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CONTRIBUTION TO THE KNOWLEDGE OF THE CADDISFLY (INSECTA: TRICHOPTERA) FAUNA OF THE EASTERN PART OF KOSOVO WITH THE FIRST RECORD OF *WORMALDIA JULIANI* KUMANSKI, 1979

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Sadiku, P. & Ibrahimi, H.: Contribution to the knowledge of the caddisfly (Insecta: Trichoptera) fauna of the eastern part of Kosovo with the first record of *Wormaldia juliani* Kumanski, 1979. Nat. Croat., Vol. 34, No. 1, _____, December 31, 2025, Zagreb.

Adult caddisflies were collected with ultraviolet light traps during June and September 2017 in two localities in eastern Kosovo. We found 17 species in total, belonging to the following families: Rhyacophilidae, Hydropsychidae, Psychomyiidae, Philopotamidae and Limnephilidae. At the first sampling station we registered the species *Wormaldia juliani* Kumanski, 1979 for the first time from Kosovo. The male genitalia of these specimens generally correspond with the described species, with slight differences in harpagos and tergite VIII, which can be explained by geographical variability. We also found few other rare species such as *Tinodes janssensi* Jacquemart, 1957 and *Rhyacophila macedonica* Valladolid, Karaouzas & Ibrahimi, 2022 among other.

Key words: aquatic insects, rare species, Philopotamidae, first records, Balkans

Sadiku, P. & Ibrahimi, H.: Prilog poznavanju faune tulara (Insecta: Trichoptera) istočnog dijela Kosova, s prvim nalazom vrste *Wormaldia juliani* Kumanski, 1979. Nat. Croat., Vol. 34, No. 1, _____, December 31, 2025, Zagreb.

Odrasli tulari prikupljani su s UV klopkama tijekom lipnja i rujna 2017. na dva lokaliteta na istočnom Kosovu. Pronađeno je ukupno 17 vrsta iz sljedećih porodica: Rhyacophilidae, Hydropsychidae, Psychomyiidae, Philopotamidae i Limnephilidae. Na prvoj postaji po prvi puta za Kosovo zabilježili smo vrstu *Wormaldia juliani* Kumanski, 1979. Genitalije mužjaka prikupljenih primjeraka uglavnom odgovaraju opisu vrste, s malim razlikama u harpagosu i tergitu VIII, što možemo objasniti geografskom varijabilnosti. Zabilježili smo također neke druge rijetke vrste, kao što su *Tinodes janssensi* Jacquemart, 1957 i *Rhyacophila macedonica* Valladolid, Karaouzas & Ibrahimi, 2022.

Ključne riječi: vodeni kukci, rijetke vrste, Philopotamidae, prvi nalazi, Balkan

INTRODUCTION

Trichoptera is one of the most species-rich orders of aquatic insects adapted to diverse freshwater habitats. Their larvae are exclusively aquatic and play a crucial role in freshwater ecosystems, serving as a significant component of food webs and food chains. Caddisfly larvae are frequently

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used in biomonitoring protocols to assess water quality due to their sensitivity to environmental changes. Adults are terrestrial and are typically found near vegetation nearby water bodies. They are frequently attracted to artificial light sources, especially at night (MORSE *et al.*, 2019; IBRAHIMI, 2024).

In recent years, the caddisfly fauna of Southeastern Europe has been the subject of extensive investigations, resulting in numerous studies focusing on their distribution, ecology, taxonomy, and molecular barcoding (OLAH *et al.*, 2014, 2016, 2018a, 2018b, 2019; KUČINIĆ *et al.*, 2015; WARINGER *et al.*, 2015; IBRAHIMI *et al.*, 2017, 2019d, 2022, 2023; BILALLI *et al.*, 2018; CERJANEC *et al.*, 2020; HINIĆ *et al.*, 2020; MUSLIU *et al.*, 2020; SLAVEVSKA-STAMENKOVIĆ *et al.*, 2020; 2021; HINIĆ-JORDANOVSKA *et al.*, 2025). Within this broader regional context, the caddisfly fauna of Kosovo has also gained considerable attention, particularly over the past decade. Since the first published study on the caddisflies of Kosovo by PONGRÁCZ (1923), numerous investigations have been conducted in various parts of the country (e.g., IBRAHIMI *et al.*, 2013, 2014a, 2015, 2019a, 2019b, 2019c; GASHI *et al.*, 2015; IBRAHIMI & VEHAPI, 2017; IBRAHIMI & SEJDIU, 2018).

Most studies on caddisflies in Kosovo have concentrated on ecologically significant areas such as the Sharr Mountains, Bjeshkët e Nemuna, and the Kopaonik Mountains (e.g., IBRAHIMI *et al.*, 2012a, 2012b; 2014b; 2025). However, central and eastern parts of Kosovo remain underexplored, with only a few investigations conducted in these regions, emphasizing the importance of expanding research efforts to these areas. All these studies are exceptionally important in light of ongoing degradation and pollution of freshwater ecosystems in Kosovo (IBRAHIMI *et al.*, 2008a, 2008b, 2021; GASHI *et al.*, 2016; MUSLIU *et al.*, 2018; GRAPCI *et al.*, 2020; ZOGARIS *et al.*, 2024; BILALLI *et al.*, 2022; BUÇINCA *et al.*, 2024) for documenting the presence of rare species and undertaking conservation and preservation measures. The ongoing degradation of rivers and pollution caused by industrial effluents, agricultural runoff, and untreated sewage significantly impact water quality and aquatic biodiversity in Kosovo. Above-mentioned studies highlight several factors that may endanger caddisfly species and their associated habitats. The pressures from urbanization and industrial development further exacerbate the environmental challenges, underscoring the need for immediate conservation measures.

The goal of this paper is to contribute to the knowledge of the caddisfly fauna of this unexplored area in Kosovo and provide an overview of some rare species of the found caddisflies.

MATERIAL AND METHODS

Study area

Sampling was carried out at two localities in eastern part of Kosovo. The first sampling station was located at a small stream at the Kishnapole village (42˚ 28′ 17″ N, 21˚ 17′ 8″ E, 734 m asl) in Gjilan Municipality. The width of the streambed at this sampling station was 3 m, surrounded by high vegetation on the shore. The substrate was composed of stones of different sizes. The second sampling station was located at a small streamlet in Sllovi village (42˚ 30′ 16″ N, 21˚ 14′ 16″ E, 677 m asl) in the Lipjan Municipality. The streambed at this sampling station was approximately 1.2 m wide surrounded by rich shore and nearby vegetation. The stream substrate was composed of pebbles, mud, small stones and sand.

Data sampling and processing

Adult caddisfly specimens were collected during June and September 2017. Sampling was conducted using ultraviolet light traps during the night. The light traps were placed on stream banks and operated for one hour and fifteen minutes immediately after the dusk. Collected samples were preserved in 80 % ethanol. The specimens were identified under a stereomicroscope with identification keys from MALICKY (2004) and KUMANSKI (1985, 1988).

All specimens were identified to the species level with the exception of females of two genera (*Hydropsyche* Pictet, 1834 and *Tinodes* Leach, 1815) which were identified only to the genus level. The collection is deposited at the Laboratory of Zoology of the Faculty of Mathematics and Natural Sciences, University of Prishtina, Republic of Kosovo. Systematic presentation was done according to MORSE (2025).

RESULTS

During this investigation, a total of 264 adult caddisfly specimens were collected from two sampling stations, comprising 239 specimens from Station 1 and 25 specimens from Station 2 (Tab. 1). These specimens represent eight families and seventeen species. At Station 1, sampling resulted in 141 females and 98 males. The most diverse families were Rhyacophilidae (three species), Hydropsychidae (three species), and Philopotamidae (three species). Notably, *Rhyacophila fasciata* Hagen, 1859 was the most abundant species at this station, with 95

specimens recorded during both months, followed by *Rhyacophila polonica* McLachlan, 1879 with 38 specimens. Other abundant species included *Hydropsyche* sp., with 60 specimens, and *Wormaldia subterranea* Radovanovic, 1932 contributing 18 specimens.

Tab. 1. The composition of the caddisfly fauna at two sampling stations in the eastern part of Kosovo. Station 1 = Kishnapole; Station 2 = Sllovi.

Species / Stations	Station 1						Station 2					
	June			September			June			September		
	♀	♂	∑	♀	♂	∑	♀	♂	∑	♀	♂	∑
Rhyacophilidae												
Rhyacophila fasciata Hagen, 1859	32	22	54	12	29	41						
Rhyacophila obliterata McLachlan, 1863				3	3	6						
Rhyacophila polonica McLachlan, 1879	29	5	34		4	4		1	1		2	2
Psychomyiidae												
Tinodes jansenssi Jacquemart, 1957	5	2	7									
Psychomyia pusilla Fabricius, 1781	3		3									
Polycentropodidae												
Plectrocnemia conspersa Curtis, 1834							3	2	5	4		4
Hydropsychidae												
Hydropsyche peristerica Botosaneanu & Marinkovic, 1966					1	1						
Hydropsyche sp. females	29		29	31		31	3		3	2		2
Hydropsyche instabilis Curtis, 1834		1	1					1	1			
Philopotamidae												
Philopotamus montanus Donovan, 1813					2	2	1	2	3			
Wormaldia subterranea Radovanovic, 1932				7	4	11		1	1			
Wormaldia juliani Kumanski, 1979		1	1									
Limnephilidae												
Potamophylax pallidus Klapalek, 1899	2		2		2	2						
Micropterna caesareica Schmid, 1959	2		2					3	3			
Leptoceridae												
Mystacides azurea Linnaeus, 1761	1		1									
Athripsodes bilineatus Linnaeus, 1758	2	1	3									
Sericostomatidae												
Oecismus monedula Hagen, 1859	3	1	4									
Total	108	33	141	53	45	98	7	10	17	6	2	8

At Station 2, sampling resulted in a total of 25 specimens, consisting of 17 males and 8 females. These specimens belong to six families and eight species. The most frequently collected species at this station were *Plectrocnemia conspersa* Curtis, 1834 (9 specimens) and *Hydropsyche* sp. (8 specimens), followed by *Micropterna caesareica* Schmid, 1959 with 6 specimens. Species richness was lower at Station 2 compared to Station 1, reflecting differences in habitat conditions and sampling intensity.

Overall, the collection highlights the dominance of species from the family Rhyacophilidae and Hydropsychidae, indicating the ecological importance of these taxa in the sampled regions. Additionally, the significant variation in species abundance and richness between the two stations underscores the role of local environmental factors in shaping caddisfly community structure.

DISCUSSION

Most species identified in this study are widespread across Kosovo, the Balkans, and Europe, reflecting the general biodiversity trends of caddisflies in these regions. Notably, *Wormaldia juliani* was recorded for the first time in Kosovo. This species, initially described by Kumanski in 1979, has been reported in other regions of the Balkans, such as Greece and North Macedonia (NEU, 2015; NEU *et al.*, 2018). Recent taxonomic revision (NEU, 2015) has clarified its distinction from closely related species within the *Wormaldia occipitalis* group. This revision provided detailed morphological analyses, especially focusing on the male genitalia, to differentiate *W. juliani* from other species in this complex. The presence of *W. juliani* in Kosovo not only extends its known distribution but also underscores the region's significance in the biodiversity of the Balkan Peninsula. Specimens of *W. juliani* from Kosovo generally correspond with the described species with slight differences in male genitalia, such as longer harpagos and slightly differently shaped tergite VIII (Fig. 1). These differences can be attributed to geographical variability.

Additionally, *Tinodes janssensi*, an endemic species of the Balkan Peninsula, was identified, further underscoring the area's significance as a biodiversity hotspot. In Kosovo, this species inhabits upstream areas of small streamlets, primarily within or in close proximity to forested regions and away from human disturbance (IBRAHIMI *et al*., 2016). Endemic species such as *T. janssensi* emphasize the need for conservation efforts to protect the unique habitats supporting these taxa.

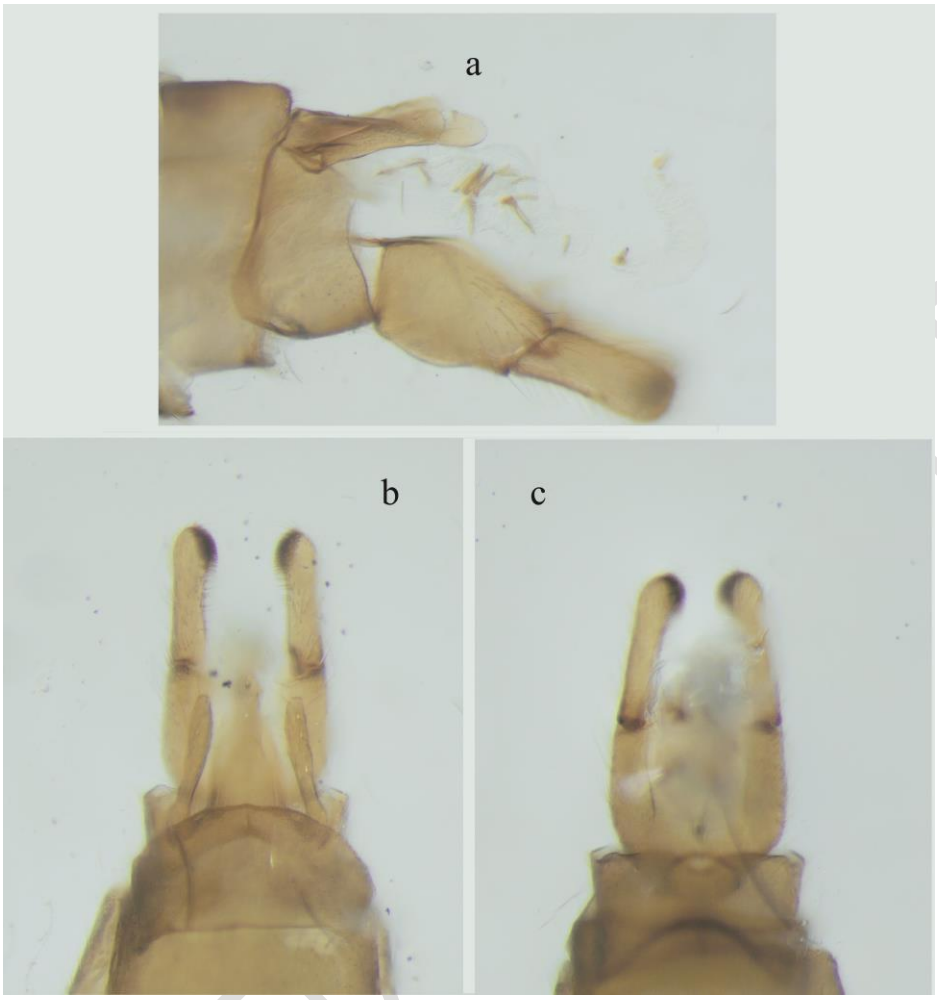

Fig. 1. Male genitalia of *Wormaldia juliani*: a) left lateral view; b) dorsal view; c) ventral view.

Rhyacophila fasciata, a species prevalent in Europe (NEU *et al.*, 2018), is particularly widespread in Kosovo, occurring in all three major river basins (IBRAHIMI *et al.*, 2012b). Recent molecular analyses suggest that populations previously identified as *R. fasciata* may comprise multiple cryptic taxa. This has led to the description of *Rhyacophila macedonica* Valladolid, Karaouzas & Ibrahimi, 2022, a species closely related to *R. fasciata* and found in Kosovo, Greece, North Macedonia, and Serbia (VALLADOLID *et al.*, 2021, 2022). Such discoveries underscore the importance of integrating molecular techniques with traditional taxonomy to better resolve species boundaries within morphologically similar groups. Other *Rhyacophila* species, such as *Rhyacophila polonica* and *Rhyacophila obliterata*, are also widespread in Europe and Kosovo (NEU *et al.*, 2018; IBRAHIMI *et al.*, 2012b). In this study, all three species of Rhyacophilidae were

collected at Station 1, with *Rhyacophila polonica* additionally recorded at Station 2, highlighting its broader ecological tolerance and adaptability. This addition of distribution of these *Rhyacophila* species contributes greatly to the existing knowledge on the diversity and distribution of this genus in Kosovo (e.g., IBRAHIMI *et al.*, 2012a, 2021; KARAOUZAS *et al.*,2018; SALIHU et al., 2023; BILALLI *et al.*, 2024).

The family Hydropsychidae, known for its abundance in European lowland rivers and streams, was represented by two species: *Hydropsyche instabilis* Curtis, 1834 and *Hydropsyche peristerica* Botosaneanu & Marinkovic, 1966. *H. instabilis* has been previously recorded at limited localities across Kosovo's three major river basins and is recognized for its preference for habitats with moderate flow and coarse substrates (IBRAHIMI *et al.*, 2012a, 2014a). In contrast, *H. peristerica*, commonly found in rivers and streams of the Adriatic and Black Sea basins, has been recorded primarily in areas with stable hydrological conditions (IBRAHIMI *et al.*, 2012a, 2014a). The presence of these species in both Station 1 and Station 2 reflects the ecological variability of the sampled sites and the adaptability of Hydropsychidae to different freshwater environments. Species of the genus *Hydropsyche* are an important constituent of European freshwaters counting for some 8% of the total known taxa (IBRAHIMI, 2024) and is widespread in Kosovo as well (e.g., IBRAHIMI *et al.*, 2024).

Among Philopotamidae, *Philopotamus montanus* Donovan, 1813 was notable for its widespread distribution in Kosovo, inhabiting nearly all streams, particularly in upper segments near forested areas (e.g., IBRAHIMI *et al.*, 2016; MUSLIU *et al*., 2024). Another member of this family, *Wormaldia subterranea* (formerly referred to as *W. occipitalis*), was also present at several localities across Kosovo (IBRAHIMI *et al.*, 2012a, 2014a). The presence of *W. juliani* alongside *W. subterranea* at Station 1 highlights the diversity within this genus and the potential for further discoveries in underexplored habitats.

Species from other families, including *Plectrocnemia conspersa* (Polycentropodidae), *Potamophylax pallidus* and *Micropterna caesareica* (Limnephilidae), and *Oecismus monedula* (Sericostomatidae), further expand the distributional range of these caddisflies in Kosovo (IBRAHIMI *et al.*, 2018). While *Plectrocnemia conspersa* was exclusively recorded at Station 2, likely reflecting its preference for slightly different microhabitats, *Oecismus monedula* was present only at Station 1, suggesting habitat specificity within this family.

These findings not only enhance the understanding of caddisfly biodiversity and distribution in Kosovo but also contribute to broader knowledge of the species' presence in the Balkan Peninsula and Europe. The discovery of *Wormaldia juliani* and the documentation of endemic and widespread species reinforce the region's significance as a center of biodiversity. The data from this study provide a baseline for future monitoring efforts and emphasize the importance of conserving freshwater habitats, which are increasingly threatened by anthropogenic pressures such as habitat degradation, pollution, and climate change.

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