

**Mayflies of the Crimean Peninsula. II. *Baetis braaschi*
ZIMMERMANN, 1980 (= *B. stipposus* KLUGE, 1982 syn. n.)
(Ephemeroptera: Baetidae)**

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Abstract. *Baetis braaschi* ZIMMERMANN, 1980, a little known species of subgenus *Rhodobaetis* JACOB, 2003 has been redescribed and illustrated. The synonymy of *B. braaschi* and *B. stipposus* KLUGE, 1982 has been ascertained, and possible synonymy with *B. bisri* THOMAS & DIA, 1983 has been discussed. The additional description of winged stages of *B. braaschi* has been given. The distinguishing characters, which separate these species from other close ones of the subgenus *Rhodobaetis*, have been analyzed. The generalized data on the species distribution and its natural history has been given.

Key words: Ephemeroptera, Baetidae, *Baetis*, *Rhodobaetis*, *Baetis braaschi*, Caucasus, Crimean Peninsula, Central Asia.

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I. INTRODUCTION

The description of the species *B. braaschi* was first published by ZIMMERMANN (1980) on the basis of three larvae specimens found in 1970 by D. BRAASCH in the southern part of the Crimea, in Yalta town. This material is considered to be the only one known regarding this species. For the next two decades, this species was studied once by NOVIKOVA (1987). Whilst making a revision of the family Baetidae from the USSR, she included illustrations and additional distinguishing characters of *B. braaschi*.

KLUGE (1982) described two new species of *B. rhodani* species-group (*B. oreophilus* KLUGE, 1982 and *B. stipposus* KLUGE, 1982) and for the first time gave the description of larva of *B. mycetopis* BRODSKY, 1930 from Central Asia (Uzbekistan, Kazakhstan, Turkmenistan, Tajikistan). Whilst studying the benthos of the Upper Salgir River KISELEVA (1987) recorded *B. stipposus* from the Crimea and further on cited it as a typical component of aquatic fauna of the Peninsula (KISELEVA & VASYUTA 1986; KISELEVA 1992, 1997). NOVIKOVA (1987) during her study on the distribution of *B. stipposus*, recorded it from the Central Asia, the Caucasus and the Crimea; in the latter case on the basis of one larva only, collected by A. G. KISELEVA on the 7th of July 1984 from the Al'ma River. At the same time she supposed that *B. bisri*, which had been described from south-western Lebanon by THOMAS & DIA (1983) might be a junior synonym of *B. stipposus*. JACOB (2003) has cited from the Crimea only the species *B. braaschi*.

Thus, in recent years two closely related species of subgenus *Rhodobaetis* were recorded from the Crimea, namely *B. braaschi*, known only by specimens of type series, and *B. stipposus*, which has been cited several times and the data on which were confused.

In this paper, the redescription of *B. braaschi* larvae has been presented by the rich material collected between 1984 and 2002 in mountains and foot-hills of the Crimea. The main distinguishing characters of larva are pictured and illustrated by photographs taken in scanning electron microscope. The additional description of winged stages is given. Combination of distinguishing characters of larva and male imago, separating *B. braaschi* from closely related species of subgenus *Rhodobaetis* is also given and the synonymy of *B. braaschi* and *B. stipposus* is ascertained. The possible synonymy of *B. braaschi* and *B. bisri* is discussed. Finally the data on distribution and natural history of *B. braaschi* are cited.

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II. SYSTEMATICS

Baetis braaschi ZIMMERMANN, 1980

(Figs 1-23)

Baetis stipposus KLUGE, 1982: 18 syn. n.

Baetis stipposus KLUGE: NOVIKOVA, 1987: 53

Baethis [sic!] *tiposus* [sic!]: KISELEVA & VASYUTA, 1986: 57 partim; KISELEVA, 1987: 85 partim

Baethisgr. [sic!] *steposus* [sic!]: KISELEVA, 1992: 116 partim

Baethis [sic!] *stiposus* [sic!]: KISELEVA, 1997: 40 partim

Baetis braaschi ZIMMERMANN: GODUNKO, PROKOPOV, 2000: 77; JACOB, 2003: 86

Baetis braaschi [sic!] ZIMM.: PROKOPOV, 2000: 30

Baetis braaschi ZIMM.: PROKOPOV, 2000: 30

Baetis braaschi: PROKOPOV, 2001: 35

M a t e r i a l e x a m i n e d: UKRAINE, AUTONOMOUS REPUBLIC OF THE CRIMEA: 6 larvae, Stilia River, 20.VI.1984, leg. G. A. KISELEVA; 1 larva, Al'ma River, 7.VII.1984, leg. G. A. KISELEVA; 35 larvae, Bel'bek River near Frontove village, 1.VI.1999, leg. R. J. GODUNKO; 3 larvae, Angara River (Pereval'ne village), 24.VI.1999, leg. G. A. PROKOPOV; 9 larvae, Bel'bek River near Frontove village, 9.IV.2000, leg. G. A. PROKOPOV; 1 larva, Burul'cha River near Tsvetochnoe village, 14.VI.2000, leg. R. J. GODUNKO; 2 larvae, the stream near Pryvitne village, 18.VI.2000, leg. R. J. GODUNKO; 3 larvae, 2 km E Zelene village, 21.VI.2000, leg. R. J. GODUNKO; 26 larvae, Kacha River downstream of Mostove village, 21.VI.2000, leg. R. J. GODUNKO; 21 larvae, Al'ma River near Pochtove village, 22.VI.2000, leg. R. J. GODUNKO; 1 larva, Chorna River near Chornorichens'ke village, 4.I.2001, leg. G. A. PROKOPOV; 9 larvae, 1 larval skin, Al'ma River downstream of Tarver Boundary, 30.VI.2001, leg. G. A. PROKOPOV; 3 larvae, Al'ma River near Asport Boundary, 1.VII.2001, leg. G. A. PROKOPOV; 1 larva, Salgir River (Andrusovo village – Mar'ino village), 11.X.2001, leg. Yu. YAVORSKII; 3 larvae, 2 larval skins, Salgir River near Pioners'ke village, 15.VI.2002, leg. G. A. PROKOPOV; 7 larvae, Salgir River (Lozove village – Poiners'ke village), 17.VI.2002, leg. G. A. PROKOPOV. RUSSIAN FEDERATION, KRASNODARSKIY KRAY: 1 male subimago (reared from larva) Kuban' River near Ust'-Dzheguta village, 11.VIII.1982, leg. N. Ju. KLUGE; GEORGIA: 11 male imagoes, 3 female imagoes, 1 male subimago, 2 female subimagoes, (all with larval skins), Aragvi River near Suguramskii Natural Reserve, 28.VII-2.VIII.1985, leg. N. Ju. KLUGE; TURKMENISTAN: 29 male imagoes, 15 female imagoes, 3 male subimagoes, 5 female subimagoes, 8 larvae, Western Kopet-Dag Range, 24.VI-9.VII.1981, leg. N. Ju. KLUGE (paratypes of *B. stipposus*); UZBEKISTAN: 1 male imago, 9 female imagoes, 10 larvae, 15 km E Guzara, small brook, 17.V.1978, leg. N. Ju. KLUGE (paratypes of *B. stipposus*); KAZAKHSTAN: 2 male imagoes, 25 SW Otar junction, 9.VI.1978, leg. N. Ju. KLUGE (paratypes of *B. stipposus*); TAJIKISTAN: 3 larvae, Garm town, small brook, 5.VIII.1981, leg. N. Ju. KLUGE, (paratypes of *B. stipposus*). All adults of type series of *B. stipposus* were reared from larvae. The specimens were preserved in 80% alcohol. Type series of *B. stipposus* are deposited in the collection of the Institute of Zoology, Russian Academy of Sciences (St Petersburg) and in the Department of Entomology, St Petersburg University. The specimens of *B. braaschi* from the Crimean Peninsula are preserved in the collection of the State Museum of Natural History, National Academy of Sciences of Ukraine and in the collection of G. A. PROKOPOV.

Holotype and paratypes of *B. braaschi* are deposited in the collection of the Gotha Museum of Natural History and labeled as follows: “*Baetis braaschi* n. sp. ZIMMERMANN 1980 • Holotypus • Krim 1970 • D. BRAASCH leg. • Kr. 9 Jalta • 3.6.1970”. The type locality of *B. braaschi* by ZIMMERMANN (1980) is mentioned as follows: “3 Larven, UdSSR: Halbinsel Krim, Jalta, Zuflu zum Schwarzen Meer oberhalb des Ortes, 3. VI. 1970, leg. D. BRAASCH”. These determinations of type locality are rather inexact. There are several rivers and streams flowing through the Yalta town and discharging into the Black Sea within town boundaries. Some water-flows are running within the area of Great Yalta, the administrative district, which stretches for 40 km along the Black Sea coast from Gurzuf suburb to Foros suburb. Possibly it is a small brook coming from Aipetri Mt (D. BRAASCH, pers. com.). The name and locality of water-flow, where the type series of *B. braaschi* was collected, were absent in the original description by W. ZIMMERMANN (1980). Unfortunately, we failed to get from D. BRAASCH more exact information on the type locality and this question is left open.

R e d e s c r i p t i o n. Male imago. The following should be added to earlier description by KLUGE (1982). General color of body light, yellow to yellowish-brown. Turbinate eyes mainly uniformly light yellow, sometimes with hardly visible dirty-yellow strip at the base of shaft of turbinate eyes (in one population males are presented both with unicolorous and “striped” eyes) (Fig. 1). In dorsal view turbinate eyes oval, with slightly convex external margin. Thorax yellow to light brown. Hind wing typical of the species of subgenus *Rhodobaetis*, with a costal process and three simple longitudinal veins (Fig. 2). Legs yellow to light brown. Joints of tarsal segments dark. Occasionally, distal part of femora with hardly visible diffuse dark spot (e. g. in males from the

Aragve River, colored somewhat darker). Abdomen unicolorous yellow, last 3-4 terga distinctly darker than others, yellowish-brown. Basal segment of forceps nearly quadrate, almost as long as wide, slightly drawn closer towards apex (Fig. 3). Segment 1 relatively wide with subparallel margins. Segment 2 distinctly widening towards segment 3, the widened part being $1/2-2/3$ its length. Inner margin of segment 2 clearly concave. Segment 3 oval or asymmetric with truncate inner margin.

Female imago. Length: body 7.3-8.2 mm; fore wings 6.5-7.6 mm; cerci 9.5-11.7 mm. General color of body similar to male imago, sometimes distinctly darker, yellowish-brown. Thorax yellow, sometimes distinctly brown. Wings hyaline, transparent. Fore wings with whitish pterostigmatic area. Venation of wings yellowish-brown. Legs uniformly yellow. Distal femoral dark spot mainly absent. Abdominal segments uniformly whitish-yellow to yellow. Cerci yellow.

Male and female subimago. Length: body 5.7-7.4 mm and 7.0-8.0 mm; fore wings 5.5-6.5 mm and 6.5-7.0 mm; cerci 10.7-12.3 mm and 9.0-11.0 mm. General color of body light yellow to yellowish-grey. A part of specimens investigated considerably darker than imago, light brownish. Turbinate eyes of male unicolorous, whitish-yellow to greyish. Wings and legs unicolorous yellowish-grey. Venation brownish. Distal dark spot on femora generally well visible.

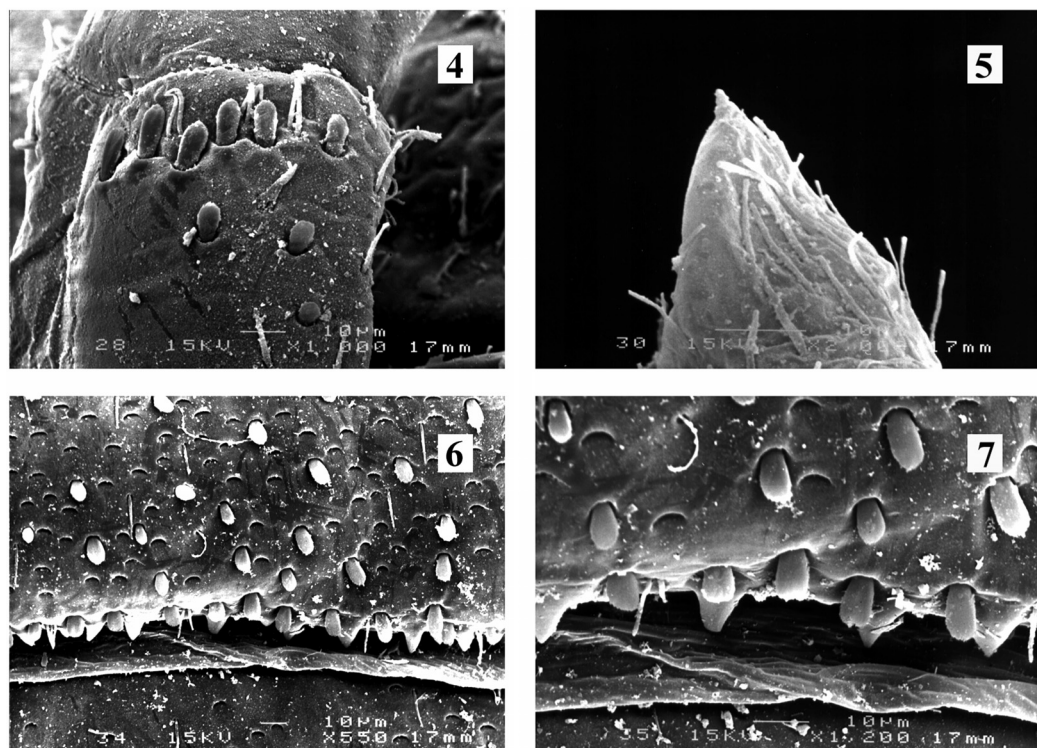


Figs 1-3. *Baetis braaschi*, male imago: 1 – head (lateral view); 2 – left hind wing (dorsal view); 3 – genitalia (ventral view).

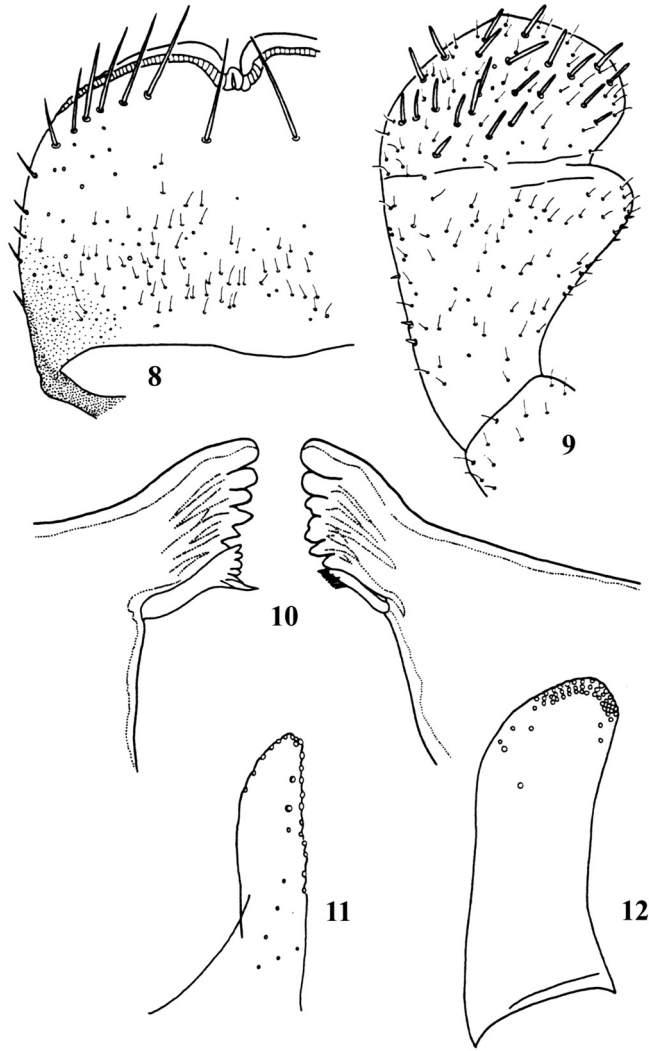
Mature larva. Length: body 7.0-8.5 mm; cerci 6.3-7.0 mm. General color of body light, yellowish-brown to brown, sometimes slightly greyish.

Head yellowish-brown with brownish spots. Frontal suture short. Frons surface with cylindrical small spatulas, base of spatulas and fine hairs. Antennae light yellowish. Pedicel spatulas relatively slender, arranged in one irregular row near distal part of segment, seldom scattered over the segment surface (Fig. 4). These spatulas relatively elongated and slender, with margins distinctly drawn closer towards apex. Surface of pedicel also with small wide spatulas proximally. Scape with small wide spatulas only. Labrum wide (the width/length ratio = 1.40) with 1+ 5-7 long bristles and with few small marginal bristles (Fig. 8). Labrum surface with numerous fine hairs. Apical parts of last segment of maxillary palps with rounded or slightly triangular projection, bearing one distinct scale and small fine hairs (Fig. 5). Mandibular incisors with 5-6 rounded or bluntly pointed teeth. First tooth of the same width and length as the second one. Prostheca on both mandibles distinctly asymmetrical (Fig. 10). Segment 3 of labial palps distinctly wide and asymmetrical, slightly pointed at the apex with numerous bluntly pointed bristles (Fig. 9). Glossae and paraglossae relatively wide (Figs 11, 12). Glossae with 10-13 bristles at the inner margin. Paraglossae with three rows of bristles at apex.

Thorax yellowish-brown to brown, with indistinct drawing on the pronotum, consisting of several brown diffuse spots. Meso- and metanotum with clear longitudinal brown stripes and smaller spots on the lateral sides of thorax. Thorax surface mainly with base of spatulas and fine hairs. Legs uniformly light yellowish-brown. Femora yellowish-brown, in some of investigated specimens with distinct brown spot distally (Fig. 13). External margin of femora with at least 15 strong setae, rounded at apex, arranged in one or two rows proximally (Figs 15-18). These setae are shorter than in other species of subgenus *Rhodobaetis*, narrowed at the base with margins clearly diverging towards apex. Apical part of setae mainly the widest, smoothly convex, with numerous fine hairs



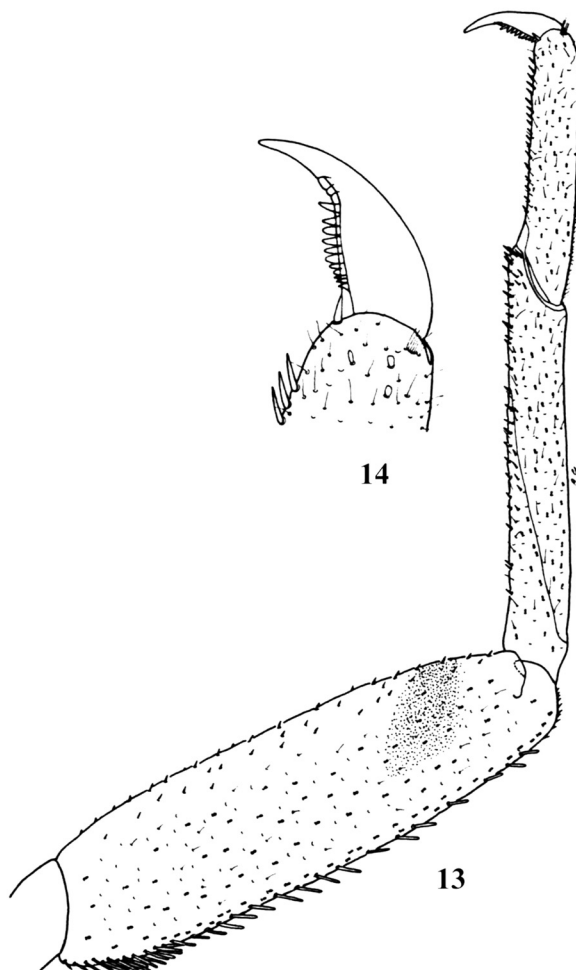
Figs 4-7. *Baetis braaschi*, larva: 4 – pedicel (X 1000); 5 – apex of maxillary palp (X 2000); 6 – posterior margin of tergite IV (X 550); 7 – idem (X 1200).



Figs 8-12. *Baetis braaschi*, larva: 8 – labrum; 9 – labial palp; 10 – mandibular incisors; 11 – glossa; 12 – paraglossa.

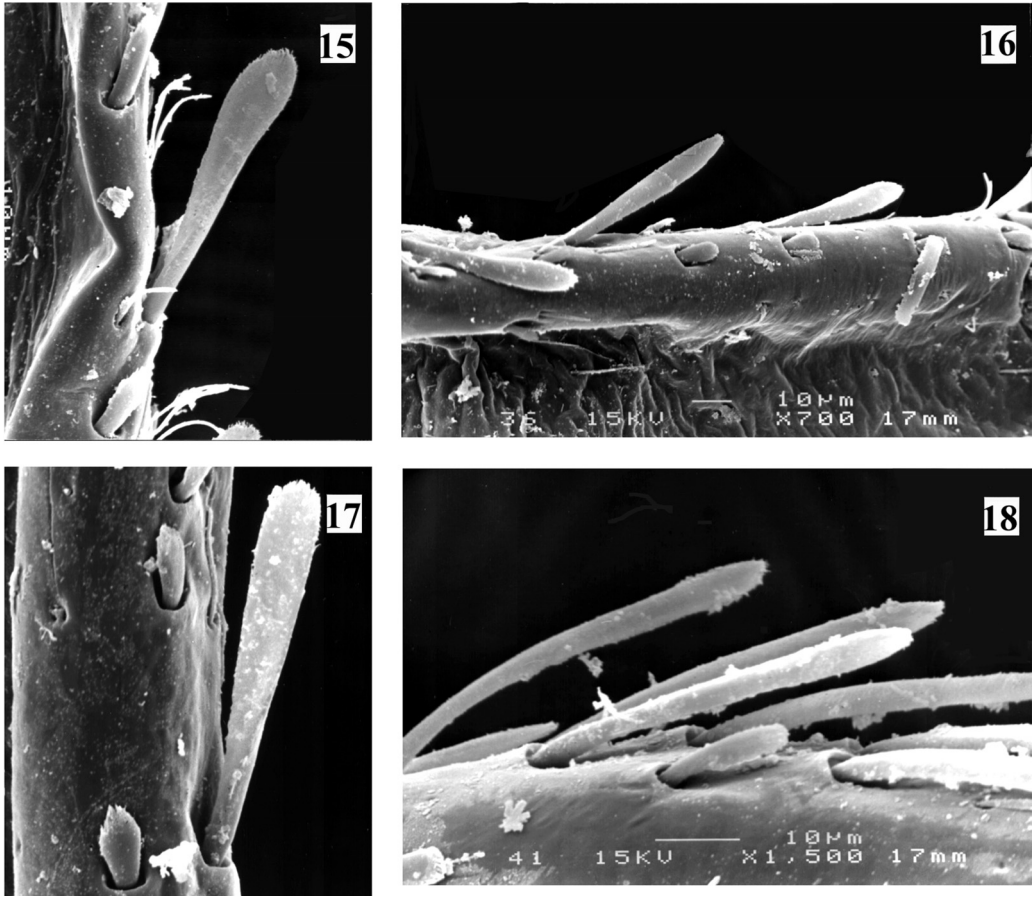
(Figs 15, 17). Also the setae are available, being the widest in their subapical part and looking slightly pointed at apex (Figs 16, 18). Subapical part of external margin of femora with small wide and rounded apically spatulas and fine hairs. Inner margin of femora with small spines and hairs only. Dorsal surface of femora with sparse small spatulas, bases of spatulas and fine hairs. These spatulas wide and rounded at apex. Tibiae yellowish-brown, their surface with wide spatulas, bases of spatulas and fine hairs. External and inner margins of tibiae with spines, in distal part being somewhat larger than in proximal one. Tarsi coloration similar to tibiae, darker distally, brownish. Tarsi spatulas wide. Inner margin of tarsi with numerous spines, external margin with sparse spines only. Tarsal claw pointed, light brown, slightly darker than tarsi, with 8-12 teeth (rarely to 13) (Fig. 14). Apex of tarsal claw without setae.

Abdominal terga light, yellowish to yellowish-brown with distinct, contrast drawing, in general consisting of: two lighter spots near anterior margin of tergite I (occasionally tergite I without



Figs 13-14. *Baetis braaschi*, larva: 13 – hind leg; 14 – tarsal claw.

spots); two light round spots and two oblique strokes drawn off the spots towards the anterior margin of segments II-IV; light central spots surrounded by darker lateral spots and two dark central points on tergite V (rarely coloration of tergite V similar to that of terga II-IV); two light round spots and two oblique strokes on terga VI-VIII (occasionally, oblique strokes absent and spots jointed together near anterior margin of tergite); two indistinct dark triangular spots near anterior margin of tergite IX (these spots may be slightly elongated). Tergite X is the lightest, uniformly color, without visible spots (Fig. 22). Rarely on terga II-VIII a monotonous drawing is visible, consisting of two central light spots. Medial strip weakly visible on anterior margin of terga II-IV and on posterior margin of terga VI-VIII. Lateral part of abdominal segments light, gill junction dark. Sterna light, yellowish. Sterna I-VI unicolorous, without spots. Only small brownish spots near anterior part of sterna VII-IX. Posterior margins of abdominal terga of various structure: posterior margin of tergite I with regular row of wide spatulas and fine hairs only; other terga with regular row of strong triangular spines, subapical wide spatulas and fine hairs (Figs 6, 7). Occasionally, posterior margins of

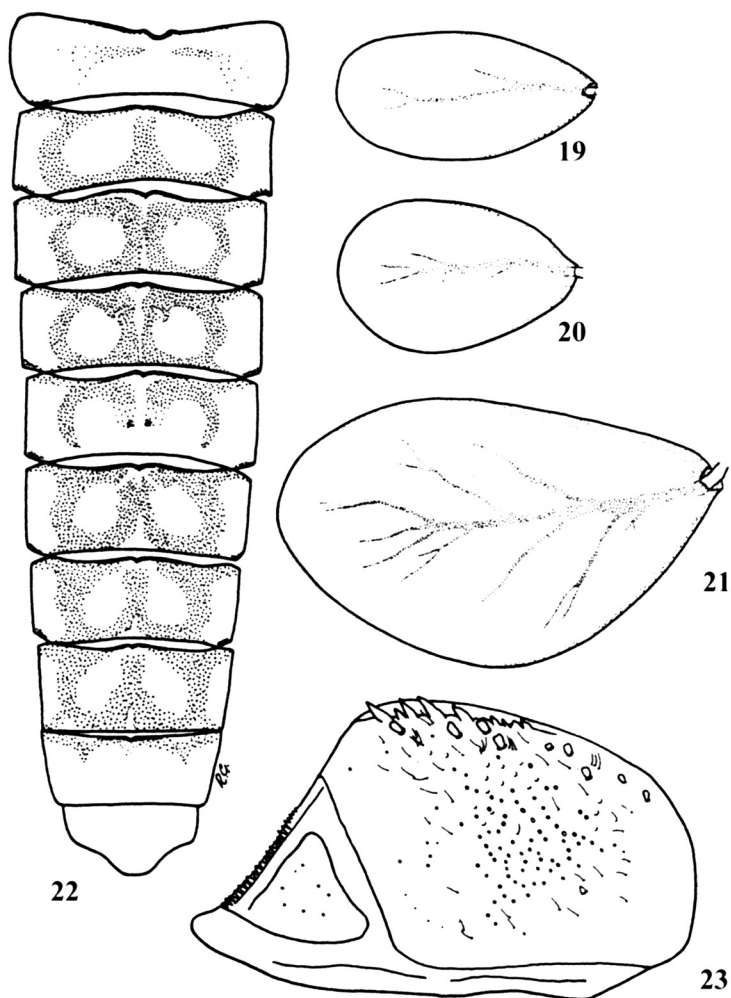


Figs 15-18. *Baetis braaschi*, larva: 15, 17 – setae of external margin of femora (X 1200); 16 – external margin of femora, central part (X 700); 18 – external margin of femora, proximal part (X 1500).

tergite I also with small, hardly visible triangular spines in central part of segment. Surface of terga with numerous wide spatulas, hardly visible triangular scales, bases of spatulas and scales, fine hairs. Gills light, whitish or slightly yellowish, with hardly visible tracheization. Gills 1 and 7 symmetrical, nearly of the same length (Figs 19, 20). Gills 2-6 distinctly asymmetric and relatively large (Fig. 21). External margin of all gills fine-serrate, with fine hair only, without strong spines. Paraproct plate with 5-10 (generally 5-8) large teeth and few small teeth on inner margin (Fig. 23). Surface of paraproct plate mainly with wide spatulas, bases of spatulas and fine hairs. Rarely paraproct plate with spatulas which margins smoothly drawn nearer towards apex, and with small spines. Cerci yellowish-brown, clearly darker at base and apex, with hardly visible brownish-grey band in the middle. Terminal filament of the same color as cerci, slightly darker apically, its length $2/3 - 3/4$ the length of cerci.

III. DISTRIBUTION AND BIOLOGY

In the Crimean Peninsula *B. braaschi* inhabits river valleys of the northern and southern macro-slopes of the Crimean Mountains (Fig. 24). In this area larvae were collected from undried up water-



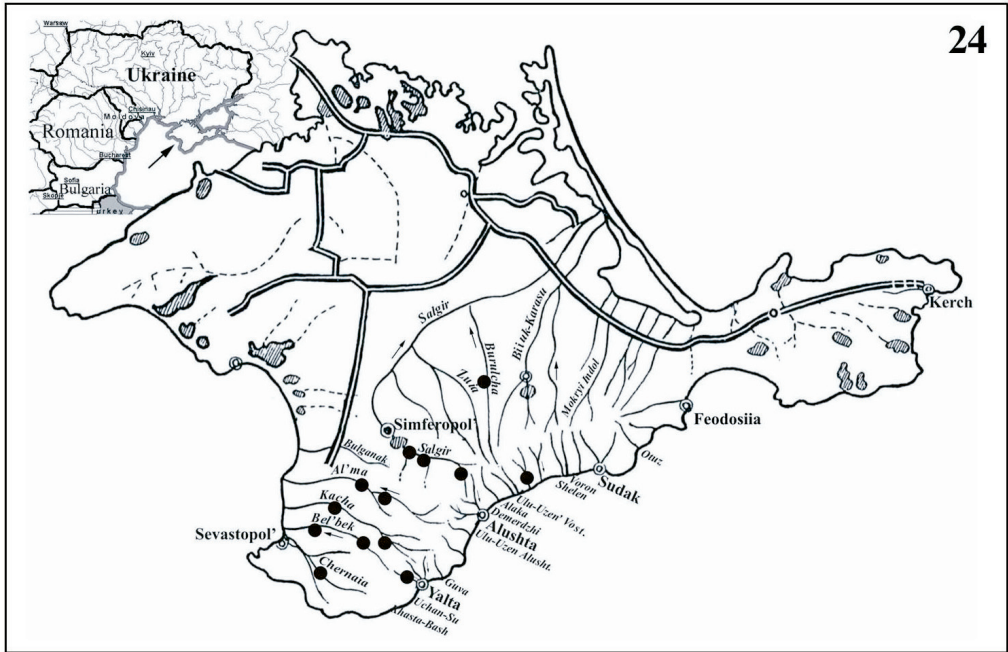
Figs 19-23. *Baetis braaschi*, larva: 19 – first gill; 20 – seventh gill; 21 – fourth gill; 22 – color of abdominal terga; 23 – paraproct plate.

courses with fast current, with rocky bed with an admixture of detritus, on the depth of 0.2-0.5 m at the altitude of 20 m to 400 m (Fig. 25). Water temperature in these localities may fluctuate from 8°C to 25°C. The mineralization of water fluctuates between 340 and 700 mg/l. In chemical composition of the water, the ions HCO_3^- (177-300 mg/l) and Ca^{2+} (44-110 mg/l) predominate.

B. braaschi is a part of metarhithral community of the Crimean rivers, where it occurs together with such representatives of macrofauna as *Caenis macrura* STEPHENS, 1835, *Hydropsyche angustipennis* CURTIS, 1834, *Hydroptila* spp., *Gomphus vulgatissima* (LINNAEUS, 1758), *Onychogomphus forcipata* (LINNAEUS, 1758), *Calopteryx taurica* SELYS, 1853 and *Wilhelmia* spp.

In the Central Asia and the Caucasus *B. braaschi* inhabits cismontane rivers and streams.

Outside the Crimean Peninsula *B. braaschi* is distributed in the foot-hills of the Northern Caucasus, southern slopes of the Great Caucasus Range, all over Georgia and Armenia (obviously in the Kara Plateau in Turkey as well), all over the Kopet-Dag Range and Tien Shan.



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Figs 24-25. 24 – Distribution of *B. braaschi* in the Crimean Peninsula; 25 – typical habitat of *B. braaschi* (Salgir River near Pioners'ke village).

IV. DISCUSSION

The description of larva *B. braaschi* by ZIMMERMANN (1980) was sufficiently detailed, although it was based on small material. Having studied the holotype, NOVIKOVA (1987) gave some

additional morphological characters of this species, concerning structural peculiarities of labrum, pedicel, paraproct pale, tergite microsculpture, thorax and abdominal of terga (NOVIKOVA, 1987: Fig. 21.1-3, Fig. 22.5-7, 9). The pictures of surface and external margin of femora and frontal "triangle", lacking in the original description (ZIMMERMANN, 1980), were also given by NOVIKOVA (1987: Fig. 22.1-4, 8). For the first time she had analyzed the structure of external margin of femora and noted the presence of long setae rounded at apex. The material investigated in our work mostly answers the diagnoses of those authors, as well as some inaccuracies in their descriptions and illustrations, which we have revealed, and which were probably conditioned by insufficient material and infraspecific variability. Thus, the illustration of surface drawing on abdominal terga in ZIMMERMANN's work (1980: Fig. 1) is rather indistinct, especially on terga I and II. Although the picture of NOVIKOVA (1987: Fig. 1) is detailed enough, it demonstrates more rare variation of coloration, when terga I-IX are colored uniformly. In fact the majority of investigated larvae have more or less light tergite V with central light spot surrounded by the darker lateral spots. The tergite IX is mainly with two indistinct triangular spots on the surface (Fig. 22).

There have been some inexactitudes in the descriptions and illustrations of scales on the posterior margin and surface of terga by ZIMMERMANN (1980: Fig. 8) and NOVIKOVA (1987: Fig. 5). In fact, scales on the posterior margin and surface of terga are more stout and wide and less elongated in comparison with those in *B. rhodani rhodani* PICTET, 1843 (Figs 6, 7). We also noted the presence of 1 + 5-7 long bristles on labrum (con. 5 in the original description), from 5 to 10 large teeth on inner margin of paraproct plate (con. 5 in the original description), distinct distal brown femoral spot in a part of studied specimens, and primary lack of triangular spines on tergite I.

The differential diagnosis of the species *B. stipposus* includes the characteristics of larvae and reared imago males (KLUGE, 1982). In his opinion, the typical characters, distinguishing this species from the others of subgenus *Rhodobaetis*, are uniformly color eyes of imago male, the presence of well developed teeth on posterior margins of all abdominal terga and typical drawing on abdominal terga in larva. In most males of type series *B. stipposus* investigated, there is a hardly visible dirty-yellow strip at the base of shaft of turbinate eyes. Body coloration of males and females, designated as *B. stipposus* is not uniformly yellow, but vary in specimens of one population so, that both bright yellow and yellowish-brown specimens and those with pronounced dark-brown coloration are present. The larval exuvia of types looked through, in rare cases only had sharp teeth on the posterior margin of abdominal tergite I. Just as in studied larva of *B. braaschi* from the Crimea, the tergite I in *B. stipposus* was with a regular row of wide spatulas and fine hairs only. The drawing on the surface of abdominal terga in this species is identical with that described in *B. braaschi*. Other larval characters of *B. stipposus*, viz. structure of mouthparts, shape of scales on antennal segments and paraproct plate, proportion of gills (especially gill 1 and 7) and structure of external margin of femora are similar to those of *B. braaschi*. The whole combination of these facts gives the grounds to assert that *B. stipposus* is a junior synonym of *B. braaschi*.

NOVIKOVA (1987: P. 79) assumed the likely synonymy of *B. stipposus* and *B. bisri* which seems groundless to us. In accordance with the original description and illustration (THOMAS & DIA, 1983) *B. bisri* markedly differs from *B. braaschi* (= *B. stipposus*) by structure of external margin of femora (especially by femoral setae pointed at apex), shape of spatulas on 1 and 2 segments of antennae and surface of paraproct plate, shape of segment 3 of labial pals, presence of 5-6 rows of bristles on apical part of paraglossae.

Only three species of subgenus *Rhodobaetis* possess setae relatively rounded at apex on external margin of femora, viz. *B. braaschi*, *B. canariensis* MÜLLER-LIEBENAU, 1971 from the Canary Islands and *B. ingridae* THOMAS & SOLDÁN, 1987 described from Corsica. *B. canariensis* occupies a relatively isolated position among above species due to presence of two fine setae near tip of tarsal claws (MÜLLER-LIEBENAU, 1971: Fig. 19k). At the same time, only *B. ingridae* is characterized by presence of spines on external margin of gills (THOMAS & SOLDÁN, 1987: Fig. 8).

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