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## A new species of *Alainites* (Ephemeroptera: Baetidae) from Borneo (East Kalimantan, Indonesia)

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A new species of *Alainites* Waltz & McCafferty, 1994 is described from East Kalimantan (Borneo): *Alainites pascalae* n. sp. It constitutes the first report of this genus from this island and its most South-Eastern record. *Alainites pascalae* can be separated from the other Oriental species by the number of gills, the spination of the distal margin of the tergites, the setation of the legs, and the shape and spination of the paraproct. This species is widespread in the study area but never abundant. It prefers small to medium streams with slow flow, and does not seem sensitive to the logging activities.

Keywords: Ephemeroptera; Baetidae; *Alainites*; new species; Borneo.

### INTRODUCTION

The genus *Alainites* Waltz & McCafferty, 1994 was established to encompass species previously included in the *muticus* species group of the genus *Baetis* Leach, 1815 (Waltz *et al.* 1994). This genus is defined by the following diagnostic characters at the larval stage: body laterally compressed, glossae covered with thin setae dorsally, prostheca of the right mandible reduced and bifurcate, femoral villopore absent, tarsal claw with a single row of denticles and without apical setae, paraproct with an apical prolongation (Müller-Liebenau 1969, 1974, Waltz *et al.* 1994, Fujitani *et al.* 2003b). Imagos possess forewings with double intercalary veins, hindwings with three longitudinal veins, the second being forked, terminal segments of male forceps spherical to slightly elongated and curved (Waltz *et al.* 1994). *Alainites* belongs to the *Indobaetis* complex; it is closely related to *Nigrobaetis* Novikova & Kluge, 1987 (Fujitani *et al.* 2003a). The two genera share in particular the laterally compressed body and the antennae close to each other generally with an interantennal carina. Their main differences are the prolongation of the paraproct and the shape of the mandibular right prostheca. *Alainites* does not belong to the *Baetis* complex as it lacks the villopore at the base of the femora (Waltz & McCafferty 1997). *Alainites* presently encompasses 18 species: 13 in the Palaearctic and five in the Oriental realm (Barber-James *et al.* 2010). The nearest species from our studied area, *Alainites laetificus* (Müller-Liebenau, 1984), was collected in the Gombak river in West Malaysia (Müller-Liebenau 1984b). Interestingly, this genus was still not reported from Sunda Islands or the Philippines (Müller-Liebenau 1982, 1984a). Two species were reported from Hong-Kong (Tong & Dudgeon 2000) and two from Taiwan (Kang *et al.* 1994). None of these five species have been mentioned since their original descriptions; therefore their distributions seem very restricted, but probably underestimated.

Aquatic insects were intensively collected in a small area of East Kalimantan, Borneo, Indonesia. The aim of the study was to assess the impact of logging activities on water quality and aquatic community structure. The study was conducted in a 85 km<sup>2</sup> area in the Bulungan forest, Malinau District (Derleth 2003). 34 samplings were made in 2000 and 2001, and revealed an extremely diversified macroinvertebrate community, with 40 mayfly genera and about 50 identified species (Sartori *et al.* 2003). A great part of the mayfly fauna was already studied in detail allowing the description of new genera and species (Sartori & Gattolliat 2003, Jacobus & Sartori 2004, Sartori *et al.* 2007, 2008, Webb & McCafferty 2007, Ubero-Pascal & Sartori 2009, Sartori & Derleth 2010). The study of the Baetidae is currently under way; two new monospecific genera are already described from this area (Gattolliat in press). However, several new taxa still need to be described as more than 13 baetid species were collected, most of them being new to science (Sartori *et al.* 2003). A new species of *Alainites* was discovered in the material collected during this survey; it represents the most South Eastern report for this genus.

The holotype and most of the paratypes of the new species are housed in the Museum of Zoology, Lausanne, Switzerland (MZL); other paratypes are deposited in the Museum of Zoology, Bogor, Indonesia (LIPI).

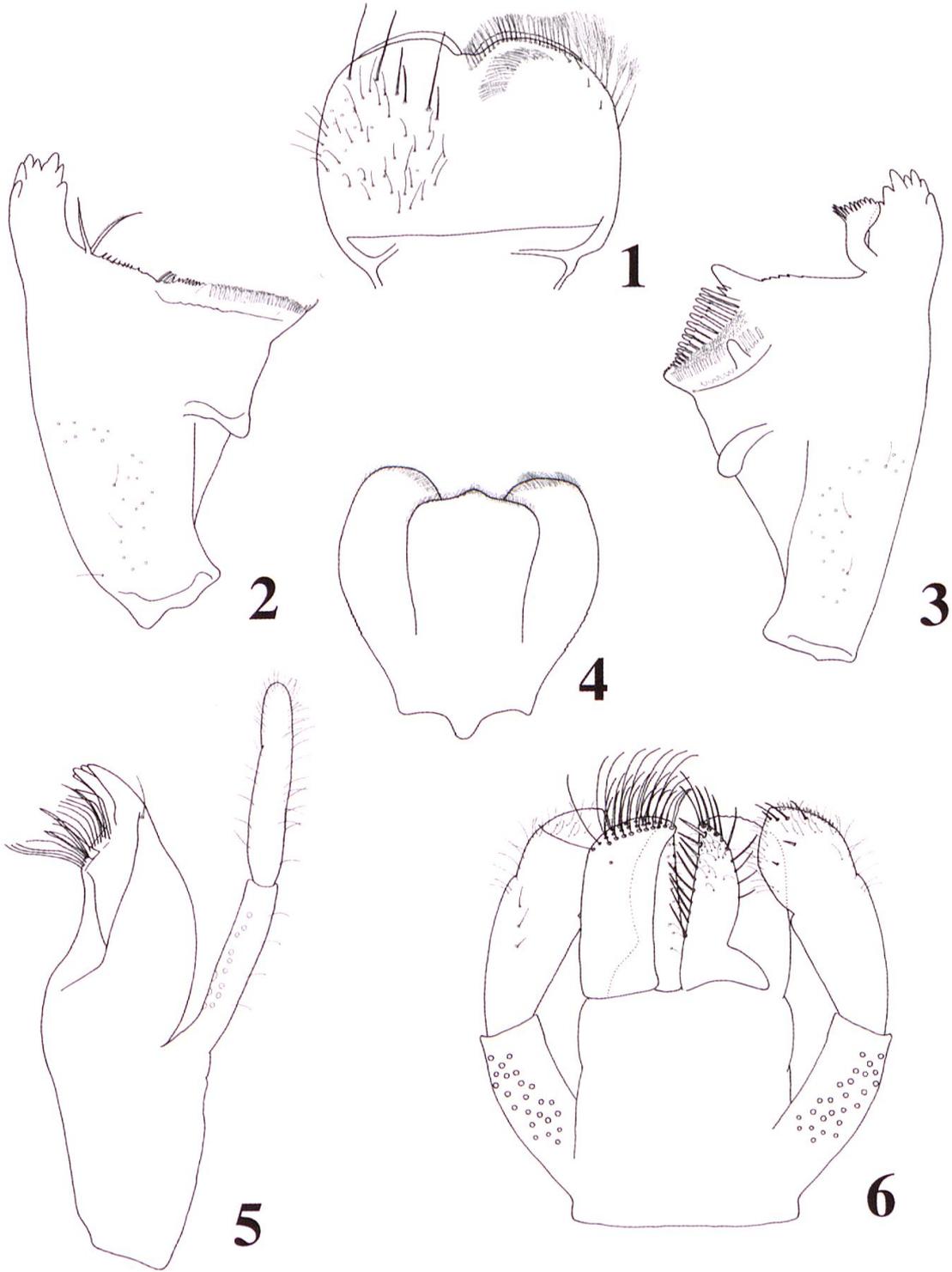
***Alainites pascalae* n. sp.**

(Figs 1–12)

*Specimens examined:*

Holotype: 1 female larva. B0121; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Rian; Loc. Langap Sud (1997-bloc 6); 3°04'04"N / 116°30'26"E; Alt. 100 m. 07.vii.2000. Coll. Derleth, P.

Paratypes: 7 male larvae, 7 female larvae (of which two mounted on microscopic slide). Same data as holotype. — 1 female larva. B0111; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Seturan; Loc. Langap Sud (1997-bloc 6); 3°04'04"N / 116°30'26"E; Alt. 100m. 05.vii.2000. Coll. Derleth, P. — 2 male larvae, 1 female larva. B0411; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Ngayo (tributary to Rian); Loc. Langap Sud (1995); 3°04'41"N / 116°31'11"E; Alt. 160m. 08.vii.2000. Coll. Derleth, P. — 1 male larva, 2 female larvae (of which two mounted on microscopic slide). B0421; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Ngayo (tributary to Rian); Loc. Langap Sud (1995); 3°04'41"N / 116°31'15"E; Alt. 160m. 12.vii.2000. Coll. Derleth, P. — 1 male larva P0513; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Tamalang (tributary to Seturan); Loc. Seturan (2001-bloc 57); 2°59'22"N / 116°30'29"E. 10.iv.2001. Coll. Derleth, P. — 1 female larva. B0631; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Wok (Sungai Guang) (tributary to Seturan); Loc. Seturan (2000-bloc 45); 2°59'11"N / 116°33'30"E. 04.viii.2000. Coll. Derleth, P. — 1 female larva. B0713; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Wok (Sungai Guang) (tributary to Seturan); Loc. Seturan (2000-bloc 44–45); 2°59'12"N / 116°33'11"E. 05.viii.2001. Coll. Derleth, P. and Feldmeyer, B. — 2 male larvae, 1 female larva. B0812; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Temalat (Sungai Guang) (tributary to Seturan); Loc. Seturan (2000-bloc 43); 2°59'29"N / 116°33'29"E. 16.viii.2000. Coll. Derleth, P. and Schlaepfer, R. — 1 male larva, 1 female larva. B0821; Indonesia; Borneo (East Kalimantan); Bas. Mali-



Figs 1–6. Larval structures of *Alainites pascalae* sp. n.: — 1: labrum (left: dorsal; right: ventral). — 2: right mandible. — 3: left mandible. — 4: hypopharynx. — 5: left maxilla. — 6: labium.

nau; Riv. Temalat (Sungai Guang) (tributary to Seturan); Loc. Seturan (2000-bloc 43); 2°59'29"N / 116°33'29"E. 16.viii.2000. Coll. Derleth, P. and Gattolliat, J.-L. — 1 female larva. B1211; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Rian; Loc. Langap Sud (1999-bloc 24); 3°01'40"N / 116°31'05"E. 11.vii.2000. Coll. Derleth, P. — 1 female larva. B1423; Indonesia; Borneo (East Kalimantan); Bas. Malinau; Riv. Seturan; Loc. Seturan (unlogged); 2°58'58"N / 116°33'30"E. 26.iv.2001. Coll. Derleth, P. and Sartori, M.

The codes B followed by four digits were created by the collector and design unambiguously each locality. They are reported on the original label. The year in brackets indicates the last logging activities.

### *Diagnosis*

Larva: general colouration uniformly medium brown. Antennae close to each other with a small carina. Mouthparts characteristic of *Alainites*: right prostheca bifid (Fig. 2). Leg (Fig. 7): femora dorsally with about eight long setae, ventrally with a few pointed setae, dorsal margin of midtibiae with pointed setae. Hindwing pads present. Six pairs of gills. Prolongation of the paraprocts covered with numerous small spines, with broad, triangular spines laterally.

Imago: unknown.

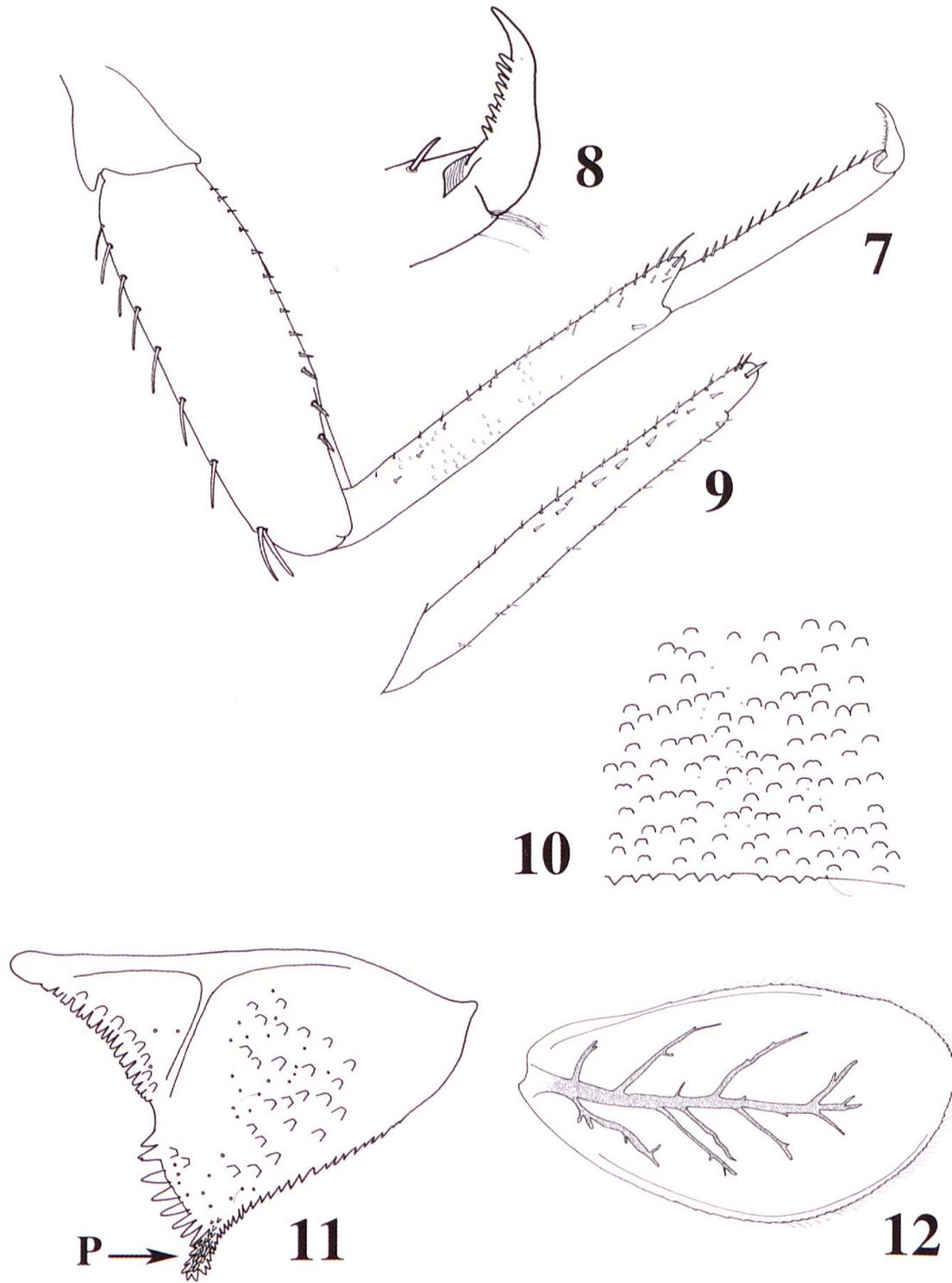
### *Description*

#### Larva

Length. Fully grown female: general body 3.9–4.9 mm; cerci 2.4–2.7 mm; median caudal filament 1.3–1.5 mm. Fully grown male: general body 3.6–4.2 mm; cerci 2.0–2.2 mm; median caudal filament 1.2–1.3 mm.

Colouration. General colouration brown. Head uniformly brown with vermiform marks faintly visible on vertex and frons, darker between ocelli. Turbinate eyes in male larvae purple brown. Legs ecru. Thorax uniformly brown without mark or pattern. Abdominal tergites medium brown without any pattern. Abdominal sternites light brown. Cerci ecru to light brown without bands or pattern.

Head. Antennae close to each other, with a small interantennal carina. Dorsal surface of labrum (Fig. 1) with one central long seta and a distolateral arc of four simple medium to long, stout setae, about 25 small fine setae scattered on surface; ventral surface with four small pointed setae near lateral margin; distal margin fringed with feathered setae. Right mandible (Fig. 2) with incisors composed of seven denticles, outer denticle clearly smaller than others; prostheca reduced and bifid with numerous thin setae; eight spines between prostheca and mola, tuft of setae at apex of mola present. Left mandible (Fig. 3) with incisors composed of seven denticles, outer denticle clearly smaller than others; prostheca with eight medium denticles and a comb-shaped structure; margin between prostheca and mola crenulated in apical half. Hypopharynx (Fig. 4) covered with thin setae apically; lingua with a central protuberance without stout setae; superlinguae longer than lingua. Maxillae (Fig. 5), incisors with four long and curved teeth; crown with two rows of setae, first one with small setae ending with stouter and longer ones, second row with two long stout dentisetae; a single stout seta at base of crown; palp two-segmented, segment I approximately 0.95 x length of segment II; segment II apically rounded, covered with thin setae. Labium (Fig. 6) with glossae as long as paraglossae; inner margins of glossae with stout medium setae, most apical one very stout, apical margin with



Figs 7-12. Larval structures of *Alainites pascalae* sp. n.: — 7: foreleg. — 8: tarsal claw. — 9: mid-tibia. — 10: distal margin of fourth abdominal tergite. — 11: paraproct (P = prolongation of paraproct). — 12: fourth gill.

long stout setae, dorsal margin with abundant thin scattered setae; paraglossae falcate, with three rows of long, stout setae apically; labial palp three-segmented; segment I 0.7 x length of segment II and III combined; segment II with a dorsal oblique row of three medium setae; inner margin of segment III truncated, with medium stout setae and small pointed setae apically.

Thorax. Forelegs (Fig. 7). Trochanter bare. Femora dorsally with one row of about seven long, stout setae, without another row of setae subparallel to dorsal margin; dorsoapical setal patch formed by two stout, long and apically rounded setae; ventral margin with pointed short setae, distal ones longer; lateral margins bare. Tibiae with only a single subapical spatulate seta dorsally; ventral margin with small pointed setae; tibiopatellar suture indistinct; lateral margins almost bare, with scale bases. Tarsi bare dorsally; ventral margin with about 13 pointed setae. Tarsal claws (Fig. 8) hooked with one row of about eight medium teeth, apical setae absent. Mid and hindlegs (Fig. 9) similar to forelegs except tibiae with a dozen pointed setae on the dorsal margin. Hindwing pads present.

Abdomen. Tergites with numerous scale bases, not shagreened, distal margin of tergite IV with poorly developed triangular spines (Fig. 10). Sternites with scale bases; posterior margin without spination. Gills on segments II to VII, elliptic and serrated all along margins; distinct tracheation, poorly divided (Fig. 12); gill VII similar to gills II to VI. Paraproct (Fig. 11) with abundant scale bases, but almost no setae, prolongation covered with numerous small spines, margin with about eight broad, triangular spines internal to prolongation and numerous medium spines external to prolongation; postero-lateral extension with a row of scale bases parallel to margin, margin with about 15 medium spines part of them bifid or blunt.

Imago. Unknown

#### DISCUSSION

The number of pairs of gills is a reliable character to separate the different species of *Alainites*. Two of the five species known from the Oriental realm, namely *A. clivosus* (Chang & Yang, 1994) from Taiwan and *A. lingulatus* Tong & Dudgeon, 2000 from Hong-Kong, possess seven pairs of gills (Kang *et al.* 1994, Tong & Dudgeon 2000). *Alainites pascalae* and the three other Oriental species, *A. acutulus* Tong & Dudgeon, 2000 from Hong-Kong, *A. laetificus* (Müller-Liebenau, 1984) from continental Malaysia and *A. yehi* (Chang & Yang, 1994) from Taiwan possess six pairs of gills (Müller-Liebenau 1984b, Kang *et al.* 1994, Tong & Dudgeon 2000). *Alainites pascalae* and *A. laetificus* have moderately developed triangular spines on the distal margin of the abdominal tergite IV; these spines are more developed in *A. clivosus* and *A. lingulatus*, while they are absent in *A. acutulus* and *A. yehi* (Müller-Liebenau 1984b, Kang *et al.* 1994, Tong & Dudgeon 2000). The paraproct is also of high interest to separate the different species. The prolongation is well developed and covered by numerous small spines in *A. pascalae* and *A. laetificus*, while this prolongation is moderately developed in *A. acutulus* and *A. clivosus* or covered with only a restricted number of spines in *A. lingulatus* and *A. yehi*. *Alainites pascalae* and *A. laetificus* are quite similar and are also geographically the closest species. They can be separated by the absence of strong spines between the prolongation and the extension of the paraproct in *A. laetificus*, the

setation of the inner margin of the femora, the presence/absence of setae on the dorsal margin of foretibiae and the size of the spines between prostheca and mola of the right mandible (Müller-Liebenau 1984b).

#### DISTRIBUTION AND HABITAT

*Alainites pascalae* is relatively widespread as it was collected in about one third of the localities investigated by Derleth (2003). It was not abundant as only 32 specimens were found among the ca 3000 larvae of Baetidae collected from this area. The logging activities do not seem to have high impact on *A. pascalae*, as this species is present in unlogged or recently logged localities as well as in the one to three years following logging. *A. pascalae* seems to be mostly present in small to medium streams less than 6m wide and of little depth (0.15 to 0.55 m depth) and prefers slow flow (generally between 0.2 and 0.5 m/s, but at most 0.85 m/s).

#### ETYMOLOGY

This species is dedicated to Pascale Derleth Sartori who led the project and collected most of the material examined.

#### ACKNOWLEDGMENTS

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