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Description of larvae of *Neobidessus alvarengai* Young, 1981 from Brazil and key to the Argentine genera of Bidessini (Coleoptera: Dytiscidae)

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Abstract: Larval morphology of the new world bidessine genus *Neobidessus* Young, 1967 is unknown. To fill this gap, here we present descriptions of the second and third instar of *Neobidessus alvarengai* Young, 1981 based on specimens collected in Roraima state, northern Brazil. The genus is diagnosed based on current knowledge of Bidessini larval morphology. As remarkable features, *Neobidessus* larvae lack a ventroapical spinula on antennomere 3, have a relatively elongated siphon, and relatively short urogomphi with or without secondary setae. The description of this genus brings to seven (of a total of nine) the number of known Argentine Bidessini genera. A key for the identification of the mature larvae to these genera in Argentina is provided.

Key words: Adephaga, Hydroporinae, diving beetles, immature, chaetotaxy

Resumen: Descripción de las larvas de *Neobidessus alvarengai* Young, 1981 de Brasil y clave para los géneros argentinos de Bidessini (Coleoptera: Dytiscidae). La morfología larval del género de bidesino del nuevo mundo *Neobidessus* Young, 1967 es desconocida. Para llenar este vacío, presentamos descripciones del segundo y tercer estadio de *Neobidessus alvarengai* Young, 1981 sobre la base de especímenes colectados en el estado de Roraima, norte de Brasil. Se realiza la diagnosis del género sobre la base del conocimiento actual de la morfología larval de Bidessini. Como características notables, las larvas de *Neobidessus* carecen de una espínula ventroapical en el antenómero 3, tienen un sifón relativamente largo y urogonfos relativamente cortos con o sin setas secundarias. La descripción de este género eleva a siete (de un total de nueve) el número de géneros de Bidessini conocidos de la Argentina. Se presenta una clave para la identificación de las larvas maduras de los géneros argentinos.

Palabras clave: Adephaga, Hydroporinae, escarabajos buceadores, inmaduros, quetotaxia

INTRODUCTION

Members of the genus *Neobidessus* Young, 1967 are small diving beetles that inhabit lentic habitats and margins of streams in the New World, from Southern USA to Northern Argentina (Miller & Bergsten, 2016). Twenty-nine species (plus one subspecies) are registered in the world catalog of Dytiscidae (Nilsson & Hájek, 2025). The genus was revised by Young (1977, 1981) who diagnosed previously described species and added several new ones. Since then, only a single new species, *Neobidessus grandis* Pederzani & Rocchi, 2012 from NE Argentina, was described (Pederzani & Rocchi, 2012), which so far is the southernmost distributed member of the genus. The phylogenetic relationships of *Neobidessus* remain unknown.

The speciose tribe Bidessini represents one of the most extensive radiations of diving beetles, with 52 genera and more than 750 species (Nilsson & Hájek, 2025). Despite this high diversity, larval morphology of barely a third of these genera and a very small fraction of the species

have been documented, some of them superficially. In the past recent years, the authors of this paper have provided several descriptions of so far unknown genera, contributions that may be seen as steps toward a more comprehensive understanding of the larval morphology of this tribe (see Michat *et al*., 2022 and Benetti *et al*., 2025 for a review). In this context, the present paper adds an additional piece to this puzzle, taking to 19 the number of Bidessini genera with described larvae. However, as a consequence of the yet small fraction of the genera that is known, comparisons are always preliminary and subject to changes when more genera and species are described.

Extensive samplings carried out recently in the state of Roraima, northern Brazil, yielded several larval specimens associated with adults identified as *Neobidessus alvarengai* Young, 1981 (Fig. 1A), allowing us to describe in detail *Neobidessus* larval morphology for the first time. Our paper therefore aims to describe instars II and III of *N. alvarengai* in the context of the descriptive template applied to dytiscid larvae, which incorporates detailed morphometric and chaetotaxic analyses (*e.g*., Alarie *et al*., 2007; Michat & Alarie, 2008; Michat *et al*., 2022; Benetti *et al*., 2025).

Although the species described in this study is found in Brazil, it is assumed that the morphological characteristics described can be generalized to all species of *Neobidessus*, thus bringing to seven the number of genera of Bidessini found in Argentina for which the third-stage larva is known. An identification key for the Argentine third-stage larvae of these genera is thus produced in this article. Also, some interesting characters are discussed below in the restricted geographical context of Neotropics, which allows us to manage a more complete taxonomic picture, as several of the genera known as larvae belong to this region.

MATERIALS AND METHODS

The descriptions are based on four larvae of instar II and four of instar III collected in association with adults at the following locality: Brazil, Roraima state, Jauaperi river, Cachoeira do Travessão, 00°28’49’’N, 60°29’56’’W, 20.iii.2014. The association is firm as *N. alvarengai* was the only Bidessini species collected at this site. Voucher specimens are deposited in the collection of the Laboratory of Entomology (Buenos Aires University, Argentina).

Specimens were cleared in lactic acid, dissected and mounted on glass slides with polyvinyl-lacto-glycerol. Observations (at magnifications up to 1,000x) and drawings were made using an Olympus CX31 compound microscope equipped with a camera lucida. Drawings were scanned and digitally inked using a One by Wacom pen tablet.

The methodology and terminology applied in this paper follow those employed in a recent paper dealing with the larvae of the genus *Hemibidessus* Zimmermann, 1921 (Michat *et al.*, 2022). The reader is referred to this paper for explanations of the terms used in the present study. Although the larvae studied here are represented by instars II and III only, primary sensilla (*i.e*., those present in instar I) were tentatively identified on the head appendages and legs by comparison with the Bidessini ground plan whenever possible (*e.g*., Michat & Torres, 2013; Alarie & Michat, 2023). Homologies were recognized using the criterion of similarity of position (Wiley, 1981). Secondary setae were identified accordingly.

Photographs of the habitus of adult were taken with a Nikon DS-Ri2 camera attached to a Nikon SMZ25 stereomicroscope at the microscopy service of the University of León (Spain). The images were processed using the software NIS Elements AR (Nikon) version 5.41.02. Photographs of the habitus of the larva were taken with a Leica DMC2900 camera attached to a Leica MZ6 stereomicroscope at the laboratory of entomology of the University of Buenos Aires (Argentina). The images were processed using Helicon Focus version 6.7.1 Pro.

SYSTEMATIC ENTOMOLOGY

Coleoptera Linnaeus, 1758
Dytiscidae Leach, 1815
Neobidessus Young, 1967

Neobidessus alvarengai Young, 1981

Diagnosis (instars II–III).
Within Bidessini, larvae of *Neobidessus* are characterized by the following combination of characters: A3 lacking a ventroapical spinula (Fig. 5B); protarsus without secondary setae (Fig. 3); siphon well defined and relatively elongate (Fig. 4); urogomphus with secondary setae either absent (instars II–III) or present (instar III) (Fig. 4) (see Discussion below); primary seta UR8 inserted either subapically or apically on

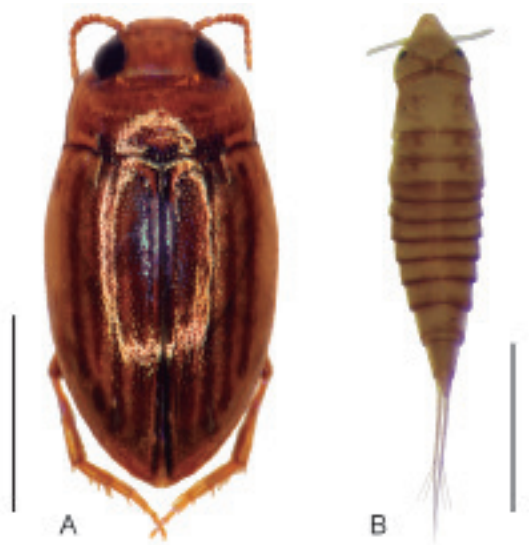

Fig. 1. *Neobidessus alvarengai* Young, 1981. (A) Habitus of adult, dorsal aspect; (B) Habitus of instar III larva, dorsal aspect (legs removed). Scale bars =

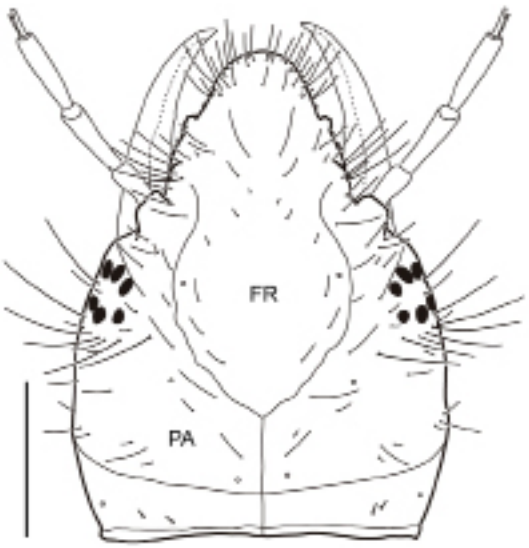

Fig. 2. *Neobidessus alvarengai* Young, 1981, instar III, head, dorsal aspect. FR: frontoclypeus; PA: parietal. Scale bar = 0.20 mm.

urogomphomere 2 (Fig. 4).

Description, instar III (Figs. 1–4).

Color (Fig. 1B). Head capsule testaceous except for a large Y-shaped light brown macula accompanying coronal suture and bases of ecdysial sutures and a light brown area posterior to occipital suture; head appendages testaceous except mandible light brown; thoracic and abdominal sclerites light brown, darker on anterior region; membranous parts, legs and urogomphi testaceous.

Body (Fig. 1B). Fusiform. Measurements and ratios that characterize body shape are shown in Table 1.

Head (Figs. 1B, 2). Cephalic capsule longer than broad, lacking neck constriction, with reticulation laterally and ventrally on posterior region; posterior half with sides curved and maximum width at about level of occipital suture; ecdysial line well marked but diffuse anteriorly, coronal line short; occipital foramen broadly emarginate ventrally; posterior tentorial pits visible ventrally on central region; frontoclypeus elongate, lateral margins sinuate; nasale moderately elongate, subtriangular, rounded apically, sinuate laterally, with one small branch at each side, well visible dorsally, and several strong spines close to it, barely visible dorsally; ventrally with several slender spinulae (forming two groups) and few robust spinulae on distal region; six rounded dorsolateral stemmata at each side. Antenna elongate, shorter than HW, composed of four antennomeres, A2 and A3 longest, subequal, A4 shortest; A3 lacking a ventroapical spinula; A3' elongate. Mandible prominent, broad basally, distal half projected inwards and upwards, apex sharp; mandibular channel present. Maxilla with cardo fused to short and broad stipes; galea absent; palpus elongate, shorter than antenna, composed of three palpomeres, MP1 and MP2 longest, subequal, MP3 shortest. Labium with prementum small, subtrapezoidal, about as long as broad, anterior margin barely indented medially, lateral margins curved, lacking spinulae; palpus elongate, composed of two palpomeres subequal in length.

Thorax ((Figs. 1B, 3). Terga convex, pronotum about as long as meso- and metanotum combined, meso- and metanotum subequal; protergite roughly trapezoid-shaped in dorsal view, more developed than meso- and metatergite; meso- and metatergite transverse, with anterotransverse carina; sagittal line well visible on three tergites; sterna membranous; spiracles present ventrally on mesothorax. Legs (Fig. 3) long, composed of six articles, L1 shortest, L3 longest; CO robust, elongate, TR divided into two parts by an annulus, FE, TI and TA slender, subcylindrical, PT with two long, slender, slightly curved claws; posterior claw shorter than anterior claw on L1 and L2, anterior claw shorter than posterior claw on L3; TI and TA covered with relatively few slender spinulae scattered on surface; TA

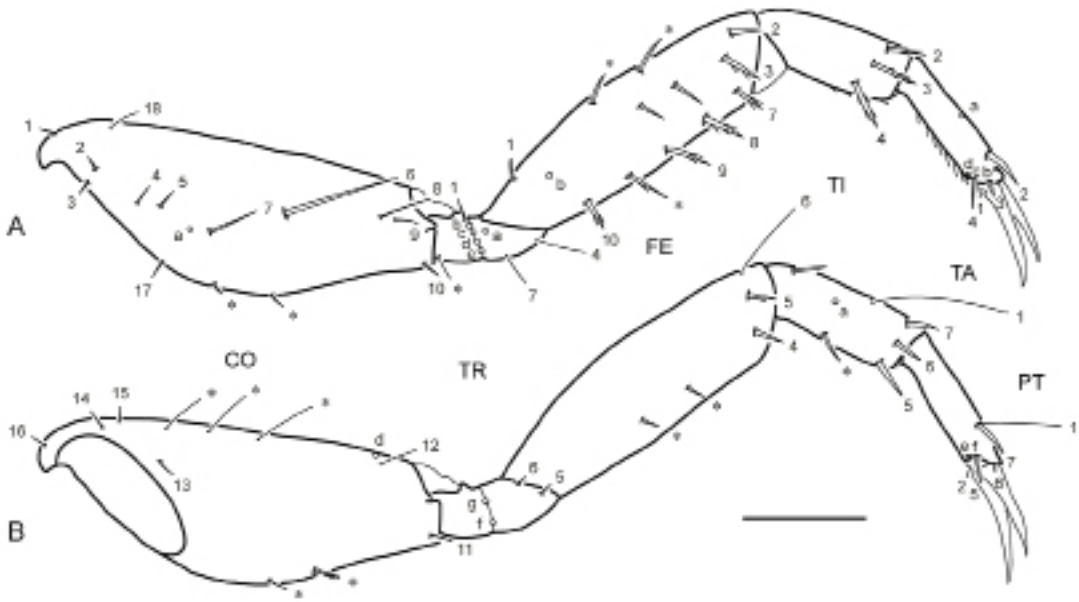

Fig. 3. *Neobidessus alvarengai* Young, 1981, instar III. (A) Left prothoracic leg, anterior aspect; (B) Right prothoracic leg, posterior aspect. Numbers and lowercase letters indicate primary setae and pores, respectively. Asterisks indicate secondary setae. CO: coxa; FE: femur; PT: pretarsus; TA: tarsus; TI: tibia; TR: trochanter. Scale bar = 0.10 mm.

Table 1. Measurements and ratios for the larvae of *Neobidessus alvarengai* Young, 1981.

Measure	Instar II (n = 2)	Instar III (n = 2)	Measure	Instar II (n = 2)	Instar III (n = 2)
TL (mm)	–	1.90–2.70	MP2/MP1	1.19–1.27	0.92–1.04
MW (mm)	–	0.55–0.70	MP2/MP3	2.38–2.71	2.75–2.89
HL (mm)	0.47–0.49	0.61–0.64	MP/LP	1.14–1.19	1.23–1.30
HW (mm)	0.38–0.39	0.51	LP2/LP1	1.25–1.40	1.00
FRL (mm)	0.39–0.41	0.46–0.49	L3 (mm)	1.11–1.12	1.42–1.50
OCW (mm)	0.29–0.30	0.42–0.43	L3/L1	1.36	1.35–1.41
HL/HW	1.22–1.26	1.19–1.25	L3/L2	1.16–1.19	1.14–1.19
HW/OCW	1.30–1.31	1.21–1.23	L3/HW	2.90	2.77–2.95
COL/HL	0.16–0.17	0.24–0.25	L3 (CO/FE)	0.93–0.96	0.99–1.00
FRL/HL	0.83–0.84	0.75–0.76	L3 (TI/FE)	0.69–0.70	0.66–0.68
A/HW	0.66–0.67	0.62–0.66	L3 (TA/FE)	0.69–0.71	0.59–0.63
A3/A1	2.38–2.50	1.46–1.71	L3 (CL/TA)	0.58–0.59	0.54–0.61
A3/A2	1.19–1.28	0.83–1.09	LAS (mm)	0.27	0.41–0.42
A4/A3	0.42–0.45	0.33–0.47	LAS/HW	0.69–0.70	0.79–0.83
A3'/A4	0.67–0.75	0.84–0.93	U (mm)	0.85–1.02	0.87–0.90
MNL/MNW	3.83–3.92	4.13–4.14	U/LAS	3.17–3.81	2.07–2.22
MNL/HL	0.48–0.49	0.47–0.48	U/HW	2.22–2.64	1.71–1.75
A/MP	1.19–1.28	1.13–1.19	U1/U2	1.38–1.58	1.68–1.93

with robust elongate spinulae on ventral surface (more developed on proTA).

Abdomen (Figs. 1B, 4). Eight-segmented; segments I–VI sclerotized dorsally, membranous ventrally; tergites I–VI narrow, transverse; segments VII–VIII completely sclerotized, ring-like; all sclerites lacking sagittal line, with anterotransverse carina, covered with minute spinulae in transverse rows; spiracles present lateroventrally on segments I–VII; segment

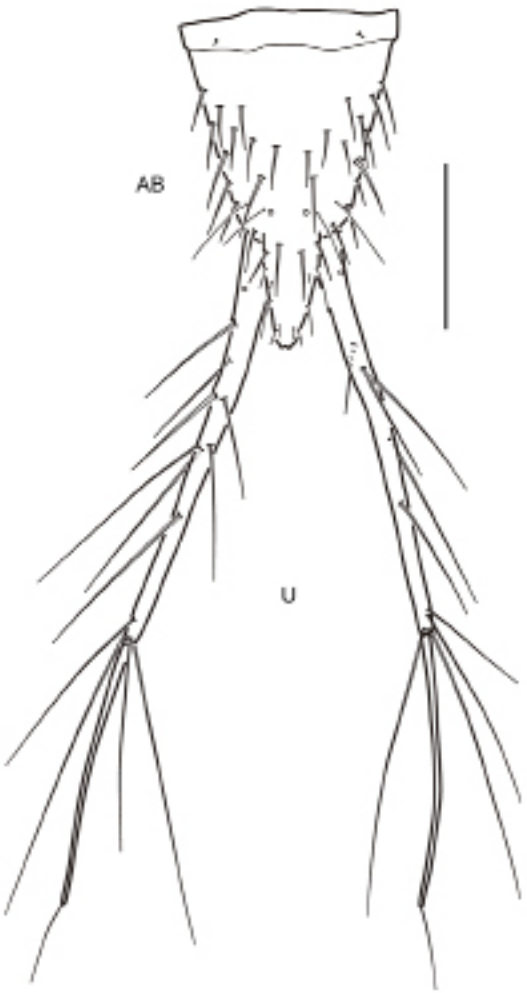

Fig. 4. *Neobidessus alvarengai* Young, 1981, instar III, abdominal segment VIII and urogomphi, dorsal aspect. AB: abdominal segment VIII; U: urogomphus. Scale bar = 0.20 mm.

VIII (Fig. 4) longest and narrowest, projected backwards into well-defined and relatively elongate subconical siphon. Urogomphus (Fig. 4) short, composed of two urogomphomeres; U1 longer than segment VIII, basal portion covered with minute spinulae; U2 narrow, setiform, shorter than U1.

Chaetotaxy. Cephalic capsule with numerous secondary setae (including one temporal spine-like setae on parietal) (Fig. 2); anteroventral margin of nasale with a half circle of 24 lamellae clypeales directed downwards; antenna, maxilla and labium lacking secondary setae; mandible with one hair-like secondary seta on basoexternal margin; secondary leg setation detailed in Table 2 and Fig. 3; abdominal segment VIII with numerous spine-like secondary setae (Fig. 4); urogomphomere 1 with 0–6 elongate secondary setae (Fig. 4); primary seta UR8 inserted either subapically or apically on urogomphomere 2 (Fig. 4).

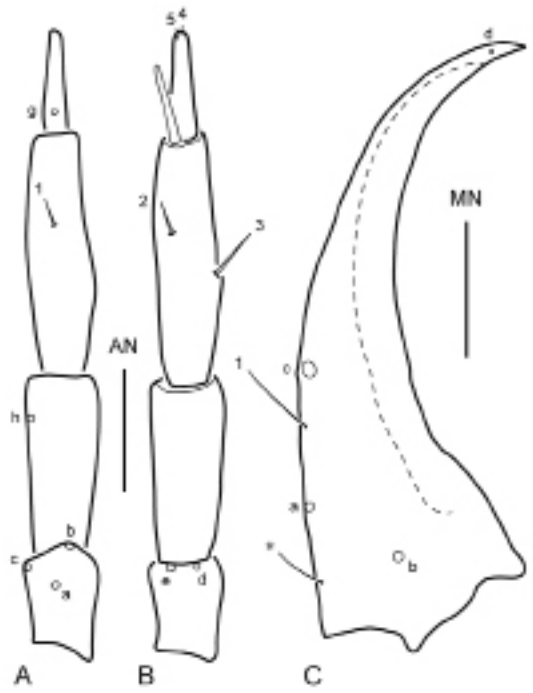

Fig. 5. *Neobidessus alvarengai* Young, 1981, instar II. (A) Left antenna, dorsal aspect; (B) Right antenna, ventral aspect; (C) Left mandible, dorsal aspect. Numbers and lowercase letters indicate primary setae and pores, respectively. Asterisk indicates secondary seta. AN: antenna; MN: mandible. Scale bars = 0.05 mm.

Description, instar II (Figs. 5–6).

As for instar III except as follows:

Color. Somewhat lighter in general.

Body. Measurements and ratios that characterize body shape are shown in Table 1.

Head. Antenna (Fig. 5A, B). A3 longest, A2 slightly shorter than A3, A1 and A4 shortest, subequal in length. Mandible (Fig. 5C). Maxilla (Fig. 6A, B). MP2 longest, MP1 slightly shorter than MP2. Labium (Fig. 6C, D). LP2 slightly longer than LP1.

Thorax. Spiracles absent.

Abdomen. Spiracles absent on segments I–VII.

Chaetotaxy. Secondary setae on cephalic capsule and abdominal segment VIII less numerous; anteroventral margin of nasale with 22 lamellae clypeales; secondary leg setation detailed in Table 2; urogomphomere 1 lacking secondary

Table 2. Number and position of secondary setae on the legs of larvae of *Neobidessus alvarengai* Young, 1981. Numbers between slash marks refer to pro-, meso- and metathoracic leg, respectively. A = anterior, AD = anterodorsal, AV = anteroventral, P = posterior, PD = posterodorsal, Pr = proximal, PV = posteroventral, V = ventral, Total = total number of secondary setae on the segment (excluding primary setae).

Segment	Position	Instar II (n = 3)	Instar III (n = 3)
Coxa	PD	1 / 1–2 / 1–2	3–4 / 3–5 / 3–4
	V	1 / 1 / 1	2–4 / 2–4 / 2–4
	Total	2 / 2–3 / 2–3	5–7 / 5–9 / 5–8
Trochanter	Pr	0–1 / 1 / 1	0–1 / 1 / 1–2
	Total	0–1 / 1 / 1	0–1 / 1 / 1–2
Femur	A	0 / 0 / 0	2–3 / 2–3 / 3–6
	AD	1–2 / 2–3 / 2–3	2 / 2 / 3–4
	AV	1 / 1 / 1–2	1 / 1–2 / 3–4
	P	0 / 0 / 0	0–1 / 0 / 0
	PV	0–1 / 0 / 2	2–3 / 3–6 / 5–6
	Total	3 / 3–4 / 5–7	7–10 / 9–12 / 15–19
Tibia	A	0 / 0 / 0–1	0 / 1 / 1–2
	AD	0 / 1 / 1–2	0–1 / 1–2 / 1
	AV	0 / 1 / 1	0 / 1 / 1–2
	PD	0 / 0 / 0	0–1 / 0–1 / 1
	PV	0 / 0 / 0–1	1 / 1 / 2–3
	Total	0 / 2 / 2–4	1–2 / 5 / 6–9
Tarsus	AD	0 / 1 / 0	0 / 0–1 / 0–2
	AV	0 / 0–1 / 1–2	0 / 1 / 2
	PD	0 / 0 / 1	0 / 0–1 / 1
	Total	0 / 1–2 / 2–3	0 / 2 / 3–5

setae; primary seta UR8 inserted distally on urogomphomere 2.

Habitat. The specimens were collected in rockpools along the banks of the Jauaperi river, northern Brazil (Fig. 7A). Pools (Fig. 7B) are formed when the river level drops, exposing the rocky shore. The site is totally exposed to insolation and has muddy bottom, lots of algae and no macrophytes.

Key to genera of Argentine Bidessini larvae (instar III).

Bidessodes Régimbart, 1895 and *Bidessonotus* Régimbart, 1895 are not included as their larvae remain unknown. These genera have been so far recorded from Corrientes, Entre Ríos and Santa Fe provinces and Buenos Aires, Chaco, Corrientes, Entre Ríos, Formosa, Jujuy, Misiones, Salta and Santa Fe provinces, respectively.

1. Frontoclypeus with egg bursters ..... Instar I
1'. Frontoclypeus without egg bursters 2

2. Mesothorax and abdominal segments I-VII without spiracles ..... Instar II
2'. Mesothorax and abdominal segments I-VII with spiracles ..... Instar III (3)

3. Tibia with natatory setae 4
3'. Tibia without natatory setae 5

4. Femur without natatory setae .... *Brachyvatus*
4'. Femur with natatory setae ..... *Hemibidessus*

5. Antennomere 3 with a ventroapical spinula . 6
5'. Antennomere 3 without a ventroapical spinula 7

6. Urogomphus without secondary setae .... *Hypodessus*
6'. Urogomphus with secondary setae .... *Amarodytes*

7. Length of abdominal segment VIII more than 0.85 times head width; length of urogomphomere 1 less than 0.95 times length of urogomphomere 2 ..... *Anodocheilus*
7'. Length of abdominal segment VIII less than 0.85 times head width; length of urogomphomere 1 more than 1.05 times length of urogomphomere 2 8

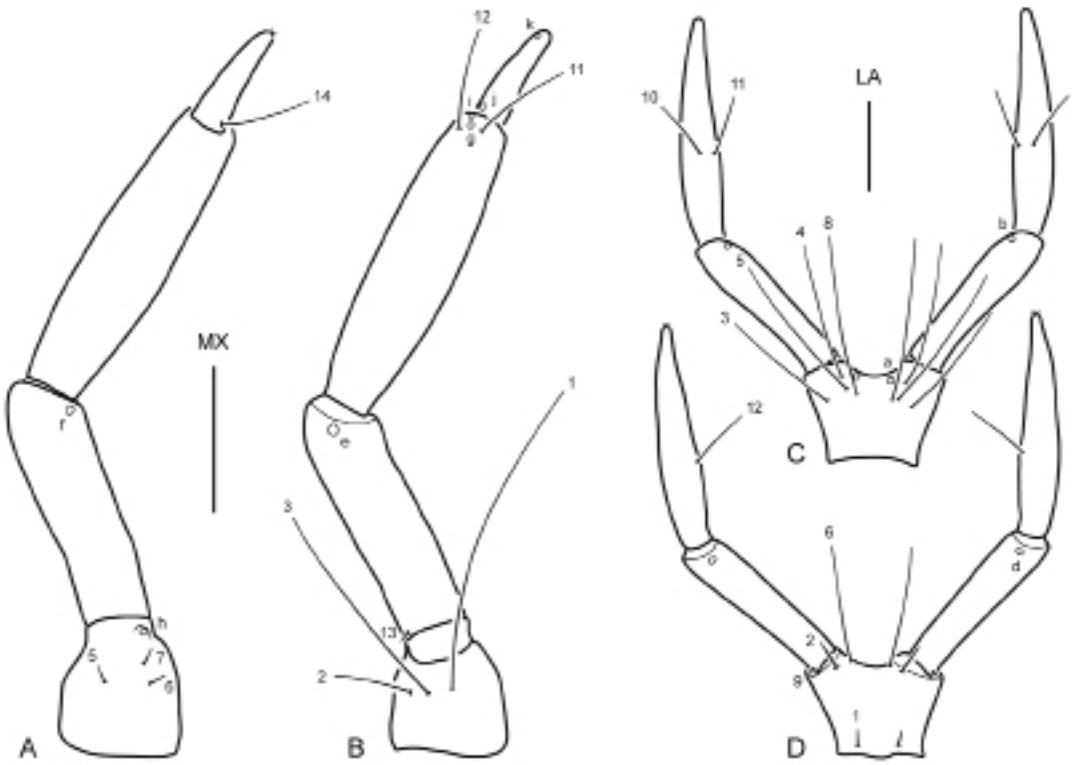

Fig. 6. *Neobidessus alvarengai* Young, 1981, instar II. (A) Left maxilla, dorsal aspect; (B) Right maxilla, ventral aspect; (C) Labium, dorsal aspect; (D) Labium, ventral aspect. Numbers and lowercase letters indicate primary setae and pores, respectively. LA: labium; MX: maxilla. Scale bars = 0.04 mm.

8. Length of urogomphus more than two times head width; length of urogomphomere 1 less than 1.50 times length of urogomphomere 2; urogomphus without secondary setae .... *Liodessus*

8'. Length of urogomphus less than two times head width; length of urogomphomere 1 more than 1.60 times length of urogomphomere 2; urogomphus with or without secondary setae ..... *Neobidessus*

DISCUSSION

Within Bidessini, the posterior projection of the last abdominal segment, commonly known as the siphon, shows a different degree of development among the genera. This characteristic, however, is not discrete, at least when the mature larvae are concerned. When compared through the different genera, a more or less continuous variation can be observed from the very short condition found in *Hemibidessus*, *Brachyvatus* Zimmermann, 1919, *Amarodytes* Régimbart, 1900 or *Hydrodessus* J. Balfour-Browne, 1953 (Michat & Alarie, 2006; Michat & Torres, 2013; Michat *et al,*. 2022; Benetti *et al.,* 2025), to a more elongated form in *Anodocheilus* Babington, 1842 and *Uvarus* Guignot, 1939 (Matta, 1983; Michat & Torres, 2006). In this context, *Neobidessus*

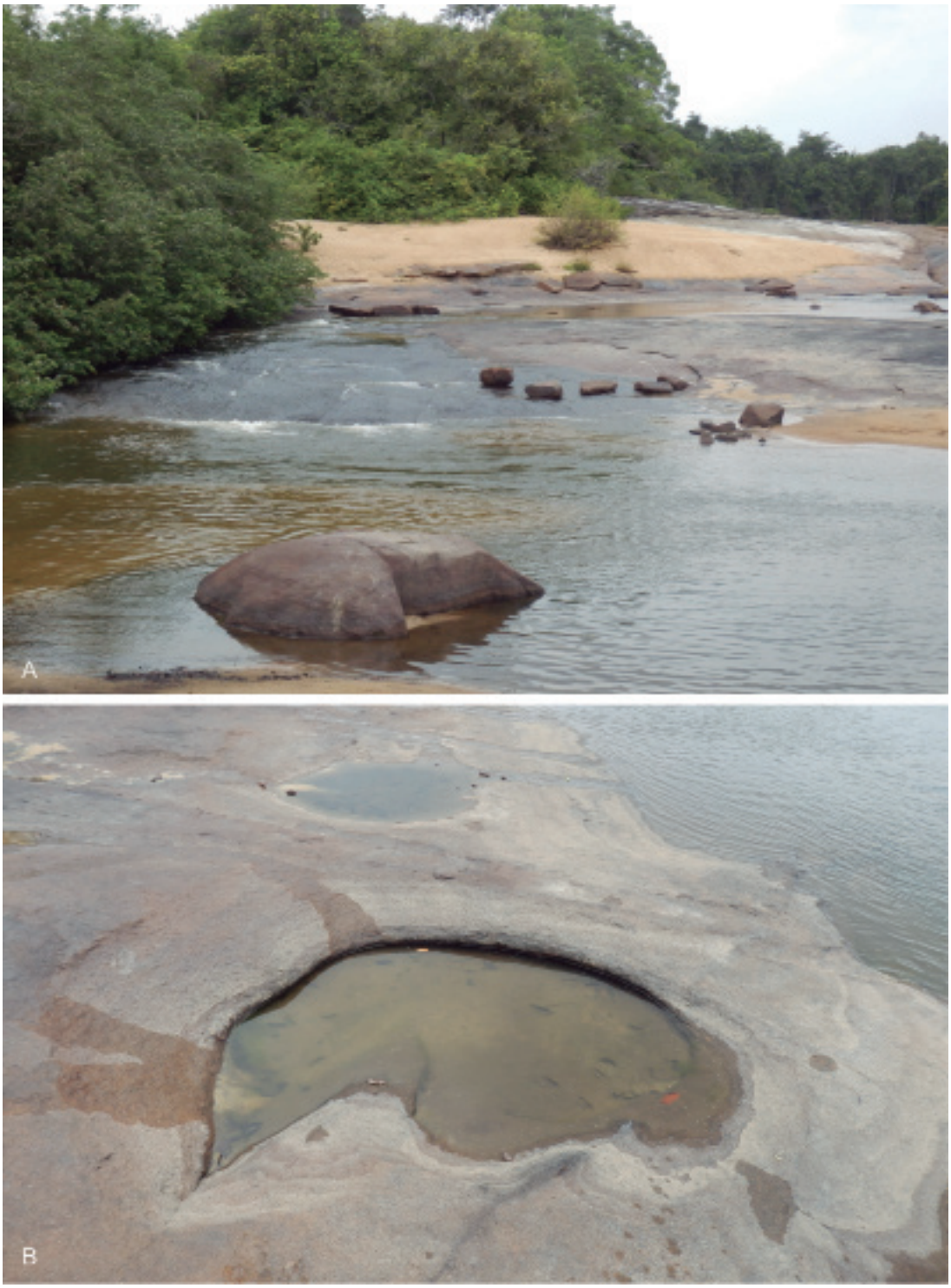

Fig. 7. Habitat of *Neobidessus alvarengai* Young, 1981. (A) Landscape in the sampling site, stream flowing over rocks in Roraima state, northern Brazil; (B) Rockpools at the side of the stream, where both adults and larvae were collected.

belongs to the group of genera that bear a relatively elongated siphon, thus clearly differing from *Hemibidessus*, *Brachyvatus*, *Amarodytes* and *Hydrodessus*. Also, a separation can be established between *Neobidessus* and those genera with an even more developed siphon (*Anodocheilus*, *Uvarus*). However, the differentiation of this genus from others showing an intermediate elongation of this structure, such as *Liodessus* Guignot, 1939, *Hypodessus* Guignot, 1939 and *Neoclypeodytes* Young, 1967 (Perkins, 1980; Alarie *et al.,* 2007; Michat & Alarie, 2008), is more difficult.

Another interesting feature of *Neobidessus* larvae is that they have short urogomphi, as relativized for example to head width, to get rid of larval size as much as possible. Within Neotropical Bidessini, this low ratio is only comparable with those found in *Anodocheilus* and *Uvarus* (Matta, 1983; Michat & Torres, 2006). All other genera have relatively longer urogomphi. On the other hand, within Neotropical genera the presence of secondary setae on the first urogomphomere is characteristic of *Amarodytes*, *Hemibidessus* and *Brachyvatus*, whereas *Liodessus*, *Hypodessus*, *Anodocheilus*, *Uvarus*, *Neoclypeodytes* and *Hydrodessus* lack secondary setae (Perkins 1980; Matta 1983; Alarie *et al.* 2007; Michat *et al.* 2022; Benetti *et al.* 2025). Curiously, mature larvae of *Neobidessus* are ambiguous regarding this character. In fact, we observed specimens that lack secondary setae on this structure, whereas others have from one to six of these setae. Even in the same individual, this number can vary from three in one urogomphomere to six in the other (Fig. 4). All specimens examined of instar II, however, lack secondary urogomphal setae, as mentioned in the description.

Finally, another useful character to distinguish Bidessini genera is the presence or absence of a ventroapical spinula on antennomere 3. Within Neotropical members of the tribe, larvae of *Hemibidessus*, *Anodocheilus*, *Brachyvatus*, *Liodessus* and *Neobidessus* lack this structure (Michat *et al.,* 2022), thus differing from *Amarodytes*, *Hypodessus* and *Hydrodessus* in which this spinulae is present (Benetti *et al.,* 2025).

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