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The larva and the life cycle of *Potamophylax pallidus* (KLAPÁLEK 1899) (Trichoptera: Limnephilidae)

Gorazd Urbanič and Johann A. Waringer

With 10 figures and 1 table

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The larva of *Potamophylax pallidus* (KLAPÁLEK 1899) is described and compared with the morphologically similar larva of *Potamophylax nigricornis* (PICTET 1834). Information for the identification of both species is given and some taxonomical, zoogeographical and ecological notes including the life cycle of *P. pallidus* are presented. In addition, the geographical distribution of both species is discussed.

1 Introduction

According to MALICKY (1983), *Potamophylax pallidus* is one of the six *Potamophylax* species reported from middle Europe. Five of them (*P. cingulatus* (STEPHENS 1837), *P. latipennis* (CURTIS 1834), *P. luctuosus* (PILLER & MITTERPACHER 1783), *P. nigricornis* (PICTET 1834) and *P. rotundipennis* (BRAUER 1857)) are included in the larval key of WARINGER & GRAF (1997, 2000), whereas *P. pallidus* has been unknown so far. Recently, larvae and pupae of a *Potamophylax* species morphologically close to *P. nigricornis* were collected from small springs and spring brooks of the River Ščavnica, NE Slovenia. Fifth instar larvae and pupae were reared to the adult stage and identified as *P. pallidus*.

2 Separation of *Potamophylax pallidus* from other Trichoptera

By following WARINGER & GRAF (1997, 2000), last instar larvae of *Potamophylax pallidus* are separated from other Central European Trichoptera by the following set of morphological characters typical for Limnephilids:

- Dorsal sclerites present on pro-, meso- and metanotum (Fig. 6);
- Mesonotum completely covered by two sclerites, a w-shaped transverse suture is lacking (Fig. 6, s);
- Metanotum incompletely sclerotized and covered by six sclerites (two anteromedian, two posteromedian, two lateral sclerites (Fig. 6, t);

- Prosternal horn present;
- Protuberances on first abdominal segment are present (Fig. 6, f; 7).

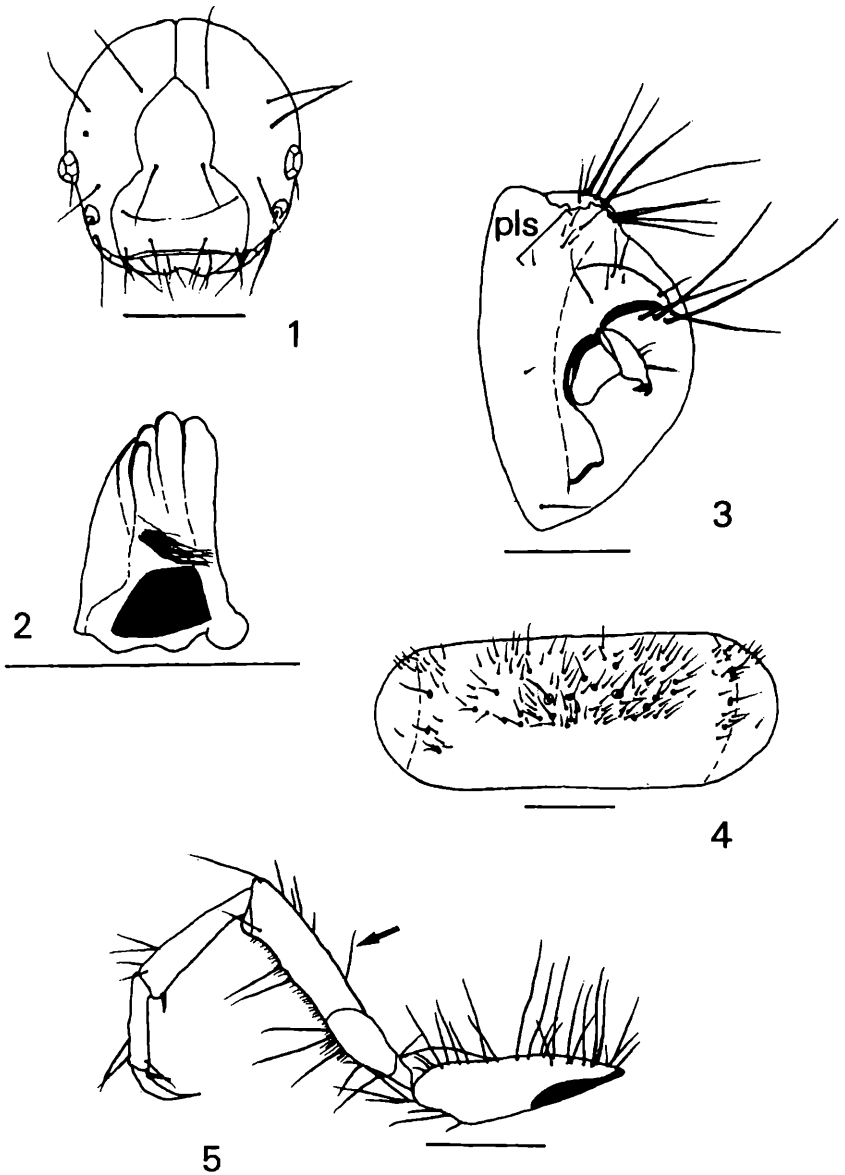
In *P. pallidus*, gills are exclusively of the single-filament type (Fig. 7). The head capsule is evenly rounded (Fig. 1) and lacks a rim around the frontoclypeus, a central concavity, a woolly layer of hairs or additional setae present in larvae of several Drusinae species. In addition, a large sclerotized plate is lacking on the first abdominal sternum (Fig. 4), the pronotum is evenly rounded and the mandibles are fitted with teeth along edges (Fig.2). Finally, a large posterior sclerite on the lateral protuberance of the first abdominal segment (Fig. 7), one proximo-dorsal seta on the dorsal edge of the hind femur (Fig. 5), a group of postero-lateral setae on the ninth abdominal segment (Fig. 3) and numerous, short black setae on a uniformely coloured pronotum (Fig. 6, p) leads to couplet 34 B (page 164) of the Limnephilid key (WARINGER & GRAF 1997). At this couplet, *P. pallidus* keys out together with *Potamophylax nigricornis*. Unfortunately, we were not able to find any reliable morphological characters for the separation of the two species. In contrast to *P. nigricornis*, we noticed a high proportion of *P. pallidus* larvae where the anterior half of the head capsule was distinctly darker than the posterior half; this was especially true at the frontoclypeus which had an almost blackish anterior portion in many specimens. In addition, we noticed many larvae of *P. pallidus* where the black postero-lateral markings of the mesonotal sclerites extended to the anterior corners of the sclerites; in *P. nigricornis*, these markings were confined to the postero-lateral corner. However, these characters were not consistently present and we do not make any attempt to separate the two species by now.

3 Description of final instar larva

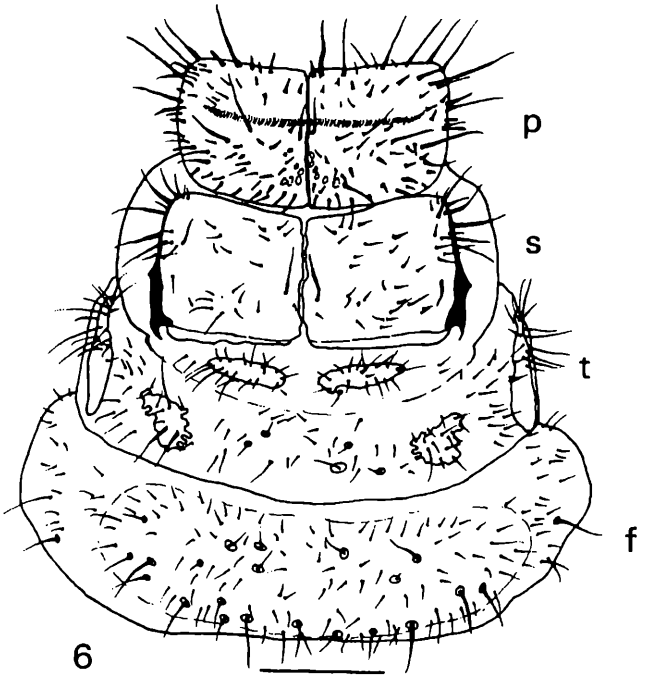
Material examined: 91 fifth instar larvae of *Potamophylax pallidus* and 52 fifth instar larvae of Potamophylax nigricornis.

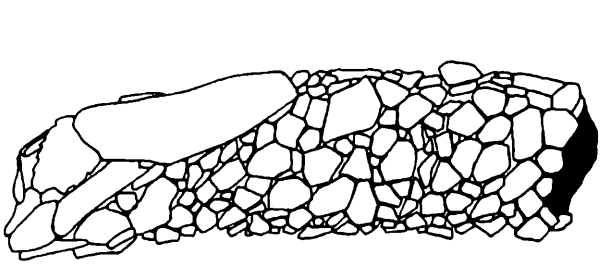
Body length: 16.6–20.5 mm, head width: 1.9–2.5 mm. Larval case very slightly curved and almost straight, cylindrical, made mainly of mineral particles; only few cases were mixed mineral (anterior two thirds)-detrital (mainly leaf fragments; Fig. 8). Case length: 19.0–24.1 mm; maximum case width: 5.0–6.5 mm; minimum case width: 5.0–6.0 mm.

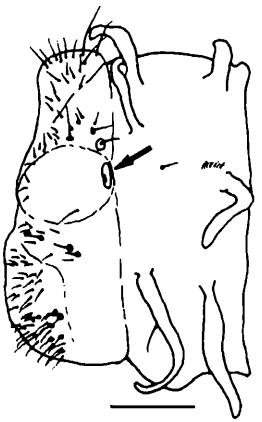
Thoracic sclerites medium brown in colour, abdominal sclerites yellowish brown. Anterior half of frontoclypeus blackish brown to black, anterior half of parietalia dark chestnut brown. Head capsule evenly rounded and without additional setae (Fig. 1). Mandibles black, with teeth along edges and with ridges in central concavity (Fig. 2).



Figs. 1–5: *Potamophylax pallidus*, last instar larva. 1: head; frontal view; 2: left mandible, median view; 3: tip of abdomen, left lateral view; 4: first abdominal sternum; 5: left hind leg, posterior face. pis = postero-lateral setae on ninth abdominal segment, arrow = proximo-dorsal seta on third femur. Scale bars = 1 mm







Figs. 6–8: *Potamophylax pallidus*, last instar larva. 6: thorax and first abdominal segment, dorsal view; 7: first and second abdominal segment, left lateral view; 8: case, right lateral view. f = first abdominal segment, p = Pronotum, s = mesonotum, t = metanotum, arrow = large sclerite on posterior region of first abdominal lateral protuberance. Scale bars = 1 mm

Pronotum with transverse rim at the anterior third and densely covered by short, black setae (Fig. 6, p). Metanotum with narrow anteromedian sclerites, their maximum width (measured from anterior to posterior border) distinctly smaller than their median separation (Fig. 6, t). A large group of setae is present between both posterior metadorsal sclerites (Fig. 6, t). Anterior and posterior faces of mid and hind femora without additional setae (e.g. Fig. 5) and with only one proximo-dorsal seta on third femur (Fig. 5, arrow).

Posterior region of first abdominal lateral protuberance with a distinct large sclerite without setae, but with one to three holes (Fig. 7, arrow). Setal counts on first abdominal sternum are 100 and more with sclerotized bases of setae well separated from each other and never fused (Fig. 4).

Lateral fringe present from posterior border of second (Fig. 7) to the end of eighth segment. All gills are single-filament (e.g. Fig. 7). At most, dorsal gills are present from second (presegmental) to seventh segment (presegmental), lateral gills from second (dorsolateral presegmental) to fourth segment (ventrolateral postsegmental) and ventral gills from second (presegmental) to seventh segment (postsegmental).

On ninth abdominal dorsum, several postero-lateral setae are present (Fig. 3, pls). In addition, two intermediate C-setae are present on the ninth abdominal tergite.

4 Habitat and distribution

The stream Ščavnica originates in the forested area of the northern part of the Slovenske gorice (NE Slovenia), at an altitude of 330 m. The dominating bottom substrate consisted of sand and gravel, with rare patches of cobbles in-between. The annual water temperature ranged from 1.4 °C to 12.4 °C, whereas conductivity range was 380-600 µS/cm. The stream had alkaline pH (7,9-8,6) and high oxygen saturation over the whole year (> 90 %). Detailed morphological and physico-chemical data are given in URBANIČ & al. (2000). Other Trichoptera species observed at this location were *Rhyacophila hirticornis* MCLACHLAN, *Rhyacophila laevis* PICTET, *Wormaldia occipitalis* (PICTET), *Plectrocnemia conspersa* Curtis, *Chaetopteryx rugulosa* Kolenati, *Chaetopteryx major* MCLACHLAN, *Crunoecia kempnyi* MORTON, *Beraea pullata* (CURTIS), *Ernodes vicinus* (MCLACHLAN) and *Ernodes articularis* (PICTET). The distribution of *P. pallidus* in Slovenia and adjacent regions is shown in Fig. 9.

The habitats are very similar to those reported for *Potamophylax nigricornis*, i.e. springs and upper sections of spring brooks (DITTMAR 1955, IVERSEN 1976, HIGLER & SOLEM 1986). *P. pallidus* was frequently observed in wet leaf packages alongside the border of springs, but pupae were found only in spring brooks. Prior to pupation specimens probably migrate into small spring brooks

as observed in *P. nigricornis* by DITTMAR (1955) and IVERSEN (1976). It seems that these species occupied similar habitats. According to HIGLER & SOLEM (1986) and TOBIAS & TOBIAS (1981), *P. nigricornis* is a spring species with a flight period from April to July. However, in Slovenia, both species are on the wing in summer and early autumn (KRUŠNIK 1984, 1987b, 1991; KOS, 1985; URBANIČ 1999).

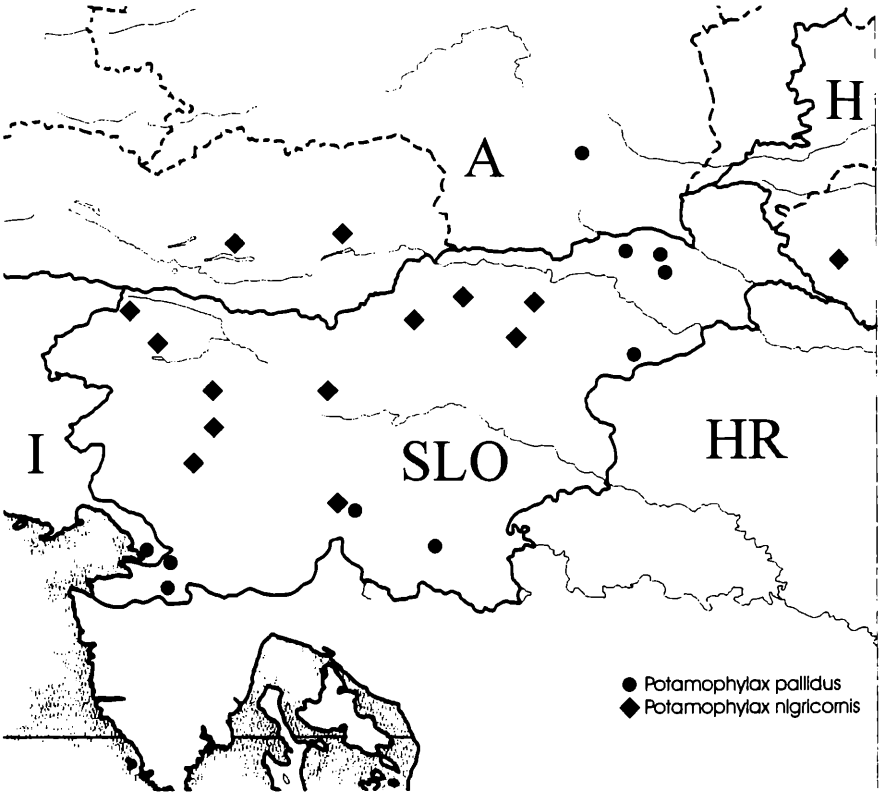


Fig. 9: Distribution of *P. pallidus* in Slovenia and adjacent regions of Austria. Map data after BOTOSANEANU & MALICKY (1978), KRUŠNIK (1984), KOS (1985), URBANIČ (1999) and URBANIČ (unpublished)

Based on its distribution pattern in Europe *P. pallidus* is considered a Central-SE-European species (KUMANSKI & MALICKY 1999). The species is known from Austria (MALICKY 1999), Slovenia (KRUŠNIK 1991, KRUŠNIK & URBANIČ 2000, URBANIČ 1999), Croatia (URBANIČ, unpublished), Bosnia and Herzegovina (RADOVANOVIĆ 1935, MARINKOVIĆ-GOSPODNETIĆ 1975) Yugoslavia (MARINKOVIĆ-

GOSPODNETIĆ 1975, KRUŠNIK 1987a) Macedonia (MARINKOVIĆ-GOSPODNETIĆ 1975, URBANIČ, unpublished), Bulgaria (KUMANSKI 1988), and Greece (BOTOSANEANU & MALICKY 1978). Some adult specimens were collected also at the small stream Krvavi potok, which marks the border between Slovenia and Italy (URBANIČ, unpublished). In contrast, *P. nigricornis* is widespread in Europe, but lacking in Great Britain, Ireland and Iceland (BOTOSANEANU & MALICKY 1978, WALLACE & al. 1990).

According to our present knowledge, both species seem to be more or less separated from each other in middle Europe. However, at several streams of the Dinaric region of Slovenia, adult specimens of both species were caught by the same light trap (RADOVANOVIĆ 1935; KOS, 1985; KUMANSKI, 1988), suggesting that both species may be syntopic in suitable habitats.

5 Life cycle

Larvae, pupae and adult specimens were collected on ten occasions between 15 October 1998 and 15 September 1999 and revealed an univoltine life cycle (Table 1). Instar 2 was collected from August until October. Most specimens overwintered in instars 3 and 4. However, instar 5 was sampled as early as January and it was present in all further samplings until August. First pupae appeared at the end of April and were found until September, whereas adults were caught from June to September. However, in southwest Slovenia, adult specimens were found until the second half of October (KRUŠNIK 1991).

Table 1: Life history table of *Potamophylax pallidus*, showing the temporal distribution of instars 2-5, pupae (P) and adult specimens (A) in the River Ščavnica. Date: day-month-year, HW = Head width range (mm)

	Date	15-10 1998	01-12 1998	15-01 1999	01-03 1999	02-04 1999	29-04 1999	28-05 1999	26-06 1999	14-08 1999	05-09 1999
Instar	HW										
2 (n=8)	0.59-0.64	+								+	+
3 (n=5)	0.92-1.02	+									
4 (n=12)	1.54-1.63										
5 (n=64)	1.89-2.48										
P (n=15)											
A (n=20)									+	+	+

As only instars 2-5 could be collected in the field, the head width of first instar larvae was extrapolated using Dyar's rule (MACKAY 1978) by plotting instar number against the logarithm of the head capsule width ($y = 0.195x - 0.61$, $r = 0.998$; Fig. 10).

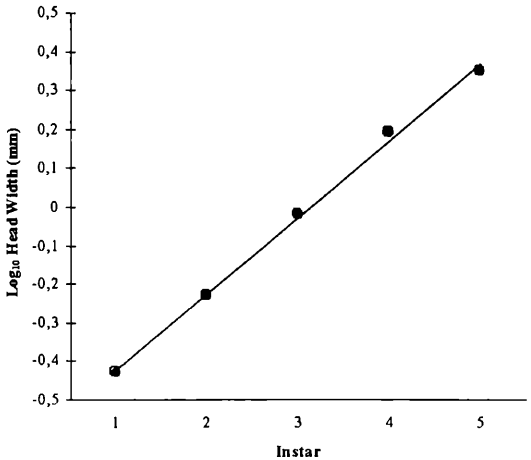


Fig. 10: *Potamophylax pallidus.* Semi-logarithmic plot of larval instar *versus* head width

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Author's addresses: Gorazd Urbanič, Department of Biology, Biotechnical Faculty, University of Ljubljana, Večna pot 111, SI-1001 Ljubljana, Slovenia; e-mail: Gorazd.Urbanic@uni-lj.si. Dr. Johann Waringer, Limnological Department, Institute of Ecology and Conservation Biology, University of Vienna, Althanstraße 14, A-1090 Vienna, Austria; e.mail Waringer@pflaphy.pph.univie.ac.at

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