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Article

Description of the hitherto unknown female of *Rhyacophila siparantum* Ibrahimi, Bilalli & Kučinić, 2021 (Trichoptera: Rhyacophilidae) from Kosovo

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Abstract
The hitherto unknown female of *Rhyacophila siparantum* Ibrahimi, Bilalli & Kučinić, 2021 is described. In addition, some ecological notes about this rare species of Kosovo are provided. The female genitalia of *R. siparantum* are very similar to those of *Rhyacophila hirticornis* McLachlan, 1879 (known from numerous locations in Europe) and *Rhyacophila schmidinarica* Urbanič, Krušnik & Malicky, 2000 (known only from Slovenia and Croatia). The female genitalia of *Rhyacophila siparantum* can be easily distinguished from both species by its rounded apical part of segment VIII on ventral view, along with other morphological differences.

Key words Balkans, endemic species, aquatic insects, caddisflies, biodiversity, description, taxonomy.

Introduction

Species of the family Rhyacophilidae play a crucial role in food webs of freshwater ecosystems, serving as vital components of aquatic biodiversity. They are frequently utilized as bioindicators due to their sensitivity to environmental changes. Therefore, comprehensive documentation of their biodiversity and understanding all life stages of different species is imperative for effectively utilizing their ecosystem services (Holzenthal *et al*. 2015; Morse *et al*. 2019).

Over the years, there has been a significant increase in knowledge about the species of this family in the Balkan Peninsula, with numerous new species being described (Ibrahimi *et al*. 2021; Oláh 2010; Oláh & Beshkov 2016; Oláh *et al*. 2022; Valladolid *et al*. 2020, 2022). In this regard the knowledge about the caddisfly fauna of Kosovo has significantly increased during the past decade

(Bilalli *et al*. 2018, 2019; Ibrahimi *et al*. 2015a, b, 2016a, b, 2017, 2018, 2019a, b, c, 2021, 2023; Karaouzas *et al*. 2018; Musliu *et al*. 2020; Oláh *et al*. 2017, 2018, 2019; Musliu *et al*. 2020; Valladolid *et al*. 2022).

In 2021, a new species of the *Rhyacophila philopotamoides* group, namely *Rhyacophila siparantum* Ibrahimi, Bilalli & Kučinić, 2021 was described from the Bjeshkët e Nemuna Mountains in Kosovo based solely on male specimens. In this contribution, the previously unknown female of *R. siparantum*, collected also from the same locality, is described. In addition, some ecological notes of this rare and endemic species in Kosovo are provided.

Material and Methods

Sampling area. Specimens of the endemic species *R. siparantum* were collected from the spring area of the Bogë Stream, which is a tributary of the Lumbardhi i Pejës River. This spring area is characterized by several small, open-field rheocrene springs that converge shortly after their emergence and then flow through a densely forested region. Eventually, the Bogë stream, in conjunction with the Stankaj stream, merges into the Haxhaj stream, forming the upper section of the Lumbardhi i Pejës River. This specific site is located within the Rugovë Mountain, which is part of the Bjeshkët e Nemuna Mountain range. It is important to note that this area is within the boundaries of the Bjeshkët e Nemuna National Park (Figures 1 and 2).

Bjeshkët e Nemuna National Park, located in the western Kosovo, part of the Dinaric Alps, spans 63,028 hectares of mountainous terrain, boasting a diverse range of ecosystems and biodiversity. It features dense deciduous and coniferous forests, alpine landscapes, and numerous lakes (MESP 2016; UNEP 2010).

Fieldwork, identification and taxonomic work. Adults of *R. siparantum* and other caddisflies were collected with entomological nets and ultraviolet light traps. Nocturnal light trapping followed Malicky (2004). Specimens were fixed and stored in 90% ethanol for morphological analysis. The collected material is deposited at Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina "Hasan Prishtina", Prishtinë, Kosovo. For comparative assessments of morphological features of female of *Rhyacophila siparantum* we used drawings of *R. schmidinarica* and *R. hirticornis* in Urbanič, Krušnik and Malicky (2000), Malicky (2004). Other caddisfly specimens were identified by using Malicky (2004) and Olah *et al*. (2017). Systematic nomenclature follows Morse (2024).

Morphological characteristics of male terminalia of the new species were examined in specimens cleared in 10 % KOH solution. Nomenclature of male terminalia follows Urbanič, Krušnik and Malicky (2000).

Morphological features of genitalia of *Rhyacophila siparantum* were analyzed from 2 female specimens. Illustrations were prepared in Adobe Illustrator (version Creative Cloud 2018) by digitizing pencil templates made with a camera lucida.

Results

Description of female of *Rhyacophila siparantum* Ibrahimi, Bilalli & Kučinić, 2021

Material examined: Republic of Kosovo, Bjeshkët e Nemuna Mountains, Rugova Mountain, Pejë Municipality, spring area of the Bogë Stream, 42.763243˚N, 20.057842˚E, 1598 m asl (Figure 1), 04.07.2023, 2 ♀♀, 21 ♂♂, leg. Astrit Bilalli and Milaim Musliu.

Specimens are deposited at the Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina "Hasan Prishtina," Prishtinë, Kosovo, Collection "Halil Ibrahimi-Bjeshkët e Nemuna".

Distribution. Kosovo, Bjeshkët e Nemuna.

Figure 1. Left: Type locality of *Rhyacophila siparantum* Ibrahimi, Bilalli & Kučinić, 2021: Bogë Stream, Rugovë Mountain, Kosovo; Right: Ultraviolet light trap deployed on site for adult caddisfly collection.

Description. *General morphology.* Head and appendages brown. Thorax brown dorsally, and lighter ventrally. Legs yellowish brown, spurs brown, palpi light brown. Abdomen dark brown dorsally with irregular lines and patches and pale ventrally. Wings generally brown, with patches of dark brown along the wing venation. Forewing length 11.5 – 11.9 mm, spur formula 3-4-4. Antennae brown. There is a ventral tooth on the abdominal segment VII; triangularly shaped in lateral view, and considerably smaller than abdominal tooth on segment VII in males.

Female genitalia (Figures 3 and 4). In lateral view, segment VIII with deep V-shaped indentation, making the segment appear almost two-lobed, with ventral valve longer than the dorsal one; apex of ventral valve sharply acuminate; apex of dorsal valve bluntly rounded; small setae present throughout ventral part of segment VIII. In ventral view, segment VIII wide on basal half and gradually narrowing towards the apex; apex long and rounded. In dorsal view, segment VIII wide along basal 2/3rds and narrowing through the apex, ending bipartite with a small V shaped indentation between. Apodeme extending anterior to segment VI.

Vaginal apparatus simple, in lateral view the apex is composed by two rounded lobes, basally ending with two long triangularly shaped teeth encircling the membranous area.

Figure 2. Map of sampling station, Bogë Stream, Rugovë Mountain, Kosovo.

Ecology and distribution. Several streams have been sampled during 2023 in Rugova Mountain and *Rhyacophila siparantum* was found only at the type locality. The sampling area has a width of 1.5 - 2 meters and a depth of approximately 20 - 30 cm. The substrate consists of boulders and gravels, indicating a rocky bottom. Along the stream banks, there are coniferous plants-pine. During this sampling the species was found in sympatry with the following species: *Rhyacophila tristis* Pictet, 1834 (4 ♂♂, 1 ♀), *R. polonica* McLachlan 1879 (1 ♂), *R. laevis* Pictet, 1834 (2 ♂♂, 1 ♀), *R. loxias* Schmid, 1970 (6 ♂♂, 2 ♀♀), *Philopotamus montanus* (Donovan, 1813) (13 ♂♂, 8 ♀♀), *Hydropsyche saxonica* McLachlan, 1884 (2 ♂♂, 3 ♀♀), *Plectrocnemia geniculata* McLachlan, 1871 (2 ♂♂, 1 ♀), *Tinodes pallidulus* (McLachlan, 1878) (3 ♂♂, 1 ♀), *Drusus discolor* (Rambur, 1842) (2 ♂♂, 1 ♀) and *Micropterna caesareica* Schmid, 1959 (4 ♂♂, 3 ♀♀).

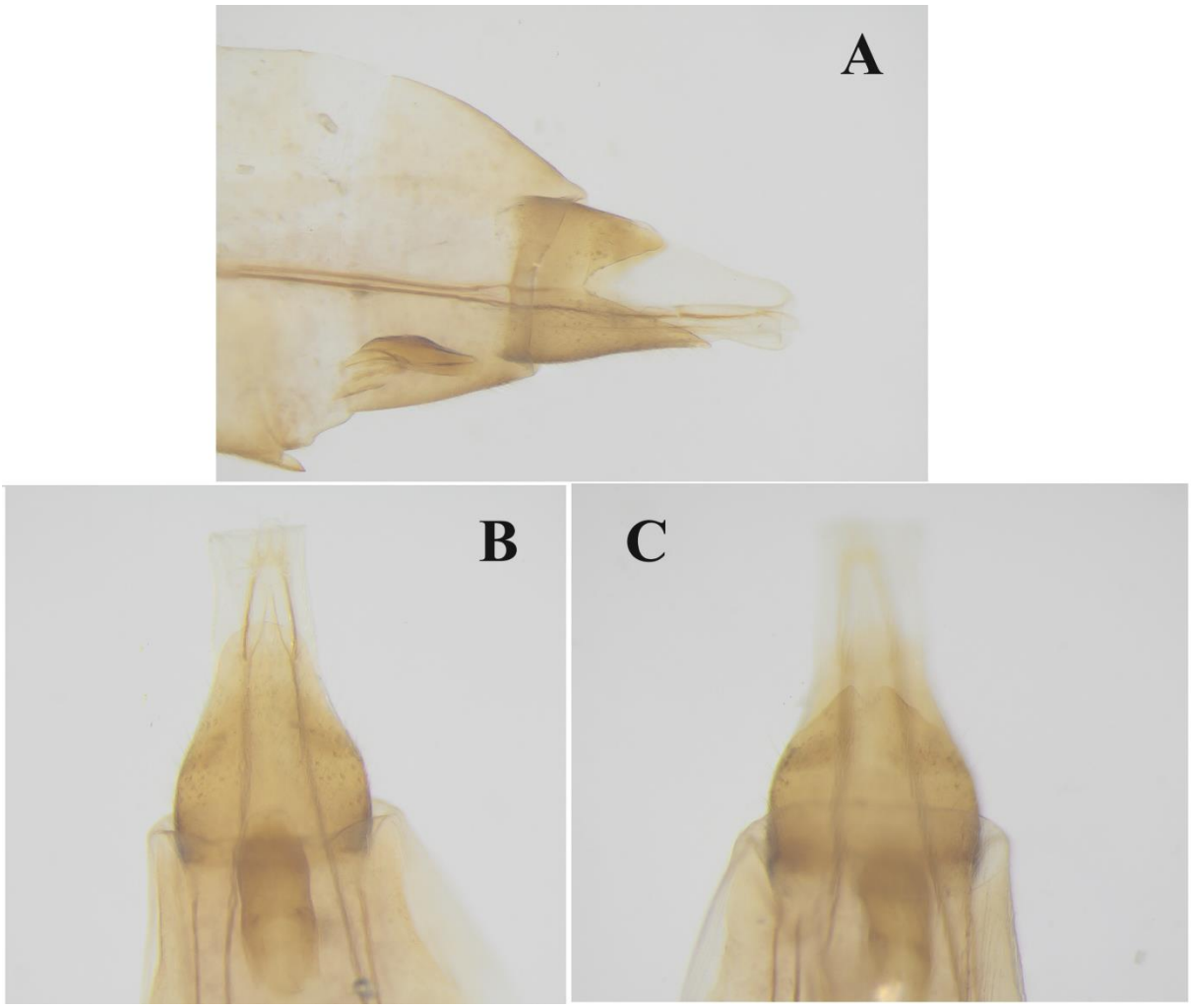

Figure 3. Photo of the female genitalia of *Rhyacophila siparantum*: A – lateral view; B – ventral view and C – dorsal view.

Discussion

The presence of species of the *Rhyacophila philopotamoides* group in the Western Balkans is relatively rare. Beside Kosovo, from where *Rhyacohpila siparantum* was recently described, *Rhyacophila hirticornis*, another species from the group is reported only from Serbia (Živić *et al*. 2002).

Rhyacophila siparantum can clearly be separated from *R. hirticornis* and *R. schmidinarica* by differences in male genitalia and based on molecular analysis as well. The observed differences in female genitalia now support as well the species' taxonomic status (Table 1). Females of *Rhyacophila siparantum* arevery similar to females of *Rhyacophila hirticornis* but share some resemblance with *Rhyacophila schmidinarica* as well. It can be distinguished from both species with its remarkable rounded apex of segment VIII in ventral view; in two other species the apex of segment VIII in ventral view is straight and truncated. Similar to *Rhyacophila hirticornis* it can be distinguished from *Rhyacophila schmidinarica* by higher segment VIII, both in ventral and dorsal views. In *Rhyacophila schmidinarica*, unlike the two other species, segment VIII in dorsal view apically ends with two rounded lobes with high V shaped indentation in between; *in R. siparantum* and *R. hirticornis* segment VIII in dorsal view ends apically with two triangular small lobes with small V shaped indentation in between. *Rhyacophila siparantum* also differs by both species by its sharp acuminate apex of ventral lobe of segment VIII in lateral view; in two other species the apex is blunt, nearly triangular. *R. siparantum* can be also clearly distinguished from *R. hirticornis* in the shape of vaginal apparatus, both in lateral and ventral views. The vaginal apparatus of *R. schmidinarica* has not been described.

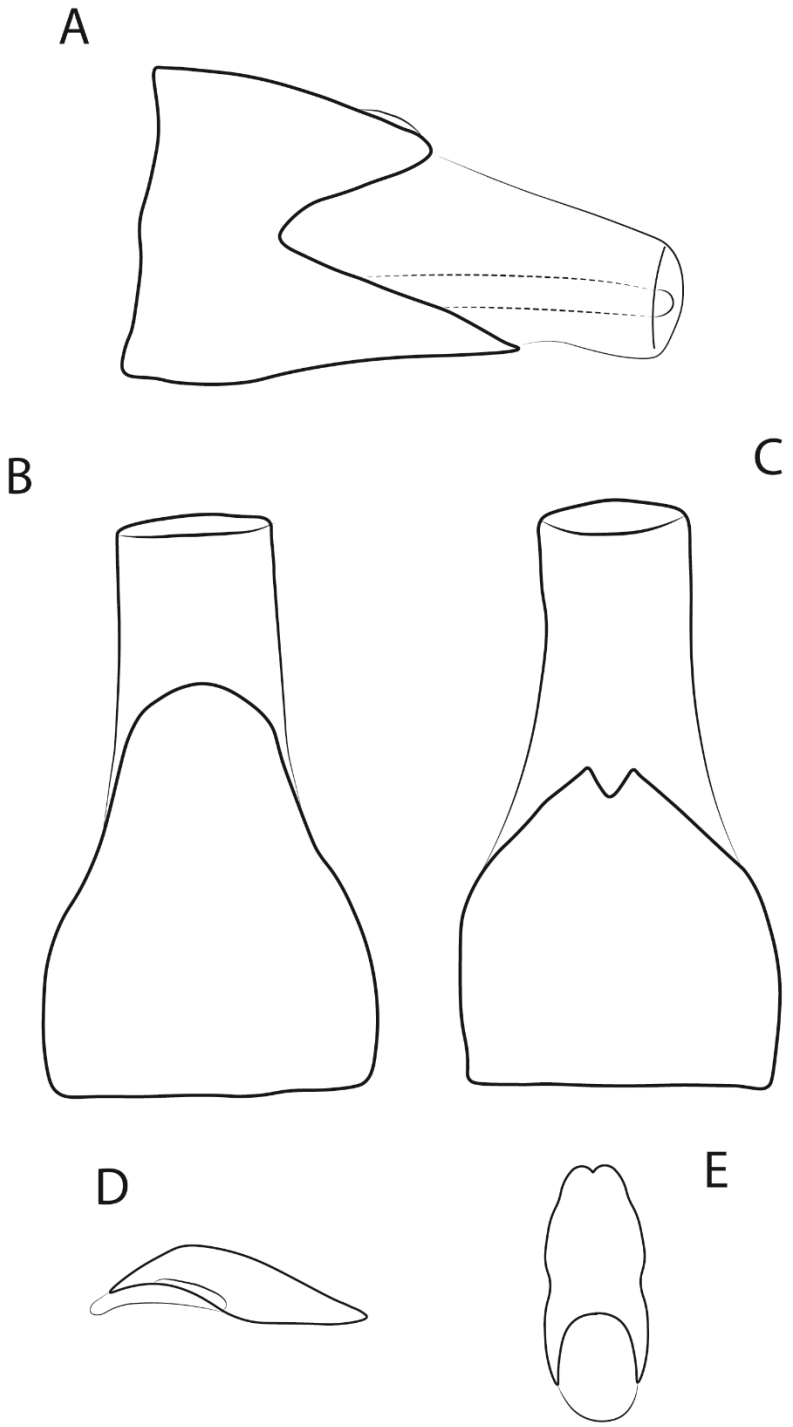

Figure 4. Female genitalia of *Rhyacophila siparantum*: A – lateral view; B – ventral view and C – dorsal view; D – vaginal apparatus, lateral view and E – vaginal apparatus, ventral view.

Species of the family Rhyacophilidae in Kosovo are the most widespread caddisflies, present in all river basins and all segments of streams and rivers (Bilalli *et al*. 2018; Ibrahim & Thaqi 2016; Ibrahimi & Vehapi 2017; Ibrahimi & Sejdiu 2018; Ibrahimi *et al*. 2012a, b, 2014, 2015b, 2016c, 2018, 2019a, b, c, d; Karaouzas *et al*. 2018; Muslia *et al*. 2020; Salihu *et al*. 2023; Valladolid *et al*. 2022). Beside *R. siparantum* in Bjeshkët e Nemuna in Kosovo there are two species which are present in Kosovo only in this mountainous massive, namely *Rhyacophila aurata* and *Rhyacophila trescavicensis* (Ibrahimi *et al*. 2012b, 2019b). Furthermore, Bjeshkët e Nemuna are known for the interesting composition of caddisfly fauna with many endemic and rare species.

Table 1. Diagnostic matrix for female genitalia of *Rhyacophila siparantum*, *R. schmidinarica* and *R. hirticornis*.

Character	*R. siparantum*	*R. schmidinarica*	*R. hirticornis*
Lateral view			
Segment VIII	Sharp acuminate apex of ventral lobe	Blunt apex of ventral lobe, nearly triangular	Blunt apex of ventral lobe, nearly triangular
Vaginal apparatus	Sclerotized part large, membranous part small	NA	Sclerotized part small, membranous part large
Ventral view			
Segment VIII	Segment generally high, with rounded apex	Segment generally low, with straight, truncated apex	Segment generally low, with straight, truncated apex
Vaginal apparatus	Sclerotized dorsal part high, basally ending with two high teeth encircling small membranous ventral part	NA	Sclerotized dorsal part low, basally ending with two low teeth encircling large membranous ventral part
Dorsal view			
Segment VIII	Segment generally high, apically ending with two triangular small lobes with small V shaped indentation in between	Segment generally low, apically ending with two rounded lobes with high V shaped indentation in between	Segment generally high, apically ending with two triangular small lobes with small V shaped indentation in between

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