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The First Instar Larva of *Hydrobius pauper* Sharp (Coleoptera, Hydrophilidae)

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Abstract The first instar larva of *Hydrobius pauper* Sharp, 1884 is described. The larvae show intraspecific variation in the sclerotisation of the first maxillary palpomere which is usually incompletely sclerotised dorsally, but rarely the dorsal sclerotisation is complete, forming completely cylindrically sclerotised maxillary palpomere 1. The arrangement of mandibular sensilla MN1–3 of the first instar is shown to differ from larvae of the second and third instars. The thoracic and abdominal membranes of the first instar are without short pubescent tubercles, whereas the second and third ones bear short pubescent tubercles on the surfaces.
Key words water scavenger beetle, Hydrophilinae, Hydrobiusini, larva, morphology, chaetotaxy

Introduction

After the publication of our study on the larval morphology of *Hydrobius pauper* Sharp, 1884 of the tribe Hydrobiusini (Minoshima & Hayashi, 2011), we had the opportunity to examine the first instar larva of the species and describe its morphology which has been unknown so far. We also provide short comments on the variation of two characters considered previously as invariable intraspecifically and used in previous studies (*e.g.*, Archangelsky, 1997, 2004; Minoshima & Hayashi, 2011) as the taxonomically and phylogenetically important.

Materials and Methods

The methods follow those used by Minoshima and Hayashi (2011). The examined material is deposited in authors' collections. We identified the larvae collected in the field by the comparing their morphology with that of second and third instars. Only single species of the genus *Hydrobius*, *H. pauper*, occurs in Japan and its second and third instar larvae were described by Minoshima and Hayashi (2011).

Photographs were taken using a Pentax K-5 digital camera attached to an Olympus SZX12 stereoscopic microscope or a Zeiss Axiophot compound light microscope with a MeCan NY-1S digital SLR microscope adapter (MeCan Imaging Inc., Saitama, Japan), and subsequently adapted in Adobe Photoshop Lightroom 4 and Photoshop CS5. Composite images were created using the focus stacking software CombineZP (Hadley, 2010).

The morphology of the first instar larva is shortly compared with those of the second and third instars which were described by Minoshima and Hayashi (2011). Regarding the morphological terminology, we follow Archangelsky (1997) and Minoshima and Hayashi (2011) with the exception

of the antennal segments, for which we follow Beutel (1999) and Fikáček *et al.* (2008); for the chaetotaxy of the larval head we refer to Fikáček *et al.* (2008) and Byttebier and Torres (2009).

Abbreviations are used as follows: AN: antenna; FR: frontale; gAN: group of antennal sensilla; gAPP: group of sensilla on the inner appendage of the maxilla; gFR: group of sensilla on the frontale; gLA: group of sensilla on the labium; gMX: group of sensilla on the maxilla; L1: first instar larva; LA: labium; MN: mandible; MX: maxilla; PA: parietale; SE: sensorium.

Description of Larva

Hydrobius pauper Sharp, 1884

(Figs. 1–4)

Material examined. 17 L1, Bibi-gawa River, Chitose-shi, Hokkaido, Japan, 29–VII–2011, M. Hayashi leg.

Additional description.

General morphology. First instar. Colour. Head and sclerotised parts light yellowish brown; membranous parts slightly greyish white (Fig. 1).

Head. Antenna (Fig. 3A–B) rather stout. Antennomere 1 about as long as antennomere 2; antennomere 3 two-fifths as long as antennomere 2. Ventral surface of antennomere 2 bearing sparsely arranged small cuticular projections on inner part (Fig. 3B).

Maxilla (Figs. 3E–F, 4). Dorsal surface of intersegmental membrane between palpomeres 2 and 3 with a few small cuticular projections; palpomere 1 incompletely sclerotised cylindrically on dorsal surface (Figs. 3E, 4A–B), but rarely, cylindrically sclerotised (Fig. 4C).

Thorax and abdomen. Setation on sclerites of thoracic and abdominal segments sparser than those of the second and third instars. Dorsal and lateral surface of thoracic and abdominal membranes without small pubescent tubercles (this character was not mentioned in Minoshima and Hayashi (2011): the third instar larva bears densely arranged small pubescent tubercles on dorsal and lateral surface of thoracic and abdominal membrane; the second instar bears a few small pubescent tubercles on the surface).

Primary chaetotaxy of head. Without additional sensilla, arrangement of primary sensilla closely similar to that of the second and third instars.

Antenna (Fig. 3A–B). AN6 on anterior third of sclerite.

Mandible (Fig. 3C–D). MN1 situated posterolaterally to MN2; MN2 between MN1 and MN3.

Maxilla (Fig. 3E–F). MX4–6 closely aggregated, situated lateroventrally on subapical portion of sclerite of stipes; MX5 located mesally to MX4 and MX6; MX4 posteriorly to MX6.

Labium (Fig. 3G–H). LA3 rather short seta, situated anteromesally to LA4.

Discussion

In our previous study of larval Hydrobiusini (Minoshima & Hayashi, 2011), we were able to examine only a restricted number of second and third instar larvae of *Hydrobius pauper*. In the present study, we examined 17 specimens of the first instar larvae of this species. The specimens show intraspecific variation of the sclerotisation of the first segment of the maxillary palpus (Figs. 3E, 4). The segment usually bears an incompletely sclerotised sclerite (its sclerotisation is interrupted dorsally; Figs. 3E, 4A–B). In one out of 17 specimens examined, both dorsal portions of the sclerite are nar-

Fig. 1. Habitus of the first instar larva of *Hydrobius pauper* SHARP, 1884, dorsal and ventral view.

rowly connected, and a completely sclerotised cylindrical sclerite is therefore present (Fig. 4C). The character, i.e., complete or incomplete dorsal sclerotisation of the palpomere 1, has been until now considered as a taxonomically and phylogenetically informative in the Hydrophilidae (*e.g.*, ARCHANGELSKY, 1997, 2004; MINOSHIMA & HAYASHI, 2011). Our results suggest that multiple specimens should be examined in order to code this character properly in the future phylogenetic studies.

The arrangement of the mandibular sensilla MN1–3 on first instar larva (Fig. 3C–D) is different from those on the second and third instars (see MINOSHIMA & HAYASHI, 2011): the first instar larva has the seta MN1 situated more proximally than the pore MN3, whereas the second and third instars have the seta MN1 situated more distally than the pore MN3, the pore MN2 in all three instars is situated on the line connecting the sensilla MN1 and MN3. The arrangement is stable in the seven first instar larvae examined for this study in slide preparations. However we have examined only three second instar larvae and one third instar larva so far, and are therefore unable to exclude a possible variation of this character in higher instars. The same difference between the first and second plus third instars is

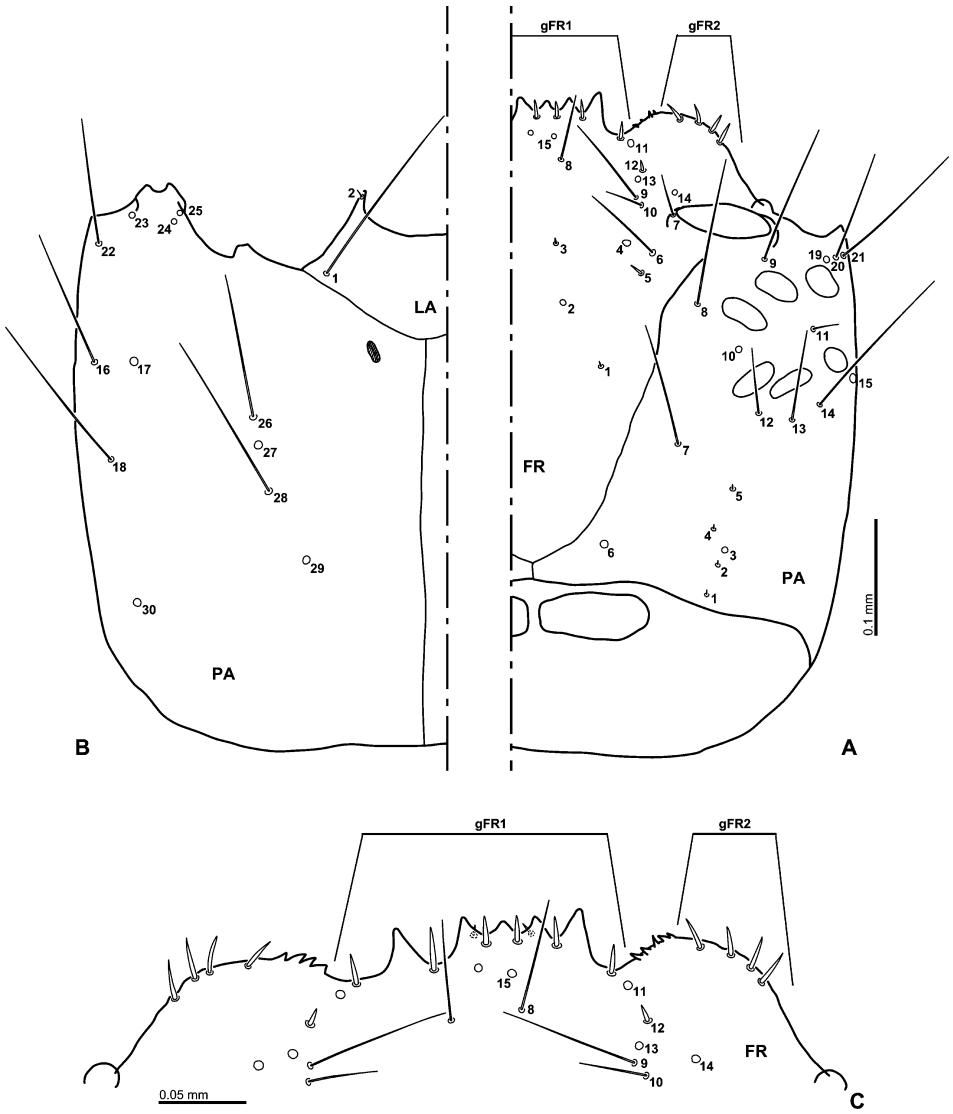

Fig. 2. Head capsule of *Hydrobius pauper* SHARP, 1884, first instar larva. —— A–B, head capsule, dorsal (A) and ventral (B) view; C, detail of anterior margin of head capsule, dorsal view.

also present in the European *Hydrobius fuscipes* (LINNAEUS, 1758) based on few larvae examined for this characters (M. FIKÁČEK, pers. comm., 2012).

In addition to the above results, we confirm the homology of sensillum LA3 in this study, which was an ambiguously homologised sensillum on the basis of the study of the higher larval instars due to the present of a secondary seta (MINOSHIMA & HAYASHI, 2011: Fig. 47C). The sensillum LA3 is rather short seta which is presented anteromesally to LA4, therefore, the labial sensilla marked as '3?' on the Figure 47C by MINOSHIMA and HAYASHI (2011) should be considered as LA3 sensillum.

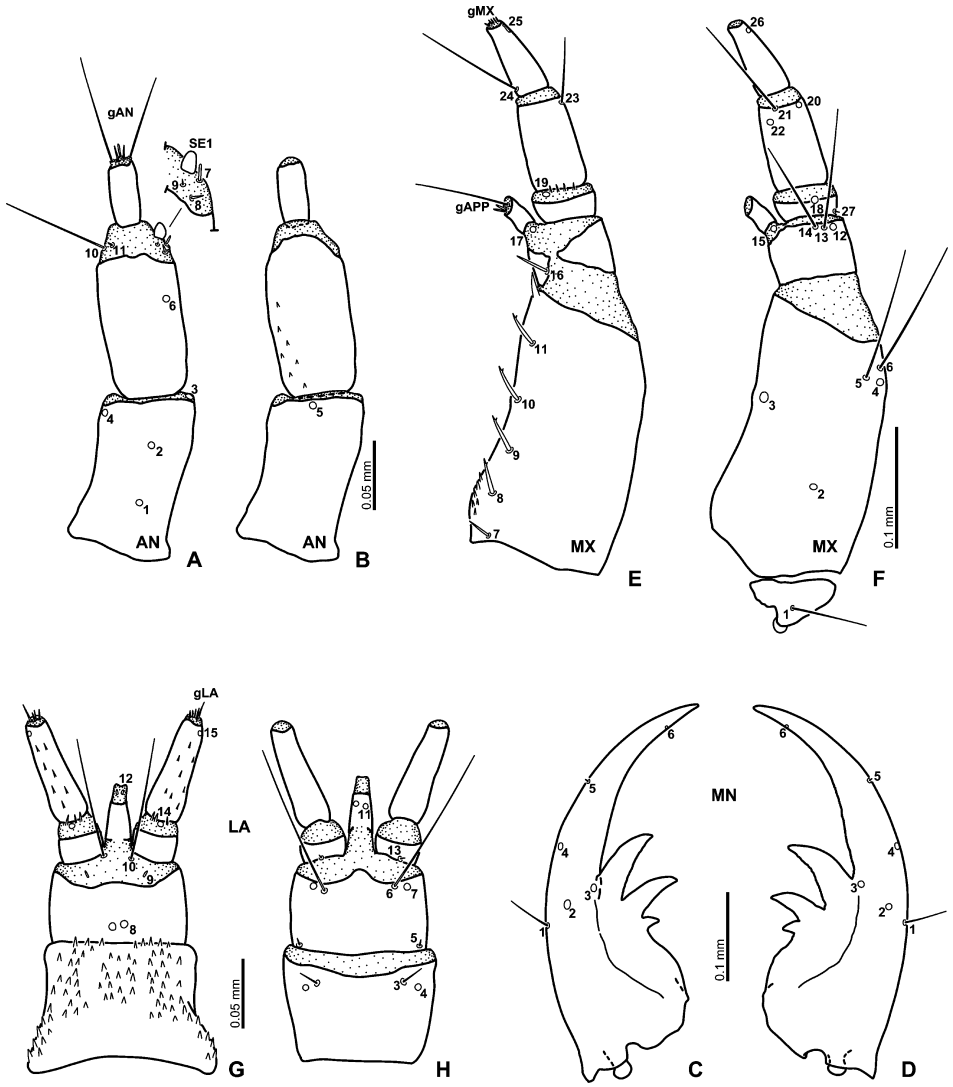

Fig. 3. Head appendages of *Hydrobius pauper* SHARP, 1884, first instar larva. —— A–B, antenna, dorsal (A) and ventral (B) view; C–D, mandible, dorsal view; E–F, maxilla, dorsal (E) and ventral (F) view; G–H, labium, dorsal (G) and ventral (H) view.

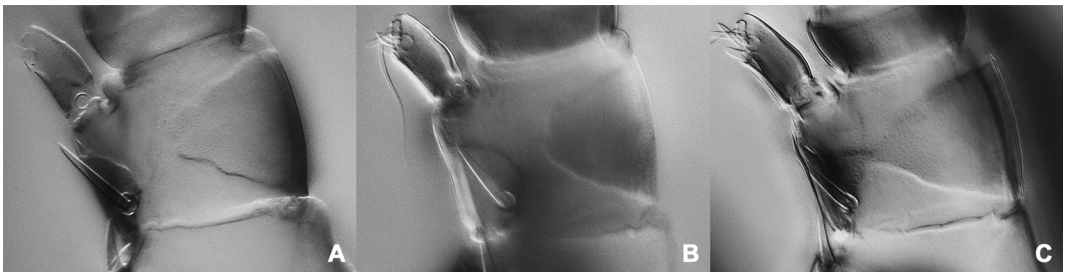

Fig. 4. Intraspecific variation of the first maxillary palpomere, first instar larva, dorsal view.

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要　　約

蓑島悠介・林　成多：スジヒメガムシ（鞘翅目ガムシ科）一齢幼虫の形態. —— スジヒメガムシ *Hydrobius pauper* SHARP の幼虫形態は，これまでに筆者らの先行研究 (MINOSHIMA & HAYASHI, 2011) により二齢と三齢のみが記載されている．筆者らは，新たに得られた本種の一齢幼虫を用いて，その形態を観察し記載を行った．研究の結果，一齢幼虫の形態の多くは二・三齢幼虫の形態によく合致したが，いくつかの異なる点が明らかとなり，かつ個体変異が観察された．小顎肢第一節が完全に節片化（円筒形に節片化する）か否かは，従来有用な同定・系統形質と見なされてきた．本種の幼虫の小顎肢第一節背面の節片化は一般に不完全であるが，希に完全に節片化する個体が存在することが分かった．これは，本形質を同定・系統研究に利用する際に，複数の個体を観察して総合的に形質を判断する必要があることを示唆している．これまで，安定した形質であると考えられてきた大顎 MN1–3 感覚器の配置について，一齢と二・三齢で異なることが分かった．MINOSHIMA and HAYASHI (2011) では言及されていなかった胸部・腹部膜質部の表面の形質について，各齢期で異なることが分かった．一齢では軟毛を備えた小突起が見られないのに対し，二齢ではわずかな数の小突起が背面・側面側に観察され，三齢ではこれが密に分布していた．これらの結果に加え，MINOSHIMA and HAYASHI (2011) において相同性が確認されなかった LA3 刺毛について，その相同性を確認した．すなわち，MINOSHIMA and HAYASHI (2011) での本種の記載において，「LA3?」として扱われていた刺毛は LA3 刺毛である．

References

ARCHANGELSKY, M., 1997. Studies on the biology, ecology, and systematics of the immature stages of New World Hydrophiloidea (Coleoptera: Staphyliniformia). *Bull. Ohio biol. Surv.*, (n. ser.), **12**: 1–207.

———— 2004. Higher-level phylogeny of Hydrophilinae (Coleoptera: Hydrophilidae) based on larval, pupal and adult characters. *Syst. Ent.*, **29**(2): 188–214.

BEUTEL, R. G., 1999. Morphology and evolution of the larval head of Hydrophiloidea and Histeroidea (Coleoptera: Staphyliniformia). *Tijdschr. Ent.*, **142**: 9–30.

BYTTEBIER, B., & P. L. M. TORRES, 2009. Description of the preimaginal stages of *Enochrus* (*Hugoscottia*) *variegatus* (STEINHEIL, 1869) and *E.* (*Methydrus*) *vulgaris* (STEINHEIL, 1869) (Coleoptera: Hydrophilidae), with emphasis on larval morphometry and chaetotaxy. *Zootaxa*, *Auckland*, **2139**: 1–22.

FIKÁČEK, M., M. ARCHANGELSKY & P. L. M. TORRES, 2008. Primary chaetotaxy of the larval head capsule and head appendages of the Hydrophilidae (Coleoptera) based on larva of *Hydrobius fuscipes* (LINNAEUS, 1758). *Ibid*., **1874**: 16–34.

HADLEY, A., 2010. CombineZP (6th of June 2010). [Available online at http://www.hadleyweb.pwp.blueyonder.co.uk/].

LINNAEUS, C., 1758. Systema naturæ per regna tria naturæ, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus I. Editio decima, reformata. 4 + 824 pp. Holmiæ, Laurentii Salvii.

MINOSHIMA, Y., & M. HAYASHI, 2011. Larval morphology of the Japanese species of the tribes Acidocerini, Hydrobiusini and Hydrophilini (Coleoptera: Hydrophilidae). *Acta ent. Mus. nat.*, *Pragae*, **51** (supplementum): 1–118.

SHARP, D., 1884. The water-beetles of Japan. *Trans. ent. Soc.*, *London*, **1884**: 439–464.

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