F. Díaz, 1 female (with pupal exuvium); same date except 27-IV-2011, 1 male (with pupal exuvium), 2 females (with pupal exuviae); same data except 13-XI-2011, 1 female (with pupal exuvium); Estación Biológica Corrientes, 27°32′51.8″ S, 58°40′44.8″ W, 52 m; 29-III-2012, Díaz-Marino, 2 males (with pupal exuviae), 1 female (with pupal exuvium).

Material examined by with SEM, Sierra de la Ventana, arroyo Napostá Grande, 38°08′44.2″ S, 62°05′32.7″ W, 300 m, 7-II-2007, F. Díaz, 1 larva; ruta Nac. 12, arroyo Vega, 30°06′40.6″ S, 59°31′56.9″ W, 20 m, 18-IX-2010, F. Díaz, 1 larva.

4. Taxonomic discussion

The larva of *A. amazonica* is very similar to its Neotropical congener *A. schnacki* by virtue of the labrum longer than broad, the hooked mandible with two teeth, long and cylindrical maxillary palpus and the caudal segment bearing 6 pairs of setae (4 long, 2 thinner ones). However, *A. schnacki* differs by following combination of the characters: brownish coloration in life, the palatum with 3 pairs of sensilla styloconica, 2 pairs of sensilla trichoidea and 3 pairs of sensilla campaniform, the scopae armed with 4-5 short teeth, the mandible with elongated and pointed apical tooth, the maxillary palpus with 2 bunches of 4 papillae each, smooth hypostoma and the epipharynx with a dorsal comb armed with 16 teeth, a ventral comb (comb 4) with three tridentate pointed teeth and the comb 2 with 20–22 fine teeth. The pupae of *A. schnacki* is readily distinguished by the dorsal apotome smooth and wrinkled laterally, by the presence of four dorsal sensilla on the cephalothorax, the respiratory organ with 23–26 pairs of distal pores, the presence of three ocular sensilla, lacks of the D-5-I/D-7-I on the first abdominal segment and by divergent terminal processes of the segment 9, each with recurved tip.

We have compared the pupae of these two species with the pupae of the following Neotropical species, although their descriptions are very incomplete: *Alluaudomyia bella*, *Alluaudomyia biestroi*, *Alluaudomyia caribbeana* and *Alluaudomyia distispinulosa*. The respiratory organ of *A. bella* has 20–25 distal pores and 2–3 lateral ones and the dorsal apotome exhibits a single dorsal apotome sensillum, the respiratory organ of *A. biestroi* has 12 pairs of distal pores and 2 lateral ones. *A. caribbeana* apparently lacks the dorsal apotomal sensilla and bears 14–15 distal pores on the respi-

ratory organ, and while *A. distispinulosa* has a single dorsal apotome sensillum and the respiratory organ by 18 pairs of distal pores.

The descriptions of the pupae of the Nearctic species *Alluaudomyia footei* Wirth, *Alluaudomyia megaparamera* Williams, *Alluaudomyia needhami* Thomsen, *Alluaudomyia paraspina* Wirth and *Alluaudomyia parva* Wirth are also very incomplete. The exuvium of *A. footei* is uniformly brownish and its respiratory organ bears 32–34 distal and 2–4 lateral pores. *A. megaparamera* differs by the presence of 30–40 distal pores in the respiratory organ, *A. paraspina* posseses a golden brown color and the respiratory organ with 13–20 distal and one lateral pores, and *A. parva* differs by the dorsal apotome as long as wide with a single dorsal sensillum, the respiratory organ bearing 7 pairs of distal pores and 2–3 lateral ones and by terminal process of the segment 9 smooth, with pale tip.

Finally, the immatures of *A. amazonica* and *A. schnacki* were also compared with the four Australian species whose larvae and pupae were fairly well described by Elson-Harris and Kettle (1985). The larva of *Alluaudomyia appendiculata* Debenham differs from *A. amazonica* and *A. schnacki* by its greenish brown color in life, the epipharynx with four combs, the dorsal comb with 16 teeth, the comb 2 with one tooth, the comb 3 with 2 teeth and the ventral comb (comb 4) with 16–17 teeth, and the caudal segment with 9 pairs of setae; the pupa differs by the presence of two ocular sensilla and by the presence of 50 distal pores in the smooth respiratory organ. The larva of *Alluaudomyia fumosipennis* Debenham can be distinguished from the Neotropical species herein described by reddish-brown pigmentation, presence of three combs on the epipharynx, the dorsal comb with 15–17 teeth, the comb 2 with one tooth and the ventral comb (comb 4) with 4 teeth and by 9 pairs of setae on segment 9; the pupa is clearly distinguished by the presence of 8–11 distal pores in the smooth respiratory organ. The pupa is the only known preimaginal stage of the remaining two Australian species, *Alluaudomyia reyei* Debenham and *Alluaudomyia unguistyla* Debenham; the latter species is characterized by the presence of one dorsal apotomal sensillum and by the respiratory organ has 11 distal pores and a single lateral one. *A. reyei* has only one dorsal apotomal sensillum, and one clypeal sensillum, one labral sensillum and its respiratory organ bears 9–12 distal pores and 1–2 lateral ones.

5. Bionomics

Larvae and pupae of *A. amazonica* were collected in temporary ponds on the aquatic fern *S. biloba* Raddi emend. De la Sota, cohabiting with other species of Ceratopogonidae, e.g., *Dasyhelea paulistana* Forattini & Rabello, *Stilobezzia* (*Stilobezzia*) *punctulata* Lane and *Bezzia pulchripes* Kieffer. *A. schnacki* was not only collected in temporary ponds but it was also found in streams in Corrientes and Buenos Aires provinces, always associated to *A. filiculoides* Lam.

Immatures of *A. amazonica* were collected three times between 2010 and 2012. Larvae lasted three days to reach to pupal stage in the laboratory and the pupae that reached the adult stage took 4–5 days to emerge. Immatures of *A. schnacki* were collected five times between 2006 and 2007 and 2010-2012. The first group of larvae of *A. schnacki* were collected in November 2006 and February 2007 in Buenos Aires province. It has taken them five days to reach the pupal stage and after 3–4 days the adults have been emerged. The second group of larvae were collected in September 2010, November 2011 and April 2012 in Corrientes. In this case, the larvae reached the pupal stage after three days and the adults emerged 4–5 days later.

The larvae of both species show either fast and undulatory swimming motions on the water surface or writhing through the surface material above the water line. They swim fast between aquatic fern where they remain hidden and immobile. These species are the most abundant ceratopogonid larvae encountered from September to March.

The collected pupae of *A. amazonica* and *A. schnacki* were found most commonly at the edge of the ponds or near vegetation upon which they climbed just before emergence. The pupae exibits the typical semi-circular slow adbominal movement typical of other ceratopogonid pupae.

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