First record of *Chaetopteroides kosovarorum* Ibrahimi & Oláh, 2013 (Insecta: Trichoptera) from the Republic of North Macedonia

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Abstract
Caddisfly specimens were collected with entomological net and ultraviolet light trap during 2016 and 2017 at eight localities in North Macedonia, Kosovo and Serbia. During this investigation we found 13 species. Here we report first record of *Chaetopteroides kosovarorum* from North Macedonia, as well as new localities for this species in Kosovo and Serbia. This species belongs to an extremely rare genus, inhabiting only few mountainous areas in the Balkans, and until recently has been reported only from its type locality in Kosovo.

Beside this, several other rare species were recorded during this investigation such as: *Rhyacophila obtusa* and *Drusus botosaneanui*.

Key words: Trichoptera, *Chaetopteroides kosovarorum*, North Macedonia, Kosovo.

Introduction
The Balkan Peninsula is one of the most important biodiversity hotspots for aquatic insects and caddisflies in Europe with a high rate of endemism due to the geological, hydrological and climatic features of the area (e.g. Previšić et al. 2013; Schmidt-Kloiber et al. 2017). However there are still areas where knowledge about caddisfly fauna is still low. This is especially true for North Macedonia, but for several mountainous areas in Kosovo, Serbia, Albania and Montenegro as well. During the past decade, there is an intensification of studies related to caddisfly ecology, biogeography and taxonomy in the Balkan Peninsula (e.g. Graf et al., 2008; Ibrahimi et al. 2012a, b, 2013, 2014a, b; Kučinić et al. 2013; Malicky 2005; Oláh 2010; Oláh et al. 2011; Oláh et al. 2013a, b, c; Previšić et al. 2014; Vučković et al. 2011; Waringer et al. 2009; Živić et al. 2006). Several investigations are also focused in Kosovo and North Macedonia, producing new records and species from the area (Bilalli et al. 2018; Gashi et al. 2015; Ibrahimi et al. 2012a, b, 2013, 2014a, b, 2016;
Oláh et al. 2010, 2011, 2013a, b, 2011, 2018; Oláh & Kovács, 2013, 2014; Rimcheska et al. 2015; Slavevska-Stamenković et al. 2016).

The goal of this investigation is to contribute to the distribution and ecology of *Chaetopteroides kosovarorum* in the Balkan Peninsula.

### Material and Methods

#### Data sampling and processing

Adult caddisfly specimens were collected with entomological net and ultraviolet light trap during 2016 and 2017 Kosovo, North Macedonia and Serbia.

Collected samples were preserved in 80% ethanol. The specimens were identified under a stereomicroscope with determination keys from Malicky (2004) and Kumanski (1985, 1988). The collection is deposited at the Laboratory of Zoology of the Faculty of Natural and Mathematical Sciences, University of Prishtina, Kosovo

#### Study area

Five of the sampling sites are located in the Karadak Mountains in North Macedonia (Tanushë, Brodec III and Brodec II) and Kosovo (Dërmjak and Dëbëlldeh) (Tab. 1). This mountainous area is located in the northern part of the Republic of North Macedonia, between the Skopje valley in the south, the Kumanovo valley in the east, the Lepenc river valley in the west, and Kosovo and Serbia in the north. The entire mountain range (in all 3 countries) covers an area of 836.3 km², of which the Republic of Macedonia belongs 459.3 km² or 55% while other part belongs Kosovo and Serbia (Milevski 2016). Freshwater ecosystems of this area belong to the Aegean Sea Basin (Vardar) and the Black Sea Basin (Morava). The highest peaks in the Karadak Mts. are Ramon (1651m), Maja e Kopilaqës (1.490m), Maja e Zezë (1.219m) and Maja Topan (1.178m). Three other sampling stations are located in Serbia (Metodje - Kopaonik, Vlasina Reka and Majorova Cesma - Jastrebac)

#### Table 1. Locality data for the 8 sampling stations of caddisflies in Kosovo, North Macedonia and Serbia

| Code | Sampling Stations          | Latitude 'N | Longitude 'E | Altitude m |
|------|----------------------------|-------------|--------------|------------|
| SMK1 | Tanushë                    | 42.23356    | 21.42733     | 1358       |
| SMK2 | Brodec III                 | 42.160165   | 21.448974    | 1400       |
| SMK3 | Brodec II                  | 42.150596   | 21.455415    | 1362       |
| SK4  | Dërmjak                    | 42.17264    | 21.31582     | 620        |
| SK5  | Dëbëlldeh                  | 42.25454    | 21.40008     | 982        |
| SR6  | Metodje Kopaonik           | 43.293670   | 20.854149    | 1565       |
| SR7  | Vlasina Reka               | 43.40256    | 21.38337     | 842        |
| SR8  | Majorova Cesma, Jastrebac  | 43.413384   | 21.405813    | 955        |

#### Results

During this investigation we found 13 species belonging to the following families: Rhycaphilidae (3), Philopotamidae (2), Polycentropodidae (1), Limnephilidae (5), Uenoidae (1) and Sericostomatidae (1).

Three species were registered with higher number of specimens: *Wormaldia occipitalis* (Pictet, 1834) (119 specimens) *Oecismus monedula* (Hagen, 1859) (90 specimens) and *Philopotamus montanus* (Donovan, 1813) (49 specimens). Other species were found with considerably lower number of specimens, while *Drusus botosaneanui* Kumanski, 1968 was found with a single specimen only.
FIRST RECORD OF \textit{CHAETOPTEROIDES KOSOVARORUM} FROM NORTH MACEDONIA

**Figure 1.** Distribution of the \textit{Chaetopteroides kosovarorum}. Yellow dots - previous records (Olah et al. 2013). Red dots - records from this investigation.

\textbf{Systematic list of caddisflies collected in Kosovo, North Macedonia and Serbia during 2016 and 2017.} \textit{EN} - Entomological net; \textit{UV} - Ultraviolet light trap

1. \textit{Rhyacophila obtusa} Klapalek, 1894  
   SMK1 Tanushë, MK: (EN) 03.06.2017. 4 ♂♂, 1 ♀; (EN) 22.06.2017. 6 ♂♂. SMK3 Brodec II, MK: (EN) 04.06.2017. 1 ♂.

2. \textit{Rhyacophila polonica} McLachlan, 1879  
   SMK1 Tanushë, MK: (EN) 05.08.2017. 2 ♂♂ 1 ♀.

3. \textit{Rhyacophila tristis} Pictet, 1834  
   SMK1 Tanushë, MK: (UV) 23.07.2017. 1 ♀; (EN) 22.06.2017. 3 ♂♂ 1 ♀♀; SMK2 Brodec II, MK: (EN) 03.06.2017. 6 ♂♂, 1 ♀. SMK3 Brodec II, MK: (EN) 04.06.2017. 2 ♂♂; (UV) 23.06.2017. 1 ♂.

4. \textit{Philopotamus montanus} (Donovan, 1813)  
   SMK3 Brodec II, MK: (EN) 04.06.2017. 3 ♂♂; (EN) 25.09.2016. 5 ♂♂, 1 ♀; (UV) 23.07.2017. 2 ♂♂, 2 ♀♀; 06.08.2017. (UV) 1 ♀. SK4 Dërmjak, KS: (UV) 15.10.2017. 3 ♂♂, 2 ♀♀; (EN) 02.10.2016. 2 ♂♂; (EN) 15.09.2017. 2 ♂♂. SMK1 Tanushë, MK: (EN) 25.09.2016. 1 ♂. (EN) 03.06.2017. 2 ♂♂, 1 ♀; (UV) 04.06.2017. 2 ♂♂; (UV) 23.06.2017. 5 ♂♂, 3 ♀♀; 05.08.2017 (EN) 1 ♂; 06.08.2017. (UV) 4 ♂♂. SMK2 Brodec III, MK: (EN) 03.06.2017. 1 ♂; (UV) 23.07.2017. 1 ♂; 06.08.2017. (UV) 1 ♂. SK5 Dëbëlldëh, KS: (EN) 30.08.2017. 1 ♂; (UV) 30.08.2017. 2 ♂♂; (UV) 17.09.2017. 1 ♂.

5. \textit{Wormaldia occipitalis} (Pictet, 1834)  
   SMK1 Tanushë, MK: (EN) 25.09.2016. 1 ♂, 1 ♀; (UV) 04.06.2017. 1 ♂; (EN) 03.06.2017. 1 ♂; (UV) 05.08.2017. 2 ♂♂; (UV) 10.09.2017. 1 ♂; (EN) 10.09.2017. 1 ♂; (EN) 14.10.2017. 3 ♂♂ 4 ♀♀. SMK2 Brodec III, MK: (UV) 15.10.2017. 3 ♂♂; (EN) 15.10.2017. 13 ♂♂; (EN) 09.09.2017. 3 ♂♂; (EN) 25.09.2016. 4 ♂♂ 2 ♀♀; (EN) 03.06.2017. 4 ♂♂; (UV) 23.06.2017. 3 ♂♂. SMK3 Brodec II, MK: (EN) 04.06.2017. 14 ♂♂, 1 ♀; (UV) 23.06.2017. 7 ♂♂, 2 ♀♀; (EN) 05.08.2017. 3 ♂♂ 3 ♀♀; (UV) 06.08.2017. 4 ♂♂ 1 ♀; (UV) 10.09.2017. 3 ♂♂, 1 ♀; (UV) 15.10.2017. 5 ♂♂; (EN) 15.10.2017. 15 ♂♂; (EN) 09.09.2017. 5 ♂♂ 8 ♀♀.
6. *Plectrocnemia conspersa* (Curtis, 1834)  
SMK3 Brodec II, MK: (UV) 23.07.2017. 1 ♂; (UV) 10.09.2017. 1 ♀. SMK2 Brodec III, MK: (UV) 23.07.2017. 4 ♂♂. SMK1 Tanushë, MK: (UV) 23.07.2017. 5 ♂♂; (UV) 06.08.2017. 1 ♂ 1 ♀.

7. *Drusus botosaneanui* Kumanski, 1968  
SMK1 Tanushë, MK: (UV) 10.09.2017. 1 ♂.

8. *Limnephilus lunatus* Curtis, 1834  
Tanushë, MK: (UV) 04.06.2017. 3 ♂♂, 2 ♀♀; (UV) 23.07.2017. 4 ♀♀; (EN) 05.08.2017. 1 ♂; (UV) 06.08.2017. 9 ♂♂ 11 ♀♀; (UV) 10.09.2017. 1 ♂ 1 ♀; (UV) 23.07.2017. 1 ♀. Brodec II, MK: (UV) 15.10.2017. 1 ♂; (UV) 06.08.2017. 11 ♂♂ 6 ♀♀. Brodec III, MK: (UV) 06.08.2017. (UV) 15.10.2017. 1 ♂; (UV) 10.09.2017. 1 ♂ 1 ♀; (UV) 23.07.2017. 1 ♀.

9. *Chaetopteroides kosovarorum* Ibrahimi & Oláh, 2013  
Tanushë, MK: (UV) 15.10.2017. 10 ♂♂; (EN) 21.09.2016 1 ♀; (EN) 25.09.2016 2 ♀♀. Brodec III, MK: (UV) 10.09.2017. 8 ♂♂. Brodec II, MK: (UV) 15.10.2017. 3 ♂♂. Dëbëldeh, KS: (UV) 22.10.2017. 1 ♂. Dërmjak, KS: (UV) 15.10.2017. 1 ♂, 5 ♀♀. SR6 Metodje Kopaonik SRB: (UV) 25.10.2016. 4 ♂♂. SR7 Vlasina Reka SRB: (UV) 13.11.2016, 1 ♂, (UV) 8.11.2016. 1 ♂. SR8 Majorova Cesma, Jastrebac SRB: (UV) 21.11.2016, 2 ♂♂, (UV) 15.09.2016, 6 ♂♂, 1 ♀.

10. *Limnephilus vittatus* (Fabricius, 1798)  
Brodec III, MK: (UV) 04.06.2017. 1 ♂; (UV) 06.08.2017. 1 ♂. Brodec II, MK: (UV) 06.08.2017. 6 ♂♂ 15 ♀♀. Tanushë, MK: (UV) 06.08.2017. 4 ♂♂, 4 ♀♀; (EN) 14.10.2017. 1 ♀.

11. *Potamophylax pallidus* (Klapalek, 1899)  
Brodec II, MK: (EN) 25.09.2016. 2 ♂♂; (UV) 10.09.2017. 2 ♂♂ 2 ♀♀; (UV) 15.10.2017. 11 ♂♂. Brodec III, MK: (UV) 06.08.2017. 1 ♂; (UV) 15.10.2017. 7 ♂♂. Tanushë, MK: (UV) 15.10.2017. 2 ♂♂ 10.09.2017. 2 ♂♂ 2 ♀♀.

12. *Thremma anomalum* McLachlan, 1876  
Brodec III, MK: (EN) 25.09.2016. 3 ♂♂; (EN) 09.09.2017. 5 ♂♂ 6 ♀♀; (EN) 10.09.2017. 2 ♂♂. Taushë, MK: (EN) 05.08.2017. 2 ♂♂; (EN) 22.07.2017. 3 ♂♂ 3 ♀♀. Brodec II, MK: (UV) 15.10.2017. 1 ♂; (UV) 10.09.2017. 1 ♂; (EN) 09.09.2017. 5 ♂♂ 6 ♀♀.

13. *Oecismus monedula* (Hagen, 1859)  
Dërmjak, KS: (UV) 12.06.2017. 8 ♂♂, 3 ♀♀; (UV) 31.07.2017. 11 ♂♂, 9 ♀♀; (UV) 24.08.2017. 1 ♂. Dëbëldeh, KS: (UV) 20.06.2017. 1 ♂; (EN) 29.07.2017. 1 ♂; (UV) 29.07.2017. 6 ♂♂, 8 ♀♀. Brodec II, MK: (UV) 06.08.2017. 15 ♂♂, 16 ♀♀. Tanushë, MK: (UV) 06.08.2017. 1 ♂.

**Discussion**

Results presented in this paper are continuation of the initiated large scale investigation of caddisflies of the Karadak Mountains. Several first records of rare caddisfly species were presented in this area for Kosovo and North Macedonia during the past period, within these investigations (Bilalli et al. 2018).

During the 60ties of the last century two species of the genus Chaetopteroides (*Chaetopteroides bulgaricus* Kumanski, 1969) and *Chaetopteroides maximus* (Kumanski, 1968)) were discovered from Pirin and Vitosha mountains in Bulgaria. For several decades the localities from where these species were described were the only places from where both species were known. During 2013 (Olah et al. 2013) three other species of this genus were described from Kosovo and North Macedonia (*Chaetopteroides kosovarorum*, *Chaetopteroides tunik* Oláh, 2013 and *Chaetopteroides veges* Oláh, 2013), all of them from single localities each. Finding of *Chaetopteroides kosovarorum* in Karadak Mountains during this investigation was somehow unexpected, considering the fact that it was previously considered that all species of this genus have narrow area of distribution. Additional sampling conducted in Serbia revealed that *Chaetopteroides kosovarorum* is widely distributed in the Balkan Peninsula. Currently it is known from 10 localities. It is probably the ancestral species of this genus from which most of the other species diverged. It was found that this species usually inhabits hypocrenal area of mountainous streams, usually shaded with high vegetation. Most of the localities where this species was found are located above or close to 1000 m, with the exception of station SK4 in Dërmjak village in Kosovo where it was found in considerably lower altitude (620 m). The highest altitude where this species was found is 1565 m asl.

During this investigation we found few other endemic species, contributing thus in the expansion of their known distribution area, namely *Rhyacophila obtusa* and *Drusus botosaneanui*. *Rhyacophila obtusa* is a
rare species in the Balkan Peninsula known, only from few mountainous headwater streams in the area. A single specimen of Drusus botosaneanui found during this investigation in station SMK1 Tanushë shows that although in low abundance, this species is widely distributed in the Balkan Peninsula. It is one of the rarest species of the genus Drusus adapted to live in different qualities of streams and rivers, up to the considerably polluted environments.

This investigation adds to the ecology of Chaetopteroides kosovarorum and contributes to the better knowledge of the caddisfly fauna of Kosovo and North Macedonia.

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