

CONTRIBUTION TO 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. & Ibrahim, 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. 2, 257–266, 2025, Zagreb.

Adult caddisflies were collected with ultraviolet light traps during June and September 2017 in two localities in eastern Kosovo. In total, we found 17 species, 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 a few other rare species such as *Tinodes janssensi* Jacquemart, 1957 among others.

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

Sadiku, P. & Ibrahim, H.: Prilog poznavanju faune tulara (Insecta: Trichoptera) istočnog dijela Kosova, s prvim nalazom vrste *Wormaldia juliani* Kumanski, 1979. Nat. Croat., Vol. 34, No. 2, 257–266, 2025, Zagreb.

Odrasli tulari prikupljeni su pomoću UV svjetlosnih klopki tijekom lipnja i rujna 2017. na dva lokaliteta na istočnom Kosovu. Zabilježili smo ukupno 17 vrsta iz sljedećih porodica: Rhyacophilidae, Hydropsychidae, Psychomyiidae, Philopotamidae i Limnephilidae. Na prvoj postaji prikupili smo po prvi puta za Kosovo vrstu *Wormaldia juliani* Kumanski, 1979. Muški genitalni organi ovih primjeraka uglavnom odgovaraju opisanoj vrsti, uz manje razlike u harpagu i tergitu VIII koje se mogu objasniti geografskom varijabilnošću. Također smo pronašli još nekoliko drugih rijetkih vrsta, među ostalima *Tinodes janssensi* Jacquemart, 1957.

Ključne riječi: vodeni kukci, rijetke vrste, Philopotamidae, prvi nalaz, 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 used in biomonitoring protocols to assess water quality, due to their sensitivity to environmental changes. Adults are terrestrial

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and are typically found near vegetation near 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 its 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; BILALI *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 attracted 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 the 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; BILALI *et al.*, 2022; BUČINCA *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 impacts water quality and aquatic biodiversity in Kosovo. The above-mentioned studies highlight several factors that may endanger caddisfly species and the habitats associated with them. The pressures from urbanization and industrial development 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 in two localities in the eastern part of Kosovo. The first sampling station is located in a small stream at the Kishnapole village (42° 28' 17" N, 21° 17' 8" E, 734 m asl) in Gjilan Municipality. The three-metre wide streambed at this sampling station surrounded by shore high vegetation was bordered by banks with high vegetation. The substrate was composed of stones of different sizes. The second sampling station is located in a small streamlet in Sillovi village (42° 30' 16" N, 21° 14' 16" E, 677 m asl) in Lipjan Municipality. The approximately 1.2 m wide streambed at this sampling station was edged by richly vegetated banks. 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 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 are identified only to the generic 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, 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 represented 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 in 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		
	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ
Rhyacophilidae												
<i>Rhyacophila fasciata</i> Hagen, 1859	32	22	54	12	29	41						
<i>Rhyacophila obliterata</i> McLachlan, 1863				3	3	6						
<i>Rhyacophila polonica</i> McLachlan, 1879	29	5	34		4	4		1	1		2	2
Psychomyiidae												
<i>Tinodes jansenssi</i> Jacquemart, 1957	5	2	7									
<i>Psychomyia pusilla</i> Fabricius, 1781	3		3									
Polycentropodidae												
<i>Plectrocnemia conspersa</i> Curtis, 1834							3	2	5	4		4
Hydropsychidae												
<i>Hydropsyche peristerica</i> Botosaneanu & Marinkovic, 1966					1	1						

Species / Stations	Station 1						Station 2					
	June			September			June			September		
	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ
<i>Hydropsyche</i> sp. females	29		29	31		31	3		3	2		2
<i>Hydropsyche instabilis</i> Curtis, 1834		1	1					1	1			
Philopotamidae												
<i>Philopotamus montanus</i> Donovan, 1813					2	2	1	2	3			
<i>Wormaldia subterranea</i> Radovanovic, 1932				7	4	11		1	1			
<i>Wormaldia juliani</i> Kumanski, 1979		1	1									
Limnephilidae												
<i>Potamophylax pallidus</i> Klapalek, 1899	2		2		2	2						
<i>Micropterna caesareica</i> Schmid, 1959	2		2					3	3			
Leptoceridae												
<i>Mystacides azurea</i> Linnaeus, 1761	1		1									
<i>Athripsodes bilineatus</i> Linnaeus, 1758	2	1	3									
Sericostomatidae												
<i>Oecismus monedula</i> 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 low 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 & Ibrahim, 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 oblitterata*, 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. The inclusion of distribution data for these *Rhyacophila* species contributes greatly to current knowledge of on the diversity and geographical range 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 in 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 accounting for some 8% of the total known taxa (IBRAHIMI, 2024) and are 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 their 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 in 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, probably 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 under threat from anthropogenic pressures such as habitat degradation, pollution, and climate change.

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