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First record of *Boreoheptagyia monticola* Serra-Tosio, 1964 (Diptera, Chironomidae) in Serbia

Original Article

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Abstract:

The non-biting midge *Boreoheptagyia monticola* Serra-Tosio, 1964 is recorded for the first time in Serbia, based on a larval specimen collected in June 2022 from the middle course of the Studenica River within the Golija–Studenica Nature Reserve, a UNESCO-protected area. The species was found in a fast-flowing, well-oxygenated river section characterized by a predominantly stony substrate, which represents typical habitat conditions for this species. Moreover, this finding constitutes the first representative of the genus *Boreoheptagyia* for the Serbian fauna. Given the restricted habitat preferences and limited dispersal capacity of the species, which is known to occur in narrow and often isolated geographic ranges in Central and Southern Europe, this finding provides important biogeographical and faunistic insight into the distribution of this genus.

Key words:
Boreoheptagyiini, Diamesinae, non-biting midge, Studenica River

Apstrakt:

Prvi nalaz vrste *Boreoheptagyia monocotila* Serra-Tosio, 1964 (Diptera, Chironomidae) u Srbiji

Vrsta *Boreoheptagyia monticola* Serra-Tosio, 1964 po prvi put je zabeležena u Srbiji, na osnovu larvenog primerka prikupljenog u junu 2022. godine u srednjem toku reke Studenice, u okviru Rezervata prirode Golija-Studenica, područja pod zaštitom UNESCO-a. Vrsta je registrovana u brzotekućem, dobro oksigenisanom delu reke sa pretežno kamenitim supstratom, što predstavlja tipične stanišne uslove za ovu vrstu. Pored toga, ovaj nalaz predstavlja prvog zabeleženog predstavnika roda *Boreoheptagyia* za faunu Srbije. S obzirom na ograničene stanišne preferencije i ograničene disperzione sposobnosti vrste, za koju je poznato da se javlja u uskim i često izolovanim geografskim područjima Centralne i Južne Evrope, ovaj nalaz pruža značajan biogeografski i faunistički uvid u rasprostranjenost ove vrste.

Ključne reči:
biljni komarci, Boreoheptagyiini, Diamesinae, Studenica

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Introduction

Chironomidae (non-biting midges) represent one of the most abundant and taxonomically diverse insect families in freshwater ecosystems worldwide (Smaoune et al., 2025). They occur across all major zoogeographical regions and inhabit a wide range of aquatic environments, colonizing habitats that span extreme conditions, from cold Antarctic waters to warm freshwater springs, as well as ecosystems ranging from pristine to heavily impacted by human activities (Kozeretska et al., 2022; Ergović et al., 2026). Because of their ecological diversity, high abundance, and sensitivity to environmental change, chironomids are widely used as key bioindicators in biological monitoring and ecosystem assessment programs (Milošević et al., 2013; Molineri et al., 2020). However, despite their ecological importance, knowledge of chironomid diversity remains limited in many regions due to taxonomic challenges, especially difficulties in species-level identification and a lack of specialized expertise (Milošević et al., 2025).

The genus *Boreoheptagyia* (Brundin, 1966) (Diamesinae: Boreoheptagyiini) includes 26 valid species worldwide, with the majority distributed in the Palaearctic region (Makarchenko et al., 2008; 2020; Lin et al., 2021). In Europe, the genus is represented by eight species and is distributed mainly in the central and southern parts of the continent (Ergović et al., 2023). The larvae of *Boreoheptagyia* are typically found in cool, clear mountains or glacier-fed streams (Lin et al., 2021). Due to their

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habitat specialization and limited dispersal ability, these species are of biogeographical interest, with many taxa confined to narrow and often isolated geographic ranges (Rossaro, 2017).

Here, we present a contribution to the knowledge of Serbian chironomid fauna by reporting the first record of the genus *Boreoheptagyia* and the species *Boreoheptagyia monticola* Serra-Tosio, 1964.

Material and methods

Field investigations were conducted in June 2022 in the Studenica River gorge, near the Studenica Monastery, within the Golija–Studenica Biosphere Reserve (43°28′16.5″N 20°32′42.7″E; 437 m a.s.l.) which was designated as the first UNESCO Biosphere Reserve in Serbia in 2001 (**Fig. 1**). Larval specimens of Chironomidae were collected together with other aquatic macroinvertebrates using a Surber sampler (sampling area = 25 × 25 cm, mesh size = 500 μm). The collected material was preserved in 96% ethanol, transported, and stored at the Laboratory of Hydroecology, Faculty of Science, University of Kragujevac, Serbia. Simultaneously with biological sampling, basic physical and chemical parameters of the water were assessed. Dissolved oxygen concentration and oxygen saturation were measured *in situ* using a digital multiparameter oximeter (Mettler Toledo SevenGo Duo, Schwerzenbach, Switzerland), while water temperature, pH, electrical conductivity, and water hardness were determined using combined digital instruments (Hanna Instruments Ltd., Leighton Buzzard, UK). Concentrations of total phosphorus (P), orthophosphate (PO_4–P), phosphorus pentoxide (P_2O_5), nitrate-nitrogen (NO_3–N), ammonium-nitrogen (NH_4–N), ammonia-nitrogen (NH_3–N), and total nitrogen (N) were determined photometrically using an Aqualytic AL400 photometer (Nhat Anh Company, Vietnam) and appropriate reagents, following standard APHA protocols (2012). In the laboratory, chironomid larvae were separated from the remaining material and identified to the lowest possible taxonomic level using standard taxonomic identification keys (Moller Pillot et al., 2009; Andersen et al., 2013), under a Nikon SZM stereomicroscope (Nikon Corporation, Tokyo, Japan) and a Nikon Eclipse E100 light microscope (Nikon Corporation, Tokyo, Japan). The species *Boreoheptagyia monticola* was identified according to Bitušík (2000).

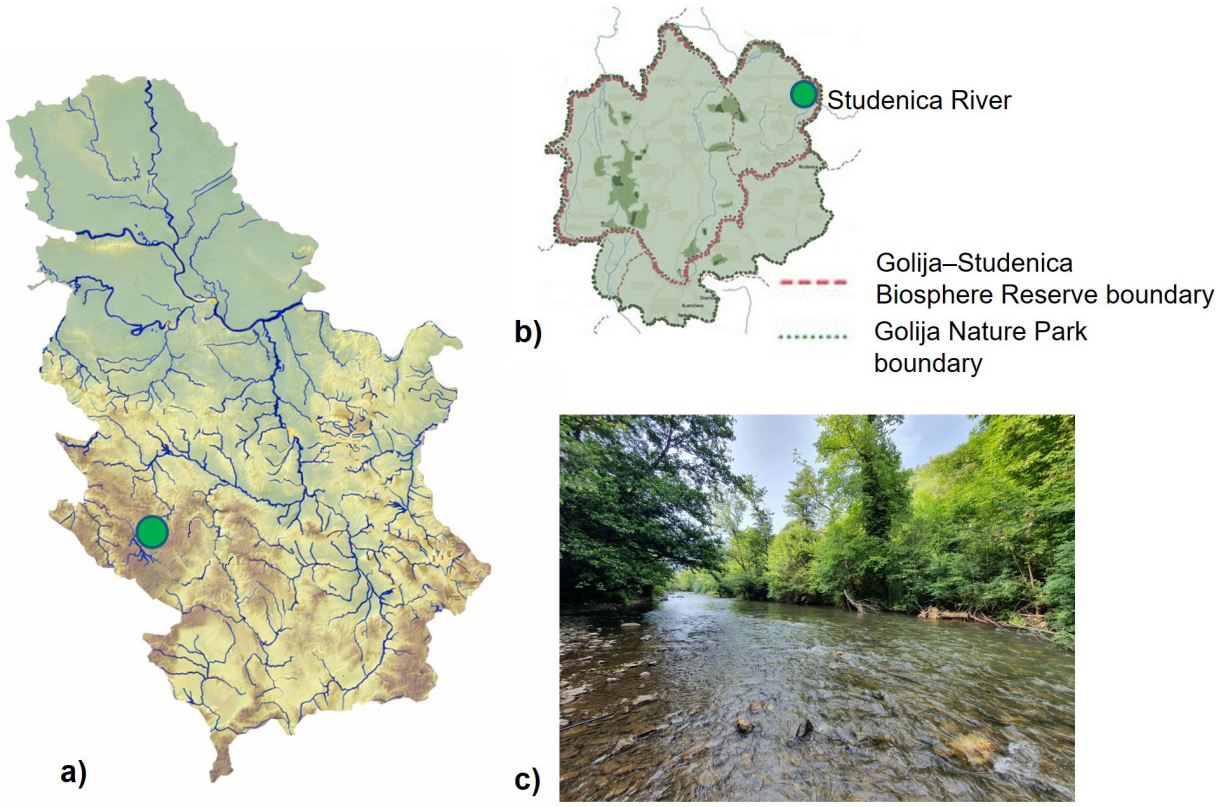

Fig. 1. Geographic location of the Golija Nature Park in Serbia (**a**); Boundaries of the Golija Nature Park and the Golija–Studenica Biosphere Reserve (**b**); Sampling site where Boreoheptagyia monticola was recorded (**c**).

Results and Discussion

The species *Boreoheptagyia monticola* (**Fig. 2**), represented by a single larval specimen, is reported here for the first time in Serbia. Physical and chemical parameters at the sampling site (**Tab. 1**) indicated a water temperature of 12.5 °C, dissolved oxygen concentration of 10.24 mg L^{-1}, and oxygen saturation of 102.7%, reflecting well-oxygenated, fast-flowing conditions with a predominance of rocky substrate; concentrations of all measured inorganic nutrients were below the detection limits. Within the same sampling period, several other Chironomidae taxa were recorded in association with this species, including *Eukiefferiella lobifera* (Kieffer, 1912), *Eukiefferiella devonica* group, *Orthocladius frigidus* (Zetterstedt, 1838), *Polypedilum convictum* (Walker, 1856), *Parametriocnemus stylatus* (Kieffer, 1924), *Cricotopus tremulus* (Linnaeus, 1758), and *Paratanytarsus dissimilis* agg.

The taxonomy and distribution of many Chironomidae taxa, including the genus *Boreoheptagyia*, remain insufficiently resolved, particularly in poorly studied regions, underscoring the relevance of new distributional records. This taxonomic uncertainty is largely because some species of this genus have been described exclusively from their larval or pupal stages, which hampers reliable species delimitation and faunistic comparisons (Serra-Tosio, 1989; Rossaro et al., 2006). According to Andersen et al. (2013), larvae of this genus typically inhabit cool, clear mountain or glacier-fed streams, usually at altitudes above 1 000 m a.s.l. The best-studied populations occur in the Alpine region, particularly in the French and Italian Alps, where several species are considered endemic (Lencioni & Rossaro, 2005; Rossaro et al. 2006; Rossaro, 2017; Ergović et al., 2023). Only one species, *Boreoheptagyia legeri* (Goetghebuer, 1933), has been recorded outside mountainous areas, inhabiting lowland streams below 500 m a.s.l., such as those in Croatia (Ergović et al., 2023). Like most species of the genus, *B. monticola* is a cold-stenothermic taxon and has been reported as a member of kryal chironomid communities at high altitudes in the Italian Alps (Lencioni et al., 2007) and in permanent streams of the Sierra Nevada at approximately 700 m a.s.l. (Langton & Casas, 1999). The species has also been recorded in Czechia, Poland and Slovakia, while in the Balkans it has so far been documented only in North Macedonia (Bitušík & Trnková, 2016; Bitušík et al., 2025). The results

Table 1. Physical and chemical parameters measured at the sites investigated in the Studenica River.

Physical and chemical parameters	values
Water temperature (°C)	12.5
Electrical conductivity (mS^{-1})	210
Water hardness (mg L^{-1})	100
pH	7.78
Dissolved oxygen concentration (mg L^{-1})	10.24
Oxygen saturation (%)	102.7
Ammonium-nitrogen (NH_4-N) (mg L^{-1})	<0.04
Ammonia-nitrogen (NH_3-N) (mg L^{-1})	<0.03
Nitrate-nitrogen (NO_3-N) (mg L^{-1})	11
Total nitrogen (N) (mg L^{-1})	6
Orthophosphate (PO_4-P) (mg L^{-1})	<0.06
Total phosphorus (P) (mg L^{-1})	<0.05
Phosphorus pentoxide (P_2O_5-P) (mg L-1)	<0.06

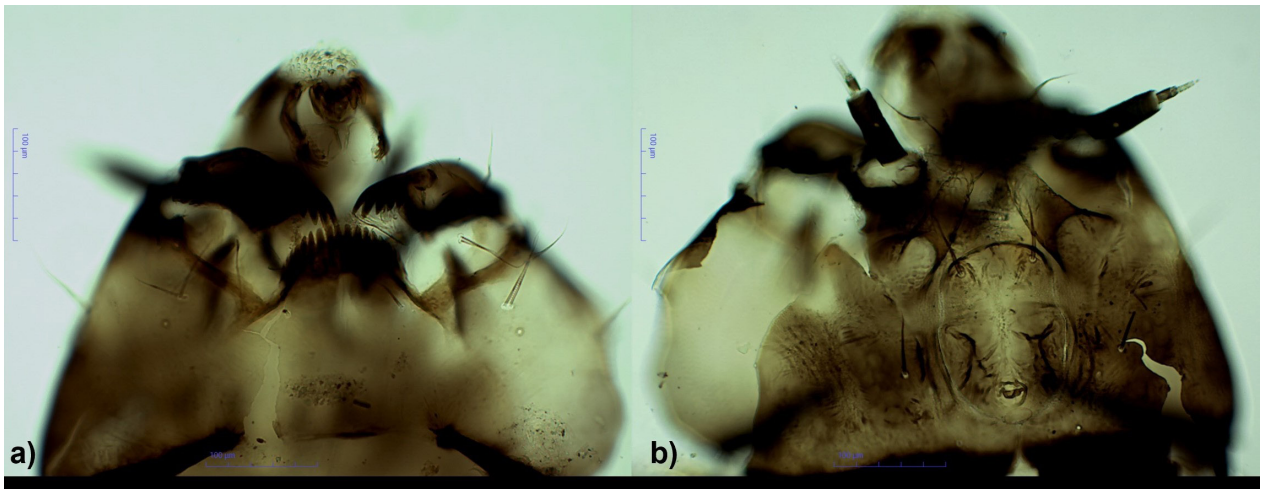

Fig. 2. Head capsule of the larva *Boreoheptagyia monticola*: ventral view of the head capsule (**a**); dorsal view with long tubercles (**b**).

of the present study support previous findings on the ecological preferences of *B. monticola*, particularly in relation to habitat characteristics. Although the altitude of the Studenica River site is somewhat lower than the typical range reported for this species, the environmental conditions correspond to those of a typical mountain stream. The river supports a well-developed macroinvertebrate community dominated by Ephemeroptera, Plecoptera, and Trichoptera (Stojanović, 2017), along with characteristic chironomids such as *Eukiefferiella lobifera, Eukiefferiella devonica* group and *Parametriocnemus stylatus*.

The Studenica River is one of the most prominent protected freshwater areas in Serbia; however, increasing concern has been raised in recent years regarding its degradation under anthropogenic pressures. Consequently, this river should remain a conservation priority, and continued investigation of its biodiversity is essential for effective protection and management. Previous studies have documented the presence of locally threatened macroinvertebrate species (e.g., *Perlodes microcephalus* (Pictet, 1833), *Dinocras megacephala* (Klapálek, 1907), *Brachyptera seticornis* (Klapálek, 1902), which are protected under national legislation (Official Gazette of the Republic of Serbia Nos. 5/2010, 47/2011, 32/2016, and 98/2016). An additional conservation value of the Studenica River lies in its rich ichthyofauna, which includes a high number of threatened fish species, like *Sabanejewia balcanica* (Karaman, 1922), *Cottus gobio* (Linnaeus, 1758), *Salmo trutta* Linnaeus, 1758, *Barbus balcanicus* Kotlík, Tsigenopoulos, Ráb & Berrebi, 2002 (Official Gazette of the Republic of Serbia Nos. 5/2010, 47/2011, 32/2016, and 98/2016).

Finally, future studies should include a greater number of sampling sites and microhabitats, particularly within high-altitude lentic systems, to improve understanding of the true distribution and ecology of enigmatic Chironomidae species such as *B. monticola*. This need is emphasized by the limited availability of published data on these species, which is widely considered to result from insufficient taxonomic expertise and the inaccessibility of their high-elevation habitats.

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