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## A survey of the genus *Potamophylax* WALLENGREN 1891 in the Balkan Peninsula, with description of two new species (Trichoptera: Limnephilidae)

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**Key words:** Trichoptera, *Potamophylax*, new species, Balkan Peninsula, distribution

**Abstract.** *Potamophylax juliani* n.sp. from western Bulgaria (Osogovo Mts.) and *P.haidukorum* n.sp. from northern Bosnia, both close relatives of *P.winneguthi* from Bosnia, are described. The lectotype of *P.winneguthi*, most probably representing the specimen figured by KLAPÁLEK (1902), is designated. The male genitalia of these species are figured. The Bulgarian populations of *P.cingulatus* belong to ssp. *depilis*. Notes on the distribution of *P.borislavi* are given. *P.goulandrionum* is newly recorded for Macedonia. A survey of the distribution of the 13 species of the genus known in the region is given.

### Introduction

The following species of the genus *Potamophylax* are now known from the Balkan Peninsula: *P.borislavi* KUMANSKI 1975, *P.cingulatus* (STEPHENS 1837) (with *P.cingulatus depilis* SZCZESNY 1994), *P.goulandrionum* MALICKY 1975, *P.gurunaki* MALICKY 1992, *P.haidukorum* sp. n. MALICKY, *P.juliani* sp. n. KUMANSKI, *P.latipennis* (CURTIS 1834), *P.nigricornis* (PICTET 1834), *P.pallidus* (KLAPÁLEK 1899), *P.rotundipennis* (BRAUER 1857), *P.schmidti* MARINKOVIĆ 1970, and *P.winneguthi* (KLAPÁLEK 1902).

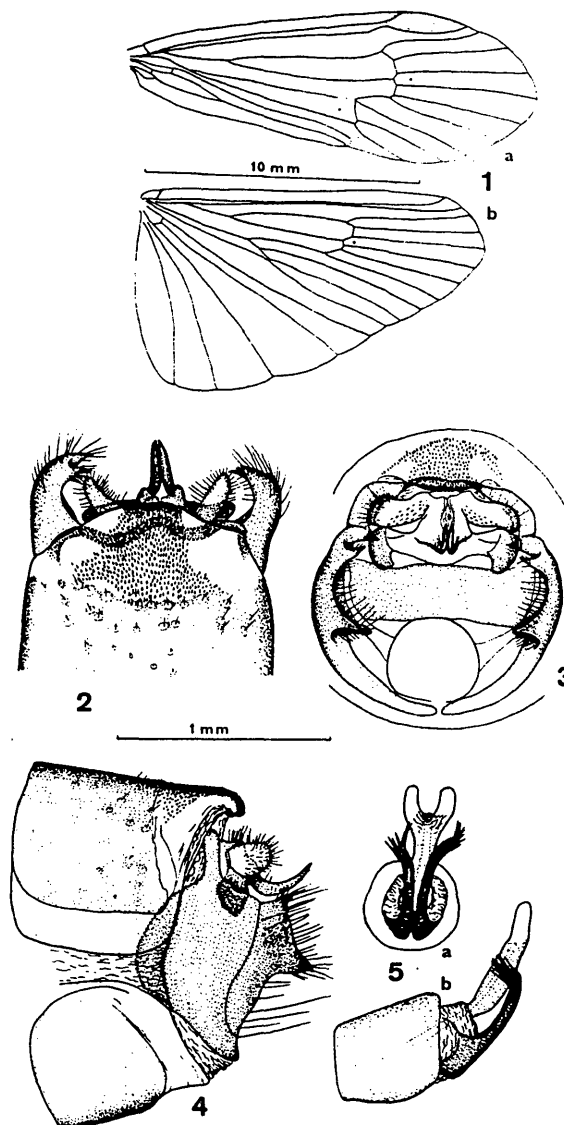
### Description of the new species

#### *Potamophylax juliani* n.sp. KUMANSKI

Description of male. Similar to *P. winneguthi*. Head, palps and antennae dark brown; prothorax lighter, yellowish-brown; sclerites of meso- and metathorax and all coxae dark brown to black; femora and tibiae (including spurs) smoky yellow-brown, tarsi gradually darkening toward apex. Abdominal tergites and sternites smoky brown, relatively light; pleurae whitish. Forewing uniformly smoky brown, except for the pterostigma area (specimen in alcohol). Hindwing hyaline. Wing venation (Fig. 1a, b) and chaetotaxy as in *winneguthi*. Length of forewing 15 mm. Spurs: 1,3,4.

Male genitalia: general structure also following the pattern of *winneguthi*. Tergite 8 with a zone, not symmetrical, of small, dark spinules, scattered on its semi-membranous distal portion; the larger proximal portion well sclerotized (Fig. 2), brown, somewhat darker than the preceding tergites. Lateral portions of segment 9 broad, their rounded proximal areas entering deeply into segment 8 (Fig. 4); distal margins of these portions a stretched, reversed S, the inferior appendages broadly attached. Both dorsal and ventral regions of segment 9 very short; dorsal one represented by a faint sclerotized bridge, ventral one interrupted at the middle (Fig. 3). Superior appendages small, laterally rounded, ovoid, dorsally set to each other at a right angle. Intermediate appendages as long, slender and acuminate sickles. Inferior appendages quite short, their protruding upper portion also shortened, directed almost caudad, as high as half of the entire appendage's height; both the dorsal and ventral corners forming strong points, directed mesially (Figs. 3, 4). Structure of segment 10 complicated; the latero-basal corners strongly sclerotized, situated below the superior appendages (Fig. 3). A broad semi-membranous area between the bases of the inferior appendages separates the segment 10 from the opening of the phallic apparatus. Phallic apparatus with a voluminous phallobase, a phallus feebly sclerotized, enlarged and deeply incised at the tip, and a pair of parameres. The latter characteristically shaped: robust, strongly sclerotized and black-brown, bearing a terminal bunch of moderately sized, conspicuous, spines (Fig. 5a, b); parameres broadly attached to the basal phallic membrane, clearly shorter than the phallus. Female: unknown.

Material studied: Osogovo Mts. (W-Bulgaria), upper stream of the Mlachka river, with very small brooklets nearby (mixed coniferous and deciduous forest, 1600-1700 m a.s.l.), 10.11.1996. Holotype male (leg. Kumanski). The type specimen deposited (in alcohol, the abdomen separated and treated in KOH) in the collection of the National Museum of Natural History, Sofia.



Figs. 1-5: *Potamophylax juliani* sp. n., holotype male. 1 - fore (a) and hind (b) wing; 2 - genitalia (aedeagus omitted), dorsal; 3 - the same, caudal; 4 - the same, lateral; 5 - aedeagus, caudal (a) and lateral (b).

**Discussion:** *Potamophylax juliani* sp. n. is a very close relative of *P. winneguthi* and *P.haidukorum* n. sp. These three species, together with *P.gurunaki* from northern Greece, form a tetrad of endemics inhabiting mountains of the central and north-western part of the Balkan Peninsula. The following distinctive features in the male genitalia separate *P.juliani* n.sp. (though known only from a single specimen so far) from *P.winneguthi* and *P.haidukorum* n.sp.: a) - the shape of the parameres - strongly sclerotized and robust, considerably shorter than the aedeagus, bearing a terminal bunch of strong, moderately long spines (*juliani* n.sp.); slender, more or less sinusoidal and as long as the aedeagus, with several (5-6) long spines, each of them set separately from the others along the distal half of the aedeagus (*winneguthi*), or without any additional spines (*haidukorum* n.sp.); b) - dimension and proportions of the upper part of the inferior appendages - short and broad (the ratio length/height is 1:2), its caudal corners forming two sharp, turned mesally, points, well visible from caudally and laterally (*P.juliani* n.sp.), and longer but narrower (as long as high) one, with its caudal points somewhat less developed, better visible caudally (*winneguthi* and *haidukorum*). The intermediate appendages appear somewhat slender and more acuminate in the new species. Finally, these three species can be roughly distinguished from their geographical isolation within the Balkans.

The above comparison of the new species has been made after re-examination of two males from the type series of *P.winneguthi*, and the type material of *P.haidukorum*.

Derivatio nominis: named after the first author's younger son.

*Potamophylax haidukorum* n.sp. MALICKY

Description of male: Head and appendages brown, prothorax reddish yellow, sclerites of meso- and metathorax and coxae brown. Femora, tibiae and tarsi reddish yellow, the tarsi (in particular those of the fore legs) continuously darkened to their ends by a brown, adjacent pilosity. Abdomen irregularly brownish speckled. Length of anterior wings 11-18 mm, smoky brown, costal area whitish. There are white spots near the bases of the forks 2 and 4, proximal to the main bifurcation of the media, and along the transverse vein between Cu2 and An1. The principal veins bear rows of long, projecting hairs which are longest and most dense on Cu and An. The wing membrane bears also, in its basal part, shorter, projecting bristles, otherwise it is covered with a fine pubescence. Hindwings transparent, almost colourless, very slightly tinged brown. Male genitalia (Fig.8-11): Tergite 8 with a dorsal irregular area of bristles. Segment 9 laterally broad, ventrally narrow, dorsally narrow and medially interrupted. Preanal appendages square and rounded. Intermediate appendages long, sickle-shaped, turned upwards. Inferior appendages broadly connected with the segment, parallel-edged, dorsally truncated in a rectangular manner, slightly longer on their ventral edge, with a slightly downward curved point. Aedeagus long and slender, bulbous, with two distally protruding papillae, but narrow in the middle part. The parameres are two simple sticks each with a terminal bristle, curved in a characteristic lyre-shaped manner as shown in the figure. This is the main difference for separating this species from *P. winneguthi* and *P. juliani*.

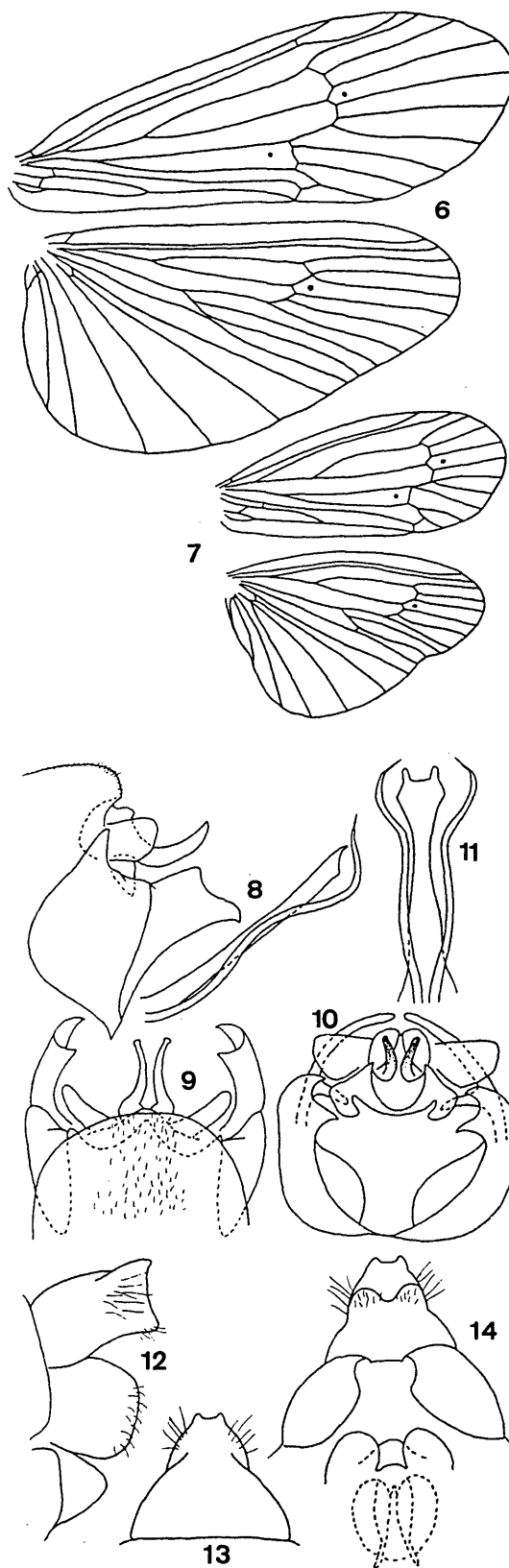
While the male is a normally shaped caddisfly like other *Potamophylax* species, the female resembles a *Chaetopteryx*, in being brachypterous and unable to fly. The females have the same colours as the males, but the brown of the body is lighter. Forewings light reddish brown, 7-12mm long. The light patches are arranged as in the male, but with less contrast. The wing membrane is vaulted so that the wings envelope the body; flight is not possible. The thorax is distinctly more slender than in the male and has reduced wing musculature. The veins of the forewings are densely covered by long, projecting strong hairs. Slightly shorter and finer hairs are found on the membrane itself. Hindwings transparent. The female genitalia (Fig. 12-14) include a large cone, reminiscent of several species of *Allogamus*. There seems to be no clear feature for separating the females of *P. haidukorum* and *P. winneguthi*.

Holotype male, and many paratypes males and females, from the surroundings of the Motel Hajdučka voda (Bosnia), between Dobož and Banja Luka, field-collected 28.10.1988, and bred in 1989 and 1990, in the collection of the second author. One pair (male and female) in the collection of the National Museum of Natural History, Sofia.

This species has already been described by MALICKY & KRUŠNIK (1991) under the name *Potamophylax winneguthi*, together with a description of the biology. The males had been identified from the drawings by KLAPÁLEK (1902) which are quite good but not detailed enough to see clearly that we had another species. In the light of the findings of the first author, particularly his study of the type series, it is now clear that the specimens from Hajdučka voda are not *P. winneguthi*. The second author had collected two males and a dozen females from Hajdučka voda (see above), and one female from Vareš near Sarajevo, on 2 November 1988. Eggs from both places were obtained from the females, and a following generation was bred in the laboratory which resulted in many males and females from Hajdučka voda, but only one male and several females from Vareš. This confirmed that these strongly sexual-dimorphic specimens belonged together. Now, after the study of KLAPÁLEK'S types by the first author, these specimens were re-examined, and it was found that those from Hajdučka voda represented a new species, but those from Vareš belonged to *P. winneguthi*, whose field-collected female could not be distinguished from the *haidukorum* females.

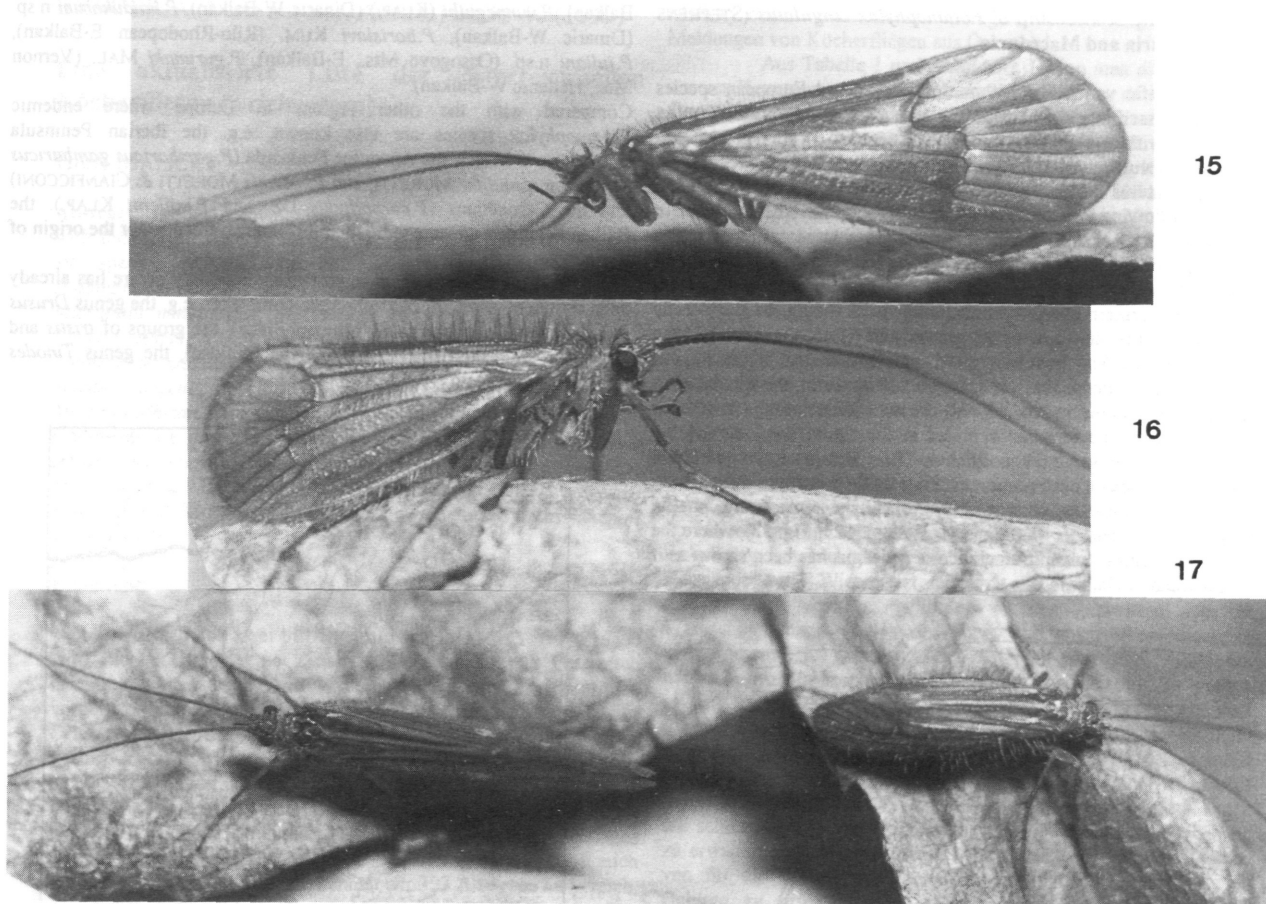
Derivatio nominis: named after the place where the specimens were been collected.

Details of the extraordinary biology of this species have been given by MALICKY & KRUŠNIK (1991), with photographs of the adults. To repeat the most important points: the larvae live in tiny brooklets in the beech forest where the free water is minimal between the fallen leaves, but they are nevertheless water-breathing and may be bred in a normal way in an aerated tank. The pupae have strongly reduced swimming hairs, and are unable to swim. The number of larval gills is reduced to a maximum of 20, that of the pupa to about 4 to 12. The species is strictly seasonal, with the activity period of the adults in September to November, but with a developing cycle which covers facultatively one, two or more years, which is, to the best of our knowledge, not known for other caddisflies in temperate regions.



Figs 6-14: *Potamophylax haidukorum* n.sp. – 6 – wings of male. 7 – wings of female. 8 – male genitalia lateral, 9 – dorsal, 10 – caudal, 11 – aedeagus and parameres ventral. 12 – female genitalia lateral, 13 – dorsal, 14 – ventral.

Adults of the closely related *P. gurunaki* were found, in the Vernon Mountains in northern Greece, in a similar biotope, so they may have a similar biology, as for *P. winneguthi* and *P. juliani*. The second author cannot remember in which circumstances the single female of *winneguthi* was found near Vareš.



Figs. 15-17: Adults of *P. haidukorum*: 15 – male, 16 – female, 17 - couple

#### Diagnostic characteristics of *Potamophylax winneguthi* from males of the type series

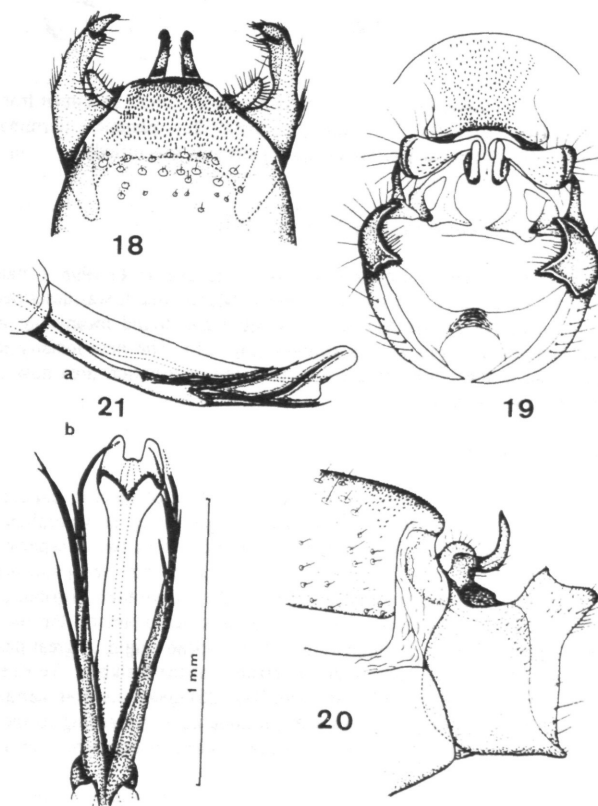
After the somewhat unexpected discovery in Bulgaria of *P. juliani*, closely related to the Bosnian endemic *Potamophylax winneguthi*, it has become necessary to compare these two forms. The only other source of taxonomic information available so far was the paper by KLAPÁLEK (1902), where both the text and figures of male genitalia appear good enough for current identification. Thanks to the courtesy of the Czech Ministry of Culture, and of Dr. P. Chvojka (National Museum, Museum of Natural History, Prague), the first author could revise the type series of *P. winneguthi*. There are two pinned males in it (instead of four as given in the description), each with a label: "12/11. *Winnegth.* (sic!) Sarajevo. 99", and "*winnegthi* (sic!) Klapálek" on the reverse side, and "*winnegthi* (sic!) Klapálek", resp. "*Wgth.* (sic!) Pale", all the labels are typewritten except the last one, which is in Klapálek's handwriting. Having cut and cleared the abdomen of the specimen from Sarajevo, the genitalia have been drawn (Figs. 18-21) and put into a hermetically closed plastic tubes in glycerine, attached to the same needle. Since no indications of types were found, red labels "Lectotype, design. Kumanski, 1998" have been added to the needle, with the syntype from Sarajevo, and "Paralectotype, design. Kumanski, 1998" to the second one.

#### New records of *Potamophylax borislavi* KUMANSKI 1975

The species has been described and known so far from two males from two localities in the Bulgarian part of the Rhodopes Mts. (KUMANSKI, 1975). Later, two males were found in the Greek part of the same mountain, near Dasiko Chorio, 1300m, in Elatia area, 10.10.1991 (MALICKY, 1994).

New locality: Bulgaria, Rila Mts., River Slavova, above the Tchaira-Dam, ca 1350 m a.s.l.: 22-23.08.1997, one male; 1-2.10.1997, 2 males (in both cases leg. Kumanski, at light).

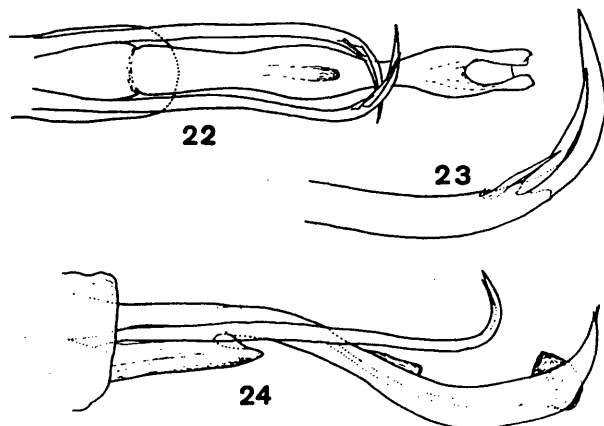
The new locality is situated at c. 100 km to the NW from the Smolyan district, where the species was known before. Thus, *P. borislavi* appears to be an endemic from both the Rila and the Rhodopes Mts., and not only from the second mountain, as earlier suggested by KUMANSKI (1988).



Figs. 18-21: *Potamophylax winneguthi* (KLAP.), lectotype male. 18 - genitalia (aedeagus omitted), dorsal; 19 - the same, caudal; 20 - the same, lateral; 21 - aedeagus, strongly magnified, lateral (a) and ventral (b).

### The sub-specific relationship of *Potamophylax cingulatus* (STEPHENS 1837) in Bulgaria and Macedonia

The infra-specific variability within this widespread European species has been discussed in a recent paper by MORETTI, SZCZĘSNY & TOBIAS (1994). As with some other widespread species of this genus (e.g. *P. luctuosus*, occurring from Central Europe to the Caucasus), the main distinctive features of *P. cingulatus* are in the shape of the phallic apparatus. Following this statement, four subspecies have been defined in the co-paper cited above. Having re-examined a large series of males from all high mountains in Bulgaria, we have found that they correspond well with the subspecies *P. c. depilis*. Thus, the distribution of this form known in the northern and eastern Carpathians including the Bieszczady Mts. in Poland stretches now to the greater part (if not the whole) of the Balkan Peninsula. The populations of some mountains in the Balkan Peninsula (Stara planina, Vitosha, Ossogovo, Rila, Pirin, the Rhodopes in Bulgaria, Shar planina in Macedonia) do not differ notably from each other. In general, the terminal spinules at the tip of the lobes of the aedeagus vary from 6 to c. 10 in number. The males have two additional sub-terminal spines on each paramere (Figs. 22-24). Further, these newly drawn figures come to correct the erroneously represented phallic apparatus of *P. cingulatus* (KUMANSKI, 1988, p. 123, Fig. 52), where the medio-distal membranous protuberance of aedeagus has been shown as if having divided the latter.



Figs. 22-24: *Potamophylax cingulatus depilis* SZCZ., male specimen from Vitosha Mts., Bulgaria. 22 - aedeagus, dorsal; 23 - paramere (terminal portion); 24 - aedeagus, lateral (all figures strongly magnified).

### *Potamophylax goulandriorum* MALICKY 1975

New locality: Macedonia, Shar Mts., River Tetovska, 16.11.1996, 1 male pupa (det. Kumanski). The species is new to Macedonia. It was described from Greece (Parnassos and Olympos Mts.) and found meanwhile in many mountain ranges in this country (Fig. 25). The new locality in Macedonia is the northernmost one, thus the distribution area now is considerably enlarged.

### Zoo-geographical notes

The genus *Potamophylax* now consists of 23 taxa of specific and sub-specific rank. They include 18 species, three being polymorphous: *P. cingulatus*, with four subspecies, *P. gambaricus* with two subspecies, and *P. luctuosus* with 2 subspecies, the latter not yet published (KUMANSKI, in preparation). All but two of them have their distribution within the limits of Europe, which places this genus among the most typical examples of a Trichoptera-unit of European origin. A great deal of the species diversity occurs in the territory of the Balkans. Thirteen species are known there, seven of them (Fig. 25) endemics from certain mountain systems, or even from a single mountain. According to their distribution, following categories of species can be distinguished in the Balkan Peninsula:

Trans-European: *P. latipennis* (CURT.), *P. rotundipennis* (BRAU.), *P. cingulatus* s. l. (STEPH.), *P. nigricornis* (PICT.);  
 Central-SE-European: *P. pallidus* (KLAP.);  
 Carpathian-Balkan: *P. cingulatus depilis* SZCZ.;  
 Balkan endemics (including local ones): *P. goulandriorum* MAL. (Hellenic and Dinaric W-Balkan), *P. schmidi* MARINK. (Dinaric W-

Balkan), *P. winneguthi* (KLAP.) (Dinaric W-Balkan), *P. haidukorum* n.sp. (Dinaric W-Balkan), *P. borislavi* KUM. (Rilo-Rhodopean E-Balkan), *P. juliani* n.sp. (Ossogovo Mts., E-Balkan), *P. gurunaki* MAL. (Vernon Mts., Hellenic W-Balkan).

Compared with the other regions in Europe where endemic *Potamophylax* species are also known, e.g. the Iberian Peninsula (*P. albergaria* MAL.), the Apennine Peninsula (*P. gambaricus gambaricus* MAL., *P. g. spinulifer* MORETTI, and *P. inermis* MORETTI & CIANFICCONI) and the Carpathians (*P. carpathicus* DZ. and *P. millenii* KLAP.), the Balkan Peninsula appears to be the most intensive centre for the origin of forms.

The role of the Balkans as an important evolutionary centre has already been shown by some other Trichoptera-complexes, e.g. the genus *Drusus* and the tribe *Chaetopterygini* (Limnephilidae), the groups of *tristis* and *stigmatica* of genus *Rhyacophila* (Rhyacophilidae), the genus *Tinodes* (Psychomyiidae), etc.

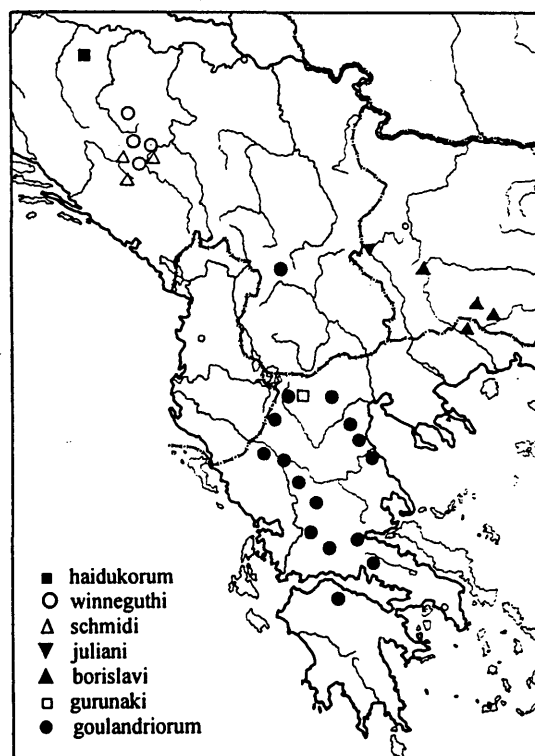


Fig. 25: Distribution of the endemic species of *Potamophylax* of the Balkan Peninsula.

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