



## An unexpected discovery of *Stactobiella risi* (Felber, 1908) (Trichoptera, Hydroptilidae) in Kosovo with notes on its habitat

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**ABSTRACT.** Caddisfly sampling conducted during 2023 in the Bistrica e Shalës River, belonging to the Ibër basin and in the Mirusha River, belonging to the Drini i Bardhë (White Drin) basin, revealed the first record of *Stactobiella risi* (Felber, 1908) for Kosovo and for Ecoregion 5 (Dinaric Western Balkans). Previously, this species had only been known from few localities in Europe. The morphology of the male genitalia in the collected specimens generally corresponds to the described species, with the exception of a less apically elongated inferior appendages in lateral view, which may be attributed to geographical variability. This discovery increases the knowledge about the distribution of family Hydroptilidae in Kosovo and the Balkans. In addition to this we provide a list of sympatric species in both localities including few rare species such as *Hydropsyche botosaneanui* Marinković Gospodnetić, 1966 and *Rhyacophila macedonica* Karaouzas, Valladolid & Ibrahim, 2022.

**Keywords:** Aquatic biodiversity, caddisflies, Dinaric Balkans, Ecoregion 5, new records

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## INTRODUCTION

The Hydroptilidae family, renowned as the most species-rich within the Trichoptera order, exhibits a global distribution, underscoring its ecological ubiquity. Presently, the family encompasses 2,665 recognized and valid species, distributed across six subfamilies and 76 genera (Thomson, 2023). As an intriguing facet of Trichopteran biodiversity, Hydroptilidae is notably one of the most widespread families, found ubiquitously across diverse faunal regions worldwide (Thomson, 2023). Hydroptilids manifest a remarkable spectrum of structural adaptations, particularly evident in the larval morphology and the construction of larval cases (Holzenthal et al., 2015). This diversity in form reflects their remarkable ecological plasticity, enabling them to thrive across a broad spectrum of aquatic habitats (Wiggins, 2004). The intricacies of Hydroptilidae's larval and case morphology underscore its status as

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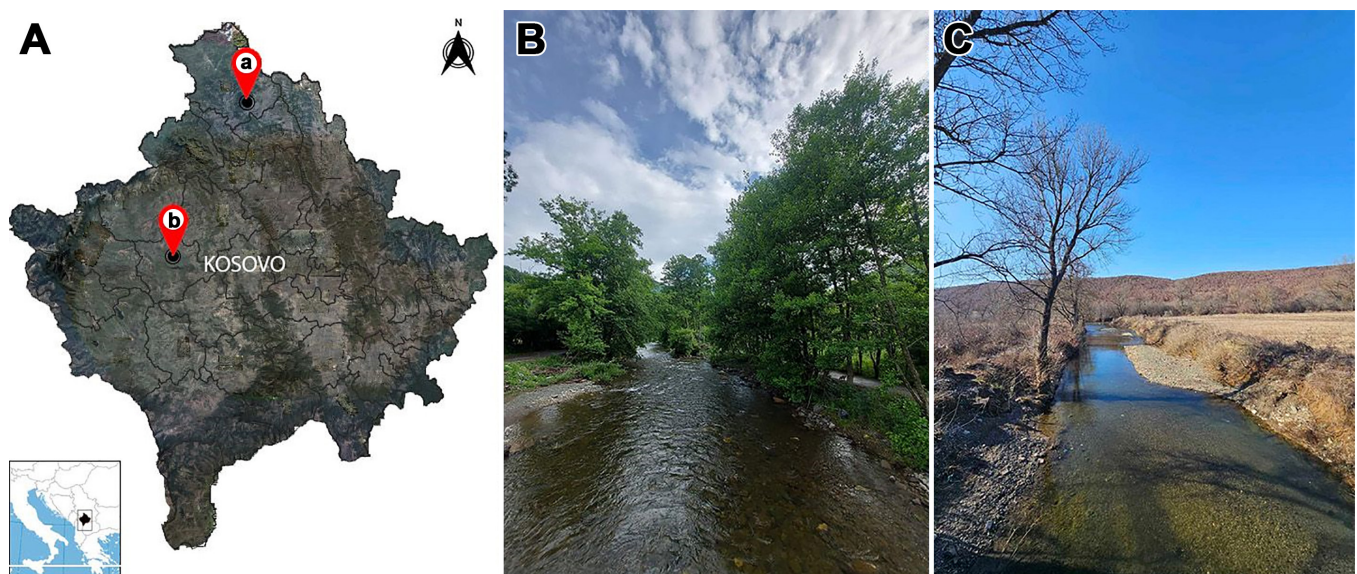
one of the most diverse caddisfly families. The current understanding of its taxonomy and systematics presents a compelling field for further scientific inquiry, urging comprehensive investigations to unravel the adaptations and evolutionary traits as well as ecological features within this exceptional caddisfly family (Holzenthal et al., 2007). Despite its taxonomic prominence, this group remains disproportionately underexplored relative to its extensive diversity. This is true for Kosovo and the Balkan Peninsula as well, from where only few records are known (Kumanski, 1988; Chvojka, 1997; Malicky, 2005; Ibrahimimi 2011; Ibrahimimi et al., 2012, 2014; Oláh & Kovács, 2014; Stojanović et al., 2015; Ibrahimimi et al., 2017, 2019; Ibrahimimi & Vehapi, 2017; Ibrahimimi & Sejdiu, 2018; Salihu et al., 2023; Bilalli et al., 2024).

In this contribution, we report the first record of *Stactobiella risi* for Kosovo and Ecoregion 5 (Dinaric Western Balkan) with notes on its habitat and ecology. In addition, we provide a list of other caddisfly species found in sympatry with *Stactobiella risi* in both localities.

## MATERIAL AND METHODS

**Sampling area.** Caddisfly material was collected from two sampling stations. The first sampling station is in the Bistrica e Shalës River (Lumbardhi i Shalës). Bistrica e Shalës is a settlement in the Leposaviq municipality in northern Kosovo, situated below the Kopaonik Mountains. The settlement lies on both sides of the middle flow of the Bistrica, a right tributary of Ibër River (Fig. 1, Table 1). The second sampling station is situated at the Mirusha River, precisely where it discharges into the Drini i Bardhë (White Drin) River. Mirusha River is located in the eastern part of the Dukagjin plain, it has the source from the Bllaca Mountains (specifically the Carraleva rock massif, approximately 1000 meters above sea level) (Fig. 1, Table 1). This river spans 38 kilometers from its source to its confluence with the Drini i Bardhë River. The Mirusha River basin is a sub-basin of the Drini i Bardhë basin.

**Fieldwork, identification and taxonomic work.** Adult caddisflies were collected using an entomological net and handpicking during the daylight. The collected specimens were stored directly in 90% ethanol and are deposited at the Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina "Hasan Prishtina," Prishtinë, Kosovo. We identified the adult caddisflies using the key provided by Malicky (2004). Photographs of the specimens were taken using an Olympus® SC53 camera attached to the Olympus® SZX16 stereomicroscope and subsequently processed with Adobe Photoshop® CC software.



**Figure 1.** Sampling sites. **A.** Map of Kosovo indicating the studied locations; **B.** Bistrica e Shalës River; **C.** Mirusha River

**Table 1.** Localities and habitat assessment data after Plafkin et al. (1989) and Barbour et al. (1999) for the two sampling stations: A. Bistrica e Shalës River, and B. Mirusha River.

Habitat parameters	Sampling station characteristics
Epifaunal Substrate/ Available Cover	<p><b>Station A:</b> 40-60% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; the presence of additional substrate in the form of newfall.</p> <p><b>Station B:</b> 20-50% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.</p>
Embeddedness	<p><b>Station A:</b> Gravel, cobble, and boulder particles are 0-35% surrounded by fine sediment. The layering of cobble provides a diversity of niche space.</p> <p><b>Station B:</b> Gravel, cobble, and boulder particles are 50-70% surrounded by fine sediment.</p>
Pool Substrate Characterization	<p><b>Station A:</b> Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.</p> <p><b>Station B:</b> Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.</p>
Velocity/Depth Combinations	<p><b>Station A:</b> All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is &lt;0.3 m/s, deep is &gt;0.5 m).</p> <p><b>Station B:</b> Only 2 of the 4 habitat regimes present.</p>
Pool Variability	<p><b>Station A:</b> Even a mix of large-shallow, large-deep, small-shallow, and small-deep pools present.</p> <p><b>Station B:</b> The majority of pools large-deep; very few shallow.</p>
Sediment Deposition	<p><b>Station A:</b> Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.</p> <p><b>Station B:</b> Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.</p>
Channel Flow Status	<p><b>Station A:</b> Water fills &gt;75% of the available channel; or &lt;25% of channel substrate is exposed.</p> <p><b>Station B:</b> Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.</p>
Channel Alteration	<p><b>Station A:</b> Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than the past 20 years) may be present, but recent channelization is not present.</p> <p><b>Station B:</b> Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.</p>
Frequency of Riffles (or bends)	<p><b>Station A:</b> The occurrence of riffles relatively frequent; the ratio of the distance between riffles divided by the width of the stream &lt;7:1 (generally 5 to 7); a variety of habitats is key.</p> <p><b>Station B:</b> Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.</p>
Bank Stability (condition of banks)	<p><b>Station A:</b> Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of banks in reach have areas of erosion.</p> <p><b>Station B:</b> Moderately unstable; 30-60% of the bank in reach has areas of erosion; high erosion potential during floods.</p>
Bank Vegetative Protection	<p><b>Station A:</b> 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.</p> <p><b>Station B:</b> Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.</p>
Riparian Vegetative Zone Width	<p><b>Station A:</b> Width of riparian zone 12-18 meters; human activities have impacted the area only minimally.</p> <p><b>Station B:</b> Width of riparian zone 6-12 meters; human activities have impacted the area significantly.</p>

## RESULTS

During this investigation, we recorded *Stactobiella risi* for the first time in Kosovo and Dinaric Western Balkans. The species was found in both investigated sampling sites with 3 and 2 specimens respectively. Our investigation revealed the presence of five families (Hydropsychidae, Hydroptilidae, Leptoceridae, Polycentropodidae, and Rhyacophilidae), seven different genera (*Cheumatopsyche*, *Hydropsyche*, *Ithytrichia*, *Stactobiella*, *Mystacides*, *Cyrnus*, and *Rhyacophila*), and eight species (*Cheumatopsyche lepida*, *Hydropsyche botosaneanui*, *Hydropsyche incognita*, *Ithytrichia lamellaris*, *Stactobiella risi*, *Mystacides azurea*, *Cyrnus trimaculatus*, and *Rhyacophila macedonica*) (Table 2). Family Hydropsychidae was represented by the highest number of species, with three in total. Following this, the family Hydroptilidae comprises two species, while Leptoceridae, Polycentropodidae, and Rhyacophilidae families were each represented by one species. *Rhyacophila macedonica*, *Cheumatopsyche lepida*, and *Mystacides azurea* were represented by the highest number of specimens, whereas the other species were represented by fewer specimens (less than ten each) (Table 2).

### *Taxonomic hierarchy*

**Class Insecta Linnaeus, 1758**

**Order Trichoptera, Kirby, 1813**

**Family Hydropsychidae Curtis, 1835**

**Genus *Cheumatopsyche* Wallengren, 1891**

***Cheumatopsyche lepida* (Pictet, 1834)**

**Material examined.** 4♂♂, 5♀♀, KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'2.18"E, 566 m), 01.VII.2023. 3♂♂, 3♀♀, KOSOVO, Mirusha River (42°31'26.094"N, 20°33'35.61"E, 257 m), 09.VII.2023, Leg.: H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** The species is widespread in Europe (Neu et al., 2018).

**Genus *Hydropsyche* Pictet 1834**

***Hydropsyche botosaneanui* Marinković Gospodnetić 1966**

**Material examined.** 3♂♂, 1♀, KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'02.18"E, 566 m), 01.VII.2023. 1♂, 2♀♀, KOSOVO, Mirusha River (42°31'26.09"N, 20°33'35.61"E, 357 m), 09.VII.2023, Leg.: H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** *Hydropsyche botosaneanui* is a rare species belonging to the *H. pellucidula*-group, from the Balkan Peninsula. Its distribution spans from Central to Southeast Europe (Neu et al., 2018). The species is relatively rare in Kosovo.

***Hydropsyche incognita* Pitsch, 1993**

**Material examined.** 3♂♂, 2♀♀, KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'2.18"E, 566 m), 01.VII.2023. 1♂, 2♀♀, KOSOVO, Mirusha River (42°31'26.09"N, 20°33'35.61"E; 357 m), 09.VII.2023, Leg.: H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** The species is widespread in Europe (Neu et al., 2018).

**Family Hydroptilidae Stephens, 1836**

**Genus *Ithytrichia* (Eaton 1873)**

***Ithytrichia lamellaris* Eaton, 1873**

**Material examined.** 3♂♂, 2♀♀, KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'02.18"E, 566 m), 01.VII.2023. 1♂, 2♀♀, KOSOVO, Mirusha River (42°31'26.09"N, 20°33'35.61"E, 357 m), 09.VII.2023, Leg.: H. H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** The species is widespread in Austria, Belarus, Bulgaria, Croatia, Czech Republic, Denmark, England, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Kazakhstan, Latvia, Lebanon, Luxembourg, Netherlands, Norway, Palestine, Poland, Portugal, Romania, Russia, Scotland, Serbia, Spain, Sweden, Switzerland, Turkey, Ukraine (Thomson, 2023). The species is relatively rare in Kosovo (Ibrahim et al., 2018).

### Genus *Stactobiella* Martynov, 1924

#### Species *Stactobiella risi* (Felber, 1908)

**Material examined.** 3♂♂, KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'02.18"E, 566 m), 01.VII.2023. 1♂, 2♀♀, KOSOVO, Mirusha River (42°31'26.09"N, 20°33'35.61"E 357 m), 09.VII.2023, Leg.: H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** The species is reported from Austria (Graf et al., 1998), Bulgaria (Kumanski, 1988), Finland, France, Germany, Greece, Italy, Hungary, Lithuania, North Macedonia, Portugal, Romania, Spain, Sweden and Switzerland (Thomson, 2023). New species for the caddisfly fauna of Kosovo.

**Diagnosis.** The morphology of the male genitalia in the collected specimens generally corresponds to the described species (Malicky, 2004), with the exception of a less apically elongated inferior appendages in lateral view, which may be attributed to geographical variability. Segment X elongated, apically narrow; superior appendages narrow, hook-shaped, curved ventrad; inferior appendages in lateral view directed dorsad, basally wider, apically narrow and rounded; aedeagus long, slender, apically slightly curved (Fig. 2).

### Family Leptoceridae Leach, 1815

#### Genus *Mystacides* Berthold, 1827

#### *Mystacides azurea* (Linnaeus, 1761)

**Material examined.** 4♂♂, 2♀♀ KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'02.18"E, 566 m), 01.VII.2023. 3♂♂, 3♀♀, KOSOVO, Mirusha River (42°31'26.09"N, 20°33'35.61"E, 357 m), 09.VII.2023, Leg.: H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** The species is widespread in Europe (Neu et al., 2018).

### Family Polycentropodidae Ulmer, 1903

#### Genus *Cyrnus* Stephens, 1836

#### *Cyrnus trimaculatus* (Curtis, 1834)

**Material examined.** 1♂, 1♀, KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'02.18"E, 566 m), 01.VII.2023. 2♂♂, KOSOVO, Mirusha River (42°31'26.09"N, 20°33'35.61"E, 357 m), 09.VII.2023, Leg.: H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** The species is relatively rare in Kosovo and widespread in Europe (Neu et al., 2018).

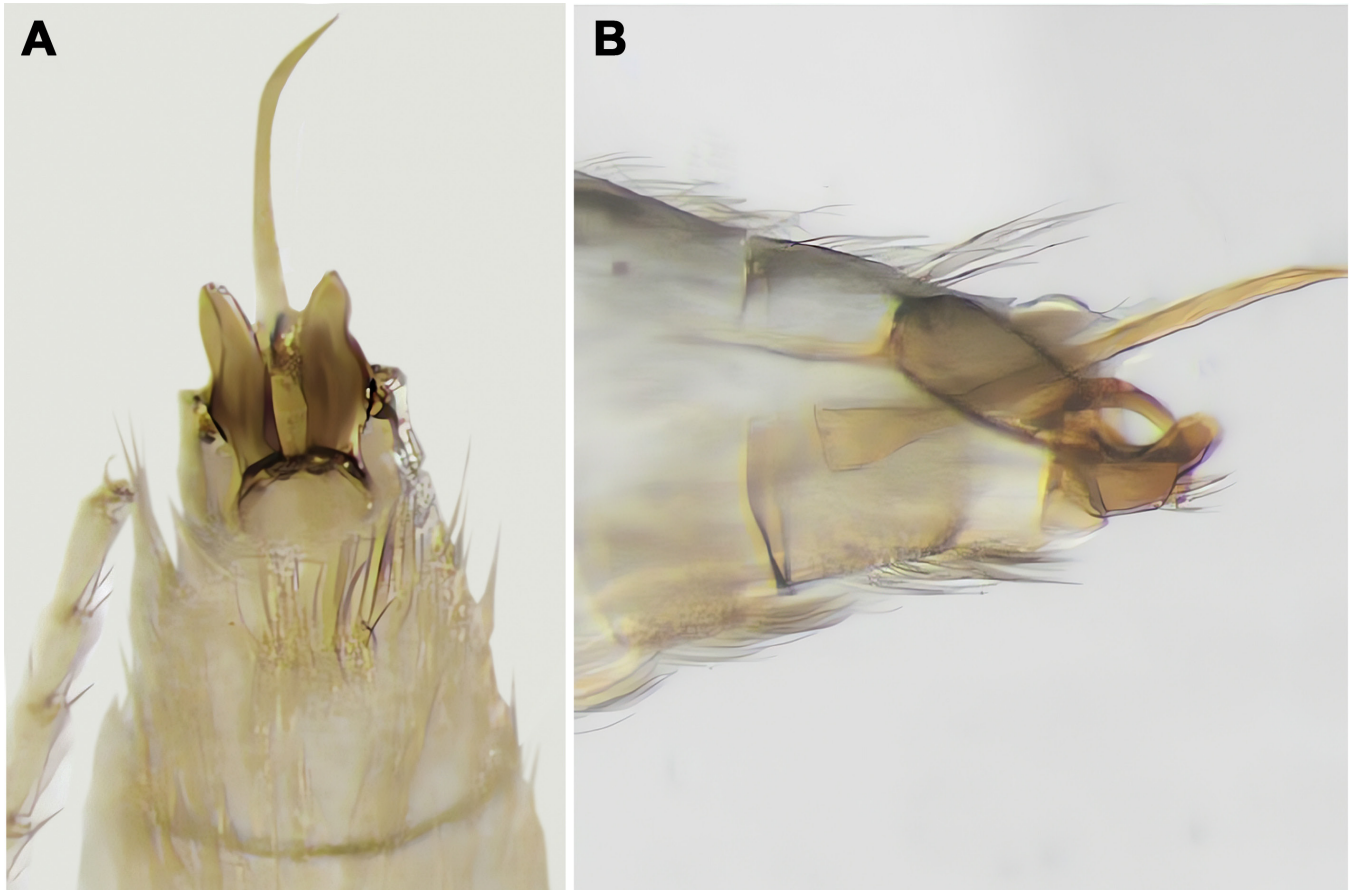
### Family Rhyacophilidae Stephens, 1836

#### Genus *Rhyacophila* Pictet, 1834

#### *Rhyacophila macedonica* Karaouzas, Valladolid & Ibrahim, 2022

**Material examined.** 8♂♂, 3♀♀ KOSOVO, Leposaviq Municipality, Bistrica e Shalës River (43°00'32.05"N, 20°52'2.18"E, 566 m), 01.VII.2023. 5♂♂, 1♀, KOSOVO, Mirusha River (42°31'26.09"N, 20°33'35.61"E, 357 m), 09.VII.2023, Leg.: H. Ibrahim, A. Bilalli, D. Geci & M. Musliu.

**Remarks.** The species was recently described from the Balkans and exhibits a relatively limited distribution encompassing Kosovo, the Republic of North Macedonia, Greece, and Serbia (Valladolid et al., 2022).



**Figure 2.** Male genitalia of *Stactobiella risi* (Felber, 1908). **A.** Ventral view; **B.** Lateral view.

**Table 2.** The composition of the caddisfly fauna in the sampling stations in the **A.** Bistrica e Shalës River and **B.** Mirusha River during July 2023.

Species/Dates of sampling and sampling sites	01.VII.2023			09. VII. 2023			Total		
	A		Σ	B		Σ	Σ		Σ
♂	♀	♂		♀	♂		♀		
<b>Hydropsychidae</b>									
<i>Cheumatopsyche lepida</i> (Pictet, 1834)	4	5	9	3	3	6	7	8	15
<i>Hydropsyche botosaneanui</i> Marinković Gospodnetić, 1966	3	1	4	1	2	3	4	3	7
<i>Hydropsyche incognita</i> Pitsch, 1993	3	2	5	1	2	3	4	4	8
<b>Hydroptilidae</b>									
<i>Ithytrichia lamellaris</i> Eaton, 1873	5	2	7	3	1	4	8	3	11
<i>Stactobiella risi</i> (Felber, 1908)	2	1	3	2	0	2	4	1	5
<b>Leptoceridae</b>									
<i>Mystacides azurea</i> (Linnaeus, 1761)	4	2	6	3	3	6	7	5	12
<b>Polycentropodidae</b>									
<i>Cyrnus trimaculatus</i> (Curtis, 1834)	1	1	2	2	0	2	3	1	4
<b>Rhyacophilidae</b>									
<i>Rhyacophila macedonica</i> Karaouzas, Valladolid & Ibrahim, 2022	8	3	11	5	1	6	13	4	17

## DISCUSSION

*Stactobiella*, a small genus of the Hydroptilidae family, currently encompasses only 22 recognized species distributed primarily across the Holarctic region (Thomson, 2023). Notably, most of these species exhibit a geographically restricted distribution, commonly confined to one or two countries. *Stactobiella risi*, heretofore was characterized by a patchy presence in Europe, has been sporadically documented in several countries, often restricted to a single locality within each region. The unexpected discovery of *Stactobiella risi* in Kosovo is particularly noteworthy, given that its neighbouring countries have only reported a single record from North Macedonia (Thomson, 2023). Furthermore, the specific geographic location within Kosovo where this species was identified falls within the Ecoregion 5 (Dinaric Western Balkans), yet it has not been documented in any other country from this ecoregion. Consequently, our findings assume significance as they substantially expand the known distributional range of *Stactobiella risi*.

In light of this discovery, we posit the hypothesis that *Stactobiella risi* may have a broader distribution across Europe, albeit with a likely restricted presence within individual countries. Our extensive investigations across the Balkan Peninsula in recent years have consistently revealed that species within the Hydroptilidae family tend to inhabit isolated habitats. This observation suggests that the Balkan Peninsula likely harbours additional undiscovered species of this family, a conjecture that extends to Kosovo, where only four species of Hydroptilidae have been documented to date. The limited knowledge of the Hydroptilidae fauna in Kosovo and the broader Balkan region underscores the necessity for continued research efforts to unveil the hidden diversity within this ecologically significant family.

## AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: H. Ibrahim: Fieldwork, identification of specimens, writing, and reviewing, A. Bilalli, D. Geci. & M. Musliu: Fieldwork sampling of specimens, photography, and writing. All authors approved the final version of the manuscript.

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This research is financially supported by the University of Prishtina.

## AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina "Hasan Prishtina", Prishtinë, Kosovo, and are available, upon request.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included plants and arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

## CONSENT FOR PUBLICATION

Not applicable.

## CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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## کشف غیرمنتظره (*Trichoptera, Hydroptilidae*) *Stactobiella risi* (Felber, 1908) در کوزوو و نکاتی از ویژگی‌های زیستگاهی آن

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**چکیده:** نمونه‌برداری انجام شده طی سال ۲۰۲۳ در محل رودخانه‌های بیستریکا اشالس، متعلق به حوضه‌ی ایبر و در رودخانه‌ی میروشا، متعلق به حوضه‌ی درینی بارد (درین سفید) به منظور جمع‌آوری حشرات راسته بال‌موداران (*Trichoptera*)، منجر به کشف حضور گونه‌ی *Stactobiella risi* (Felber, 1908) برای اولین بار در کوزوو و منطقه زیستی ۵ (بالکان غربی دینار) شد. این گونه، پیش از این تنها در چند منطقه اروپا شناخته شده بود. ریخت‌شناسی اعضای تولید مثلی نر نمونه‌های جمع‌آوری شده به استثنای زائده تحتانی کمتر توسعه یافته انتهایی (در نمای جانبی)، به طور کلی با توصیف‌های اصلی مطابقت دارد. اختلاف ممکن ناشی از تغییرات درون جمعیتی جغرافیایی باشد. یافت شدن این گونه در کوزوو، اطلاعات موجود در مورد دامنه انتشار گونه‌های تیره *Hydroptilidae* در منطقه بالکان را افزایش می‌دهد. علاوه بر این، لیستی از گونه‌های هم‌جوار در هر دو منطقه ارائه شد که شامل چند گونه کمیاب مانند *Rhyacophila macedonica* و *Hydropsyche botosaneanui* Marinković Gospodnetić, 1966 است. Karaouzas, Valladolid & Ibrahimi, 2022 است..

**واژگان کلیدی:** تنوع‌زیستی آبی، بال‌موداران، بالکان دینار، منطقه زیستی ۵، گزارش‌های جدید