

Studies on the morphology of immature stages of the tribe Agathidiini (Coleoptera: Leiodidae). Part II. *Anisotoma blanchardi*

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Abstract. The first and third larval stages of Nearctic *Anisotoma blanchardi* (Horn, 1880) are described in detail and figured for the first time; measurements and chaetotaxy of head, mouthparts, thorax, abdomen, leg and urogomphi are given. Larval morphology of the *blanchardi* group is discussed. The *blanchardi* species group, proposed after a study of adult characters, is very important phylogenetically because it is a basal group in the genus and sister group to all the remaining groups. Larval characters confirm the monophyly of the group. The common larval characters of the *blanchardi* species group are: (i) presence of primary setae below the posterior row of terga, (ii) secondary microsculpture on the head, dense, present from the base of the head to the anterolateral arms of the epicranial suture and fronto-clypeal furrow, (iii) sclerotization around sockets of primary posterior setae of thorax of instar III, (iv) presence of clypeal furrow in the third stage, (v) presence of setae Dc1, Dd1, Dc2, Dd2a on head in instar III, (vi) urogomphomere 1 and 2 similar in length and proportion.

INTRODUCTION

The tribe Agathidiini includes 10 genera (Angelini & Peck, 2000), but larvae are described in detail only for some species of the genera *Agathidium* Panzer, 1797 and *Anisotoma* Panzer, 1797 by Angelini and De Marzo (1984), Wheeler (1990a), Ratajczak [= Kilian] (1995, 1996), Růžička (1996), Kilian (1998, 2001, 2003); there exist preliminary descriptions for *Sphaeroliodes* Portevin, 1905 (Morimoto & Hayashi, 1984) and *Liodopria* Reitter, 1909 by Kilian (1998, detailed description in prep.). Immature stages of all staphylinoids have numerous characters, which seem to be phylogenetically informative (e.g. Ashe, 1986; Ashe & Wheeler, 1988). However, previous studies on the larval stages of Agathidiini showed that the proposed generic classification based on characters of adults was not consistent with that based on those of larvae, and the results of cladistic analyses depended on the taxa included (Angelini & De Marzo, 1984; Wheeler, 1990a, b; Kilian, 1998).

This paper is the second part of a study of the larval morphology of American members of the tribe Agathidiini. The first part deals with the structure of larvae of *A. discolor* Melsheimer, 1844 (Kilian, 2003). The purpose of my studies, in addition to presenting formal descriptions, is to provide data for cladistic analyses of larval structures, especially homology of chaetotaxy.

Anisotoma blanchardi (Horn, 1880) belongs to the *blanchardi* group, which is basal in the genus and sister to all the remaining groups (Wheeler, 1979). The group is defined by reduced female tarsi (tarsal formula 4-4-4) and includes four species: Nearctic *A. blanchardi* and *A. bifoveata* Wheeler, 1979, and Palaearctic *A. orbicularis* (Herbst, 1792) and *A. boukali* Angelini & Švec, 1993. In the group, the first and the third larval stages have been described in detail only for the European *A. orbicularis* (Ratajczak [= Kilian], 1996; Kilian, 1998).

Agathidiini have three larval instars but the second and third instars have very similar chaetotaxic characters, and differ only in body size and some additional small setae.

In this paper, the first and third larval instars of *A. blanchardi* are described and illustrated, including chaetotaxy and distribution of campaniform sensilla. Measurements are given for all the larval stages. Larval characters shared by and exclusive to *A. blanchardi* and *A. orbicularis*, both members of the *blanchardi* group, are listed in the discussion.

MATERIAL AND METHODS

Specimens were borrowed from the collection of Prof. A. Newton, Jr. (Field Museum of Natural History, Chicago).

Three specimens of the third instar, one of the second and one of the first instar were mounted in "Permout" medium. The heads of the larvae were separated from the rest of the body and the mouthparts dissected. All drawings of instar I were made without additional preparation because the slide-mounted specimens were fragile. Thus, detailed examination of the pronotum, mesonotum and metanotum of instar I was not possible and they were not described and illustrated.

12 specimens of mature larvae were removed from 75% ethanol, boiled in 10% KOH solution, cleared in distilled water and then mounted in glycerol-gelatine. Six of them had the mouthparts dissected.

The larvae were examined and measured at magnifications up to $\times 600$ using a Phase Contrast microscope "Nikon" and "Eco-Vision" ($\times 400$).

Two larvae were dehydrated in a graded series of ethanol, dried using Peldri II, mounted on SEM stubs with double-sided tape, coated with carbon and gold, and examined using a Jeol scanning microscope (JSM-5800LV).

The chaetotaxy system, abbreviations, designations and measurements follow my previous papers (Kilian, 1998; Ratajczak, 1995, 1996) and those of Růžička (1996), based on standards proposed by Ashe & Watrous (1984) and Wheeler (1990a).

Label data, *Anisotoma blanchardi*. 5 specimens of all instars in "Permout" medium: "N. H.: Coos Co. 0.3 mi S Jefferson

Notch, 895 m., Picea – Abies for. 23–27. VII. 1980. A. Newton, M. Thayer. ANMT 80-B *Lycogala* epid. PM". 12 specimens of mature larvae: "MAINE: Oxford Co. Albany Notch Tr., 260–360 m., SSW of Bethel, 14. VI. 1981 mixed hdwd. – Tsuga. A. Newton, M. Thayer. ANMT Lot No. 81-B. *Lycogala* epidendrum. Associated or reared adult(s) mounted".

RESULTS

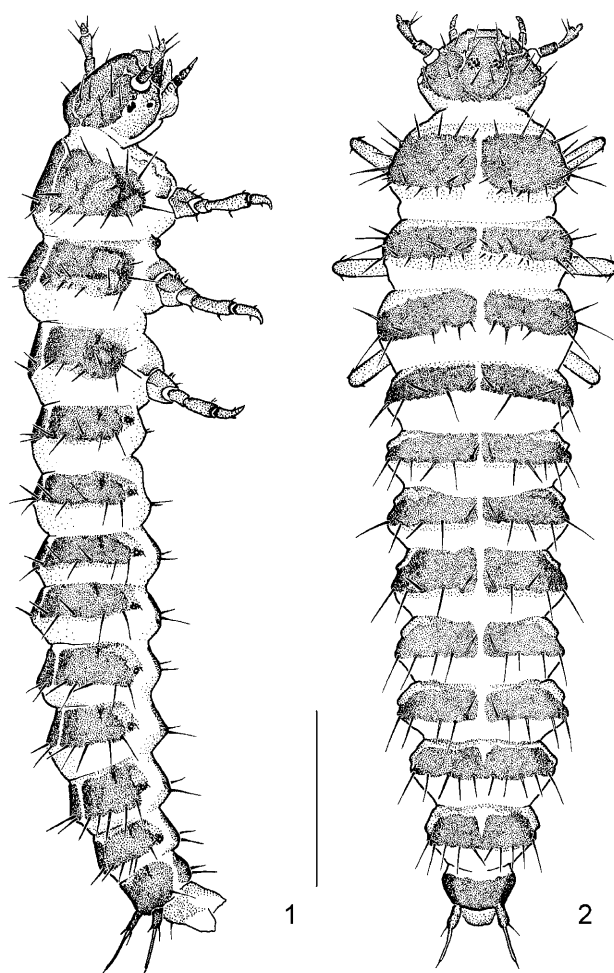
Diagnosis

For comparison with previously described larval Agathidiini: see table with distribution of characters (Kilian, 1998, Tbl.1, page 149).

Two pairs of stemmata. Solenidia at base of digitiform organ of antennomere II: 2 in instar I, 3 in instar II and III. Digitiform solenidium large, undivided. Primary, posterior setae of tergites long (average length of instar III: 0.15 mm), expanded, with longitudinal striae in instar III (Fig. 44), pointed in instar I. Primary setae of head pointed. Head wider than long. Epicranial stem absent or very short. Epicranial sutures distinct, with anterior arms bifurcated. Dorsal side of head with Da1, Dc1, Dc2 and 2 pairs of campaniform sensilla; 6 additional setae in instar III (Dc*a, Dd1, Dd2a, De*, De*a). Asperities in instar II and III: dense, on dorsal side from posterior part of head up to fronto-clypeal furrow and anterolateral arms of epicranial suture. Labrum wider than long, emarginated laterobasally, with a single median pair of large setae and 1 pair of campaniform sensilla. Antennae comparatively short (average length of instar III: 0.28 mm). Mandibles symmetrical, apically bidentate with smooth (instar I) and slightly serrated (instar III) internal edge; mola toothed on ventral side, group of spines above prosthema present, 2 setae and 1 campaniform sensillum in instar I, 4 setae and 2 campaniform sensilla dorsally in instar III. Apex of maxilla divided into fimbriate galea and falcate lacinia with 7–9 spine-like setae. Ligula with median emargination, a pair of setae and 3 pairs of campaniform sensilla. Hypopharyngeal sclerome with anterior and posterior bridges complete. Tibia with 2 campaniform sensilla near D1. The length of femur longer than in *A. orbicularis*. Dorsal integument of pronotum with honeycomb-like asperities. Tergum of pronotum, mesonotum, metanotum more sclerotized around sockets of primary, posterior setae and with primary, expanded setae (in II and III instar) below posterior row of setae (mesonotum: 3 in *A. blanchardi*, 3–4 in *A. orbicularis*; metanotum: 2 in *A. blanchardi*, 3 in *A. orbicularis*; abdominal segments: 2 in *A. orbicularis*, 1 in *A. blanchardi*). Mesonotum with 2 pairs of median setae (D1, D2). Metanotum: lack of Db setae. Both meso- and metanotum with seta above and near Dd1. Abdominal tergum IX undivided, with D11, D12 and D13 present. Anal membrane without seta D3. Urogomphi rather long (total length of instar III = 0.37 mm); segment I of instar III with 6 setae and 4–5 campaniform sensilla.

Description

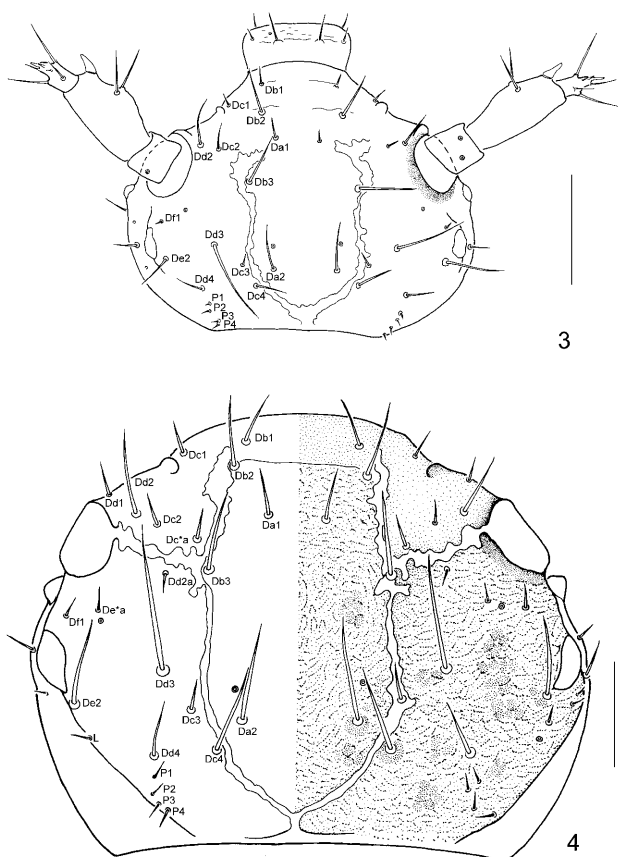
Body (Figs 1–2): Cylindrical, narrowed posteriorly, widest at metanotum. Total body length of instar I: 1.53 mm; instar II: 2.64 mm; instar III: 4.25–5.19 mm, average



Figs 1–2. *Anisotoma blanchardi*. Instar III. 1 – lateral view of larval habitus; 2 – dorsal view of larval habitus. Scale bar = 1 mm.

body length of 15 specimens: 4.63 mm. Average metanotal width of instar III: 1.06 mm. Colour (alcohol preserved specimens): The central part of tergites of thorax and abdomen yellowish-light brown. Front and back of all tergites and sternites with wide membranous area, granulated and creamy yellow. Head with mouthparts, urogomphi and legs yellowish-light brown.

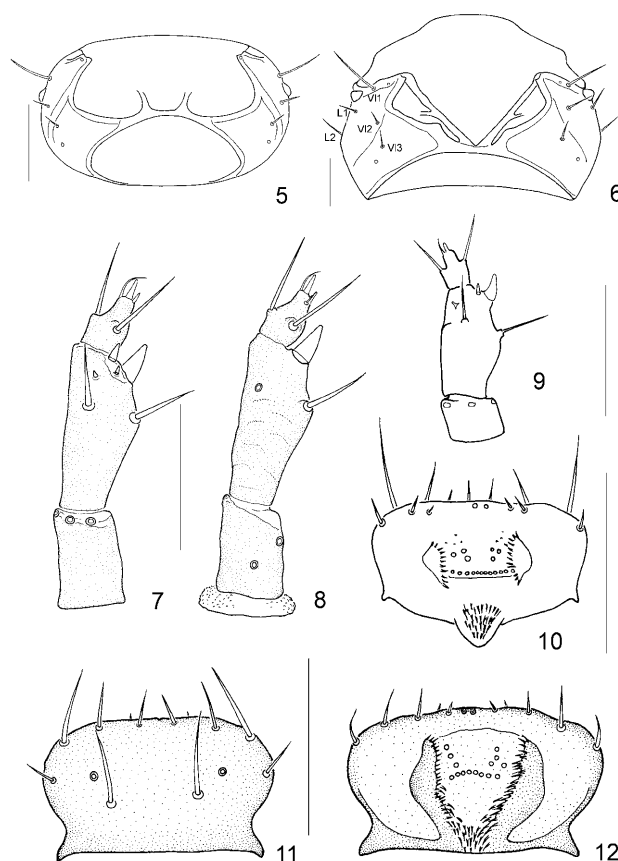
Head (Figs 3–6): Prognathous. Cranium wider than long; Instar I: HW/HL = 1.32; average head width: 0.33 mm. Stemmata 2 on each side of head, laterally and lateroventrally. Microsculpture absent. Chaetotaxy as follows: row Da with setae Da1 and Da2; row Db with 3 setae (Db1, Db2, Db3); row Dc with 4 setae (Dc1–Dc4); row Dd with 3 setae (Dd2–Dd4); row De with 1 seta (De2); seta Df1 present; lateral row with 1 seta (L); 4 posterior setae (P1–P4); 2 campaniform sensilla. Ventral side of head with 3 setae (V11–V13) and 2 campaniform sensilla. Instar II: HW/HL = 1.33; average head width: 0.41 mm. Instar III: HW/HL = 1.47; average head width: 0.64 mm. Microsculpture of dorsal side dense, arranged in rows, and partially in honeycomb-like figures; present from posterior to anterolateral arms of epicranial suture and to fronto-clypeal furrow. Chaetotaxy: as in instar I,



Figs 3–4. *Anisotoma blanchardi*. 3 – head of instar I, dorsal view; 4 – head of instar III, dorsal view. Scale bars = 0.1 mm.

with additional setae Dc*a, Dd1, Dd2a, De*a, Df1. Ventral side with visible setae L1 and L2.

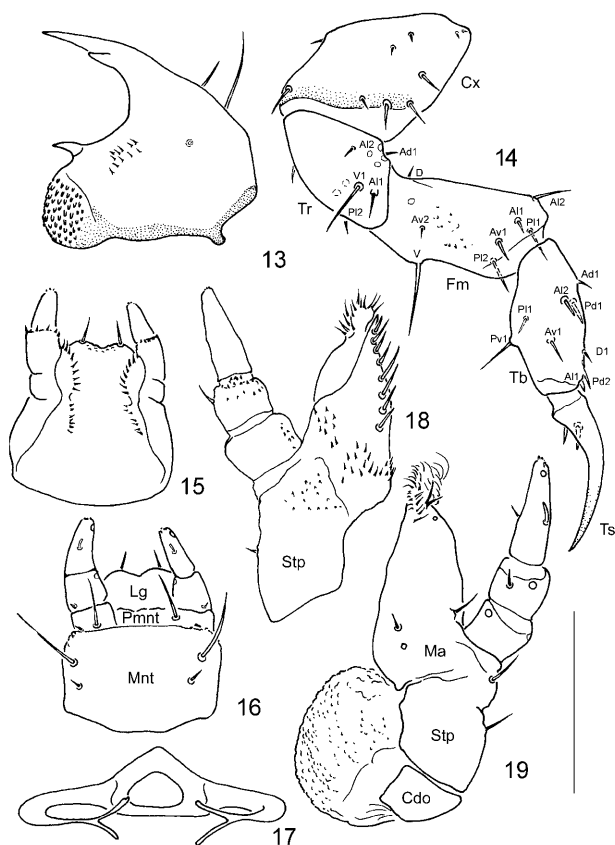
Antenna (Figs 7–9): Instar I: Length of antennomeres I+II+III = 0.156–0.160 mm. Antennal formula (length ratio of antennal segments I/II/III/digitiform solenidium of segment II) = 2:5:2:1; length of antennomere II/ digitiform solenidium length = 5; length of antennomeres II/III = 2.65. Antennomere I asetose, with 2 campaniform sensilla dorsally and 3 campaniform sensilla ventrally. Antennomere II with 3 setae in the mid part; on ventral side with one large, undivided digitiform solenidium on lateral edge and 2 small solenidia at base of digitiform solenidium. Antennomere III with 3 subapical setae, 2 apical peg-like sensilla, 1 subapical setiform sensillum and 1 apical pointed process. Instar II: Length of antennomere I+II+III = 0.198–0.210 mm (average length: 0.204 mm). Antennal formula = 2.6:4.7:1.8:1; length of antennomere II/ digitiform solenidium length = 4.7; length of antennomeres II/III = 2.6. Instar III: Length of antennomeres I+II+III = 0.235–0.301 mm (average length: 0.277 mm). Antennal formula = 2.7:4:1.4:1; length of antennomere II/ digitiform solenidium length = 4.1; length of antennomeres II/III = 3. Antennomere II with 3 small solenidia in ventro-apical membranous area and 1–2 campaniform sensilla (dorsal and ventral). Asperities on dorsal side, sparse, arranged in transverse rows.



Figs 5–12. *Anisotoma blanchardi*. 5 – head of instar I, ventral view; 6 – head of instar III, ventral view; 7 – antenna, ventral view of instar III; 8 – antenna, dorsal view of instar III; 9 – antenna, ventral view of instar I; 10 – labrum, ventral view of instar I; 11 – labrum, dorsal view of instar III; 12 – labrum, ventral view of instar III (setae situated on dorsal side are omitted). Scale bars = 0.1 mm

Labrum (Figs 10–12): Instar I: Subquadrate, without apical emargination, emarginated laterally, rounded marginally, average labrum width = 0.108 mm; average length = 0.075 mm; epipharynx with median, transverse row of ca. 10 campaniform sensilla, preceded by 3 pairs of campaniform sensilla above; lobes with microtrichiae; dorsal surface of labrum with a pair of large setae in the mid part and 1 pair laterally, 1 pair of campaniform sensilla medially; 6–7 pairs of setae on the margin of labrum: 3 pairs of ventroapical, 4 pairs of dorsoapical and a pair of tubercles ventromedially. Instar II: average labrum width = 0.136 mm; average length = 0.105 mm. Instar III: Similar to instar I, 8 pairs of setae on the margin. Average labrum width = 0.18–0.21 mm; average length = 0.088–0.010 mm.

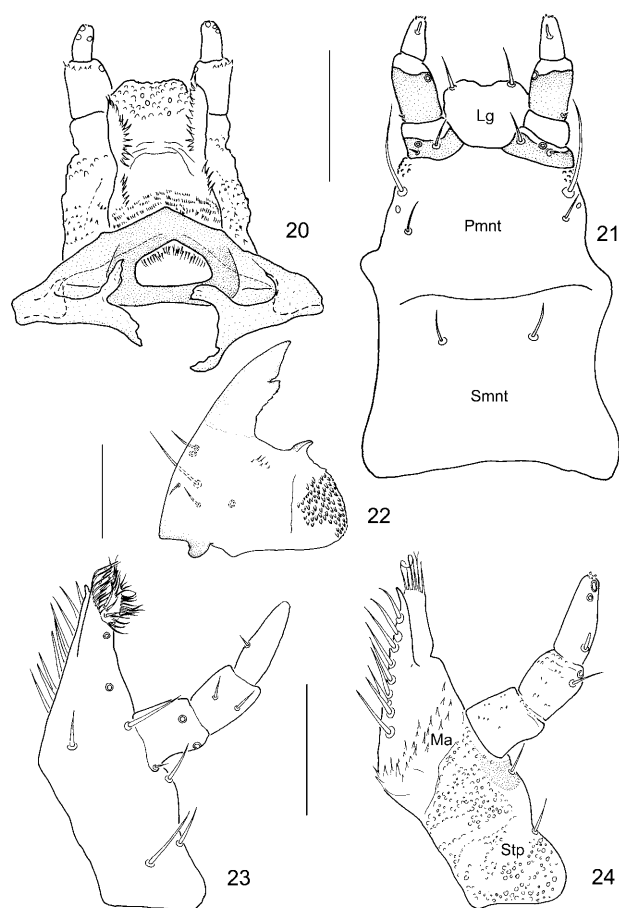
Mandible (Figs 13, 22, 41): Instar I: Mandible width = 0.125 mm; length = 0.156 mm. Apically bidentate with smooth internal edge; prosthema pointed, sclerotized with group of minute spines at its base; mola distinct with ca. 50 sclerotized teeth on ventral side. On dorsal surface 1 campaniform sensillum and 2 dorsolateral setae. Instar II: Mandible width = 0.136 mm; mandible length = 0.196 mm. Instar III: Average mandible width = 0.172–0.242 mm; average length = 0.242–0.317 mm. Internal edge



Figs 13–19. *Anisotoma blanchardi*. Instar I. 13 – ventral view of mandible; 14 – proleg; 15 – dorsal view of labium; 16 – ventral view of labium; 17 – hypopharyngeal sclerome; 18 – ventral view of maxilla; 19 – dorsal view of maxilla. Scale bar = 0.1 mm. Cdo, cardo; Cx, coxa; Fm, femur; Lg, ligula; Ma, mala; Mnt, mentum; Pmnt, prementum; Stp, stipes; Tb, tibia; Tr, trochanter; Ts, tarsungulus.

slightly saw-toothed. Mola distinct with ca. 90 sclerotized teeth. Dorsal side with 2 campaniform sensilla and 4 setae.

Maxilla (Figs 18–19, 23–24, 39–40): Instar I: Cardio transverse, triangular. Stipes broad, not distinctly separated from mala, with 1 seta. Palpifer with 1 seta. Mala with apex divided into galea and lacinia, with 2 setae and 1 campaniform sensillum dorsally; ventral surface with numerous, minute, cuticular spines. Maxillary articulating area present, well-developed. Lanceolate lacinia with 7–9 mesal spines and group of small spines below; galea with fimbriate, bibranchied apex, 2 setae between branches; maxillary palp 3-segmented, with the digitiform sensillum on the third maxillary palp as in Fig. 19; maxillary formula (length ratio of maxillary palp segments I/II/III) = 0.5:0.5:1; length of maxillary palp segments I/II = 1; length of maxillary palp segments II/III = 0.5. Instar II: maxillary formula = 0.63:0.66:1; length of maxillary palp segments I/II = 0.9; length of maxillary palp segments II/III = 0.66. Instar III: Stipes with additional 1 seta. Additional small seta at base of palpi segment I; sometimes 3 setae between fimbriate branches of galea. Maxillary formula = 0.7:0.6:1; length of maxillary palp segments I/II = 0.7–1.26 (average length = 1.07); length



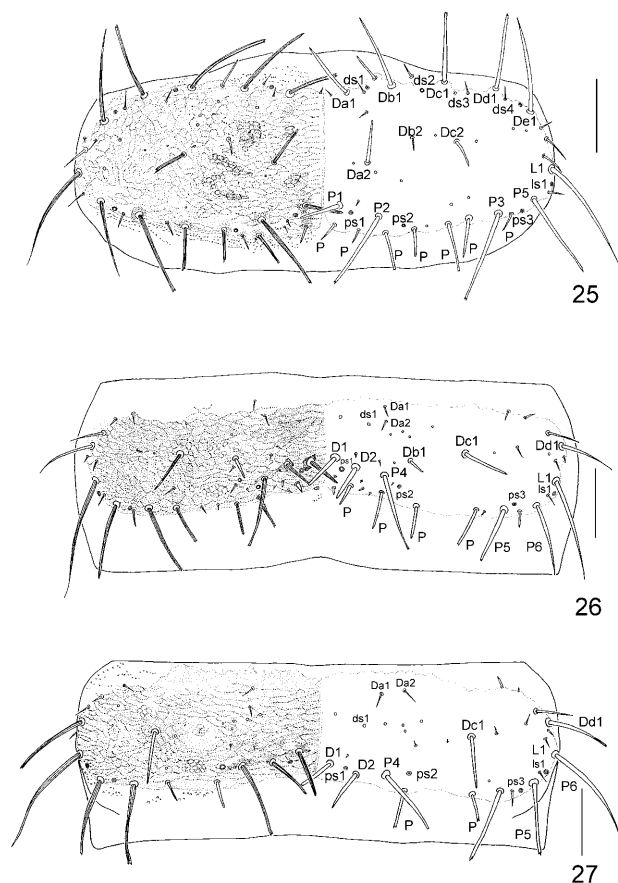
Figs 20–24. *Anisotoma blanchardi*. Instar III. 20 – dorsal view of labium; 21 – ventral view of labium; 22 – dorsal view of mandible; 23 – dorsal view of maxilla; 24 – ventral view of maxilla. Scale bars = 0.1 mm. Lg, ligula; Ma, mala; Smnt, submentum; Stp, stipes.

of maxillary palp segments II/III = 0.65–0.88 (average length = 0.69).

Labium (Figs 15–17, 20–21, 42): Instar I: Labial palp: LBI/LBII = 1.08–1.18; segment I with 1 subapical campaniform sensillum, 1 small seta near the base and a few small spines on external apical edge; segment II with 1 subapical peg-like sensillum (digitiform organ), 1 subapical campaniform sensillum and a group of apical sensilla (Fig. 42). Ligula emarginated anteromedially, with a pair of serrate lobes and 1 pair of apical setae. Praementum with 2 setae (large and small). Mentum with 2 pairs of setae. Hypopharyngeal sclerome subquadrate, with complete anterior and posterior bridges (Fig. 17). Instar II: Labial palp: LBI/LBII = 0.85. Instar III: Labial palp: LBI/LBII = 1.44; segment II with 3 subapical campaniform sensilla. Hypopharynx with 2 pairs of campaniform sensilla in the mid part. Praementum with additional pair of campaniform sensilla. Mentum as in instar I, with 1 pair of campaniform sensilla. Submentum with a pair of large setae.

Leg: 5-segmented; prothoracic leg as in Figs 14 and 30.

Coxa. Instar I: With ca. 10 anterior setae. Instar III: 12 anterior and 5 posterior setae.



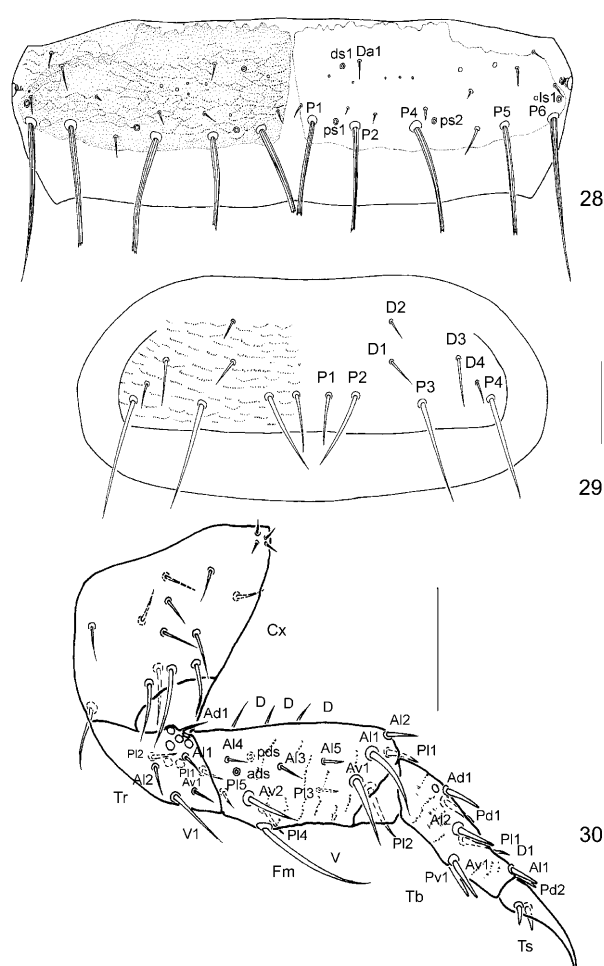
Figs 25–27. *Anisotoma blanchardi*. Instar III. 25 – pronotum; 26 – mesonotum; 27 – metanotum. Scale bars = 0.1 mm.

Trochanter: Instar I: Triangular; anterior side with 2 anterolateral setae (Al1, Al2), 1 anterodorsal seta (Ad1) and 4? campaniform sensilla, 1 ventral seta (V1); posterior side with 2 posterolateral setae (Pl1, Pl2), 2 posterior campaniform sensilla. Instar III: As in instar I, with 5 anterior campaniform sensilla and 1 anteroventral seta (Av1).

Femur: Instar I: With single ventral seta (V1), 2 anteroventral setae (Av1, Av2), 2 anterolateral setae (Al1, Al2), 1 anteroventral Av1, 2 posterolateral setae (Pl1, Pl2), 1 dorsal seta (D) and 1 anterodorsal campaniform sensillum (ads). Instar III: As in instar I, with additional: 3 anterolateral setae (Al3, Al4, Al5), 2 dorsal setae (D), 1 posterodorsal campaniform sensillum (pds), additional and not always present setae Pl3, Pl4 and Pl5, asperities arranged into rows. Seta Pd1 sometimes present near setae Al2 and Pl1.

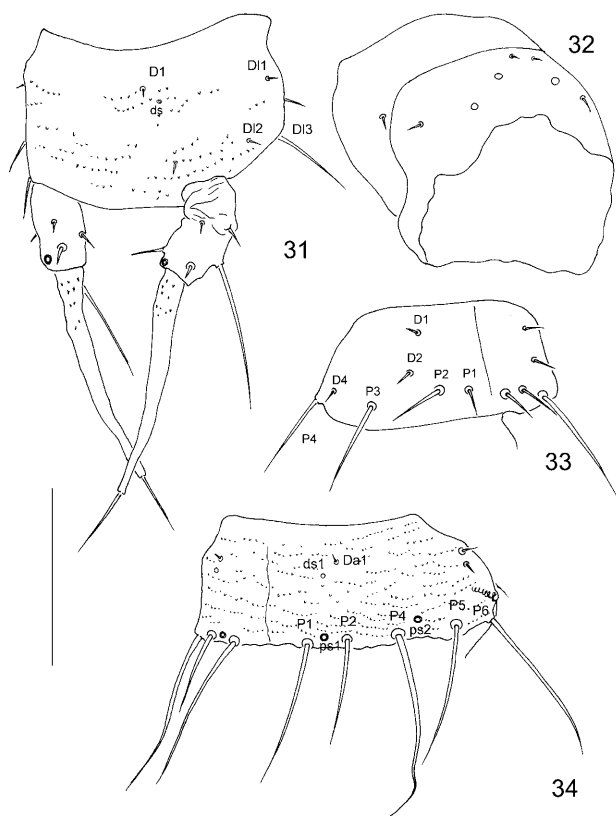
Tibia: Instar I: As long as femur, with 1 anteroventral seta (Av1), 1 anterodorsal (Ad1), 2 anterolateral setae (Al1, Al2), 1 subapical dorsal seta (D1) and 2 campaniform sensilla near, 2 posterodorsal setae (Pd1, Pd2), 1 posterolateral seta (Pl1), 1 posteroventral seta (Pv1). Instar III: 3 campaniform sensilla: 1 near D1, 1 between Al1 and Pd2, 1 above Al2.

Tarsungulus: Instar I: Long, pointed, with single pair of setae (Pv1, Pv2). Instar III: Similar to instar I.



Figs 28–30. *Anisotoma blanchardi*. Instar III. 28 – abdominal tergite I; 29 – abdominal sternite; 30 – proleg. Scale bars = 0.1 mm. Cx, coxa; Fm, femur; Tb, tibia; Tr, trochanter; Ts, tarsungulus.

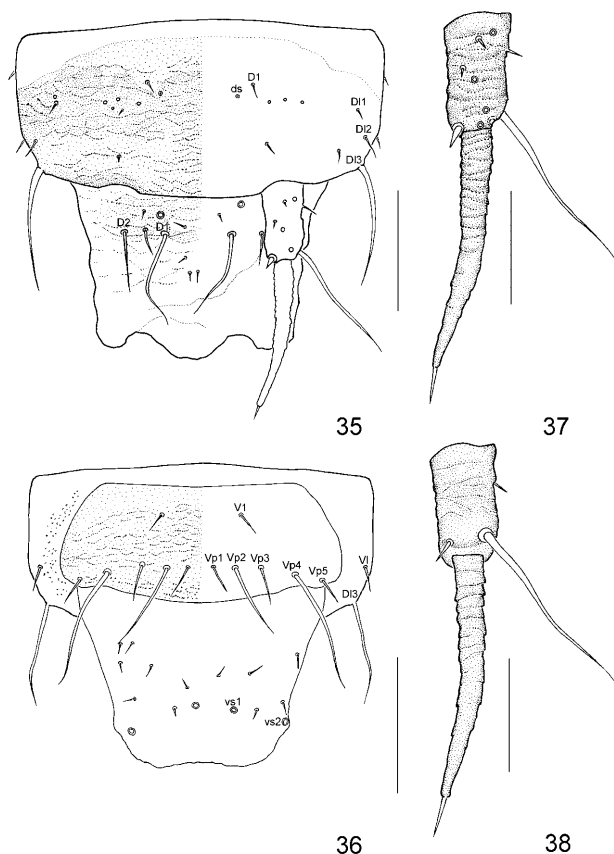
Prothorax. Instar III. Pronotum transverse (Fig. 25); NIL/N1W = 0.53; average pronotal width = 0.95 mm; chaetotaxy as follows: Row Da with 2 setae (Da1, Da2); row Db with 2 setae (Db1, Db2); row Dc with 2 setae (Dc1, Dc2); row Dd with single seta (Dd1); row De with single seta (De1); row L with 4 setae; posterior transverse row with 4 setae (P1, P2, P3, P4); below posterior transverse row: between P1/P2 2 setae, between P2/P3 4 setae; campaniform sensilla include: 1 between Da1/Db1 (ds1), 1 between Db1/Dc1 (ds2), 1 between Dc1/Dd1 (ds3), 1 between Dd1/De1 (ds4), 1 between P1/P2 (ps1), 1 between P2/P3 (ps2), 1 between P3/P4 (ps3), 1 between P4/L1 (ls1); ca. 6 small setae between and slightly below Da1/Db1/Dc1/De1 and 1 bigger between Db1/Dc1; setae Da2/Db2/Dc2 arranged into mid transverse row; dorsal surface with dense asperities arranged in honeycomb-like figures. Sclerotization around sockets of primary, posterior setae strong. Asperities dense, arranged in rows and honeycomb-like figures; ca. 6 pores in the mid part of tergum. Primary, posterior setae expanded, with longitudinal striae. Anterior sternal part (prosteron) with a pair of setae medially. Pleurites: 2 setae on episternum and 1 seta on epimeron.



Figs 31–34. *Anisotoma blanchardi*. Instar I. 31 – abdominal tergite IX with urogomphi; 32 – anal membrane, 33 – lateral view of abdominal tergite I; 34 – lateral view of abdominal sternite. Scale bar = 0.1 mm.

Mesothorax. Instar III. Mesonotum transverse (Fig. 26); $N2L/N2W = 0.43$; average mesonotal width = 1.03 mm. Transverse; chaetotaxy as follows: Row Da with small setae Da1 and Da2; row Db with 1 seta Db1; row Dc with 1 seta Dc1; row Dd with 1 seta Dd1; lateral row: L1, L2; posterior row with expanded, with longitudinal striae, setae: D1, D2, P4, P5, P6 (pointed in instar I); ca. 5 small setae below D1/D2, 3 primary, expanded setae between P4/P5 (pointed in instar I); 3 anterolateral (2 small, 1 larger) setae; campaniform sensilla include: ps1, ps2, ps3, ls1. Sclerotization around sockets of primary, posterior setae strong. Asperities dense, arranged in rows and honeycomb-like figures; ca. 6 pores in the mid part of tergum. Sternal part with a pair of setae medially between legs. Pleurites as on prothorax.

Metathorax. Instar III. Metanotum transverse (Fig. 27); $N3L/N3W = 0.38$; average metanotal width = 1.06 mm; Chaetotaxy: Row Da with Da1, Da2; row Db absent; row Dc with 1 seta (Dc1); row Dd with 1 seta (Dd1); lateral row: L1, L2; posterior row with primary, expanded (but pointed in instar I), with longitudinal striae, setae: D1, D2, P4, P5, P6; 2 primary, expanded setae between and below P4/P5 (pointed in instar I); 2 small setae between Dc1/Dd1; 3 small anterolateral setae; campaniform sensilla include: ps1, ps2, ps3, ls1. Sclerotization around sockets of primary, posterior setae strong. Asperities dense, arranged in rows and honey-comb-like figures;



Figs 35–38. *Anisotoma blanchardi*. Instar III. 35 – abdominal tergite IX with urogomphus; 36 – abdominal sternite IX with anal membrane; 37 – dorsal side of urogomphus; 38 – ventral side of urogomphus. Scale bars = 0.1 mm (figs 35, 36: scale bar = 0.3 mm).

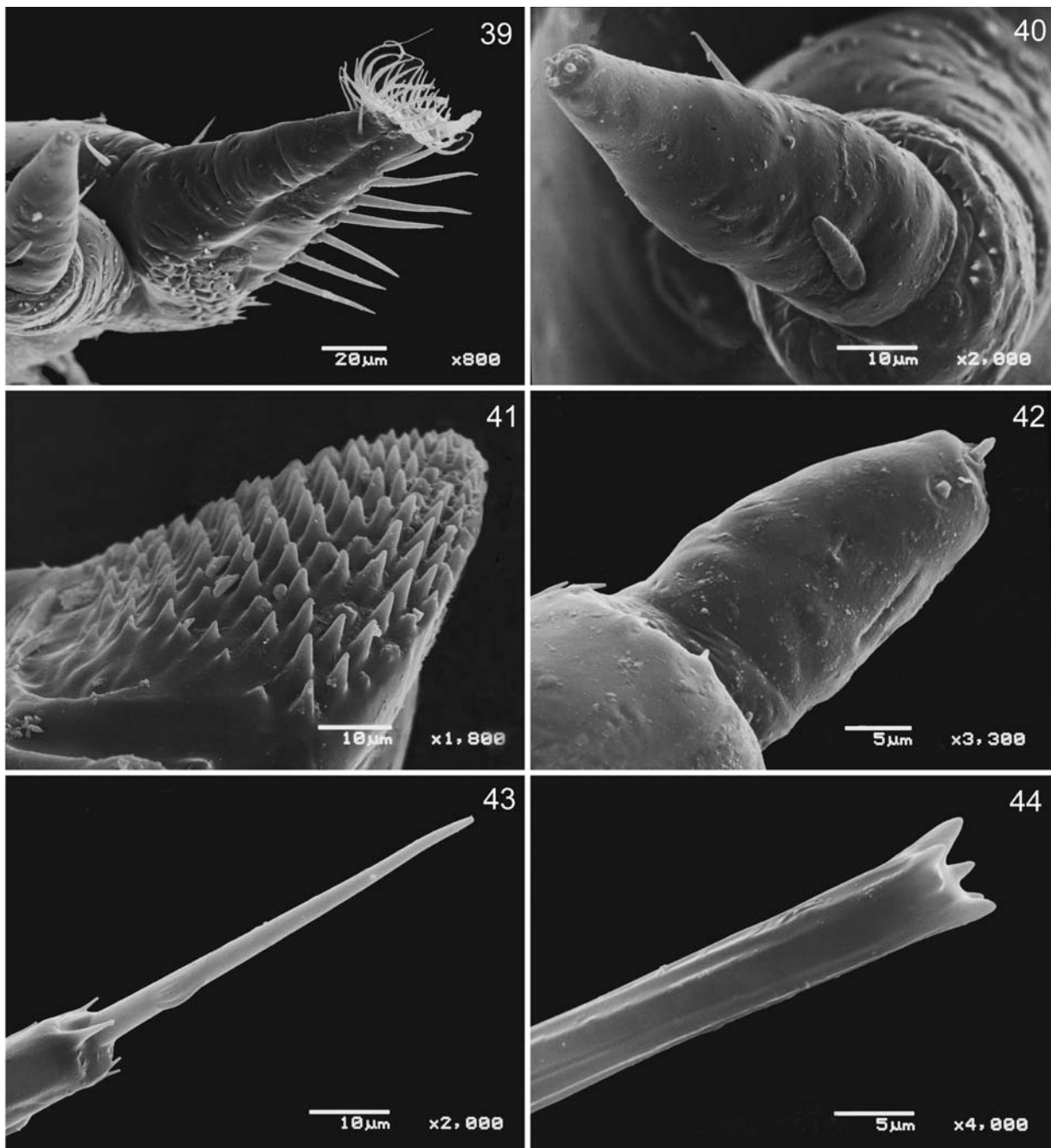
ca. 6 pores and a few minute setae in the mid part of tergum. Sternites and pleurites as on mesothorax.

Abdominal Terga I–VIII (Figs 28, 33): Instar I: Transverse. Chaetotaxy: Row Da with 1 seta (Da1); posterior transverse row with pointed (but expanded in instar II and III) setae: P1, P2, P4, P5, P6; 1 lateral seta L1; 2 small, anterolateral setae; campaniform sensilla include: ds1, ps1, ps2. Asperities arranged in rows. Instar III: $A1L/A1W = 0.35$; average abdominal width = 0.99 mm; between P4/P5 1 expanded seta; 4 campaniform sensilla (ds1, ps1, ps2, ls1); additional small setae and pores above posterior row.

Abdominal Sterna I–VIII (Figs 29, 34): Instar I: 4 setae in posterior row (P1–P4), 2 setae medially (D1, D2) and 1 seta laterally (D4). Instar III: Additional seta laterally (D3), asperities arranged in short rows.

Abdominal Tergum IX (Figs 31, 35): Instar I: With 1 pair of small, dorsal setae (D1), 1 pair of campaniform sensilla (ds); 3 pairs of dorsolateral setae (D11, D12, D13); pair of small setae in posterior part of segment; tergum undivided with sparse asperities arranged in transverse rows.

Instar III: Asperities dense; 1 additional pair of small setae posteriorly.



Figs 39–44. *Anisotoma blanchardi*. Instar III. 39 – maxilla; 40 – maxillary palp III with digitiform sensillum; 41 – mola of mandible; 42 – segment II of labial palp; 43 – distal seta of urogomphus; 44 – top of primary thoracic seta.

Urogomphus (Figs 31, 37, 38, 43): Instar I: Formula URI:URII:URIII (length ratio of urogomphal segment I/II/apical seta) = 1.8:4.2:1; length URI/URII = 0.44; length URII/URIII = 4.2; average total length of URI+URII = 0.18 mm; urogomphus segment I with 5 setae and 1 campaniform sensillum; urogomphus segment II with 1 apical seta; asperities only on segment II, sparse. Instar II: Formula URI:URII:URIII = 2:3.5:1–3:5.8:1; length URI/URII = 0.5–0.6; length URII/URIII = 3.5–5.8; total length of URI+URII = 0.28 mm. Instar III: Formula URI:URII:URIII = 2:4.3:1; length URI/URII = 0.47; length URII/URIII = 4.3; average total length of

URI+URII = 0.37 mm; urogomphus segment I with 6 setae (2 ventral, 1 lateral, 3 dorsal) and 4–5 dorsal campaniform sensilla (3 near segment II, 1–2 in the mid part of segment); small asperities arranged in transverse, short rows on both sides of segment I and on apical part of segment II.

Abdominal Sternum IX and Anal Membrane (Figs 32, 36): Instar III: With posterior, transverse row of 5 setae (Vp1–Vp5) and a pair of setae anteriorly (V1); anal membrane on dorsal side with large setae D1, D2, 2–4 pairs of smaller setae and a pair of campaniform sensilla

above; ventral side with 2 pairs of campaniform sensilla; 5–7 pairs of small setae set irregularly.

Spiracles: Annular. Normal type of respiratory system (peripneustic) with 9 pairs of spiracles: 1 pair of thoracic spiracles on laterotergites, between the prothorax and mesothorax and 8 pairs of abdominal dorsolateral spiracles on abdominal segments 1 to 8. Near each abdominal spiracle 1 seta laterally.

DISCUSSION

Within the genus *Anisotoma*, *A. blanchardi* is the eighth species for which the larvae are described. The other species examined in this respect include: *A. basalis* (Le Conte, 1853) (Wheeler, 1990a), *A. humeralis* (F., 1792) (Ratajczak [= Kilian], 1995), *A. castanea castanea* (Herbst, 1792) (Ratajczak [= Kilian], 1996), *A. orbicularis* (Ratajczak [= Kilian], 1996; Kilian, 1998), *A. axillaris* Gyllenhal, 1810, *A. glabra* (F., 1792) (Růžička, 1996) and *A. discolor* (Kilian, 2003). A key to larvae of European species of *Anisotoma* is provided by Růžička (1996). A characters state matrix, cladograms and phylogenetic implications based on analysis of the 6 previously described species of *Anisotoma* and 8 species of *Agathidium* are presented by Kilian (1998).

A preliminary comparison of all the described larvae and the larval stages of another five species, now in preparation, distinguishes a few characters shared by the known members of the *blanchardi* species group.

Larvae of *A. orbicularis* and *A. blanchardi* share the following characters: (i) the presence of primary setae below posterior row of terga, (ii) the secondary microsculpture on head, dense, present from the base of head to anterolateral arms of the epicranial suture and fronto-clypeal furrow, (iii) the sclerotization around sockets of primary posterior setae of thorax of instar III, (iv) the presence of clypeal furrow in the third stage, (v) the presence of setae Dc1, Dd1, Dc2, Dd2a on head in instar III, (vi) urogomphomere 1 and 2 similar in length and proportion in all instars.

The characters, which distinguish these species are: (i) the number of primary setae below and between primary posterior setae P4/P5 on thorax of all instars (mesonotum: 3 in *A. blanchardi*, 3–4 in *A. orbicularis*; metanotum: 2 in *A. blanchardi*, 3 in *A. orbicularis*; abdominal segments: 2 in *A. orbicularis*, 1 in *A. blanchardi*), (ii) the pointed (*A. orbicularis*) or expanded (*A. blanchardi*) top of primary thoracic setae in instar III, (iii) the presence (*A. orbicularis*) or lack (*A. blanchardi*) of secondary small setae on terga in instar III, (iv) the presence (*A. blanchardi*) or lack (*A. orbicularis*) of seta Dd1 on abdominal tergum IX in all instars, (v) the number of urogomphal setae (6 in instar I, 8 in instar III of *A. orbicularis*, 5 in instar I and 6 in instar III of *A. blanchardi*), (vi) seta D3 of anal membrane present in *A. orbicularis*, absent in *A. blanchardi* in instar III, (vii) the presence of secondary setae (Dc*, Dd1*, De1) on head in *A. orbicularis* in instar III, (viii) the length of antennae (shorter in *A. blanchardi*) in the third stage, (ix) the maxilla with 7 spine-like setae in instar I and 7–8 in instar III (*A. orbicularis*) or 8 in instar

I and 8–9 in instar III (*A. blanchardi*), (x) the length of femur in instar III (shorter in *A. orbicularis*), (xi) the presence of small secondary setae on femur in *A. orbicularis* in instar III.

A comparison of the head chaetotaxy of *A. blanchardi* and *A. orbicularis* with that of other species suggests it is necessary to verify the nomenclature.

The basis for this change is the head chaetotaxy of *A. glabra*, which has the highest number of small, primary or secondary setae. It allows the position of some setae in *A. orbicularis* to be clarified and renamed: Dd2a into Dc2, Dc* into Dd2a, Dc2 into Dc*a, De* according to Wheeler (1990a) into Df1, and renaming the setae between Dc*a and Db2 as Dc**.

All proposed changes to the nomenclature of head setae are provided in the present paper.

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