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## Immature Stages of *Hydrobiomorpha spinosa* (Orchymont, 1928) (Coleoptera: Hydrophilidae)

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### Abstract

The preimaginal stages of the Neotropical species *Hydrobiomorpha spinosa* (Orchymont) are described and figured for the first time. They are compared to the larvae of the New World species *Hydrobiomorpha casta* (Say) and to unidentified African and Australian larvae. Bionomical notes on this species are included.

### Resumen

Los estados preimaginales de la especie neotropical *Hydrobiomorpha spinosa* (Orchymont) se describen e ilustran por primera vez. Se los compara con larvas de la especie americana *Hydrobiomorpha casta* (Say) y con otras especies africanas y australianas no identificadas. Se incluyen datos bionómicos de esta especie.

**Keywords:** Aquatic Coleoptera, Hydrophilidae, *Hydrobiomorpha*, larvae, immatures, bionomics, Neotropical Region, Argentina.

### Introduction

The genus *Hydrobiomorpha* Blackburn, 1888 belongs to the family Hydrophilidae; according to Hansen (1999) it is placed within the tribe Hydrophilini, subtribe Hydrophilina. It includes 53 species (Hansen, 1999) of medium sized to large hydrophilids. *Hydrobiomorpha* is distributed mostly in tropical and subtropical regions, South America being by far the richest in species. From Argentina six species have been recorded (Bachmann, 1963, 1988), of which *H. spinosa* (Orchymont, 1928) is the commonest and most widespread in the country.

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Orchymont (1928) revised the known American species of *Hydrobiomorpha* (considered as belonging to the genus *Neohydrophilus* Orchymont at the time). About 30 years later Mouchamps (1959) stated the cogenericity of the species included in *Hydrobiomorpha* and *Neohydrophilus*. Recent revisions include those by Bachmann (1988) and Watts (1990), who revised the American and Australian species, respectively.

Regarding the immature stages of *Hydrobiomorpha*, few descriptions are available in the literature. Bertrand (1962, 1972) described the larva of an unidentified *Hydrobiomorpha* (as *Neohydrophilus*). Spangler (1973) described the third instar larva of the New World *H. casta* (Say, 1835). Berge Henegouwen (1982) described the first instar of an unidentified African species. More recently Archangelsky (1997) redescribed the larva of *H. casta*, and Watts (2002) described the larva of an Australian species (probably *H. bovilli* Blackburn, 1888).

In this paper we describe all the immature stages of *H. spinosa*; for the genus this is the first description of the egg case and the pupa. We also include information on the bionomics of this species, as well as some comparative notes with larvae of other *Hydrobiomorpha* species.

## Materials and Methods

Larvae and pupae were obtained in the laboratory, by rearing five adults (two males and three females) collected in Buenos Aires City. Adults were kept in a plastic aquarium (22 cm in diameter, 16 cm high) filled with 10 cm of tap water and aquatic plants from the collecting site. Commercial fish food was supplied to the adults every day, and one egg case was obtained 11 days after setting up the aquarium. In order to avoid cannibalism, after hatching, larvae were transferred to individual containers (4 cm in diameter, 7 cm high) with 5–10 mm tap water and a piece of *Elodea*. Larvae were fed daily, with abundant food (*Tubifex*), and water was changed every other day. To accomplish pupation, containers with prepupae were reduced to 2 cm high and transferred to terraria (15 cm by 10 cm) filled with 6 cm of soil; a small amount of water was added every day to prevent the soil from drying.

Larvae were fixed and preserved in 96% ethyl alcohol. Pupae were fixed with boiling alcohol, and punctured in the abdomen in order to avoid swelling, after fixation were preserved in 96% ethyl alcohol. Larvae were cleared in lactic acid, dissected and mounted on slides for description; the medium used was Hoyer's. Descriptions and illustrations were made with a Leica DMLB compound scope, a Zeiss stereoscopic microscope, and an Olympus CH30 compound scope, all equipped with drawing tubes.

Identification of adults was done using the keys from Bachmann (1963, 1988). For comparative notes with *Hydrobiomorpha casta* and other unidentified species, descriptions from the literature were consulted (Bertrand, 1962, 1972; Spangler, 1973; Berge Henegouwen, 1982; Archangelsky, 1997; Watts, 2002).

### *Hydrobiomorpha spinosa* (Orchymont, 1928) (Figs. 1–19)

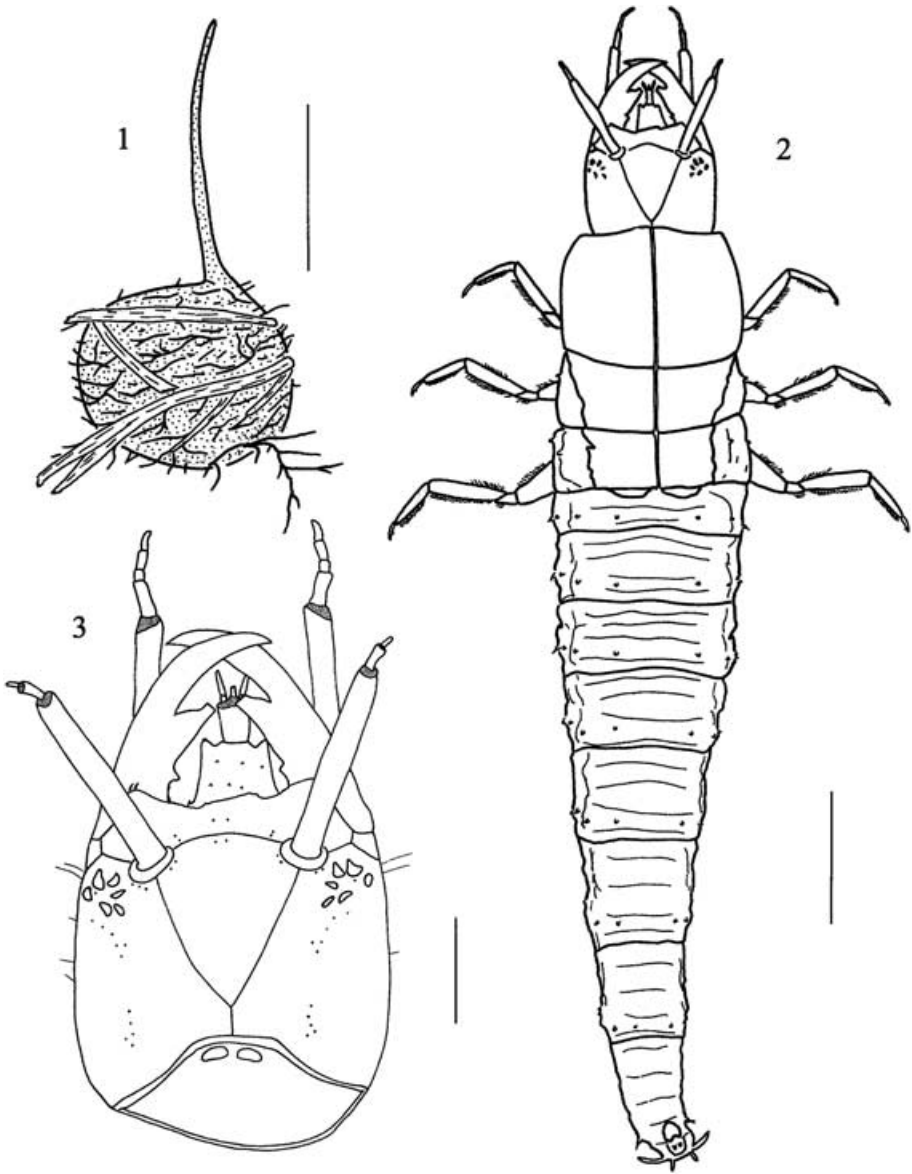
#### Material

Argentina, Buenos Aires City (one egg case, 15 larvae, four pupae).

#### Descriptions

##### *Egg case*

Length: 11 mm, width: 11 mm; mast length: 14 mm. Subspherical, oval in cross-section (Fig. 1), whitish except for brownish mast. Mast horn-shaped, arising verti-



Figures 1–3. *Hydrobiomorpha spinosa*. (1) Egg case, frontal view; (2) Habitus third instar larva; (3) Head capsule, third instar larva, dorsal view. Scale bars: Figs. 1 and 3 = 1 mm, Fig. 2 = 3 mm.

cally over the water's surface. Case without distinct cap; larvae emerged through a gap made on surface of the egg case. Constructed on the water's surface using aquatic plants (stems and roots) as support, floating freely with the upper third outside the water.

*Third instar larva*

Length: 18.5–22.0 mm (mean: 20.3 mm,  $n$ : 9). Color whitish, with sclerotized parts brown on dorsum, yellowish to light brown on legs and prosternum; non-sclerotized integument covered by fine pubescence, denser on dorsal side.

Head capsule subquadrate (Figs. 2 and 3), slightly retracted within pronotum; occipital foramen wide, dorsal part of cervix with two subrectangular cervical sclerites. Frontoclypeal suture well developed, frontoantennal sutures V-shaped, coming together close to base of head capsule; coronal suture short. Six stemmata on each side of head, close to base of antennae.

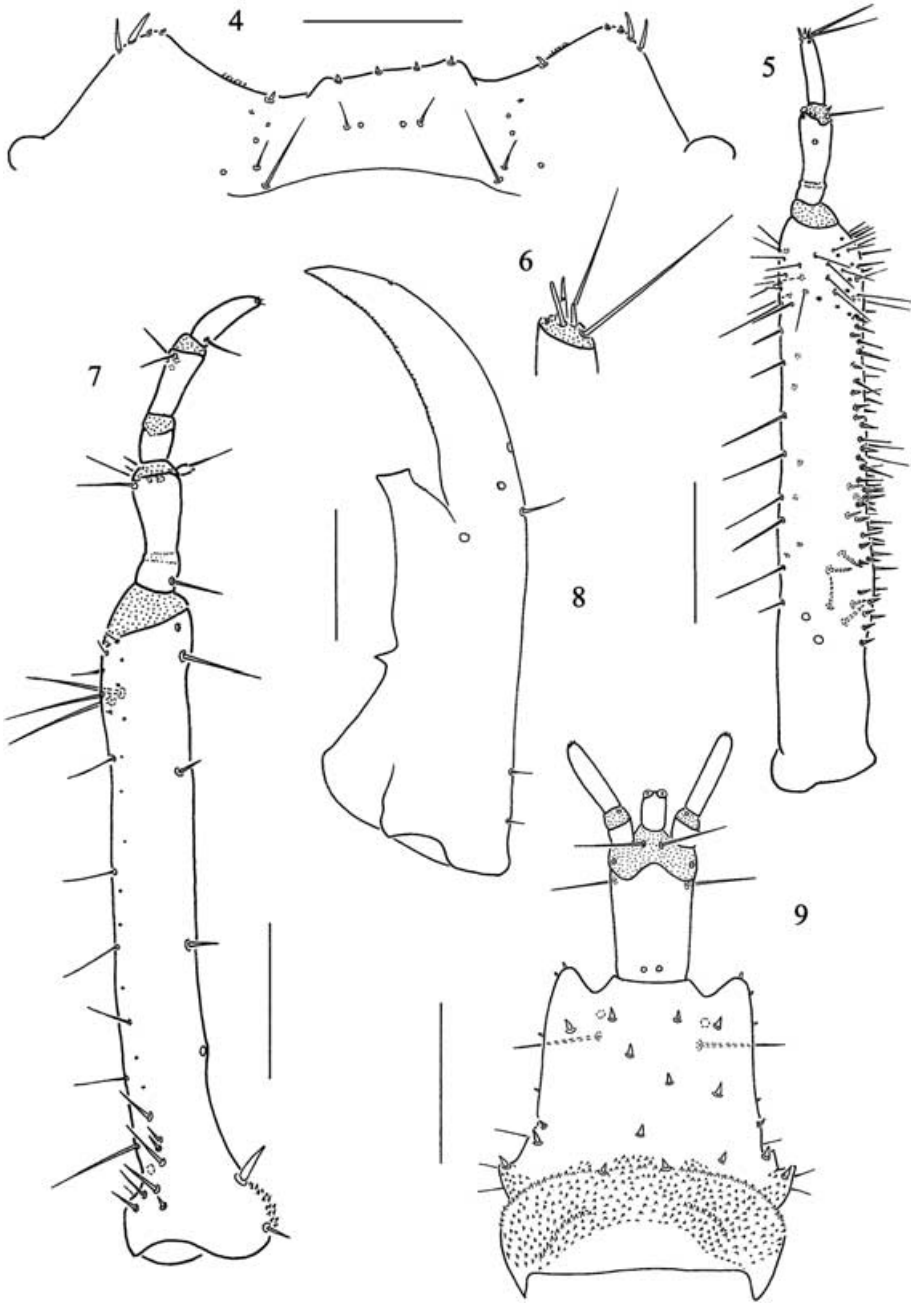
Labroclypeus slightly asymmetrical (Figs. 3 and 4). Nasale short, obliquely truncate, left side shorter than right side; four short setae present along outer margin, one more on each side of nasale. Epistomal lobes rounded, projecting farther than nasale, inner margins finely serrated; each lobe with four distal setae, inner two very short, outer two long.

Besides setae on labroclypeus, the dorsal surface of head bears several setae arranged as follows (Fig. 3): one seta among stemmata and an oblique row of six setae behind them; 4–5 setae at the base of each antenna; two setae behind frontoclypeal suture and near midline; two rows of six setae subparallel to coronal suture. Lateral sides of head with 6–9 setae, some very short, anterior two long. Ventral surface with eight setae arranged in two rows of four, subparallel to midline.

Antennae three-segmented (Fig. 5); basal segment wider and longer than other two combined, bearing numerous setae on both outer and inner margins. Second segment slender and short, partially subdivided on basal third, with five apical setae, two on inner margin (one short, one long), three on outer margin (two short, one minute); distal sensory appendage on outer margin reduced to a flat plate. Third segment the shortest, with six apical setae, two long and four short ones (Fig. 6).

Maxillae five-segmented (Fig. 7), longer than antennae; cardo small, irregularly shaped; maxillary articulating area with two subtriangular plates and small membranous inner spinose lobe. Stipes much longer than palp, base of inner margin with patch of small cuticular spines; inner margin with five setae, distal one the longest; outer margin with several setae of varying lengths, basal ones shorter. Palp four-segmented, first segment the longest, slightly curved outwards, with poorly sclerotized ring on basal third, appearing incompletely subdivided, segment bearing one basal seta on inner margin and four slender setae and short inner process on distal margin, process with one long seta and two short sensoria; second segment short, lacking setae; third segment with two subapical setae on outer margin; last segment conical, slightly curved inwards bearing one long basal seta, projecting mediad, and several short sensoria on apex.

Mandibles slightly asymmetrical (Fig. 8). Mandible serrated on distal half, with three inner teeth, one distal, two proximal; distal tooth large, bifid or truncate at apex, slightly serrated on outer margin, inner margin of distal tooth strongly excavated on left mandible, on right mandible slightly excavated, basal teeth small, conical, one dorsal (more robust in left mandible) and one ventral. Base of mandible with patch of short spines on ventral side (Fig. 18). Right mandible with dorsal side flat and



Figures 4–9. *Hydrobiomorpha spinosa*, third instar larva. (4) Clypeolabrum; (5) Left antenna, dorsal view; (6) Detail of setae on apex of third antennal segment; (7) Left maxilla, dorsal view; (8) Right mandible, dorsal view; (9) Labium, dorsal view. Scale bars = 0.5 mm.

dorsal inner margin sharp, left mandible with ventral side flat and ventral inner margin sharp, crossing over right mandible when feeding, working like scissors. Outer margin of mandibles with four setae.

Labium stout and well developed (Fig. 9). Submentum large, subhexagonal, wider than long. Mentum subtrapezoidal, longer than wide, anterolateral angles projected, posterolateral angles bearing one or two conical projections, each with short and stout seta, basal third with strong cuticular spines; several strong and short setae on dorsal side, ventral side with one pair of long, slender setae. Prementum smaller, subrectangular, longer than wide, with four long setae, two ventral ones lateral, two dorsal ones close to base of ligula; two small sensoria on membranous area at base of labial palpi. Ligula longer than first palpal segment, strongly sclerotized, with two membranous lobes on apex, each with two small subcircular sensoria. Palpi two-segmented, basal segment short, bare; distal segment long, with several apical, short sensoria.

Pronotal plate large, subrectangular with posterior margin rounded (Fig. 2), divided in two by fine sagittal line, anterior margin slightly striated; prosternum subrectangular, wider than long, with sagittal line. Meso- and metathorax shorter than prothorax, tergites smaller, subtrapezoidal with irregular sides, divided by sagittal line. Meso- and metathorax with a pair of small setose, lateral tubercles. Pleural areas with small sclerotized area subdivided into episternum and epimeron. Legs five-segmented, long, visible in dorsal view, first pair slightly shorter than other two; coxae large, cylindrical, widely separated, trochanter short, femur as long as coxa but slender, tibiotarsus slightly shorter and more slender than femur, pretarsal claw less than half the length of tibiotarsus, with two short, basal setae; inner margin of trochanter, femur and tibiotarsus, and outer margin of femur with fringe of long swimming hairs.

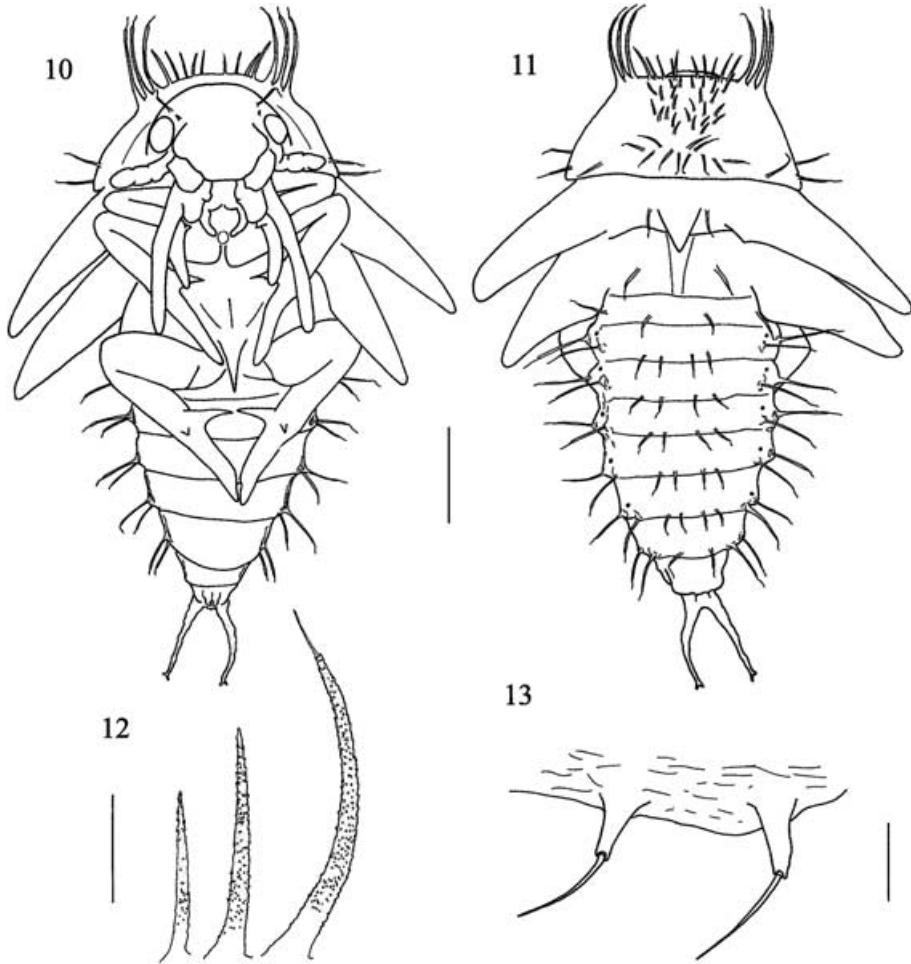
Abdomen 10-segmented, segments IX and X reduced (Fig. 2). Segments I–VII similar in shape, tapering towards posterior end. Segment I subdivided by two transverse folds, with a pair of small irregularly suboval tergites. Segments II–VII without tergites each one subdivided by four transverse folds; segments I–VII with transverse row of 12 small setiferous lobes, four dorsal, three on each lateral margin, and two ventral. Segment VIII subdivided by four transverse folds, with a large dorsal suboval plate and a pair of very short lateral lobes (mesocerci), plate posteriorly subdivided into four small lobes. Segment IX trilobed, partially covered by VIII, with a pair of short, one-segmented urogomphi close to center of segment and a pair of long paracerci on sides; a pair of long gill-like appendages originates on ventral side of segment.

Nine pairs of spiracles, one on mesothorax and eight abdominal. Thoracic and first seven abdominal pairs of spiracles non-functional. Last abdominal pair very large, annular, with closing apparatus, enclosed within spiracular atrium.

### *Pupa*

Length (excluding pronotal styli and cerci): 15.0–18.5 mm (mean: 16.9 mm; *n*: 4); maximum width at level of pronotum: 6–7 mm (mean: 6.8 mm; *n*: 4).





Figures 10–13. *Hydrobiomorpha spinosa*. (10) Pupa, ventral view; (11) Pupa, dorsal view; (12) Detail of styli on pronotum; (13) Detail of styli on eighth abdominal segment. Scale bars: Figs. 10 and 11 = 3 mm, Fig. 12 = 0.5 mm, Fig. 13 = 0.1 mm.

Color white to slightly brown in older pupae, eyes reddish-brown (pharate adult). Two elliptical sclerites on posterior margin of the head, close to midline. Antennae partially hidden by pronotum (Fig. 10). Maxillary palpi extending beyond base of mesotarsi. Pro-, meso- and metatibiae with two apical spines; inner spine on metatibia III as long as width of tibia. Metathoracic legs partially covered by wingpads. Metasternal spine short, slightly curved dorsally. Pupae of male with parameres partially developed as small lobes.

Body glabrous except for styli described below (Figs. 10 and 11). Head with two pairs of supraorbital styli, upper one larger. Pronotum with 54–57 styli distributed as

follows: 19–24 on pronotal disc and 32–35 on margins (three large styli on each side of anterior margin, 10–13 styli on medial part of anterior margin, three styli on each latero-posterior angle of pronotum and 10–11 styli along posterior margin). Mesonotum with one stylus on each side of scutellum. Metanotum with two styli near midline.

First abdominal segment with four styli. Segments II–VI with eight styli arranged as follows: a transverse row of four styli on posterior margin and a pair of larger styli mounted on small tubercles behind each spiracle. Segment VII with six styli: a pair near midline and two pairs of larger styli on each side. Segment VIII with two minute styli on posterior margin. Segment IX with two long cerci, tapering and bifid at the apex.

All styli bearing terminal seta except those on pronotal disc and the medial part of the anterior margin of pronotum. All styli spinulose (Fig. 12) except those on abdominal segment VIII (Fig. 13). The high number of pronotal styli (54–57) will separate *Hydrobiomorpha* pupae from other known Hydrophilina pupae (32 or less in all known pupae).

## Bionomical Notes

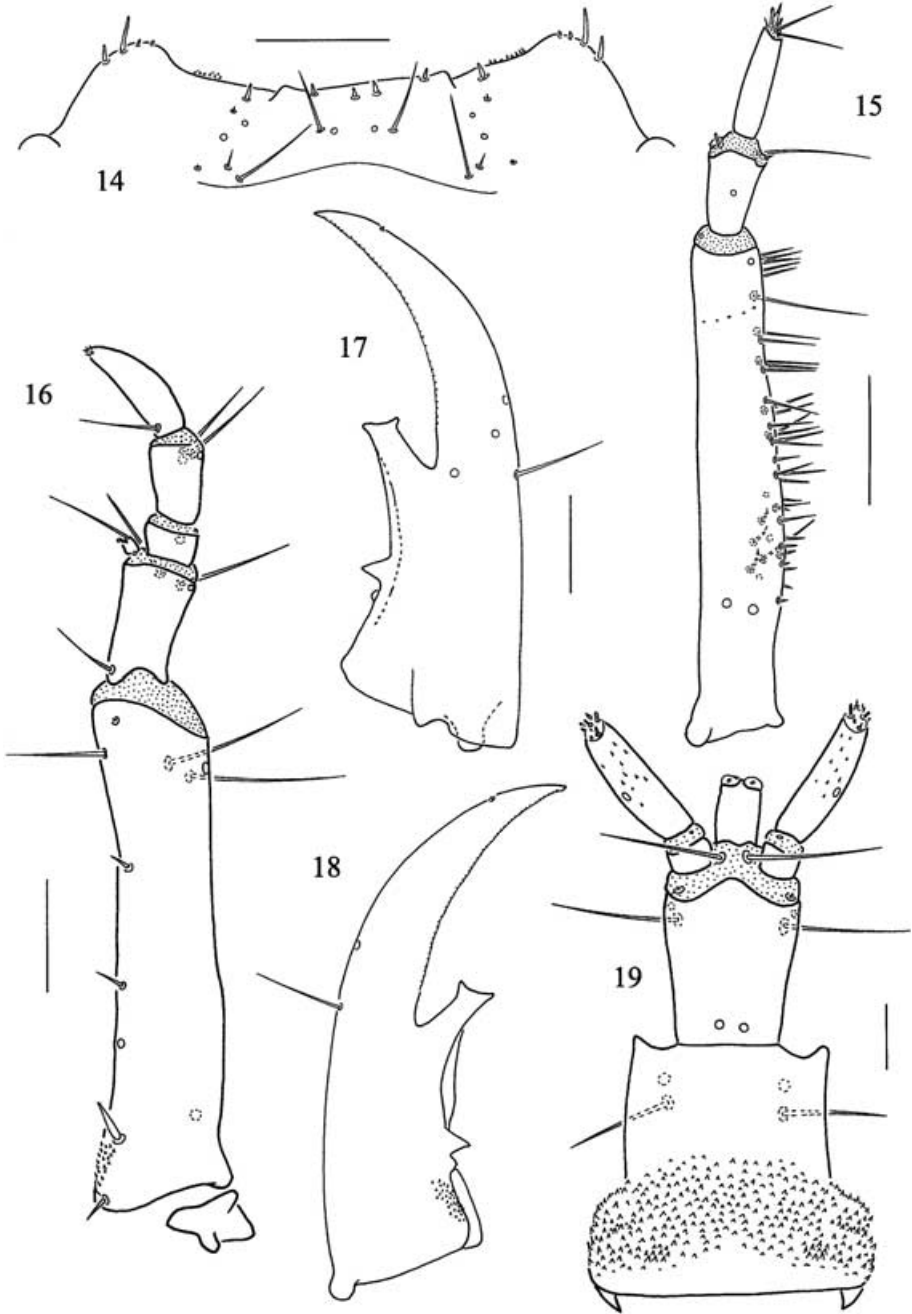
During a three-year collecting period adults and larvae have been recorded from permanent water bodies, but never from temporary habitats. Several first instar larvae were collected in mid-spring and came from ponds and shallow lakes with abundant floating vegetation (*Azolla filiculoides*, *Pistia stratiotes*, *Lemna* sp., *Salvinia* sp.). Adults were sporadically collected at night attracted by spotlights.

Adults reared for this study were collected in late spring (3.XII.2001) in a small semi-permanent pond (about 20 m long), with some littoral vegetation. The only egg case obtained was constructed during the night of 14.XII.2001.

Larvae started hatching at noon and the last larva emerged from the egg case 23 hours later. A total of 31 larvae emerged from the egg case, with the head capsule already sclerotized and pigmented. After hatching, larvae wandered for a while over the surface of the egg case. Up to four larvae could be present at the same time on the egg case, but no signs of aggression among them was observed. Adults approached the egg case frequently before, during and after hatching of larvae.

The developmental times of this species are summarized in Table 1. Larvae of all instars were very active, aggressive and voracious. Prepupae left the water at night, and construction of the pupal cell also took place during the night hours. In a few cases prepupae had to be placed on the soil in order to stimulate pupation. Pupal cells were constructed at a depth of 20–60 mm (the maximum depth of the terrarium was 60 mm); the cells were round, with a diameter of 18–19 mm. Once buried, individuals remained in the pupal chamber for 14 days before adult emergence.





Figures 14–19. *Hydrobiomorpha spinosa*, first instar larva. (14) Clypeolabrum; (15) Left antenna, dorsal view; (16) Right maxilla, dorsal view; (17) Right mandible, dorsal view; (18) Right mandible, ventral view; (19) Labium, dorsal view. Scale bars = 0.2 mm.

Table 1. Duration (in days) of preimaginal stages of *H. spinosa*. SD: standard deviation

	Range	Mean	SD	<i>N</i>
Egg case	5	5	—	1
Instar I	3–5	3.90	0.50	29
Instar II	3–4	3.59	0.50	27
Instar III (in water)	10–12	11.17	0.75	6
Buried	14	14	—	1

Table 2. Summary of characters differentiating among first, second and third instar larvae of *Hydrobiomorpha spinosa*

Character	Larva I (Figs. 14–19)	Larva II	Larva III (Figs. 2–9)
Size	7 mm ( <i>n</i> = 2)	14 mm ( <i>n</i> = 1)	20.3 mm ( <i>n</i> = 9)
Setae on nasale	Inner 2 closer to each other than to outer 2	Variable, some similar to Larva III, others intermediate	All 4 setae evenly distributed
Antennae	Outer margin of segment 1 glabrous Segment 2 entire	Outer margin of segment 1 with row of setae Segment 2 entire	Outer margin of segment 1 with row of setae Segment 2 partially subdivided on basal third
Length antennomere 1/length 2 + 3	2.2–2.3	2.7–2.9	3.3–3.7
Mandibles	Outer margin glabrous at base	Outer margin with 2–3 short setae at base	Outer margin with 2–3 short setae at base
Stipes	Outer margin without row of setae	Outer margin with row of setae	Outer margin with row of setae
Length stipes/length palp	1.35–1.50	1.60–1.76	1.85–2.02
Maxillary palp	Segment 1 entire	Segment 1 entire	Segment 1 partially subdivided on basal third
Width prementum/ Width mentum (at midlength)	0.54–0.60	0.49–0.50	0.34–0.35
Mentum	Dorsal side glabrous	Dorsal side and margins with short and stout setae	Dorsal side and margins with short and stout setae
Palpomere 2 of labium	With several short cuticular spines on dorsal side	With few short cuticular spines on dorsal side	Without spines

## Comparative Notes

### *Intraspecific comparisons between instars*

There are many differences between first and third instar larvae, the most evident difference being the size, first instar larvae range between 6.0 and 8.0 mm long ( $n = 2$ ). Details of the mouthparts of first instar larvae are shown in Figs. 14–19. Second instar larvae are more similar to third instars than to first instars, their size being about 14.0 mm ( $n = 1$ ). The principal differences to separate all three instars are summarized in Table 2.

### *Comparisons with other known Hydrobiomorpha larvae*

There are few descriptions of *Hydrobiomorpha* larvae. The most detailed ones are those of *H. casta* (Spangler, 1973; Archangelsky, 1997) and one unidentified species from Australia by Watts (2002), probably *H. bovilli* according to that author. Bertrand (1962, 1972) and Berge Henegouwen (1982) briefly describe unidentified *Hydrobiomorpha* larvae from Africa. The principal differences separating third instar larvae of *H. spinosa*, *H. casta*, and *H. bovilli?* are summarized in Table 3.

The larva described by Berge Henegouwen (1982) is most likely, due to the size (8 mm), that of a first instar. It has all the diagnostic characters defining *Hydrobio-*

Table 3. Summary of characters differentiating among third instar larvae of three species of the genus *Hydrobiomorpha*

Character	<i>H. spinosa</i>	<i>H. casta</i>	<i>H. bovilli?</i>
Clypeolabrum	Straight margin	Irregular margin	Irregular margin
	Lateral setae of nasale far from it (right one 4–5x its length, left one 2x)	Lateral setae of nasale close from base of nasale (both 1x its length)	Lateral setae of nasale close from base of nasale (both approx. 1x)
Mandibles	Middle inner tooth small	Middle inner tooth small	Middle inner tooth large
	Distal inner margin serrate	Distal inner margin smooth	Distal inner margin smooth
Antenna	Second segment partially subdivided at base	Second segment not subdivided	Second segment not subdivided
Maxilla	First palpomere partially subdivided at base	First palpomere not subdivided	First palpomere not subdivided
Labium	Prementum about 1/3 width of mentum	Prementum about 1/3 width of mentum	Prementum about 1/2 width of mentum
	Anterolateral angles of mentum at most reaching base of prementum	Anterolateral angles of mentum at most reaching base of prementum	Anterolateral angles of mentum projecting farther than base of prementum

*morpha* larvae (i.e. shape of head capsule and mouthparts, abdomen, etc.), but the detail of the description and illustrations do not allow making any comparisons. The same can be said of the descriptions and illustrations by Bertrand (1962, 1972).

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