Morphology of the fifth larval stage of *Notonecta reuteri* Hungerford, 1928, *Notonecta lutea* Müller, 1776 and *Notonecta glauca* Linnaeus, 1758 (Heteroptera aquatica)

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Kurzątkowska, A. 2012: Morphology of the fifth larval stage of *Notonecta reuteri* Hungerford, 1928, *Notonecta lutea* Müller, 1776 and *Notonecta glauca* Linnaeus, 1758 (Heteroptera aquatica). — Entomol. Fennica 23: 13–17.

This paper presents the morphological characteristics of the previously undescribed fifth larval stage of *Notonecta reuteri* Hungerford, 1928 and *N. lutea* Müller, 1776. This paper highlights the differences between the two species, and the difference with *N. glauca* Linnaeus, 1758, the most widespread backswimmer species in Poland.

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Received 19 April 2011, accepted 6 October 2011

1. Introduction

In Poland, the family Notonectidae is represented by six species: *Notonecta glauca*, *N. viridis* Delcourt, 1909, *N. maculata* Fabricius, 1794, *N. obliqua* Gallén, 1787, *N. reuteri* and *N. lutea*. The morphology and morphometry of Notonectidae larvae has not been investigated in detail to date. The only available key for identification of the fifth larval stage of the four species, *N. maculata*, *N. viridis*, *N. glauca* and *N. obliqua*, is the Czech key by Štusák (1980).

The diagnostic characters for the identification of *N. reuteri* and *N. lutea* larvae, typically found in peatland waters, have not been published to date. This study attempts to fill this gap with the use of a large collection of *N. reuteri* and *N. lutea* larvae. These two aquatic insect species are rarely encountered in Poland.

2. Material and methods

The larval material studied in this paper collected in a raised bog in Zehlau (Kaliningrad Oblast, Russia) (Biesiadka & Moroz 1996) and a valley bog near Żabi Róg (Morąg area, Poland) (Czachorowski & Kurzątkowska 1995). The Zehlau raised bog (Russia) is characterized by an abundance of *N. reuteri* and *N. lutea* populations (over 40% and approx. 25% of the total abundance of water bug fauna, respectively), while *N. glauca* is rarely encountered there (approx. 5%). The eurytopic species *N. glauca* is very common and abundant in Poland. The material analyzed in the study was collected from various water bodies near the city of Olsztyn (NE Poland). In the bog near Żabi Róg (Poland), *N. reuteri* is the only species of the genus *Notonecta*, and it is relatively abundant.

The initial larval material, which provided a basis for separating *N. reuteri* larvae, was collected in a bog near Żabi Róg (Poland). A morphological analysis of individuals in the fifth larval stage, collected in the Zehlau raised bog (Russia), has not only contributed to a study of the diagnostic features for these species, but also the distinctive features of *N. lutea* and *N. glauca*.

Notonecta lutea larvae were identified in the

material collected in the Zehlau bog system, and compared with the larval material from peatbogs in northern Poland, but only those where *N. lutea* was present (in some cases accompanied by *N. glauca*) and *N. reuteri* was absent (Kurzątkowska 1999). *Notonecta glauca* larvae were diagnosed based on extensive larval material collected in water bodies in the vicinity of Olsztyn (Poland), and they were compared with the larval material from the Zehlau raised bog.

The larvae of the studied species were preserved in 75% alcohol. The drawings were made based on larvae's preparations. The entire ventral section of the abdomen and the fore femur were dissected from specimens. These morphological fragments were cleared in 10% KOH and mounted in Fauré's fluid. Morphometric measurements were taken, using a dissecting microscope with a micrometric scale, on a group of 20 randomly selected individuals of each species. Included in the measurements taken were: body length, and the width and length of the central hair pad on the fourth abdominal sternite.

3. Description of the fifth larval stage of *Notonecta reuteri*, *N. lutea* and *N. glauca*.

In Poland, the species of the genus *Notonecta* have spindle-shaped bodies in all developmental stages (Fig. 1), with greenish and whitish pigmentation. The body size of the fifth larval stage of the analyzed species is presented in Table 1.

Larval bodies are convex dorsally with a flat ventral side. They are somewhat semicircular in cross-section. Adult individuals and larvae swim with the dorsal side down, hence the name backswimmers.

Larvae have broad, motile heads that directly contact the thorax. Eyes are large and kidney-shaped. The four-segmented rostrum is relatively short and stout. It is bent downwards under the head and the thorax in repose. Four-segmented antennae are set in elongate grooves between the head and the thorax.

The first and second pair of legs has an apical pair of claws, modified for capturing prey, and used for clinging to the substrate and vegetation. The third pair of oar-like legs is flat and fringed

Table 1. Body length at the fifth larval stage of *Notonecta reuteri*, *N. lutea* and *N. glauca*.

	Min (mm)	Max (mm)	Average (mm)	*SD*
N. reuteri	10.4	12.1	11.3	0.452
N. lutea	11.1	12.2	11.5	0.345
N. glauca	10.9	12.4	11.5	0.399

Fig. 1. Fifth larval stage of *Notonecta reuteri*, dorsal side. Scale-bar: 5 mm.

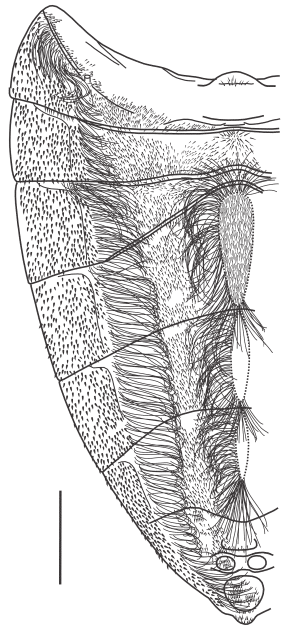

Fig. 2. Fifth larval stage of *Notonecta reuteri*, abdomen, ventral side. Scale-bar: 1 mm.

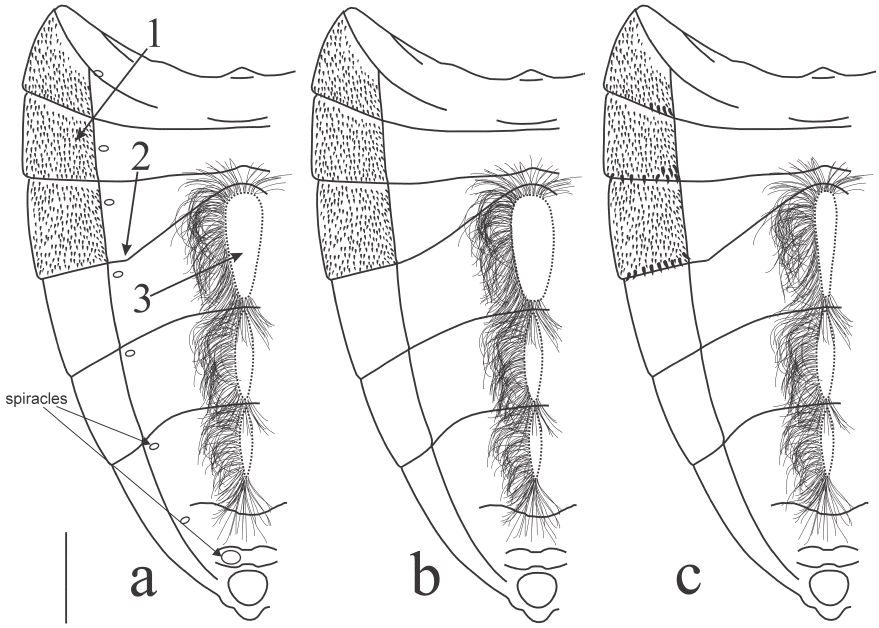

Fig. 3. Schematic drawing of ventral side of abdomen. 1: Laterotergite, 2: Postero-lateral corner of third sternite, 3: Central hair pad on fourth sternite. Scale-bar: 1 mm. – a. *Notonecta reuteri*. – b. *N. lutea*. – c. *N. glauca*.

with long swimming hairs on both edges of the tibia and the tarsus.

Wing buds stretch to the end of the second abdominal tergite.

On the ventral side of the abdomen there are two elongated grooves whose edges are bordered by four longitudinal rows of thick, long, flat-lying hairs (Fig. 2). These structures form air chambers. Eight pairs of spiracles (one pair on each sternite) open into the air chambers (Fig. 3a). The external rows of hairs grow along the internal edges of laterotergites which form the lateral section of abdominal tergites. In species of the genus *Notonecta*, laterotergites are present on the ventral side. The internal rows of hairs grow on the edges of the central hair pads on sternites 4–6. The shape of the central hair pad on the fourth sternite is of high diagnostic value (Figs. 3a, b, c). The hairs growing on central pads have a specific shape, they are flat and widen from the base to approximately 2/3 length (Fig. 2).

4. Diagnostic features of the fifth larval stage of *Notonecta reuteri*, *N. lutea* and *N. glauca*

The femur of the first pair of legs is covered with several dozen short, strong and dark-pigmented

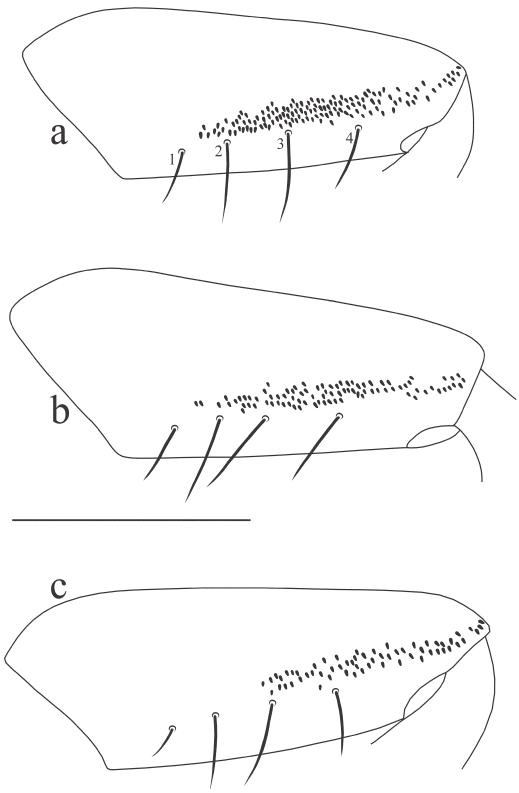

Fig. 4. Schematic drawing of femur of first pair of legs in anterior view. 1–4: Anteroventral bristles. Scale-bar: 1 mm. – a. *Notonecta lutea*. – b. *N. reuteri*. – c. *N. glauca*.

Table 2. Morphometry of the central hair pad on the fourth abdominal sternite in *Notonecta reuteri*, *N. lutea* and *N. glauca*: length, width of the broadest section and length/width ratio.

	Length (mm)				Width (mm)				L/W			
	Min	Max	Aver	*SD*	Min	Max	Aver	*SD*	Min	Max	Aver	*SD*
N. reuteri	1.05	1.20	1.13	0.034	0.28	0.35	0.32	0.021	3.14	4.09	3.60	0.227
N. lutea	1.10	1.30	1.24	0.050	0.38	0.48	0.42	0.031	2.58	3.27	2.96	0.192
N. glauca	1.03	1.28	1.16	0.073	0.20	0.25	0.22	0.019	4.40	6.38	5.27	0.498

spines on the anterior side. The spines form a band along the distal part of the femur (Figs. 4a, b, c). This morphological structure seems to be an important diagnostic feature. In *Notonecta lutea*, the spineband is longer and wider, with the spines reaching the dorsal edge of the femur, while in *N. reuteri* the spineband is less wide, and touches the joint with the tibia. The spineband in *N. lutea* is broadest between anteroventral bristles 2–4 (Fig. 4a). In *Notonecta reuteri*, the proximal spines are less approximated, and from anteroventral bristles 3 they form a straight narrow band up to the apical end of the femur (Fig. 4b). In *Notonecta glauca*, the spineband is shorter, and begins in the mid-femur section, at the level of anteroventral bristle 3 (Fig. 4c). According to Štusák (1980), among backswimmer species found also in Poland, only *N. maculata* larvae are deprived of the spineband on the femur.

Laterotergites, in the form of fine, evenly distributed and weakly pigmented spines are an important diagnostic feature in *N. reuteri* and *N. lutea* larvae (Figs. 3a, b). The larvae of *N. glauca* are additionally equipped with stronger, longer, dark-pigmented spines along the posterior edge of each laterotergite (Fig. 3c). The results of this study are not consistent with Štusák's key (1980) which suggests that strong, dark-pigmented spines are evenly distributed along the entire surface of laterotergites in *N. glauca*.

The shape of the posterior edge of the third abdominal sternite is a robust morphological feature that distinguishes *N. reuteri* from *N. lutea* larvae. In *Notonecta reuteri*, the postero-lateral corner shows an obtuse angle (Fig. 3a) which can also be observed in *N. glauca* larvae (Fig. 3c). In *Notonecta lutea* larvae, the posterior edge of the third abdominal sternite has a gently arching shape on both sides (Fig. 3b).

The identification of the investigated species is also based on the shape and size of the central hair pad on the fourth abdominal sternite (Table 2). In *Notonecta reuteri*, the hair pad is almond-shaped and relatively narrow (Fig. 3a), while it is much broader and elliptical in shape in *N. lutea* (Fig. 3b). This feature supports the differentiation of the studied species from *N. glauca* larvae where the central hair pad on the fourth abdominal sternite is very narrow (Fig. 3c).

5. Key

1. Laterotergites only with spines of same size and shape, small and weakly pigmented (Figs. 3a, b). A relatively long (approx. 2/3 femur length) band of short, strong, dark-pigmented spines on anterior side of fore femur (Figs. 4a, b) 2
– In addition to normal spines on laterotergites, also thicker, longer, darker-pigmented spines along posterior edge of laterotergites (Fig. 3c). A considerably shorter (approx. ½ femur length) band of short, strong, dark-pigmented spines on anterior side of fore femur (Fig. 4c). Posterior lateral corner of third sternite with an obtuse angle. Central hair pad on fourth sternite very narrow (Fig. 3c), refer to Table 2 *Notonecta glauca*
2. Spineband on anterior side of fore femur slightly narrower, stretching to apical end of femur (Fig. 4b). Posterior lateral corner of third sternite with an obtuse angle (Fig. 3a). Central hair pad on fourth sternite almond-shaped (Fig. 3a), refer to Table 2 *Notonecta reuteri*
– Spineband on anterior side of fore femur considerably broader, stretching to apicodorsal

end of femur (Fig. 4a). Posterior lateral corner of third sternite forms a gentle arch (Fig. 3b). Central hair pad on fourth sternite broader, with an elliptical shape (Fig. 3b), refer to Table 2 *Notonecta lutea*

Acknowledgements. I would like to thank dr. hab. R. Kujawa, Professor of the University of Warmia and Mazury in Olsztyn, for his help in taking pictures of *Notonecta reuteri* larvae. I also thank Ton van Haaren for constructive suggestions which considerably improved the paper.

References

Biesiadka, E. & Moroz, M. 1996: A preliminary description of water bugs (Heteroptera) of the Zehlau peatbog. — In: Dedkov V. (ed.), Fauna and flora of the Zehlau peatbog: 39–41. Kaliningrad. 55 pp.

Czachorowski, S. & Kurzątkowska, A. 1995: (Caddisflies (Trichoptera) and water bugs (Heteroptera) in a disappearing water body near Żabi Róg (Masurian Lakeland)). — Przegląd Przyrodniczy 6: 53–60. [In Polish.]

Kurzątkowska, A. 1999: Water bugs (Heteroptera) of high bogs and transitional moors of Masurian Lake District. — Polskie Pismo entomologiczne 68: 349–369.

Štusák, J. M. 1980: Heteroptera. — In: Rozkošny, R. (ed.), (Key to aquatic insect larvae): 133–155. CVA, Praha. 512 pp. [In Czech.]