



<http://dx.doi.org/10.11646/zootaxa.3948.2.2>

<http://zoobank.org/urn:lsid:zoobank.org:pub:9BB1C85A-E8C5-4A12-AD23-2FEE26FFE431>

Mayflies of the Caucasus Mountains. III. A new representative of the subgenus *Rhodobaetis* Jacob, 2003 (Baetidae: *Baetis*) from the South-Western Caucasus

ROMAN J. GODUNKO^{1,2,5}, DMITRY M. PALATOV³ & ALEXANDER V. MARTYNOV⁴

¹State Museum of Natural History, National Academy of Sciences of Ukraine, Teatralna 18, 79008 Lviv, Ukraine.

E-mail: godunko@seznam.cz

²Institute of Entomology, Biology Centre, Czech Academy of Sciences, Branišovská 31, CZ–37005 České Budějovice, Czech Republic

³Department of Hydrobiology, Biological Faculty, Moscow State University, 1 / 12 Leninskie Gory, Moscow, Russian Federation, 119234. E-mail: triops@yandex.ru

⁴National Museum of Natural History, National Academy of Sciences of Ukraine, Bohdan Khmelnytsky str., 15, 01030 Kiev, Ukraine.

E-mail: martynov_av@ukr.net

⁵Corresponding author

Abstract

A new species of the subgenus *Rhodobaetis* Jacob, 2003, namely *Baetis* (*Rhodobaetis*) *vadimi* sp. nov., is described based on immature larvae from several localities in Georgia and Turkey. It is the ninth species of the subgenus for Transcaucasia, following six species formally recorded from Turkey and two endemic species described from the Central Caucasus.

Larval characters are investigated and illustrated by means of scanning electron microscopy, and discussed in details. The differential diagnosis of this species is provided with regard to other representatives of the subgenus considering the feature set common for *Rhodobaetis*. The new species can be distinguished from its relatives (species which lack stout setae on the gills' margins), mainly by some characters of mouthparts (particularly labium), the shape and arrangement of stout setae and scales on the body surface, as well as the lack of subapical tiny setae on tarsal claw, and presence of numerous marginal spines and semilunar scale bases on the paraproct plate.

Key words: Ephemeroptera, Baetinae, new species, Georgia, Turkey

Introduction

Godunko *et al.* (2004b) compiled a list of 26 larval and male imaginal characters to distinguish the West Palaearctic species of the subgenus *Rhodobaetis* Jacob, 2003 (Baetidae: *Baetis*). Using these features, new representatives were described (e.g. Gattolliat *et al.* 2008; Soldán & Godunko 2008; Sroka *et al.* 2012a), and some of previously known ones were redescribed (see Godunko *et al.* 2004a; Gattolliat & Sartori 2008). We have already noticed (Soldán & Godunko 2009) that current list of diagnostic characters is far from being complete, and undoubtedly further studies are necessary for its improvement (see below). Complicated discrimination and identification of taxonomic status of morphologically closely related taxa, as well as doubtless evidences of morphological characters variability in the series of broad-areal species, denote the need of discovery new distinguishing characters for separation of *Rhodobaetis* representatives (see Godunko & Prokopov 2003; Godunko *et al.* 2004b; Sroka *et al.* 2012b). For instance, further morphological characters can be found undoubtedly in musculature and muscle insertion in connection with colour patterns. Important features for different colour pattern within species can be described on the head (e.g. shape of the epicranial suture), prothorax and abdominal segments (especially terga in larvae). Certainly, studies of chaetotaxy in larvae are also important, and it is also necessary to consider the presence and shape of different groups of setae, spines and scales on the body surface as well as extensively apply morphometric methods.

With regard to Turkey, Kazancı & Türkmen (2012) recorded five species belonging to the subgenus *Rhodobaetis*. Nonetheless, the diversity of *Rhodobaetis* in Caucasian and Minor Asian subregions is still poorly known and needs to be clarified (for details see Discussion).

Distribution and biology. So far, *Baetis vadimi* **sp. nov.** is known only from the type locality in Turkey and additional localities at the Kintrishi State Nature Reserve (Adjara, Georgia) (Fig. 42). There is a possibility that *Baetis vadimi* **sp. nov.** is very rare within the whole species range, where it may be represented by a few populations. The nymphs were found in upper parts of the streams where crenal, epi- and/or metarhithral sections of the rapids occur along alpine and subalpine areas (2000–2600 m a.s.l.) of principal mountain ranges of the South-Western Caucasus. We can preliminary consider this new species as an endemic of the Lesser Caucasus (including the Pontic Mts.).

At the type locality (Fig. 43) the larvae were observed in the flow, staying on stones and mosses (*Fontinalis* sp.) in central part of the stream or in littoral, never occurring at places with extremely turbulent flow. *Baetis vadimi* **sp. nov.** was found in streams up to 1.5–2.0 m wide and up to 0.5 m deep; larvae were recorded in water where current velocity ranged from 0.2 to 0.5 m/sec; water temperature during the observation period was 8–12°C. The taxocenes of mayflies associated with the new species were dominated by Heptageniidae (*Iron*, *Electrogena*, *Ecdyonurus* and *Rhithrogena* spp.) and Baetidae (*Nigrobaetis* (*Takobia*) and *Acentrella* spp.).

For the present moment, throughout the territory of Adjara *B. vadimi* **sp. nov.** was recorded only at Adjara-Imereti (Meskhetian) Range. Here the species was found at approximately 2150–2300 m a.s.l. The new species inhabits crenal and epirhithral zones of springs, streams and upper courses of rivers (sometimes already at the border of snowfields) (Figs 44–48). All these watercourses are characterized by relatively low current velocity (no more than 0.5 m/s) and small stream discharge. However, a few larvae of *B. vadimi* **sp. nov.** were recorded once in limnocrone (area about 0.5 m², depth—0.1–0.15 m, with flowing out stream). The mayfly taxocene of *B. vadimi* **sp. nov.** in Adjara was represented by the *Electrogena* and *Nigrobaetis* (*Takobia*) spp.

Acknowledgement

This research was supported by the Grant Agency of the Czech Republic (Project No. 206/08/1389) and was conducted with institutional support RVO: 60077344 for RJG. It was also carried out thanks to the inter-academic exchange between the Czech Academy of Sciences and the Russian Academy of Sciences (Southern Scientific Center RAS, Rostov-na-Donu, Russian Federation). Scanning electron microscopy work is partly supported by the User Facilities Center of M.V. Lomonosov Moscow State University under financial support of Ministry of Education and Science of Russian Federation for DMP. AVM is grateful to Dr. A.V. Putchkov (I.I. Schmalhausen Institute of Zoology, NASU, Ukraine) and Dr. M.E. Sergeev (Sikhote-Alin Nature Reserve, Russian Federation) for the comprehensive help in the joint expedition to Georgia in 2013.

References

- Al-Zubaidi, F., Braasch, D. & Al-Kayatt, A. (1987) Mayflies from Iraq (Insecta, Ephemeroptera). *Faunistische Abhandlungen Staatliches Museum für Tierkunde Dresden*, 14, 179–184.
- Bauerfeind, E. & Soldán, T. (2012) *The Mayflies of Europe (Ephemeroptera)*. Apollo Books, Ollerup, 781 pp.
- Beketov, M.A. & Godunko, R.J. (2005) *Baetis khakassicus* n. sp., a new species of the subgenus *Rhodobaetis* Jacob, 2003 from Middle Siberia, Russian Federation (Ephemeroptera: Baetidae). *Genus*, 16 (1), 7–12.
- Gaino, E. & Rebora, M. (1996) Fine structure of flat-tipped antennal sensilla in three species of mayflies (Ephemeroptera). *Invertebrate Biology*, 115 (2), 145–149.
<http://dx.doi.org/10.2307/3227044>
- Gaino, E. & Rebora, M. (1998) Ultrastructure of the antennal sensilla of the mayfly *Baetis rhodani* (Pictet) (Ephemeroptera: Baetidae). *International Journal of Insect Morphology & Embryology*, 27, 143–149.
[http://dx.doi.org/10.1016/S0020-7322\(97\)00001-9](http://dx.doi.org/10.1016/S0020-7322(97)00001-9)
- Gaino, E. & Rebora, M. (1999a) Flat-tipped sensillum in Baetidae (Ephemeroptera): a microcharacter for taxonomic and phylogenetic considerations. *Invertebrate Biology*, 118 (1), 68–74.
<http://dx.doi.org/10.2307/3226914>
- Gaino, E. & Rebora, M. (1999b.) Larval antennal sensilla in water-living insects. *Microscopy Research and Technique*, 47, 440–457.
[http://dx.doi.org/10.1002/\(SICI\)1097-0029\(19991215\)47:6%3C440::AID-JEMT7%3E3.0.CO;2-O](http://dx.doi.org/10.1002/(SICI)1097-0029(19991215)47:6%3C440::AID-JEMT7%3E3.0.CO;2-O)
- Gaino, E. & Rebora, M. (2003) The sensilla on the labial and maxillary palps of the nymph of *Baetis rhodani* (Ephemeroptera: Baetidae). In: Gaino, E. (Ed.), *Research update on Ephemeroptera & Plecoptera*, Università di Perugia, Perugia (Italy),

pp. 445–451.

- Gattolliat, J.-L., Hughes, S.J., Monaghan, M.T. & Sartori, M. (2008) Revision of Madeiran mayflies (Insecta, Ephemeroptera). *Zootaxa*, 1957, 52–68.
- Gattolliat, J.-L. & Sartori, M. (2008) What is *Baetis rhodani* (Pictet, 1843) (Insecta, Ephemeroptera, Baetidae)? Designation of a neotype and redescription of the species from its original area. *Zootaxa*, 1957, 69–80.
- Gillies, M.T. & Thorpe, J.R. (1996) When is a spine not a spine? A new look at an old problem in the taxonomy of the Baetidae (Ephemeroptera). *The Entomologist*, 115, 86–90.
- Godunko, R.J. & Prokopov, G.A. (2003) Mayflies of the Crimean Peninsula. I. *Baetis rhodani tauricus* ssp. n. (Ephemeroptera: Baetidae). *Acta Zoologica Cracoviensia*, 46 (3), 209–217.
- Godunko, R.J., Prokopov, G.A., Kluge, N.J. & Novikova, E.A. (2004a) Mayflies of the Crimean Peninsula. II. *Baetis braaschi* Zimmermann, 1980 (= *B. stipposus* Kluge, 1982 syn. n.) (Ephemeroptera: Baetidae). *Acta Zoologica Cracoviensia*, 47, 155–166.
<http://dx.doi.org/10.3409/173491504783995807>
- Godunko, R.J., Prokopov, G.A. & Soldán, T. (2004b) Mayflies of the Crimean Peninsula III. The description of *Baetis milani* sp. n. with notes on taxonomy of the subgenus *Rhodobaetis* Jacob, 2003 (Ephemeroptera: Baetidae). *Acta Zoologica Cracoviensia*, 47, 231–248.
<http://dx.doi.org/10.3409/173491504783995799>
- Jacob, U. (2003) *Baetis* Leach 1815, sensu stricto or sensu lato. Ein Beitrag zum Gattungskonzept auf der Grundlage von Artengruppen mit Bestimmungsschlüsseln. *Lauterbornia*, 47, 59–129.
- Jacob, U. & Zimmermann, W. (1978) Eine neue *Baetis*-Art der *rhodani*-Gruppe vom Kaukasus—*Baetis illex* n.sp. (Ephemeroptera, Baetidae). *Entomologische Nachrichten*, 22 (6), 81–88.
- Kazancı, N. (1984) New Ephemeroptera (Insecta) from Turkey. *Aquatic Insects*, 6 (4), 253–258.
<http://dx.doi.org/10.1080/01650428409361191>
- Kazancı, N. (2001) Türkiye Ephemeroptera (Insecta) faunası. Ephemeroptera (Insecta) fauna of Turkey. *Türkiye iç Suları Arastirmaları Dizisi*, Ankara, 6, 1–72.
- Kazancı, N. (2009) Ephemeroptera (Insecta) Fauna of Turkey: Records from Eastern Anatolia (Turkey). *Review of Hydrobiology*, 2, 187–195.
- Kazancı, N. & Türkmen, G. (2012) The checklist of Ephemeroptera (Insecta) species of Turkey. *Review of Hydrobiology*, 5 (2), 143–156.
- Lucentini, L., Reborá, M., Puletti, M.E., Gigliarelli, L., Fontaneto, D., Gaino, E. & Panara, F. (2011) Geographical and seasonal evidence of cryptic diversity in the *Baetis rhodani* complex (Ephemeroptera, Baetidae) revealed by means of DNA taxonomy. *Hydrobiologia*, 673, 215–228.
<http://dx.doi.org/10.1007/s10750-011-0778-1>
- Müller-Liebenau, I. (1969) Revision der europäischen Arten der Gattung *Baetis* Leach, 1815 (Insecta, Ephemeroptera). *Gewässer und Abwässer*, 28/29, 1–214.
- Müller-Liebenau, I. (1971) Ephemeroptera (Insecta) von den Kanarischen Inseln. *Gewässer und Abwässer*, 50/51, 7–40.
- Novikova, E.A. (1987) Podenki semeistva Baetidae (Ephemeroptera) fauny SSSR. [Mayflies of the family Baetidae (Ephemeroptera) of the USSR fauna]. *Dissertaciya na soiskanie uchenoi stepeni kandidata biologicheskikh nauk. Leningradskii Gosudarstvennyi Universitet*, Leningrad. [Unpublished manuscript; in Russian]
- Palatov, D.M. (2013) Novye dannye o faune i rasprostranenií podenok semejstva Baetidae (Ephemeroptera) na territorii Kavkaza i Zakavkaz'ja [New data on the fauna and distribution of mayflies family Baetidae (Ephemeroptera) of the Caucasus and Transcaucasia]. In: *Hydroentomology in Russia and adjacent countries: Materials of the Fifth All-Russia Symposium on Amphibiotic and Aquatic Insects / Papanin Institute for Biology of Inland Waters, Russian Academy of Sciences.—Yaroslavl: Filigran*, pp. 107–114. [in Russian, English summary].
- Rutschmann, S., Gattolliat, J.-L., Hughes, S.J., Báez, M., Sartori, M. & Monaghan, M.T. (2014) Evolution and island endemism of morphologically cryptic *Baetis* and *Cloeon* species (Ephemeroptera, Baetidae) on the Canary Islands and Madeira. *Freshwater Biology*, 59 (12), 2516–2527.
<http://dx.doi.org/10.1111/fwb.12450>
- Soldán, T. (1977) *Baetis baksan* sp.n., a new species of mayfly (Ephemeroptera, Baetidae) from Central Caucasus. *Acta Entomologica Bohemoslovaca*, 74 (4), 229–231.
- Soldán, T. (1978) Mayflies (Ephemeroptera) new to the fauna of Czechoslovakia found in 1972–1977. *Acta Entomologica Bohemoslovaca*, 75, 319–329.
- Soldán, T., Enktaivan, S. & Godunko, R.J. (2009) Commented checklist of mayflies (Ephemeroptera) of Mongolia. *Aquatic Insects*, Supplement 1, 31 (1), 653–670.
<http://dx.doi.org/10.1080/01650420903040732>
- Soldán, T. & Godunko, R.J. (2008) Two new species of the genus *Baetis* Leach, 1815 (Ephemeroptera: Baetidae) from Cyprus. *Annales Zoologici*, 58 (1), 79–104.
<http://dx.doi.org/10.3161/000345408783897770>
- Soldán, T. & Godunko, R.J. (2009) *Baetis zdenkae* sp. nov., a new representative of the *Baetis buceratus* species-group (Ephemeroptera: Baetidae) from Rhodos (Greece) with notes to species-grouping of the subgenus *Baetis* Leach, 1815 s. str. *Zootaxa*, 1972, 1–19.

- Sroka, P., Godunko, R.J., Novikova, E.A. & Kluge, N.J. (2012a) Contribution to the knowledge of the subgenus *Rhodobaetis* Jacob, 2003 (Ephemeroptera: Baetidae: *Baetis*) from Central Asia. Part 1. *Zootaxa*, 3311, 42–60.
- Sroka, P., Martynov, A.V. & Godunko, R.J. (2012b) Morphological and genetic variability of *Baetis* (*Rhodobaetis*) *braschi* Zimmermann, 1980 (Ephemeroptera: Baetidae). *Zootaxa*, 3323, 27–49.
- Thomas, A.G.B. & Dia, A. (1983) *Baetis bisri* n. sp., Éphéméroptère nouveau du Liban (Baetidae). *Annales de Limnologie*, 19 (3), 213–217.
<http://dx.doi.org/10.1051/limn/1983025>
- Türkmen, G. & Kazancı, N. (2013) The key to the Ephemeroptera (Insecta) larvae in running waters of the Eastern Black Sea Basin (Turkey) with the new records. *Review of Hydrobiology*, 6 (1), 31–55.
- Türkmen, G. & Özkan, N. (2011) Larval Ephemeroptera records from Marmara Island and Kapıdağ Peninsula (North-Western Turkey) with new record of *Baetis milani* Godunko, Prokopov & Soldan 2004. *Review of Hydrobiology*, 4 (2), 99–113.
- Williams, H.C., Ormerod, S.J. & Bruford, M.W. (2006) Molecular systematics and phylogeography of the cryptic species complex *Baetis rhodani* (Ephemeroptera, Baetidae). *Molecular Phylogenetics and Evolution*, 40, 370–382.
<http://dx.doi.org/10.1016/j.ympev.2006.03.004>