



RESEARCH ARTICLE

New faunistic data on the family Capniidae (Plecoptera) from the Carpathians (Romania and Ukraine)

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Abstract

Zwicknia acuta is reported for the first time from the South-Eastern Carpathians (Romania and Ukraine). Additionally, another stonefly species, *Zwicknia kovacsi*, previously described from Romania, is added to the Plecoptera fauna of Ukraine. New faunistic data are presented for two other winter-active species, *Capnia vidua rilensis* and *Zwicknia bifrons*. Based on a combination of personal and literature data we present a checklist of Capniidae from Romania and provide a key for them.

Keywords

Check-list, *Zwicknia acuta*, *Zwicknia kovacsi*, new faunistic data, the Carpathians, Romania, Ukraine, adult key.

Introduction

Capniidae is a holarctic Plecoptera family, with mostly winter-emerging species, also known as winter stoneflies. The family has more than 300 recognised species that are classified in 24 valid genera (DeWalt et al. 2020). A major revision of Capniidae based on a combination of morphology, genetic and behaviour data (drumming signals) were initiated by Murányi et al. (2014a). Those authors changed the taxonomic status of *Capnia bifrons* (Newmann, 1838) and included it in a newly emerged genus, *Zwicknia* Murányi, 2014 (Murányi et al. 2014a). To date, twelve species or subspecies of the genus are described or revised: *Zwicknia bifrons* (Newman, 1838), *Z. sevanica* (Zhiltzova, 1964), *Z. tuberculata* (Zhiltzova, 1964), *Z. turkestanica turkestanica* (Kimmins, 1950), *Z. turkestanica brevicula* (Berthélemy and Dia, 1982), *Z. acuta* Murányi and Orci, 2014 (Murányi et al. 2014a), *Z. komica* Murányi and Boumans, 2014 (Boumans and Murányi, 2014), *Z. kovacsi* Murányi and Gamboa, 2014 (Murányi et al. 2014a), *Z. rupprechtii* Murányi, Orci and Gamboa, 2014 (Murányi et al. 2014a), *Z. westermanni* Boumans and Murányi, 2014, *Z. ledoarei* Reding, Launay, Ruffoni, Vinçon and Boumans, 2016, *Z. gattolliati* Vinçon and Reding, 2018 (Boumans and Murányi 2014, Murányi et al. 2014a, Murányi et al. 2014b, Reding et al. 2016, Reding 2018, Vinçon and Reding 2018, DeWalt et al. 2020, Wolf 2016).

The Carpathians have a relatively poor Capniidae fauna, based on literature data. In the monograph of the Romanian stoneflies, five species belonging to two genera were recorded by Kis (1974). Graf et al. (2009) listed six species or subspecies of Capniidae from the whole of the Carpathians region or Ecoregion 10: *Capnia atra* Morton, 1896, *C. nigra* (Pictet, 1833), *C. bifrons* (Newman, 1838), *C. vidua rilensis* Raušer, 1955, *C. vidua vidua* Klapálek, 1904, *Capnopsis schilleri schilleri* (Rostock, 1892). The recently published revisionary work of Murányi et al. (2014a) adds only a single new species to the Carpathian fauna, *Zwicknia kovacsi*, described from the Rodnei Mountains, Eastern Carpathians, Romania and changed the taxonomic status of *Capnia bifrons* to *Zwicknia bifrons* (Newman, 1838).

Based on our recent faunistic investigations, we present additional distribution data of Capniidae from the Carpathian area, including a new record for the Ukraine, and a new record for the Romanian stonefly fauna.

Material and methods

Specimens were collected by hand in late winter to early spring from the snow surface. The collected material was preserved in 96% ethanol and was deposited in the Plecoptera Collections of the Faculty of Biology and Geology, affiliated to the Zoological Museum of the University of Babeş-Bolyai, Cluj Napoca (UBBFBGDC) as well in the Hungarian National History Museum, Budapest (HNHM). Nomenclature is based on the Plecoptera Species File (Version 5.0/5.0) (DeWalt et al. 2020).

Male terminalia were put overnight in 10% KOH and for one hour in undiluted glacial acetic acid in order to neutralise and clear the remainder of the soft tissues. Then, they were placed in glycerol to wash out the acid and, finally, in a drop of glycerol on a slide with rounded excavation, to photograph them. Genital structures were photographed with a compound Olympus microscope (CX23) equipped with a Canon 750D camera.

Results

A total number of 72 specimens belonging to four species were collected between 2018 and 2021, additional data of ten specimens were collected by the Hungarian Natural History Museum.

First record of *Zwicknia acuta* Murányi and Orci, 2014 from the Carpathians

Zwicknia acuta Murányi and Orci, 2014: Eastern Carpathians: 30 males; Ozunca-Băi, Murgó Mts., 2018.03.03, 557 m, 46.092701°N, 25.738101°E, leg. Soós Á., Szócs E. (UBBFBGDC); 20 males: Cheile Vârghişului, river Vârghiş, 2018.03.04, 653 m, 46.218972°N, 25.545092°E, leg. Dénes A., Pál M. (UBBFBGDC); 5 males: Cheile Vârghişului, river Vârghiş, 2021.01.30, 574 m, 46.209884°N, 25.548356°E, leg. Dénes A. (UBBFBGDC). Apuseni Mountains: 5 males: Finişel, 2021.02.20, 621 m, 46.670013°N, 23.417413°E, leg. Keresztes L. (UBBFBGDC); 1 female: Finişel, 2021.02.20, 621 m, 46.670013°N, 23.417413°E, leg. Keresztes L. (UBBFBGDC).

Individuals of *Zwicknia acuta* Murányi and Orci, 2014 were collected in late January and early March (air temperatures between -2 °C and +2 °C), from the banks of moderately fast flowing, medium-sized streams with *Alnus glutinosa* stock between 557 and 653m a.s.l. These conditions fit to the described ecology of the species (Murányi et al. 2014a). The high number of individuals and the continuous presence of the species in Cheile Vârghişului suggest that there is a strong reproductive population. Additionally, another population of the species was detected in the Apuseni Mountains, Romania. Male habitus, forewing and terminalia were photographed to document the morphological key features of the species (Fig.1).

First record of *Zwicknia kovacsi* Murányi and Gamboa, 2014 from the Ukraine

Zwicknia kovacsi Murányi and Gamboa, 2014: Eastern Carpathians: 2 males: Zasosljak, Zakarpatska R., 2017.04.07, 1121 m, 48.16388°N, 24.55754°E, leg. Keresztes L. (UBBFBGDC); 4 males: Drahoalat, Zakarpatska R., 2017.04.08, 895 m, 48.23819°N, 24.26929°E, leg. Keresztes L. (UBBFBGDC); 1 female: Drahoalat, Zakarpatska R., 2017.04.08, 895 m, 48.23819°N, 24.26929°E, leg. Keresztes L. (UBBFBGDC).

The species is recorded for the first time in Ukraine. Our new faunistic data represent the second location of the species, which was previously known only from

the Rodnei Mts. of the Eastern Carpathians, Romania. This new locality shares similar general features with the locus typicus (Murányi et al. 2014a). The mountainous brook near Drahoblat is characterised by large boulders and stones and cascades and rapids (Fig. 2A). Adults were collected on snow near the bank of the river on a cloudy and wet day with high humidity and air temperature of around 3–4°C. Male terminalia

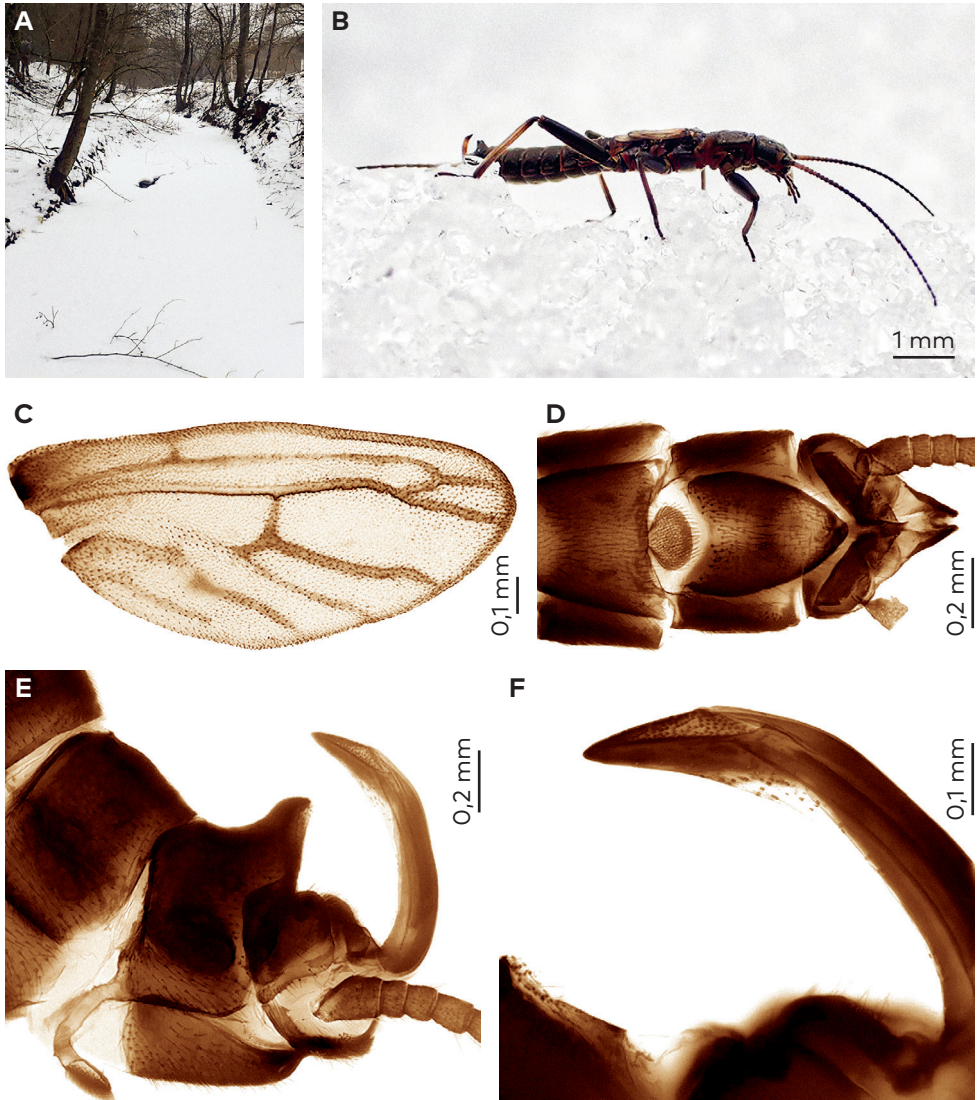


Figure 1. *Zwicknia acuta* Murányi and Orci, 2014, male: **A** Habitat of the species, Finişel, Apuseni Mountains; **B** Male habitus; **C** Male forewing; **D** Male terminalia, ventral view; **E** Male terminalia, lateral view; **F** Main epiproct sclerite, lateral view.

was photographed to document the morphological key features as well the habitat, habitus and male forewing (Fig. 2).

Additional data on *Zwickyia bifrons* (Newman, 1838) and *Capnia vidua rilensis* Raušer, 1955 in Romania

Capnia vidua rilensis Raušer, 1955: 2 males: Hășmașu Mare, 2021.02.28, 969 m, 46.701388°N, 25.767222°E, leg. Keresztes L. (UBBFBGDC) 3 males: Rodna Mts., Șesuri, Bistrița Aurie River above the village, 2011.04.02, 1060 m, 47.583333°N, 24.950000°E, leg. T. Kovács, D. Murányi (HNHM; 2 males used for sequencing); 2 females: Rodna Mts., Șesuri, Bistrița Aurie River above the village, 2011.04.02, 1060 m, 47.583333°N, 24.950000°E, leg. T. Kovács, D. Murányi (HNHM; 1 female used for sequencing); 1 female: Maramureș Mts., Borșa-Băile Borșa, Vinișor Stream, 2007.05.22, 1030 m, 47.650000°N 24.783333°E, leg. J. Béres, Cs. Csuzdi, L. Dányi, J. Kontschán, D. Murányi (HNHM); 2 female: Gilău Mts., Măguri-Răcățău, Someșul Rece River, 1965.04.17, leg. I. Imreh (HNHM); 2 males: Cluj county, Gilău Mts, Giurcuța de Jos, Someșul Cald River, 1966.03.12, leg. I. Imreh (HNHM).

Zwickyia bifrons (Newman, 1838): 2 males: Ozunca-Băi, Murgó Mts., 2018.03.03, 557 m, 46.092701°N, 25.738101°E, leg. Soós Á., Szócs E. (UBBFBGDC).

Discussion

Here, we present new faunistic data on relatively rare and sporadically collected winter stoneflies (Capniidae) from the Carpathian area. Two species, *Zwickyia acuta* and *Z. kovacsi* were only recently described, and reported as new for the fauna of Romania and Ukraine, respectively. Based on a comprehensive revisionary work of Murányi et al. (2014a) and Murányi et al. (2014b) we expect the winter stonefly fauna to be more diverse than was previously suggested by literature data (Kis 1974). An annotated checklist of Capniidae from Romania is presented, including taxonomic changes proposed by Murányi et al. (2014a). According to our recent faunistic data the number of Capniidae species from Romania was raised to seven, belonging to three different genera.

Revised checklist of *Capniidae* from Romania

Capniidae Banks, 1900

***Capnia* Pictet, 1841**

Capnia atra Morton, 1896

Capnia nigra (Pictet, 1833)

Capnia vidua rilensis Raušer, 1955

***Capnopsis* Morton, 1896**

Capnopsis schilleri (Rostock, 1892)

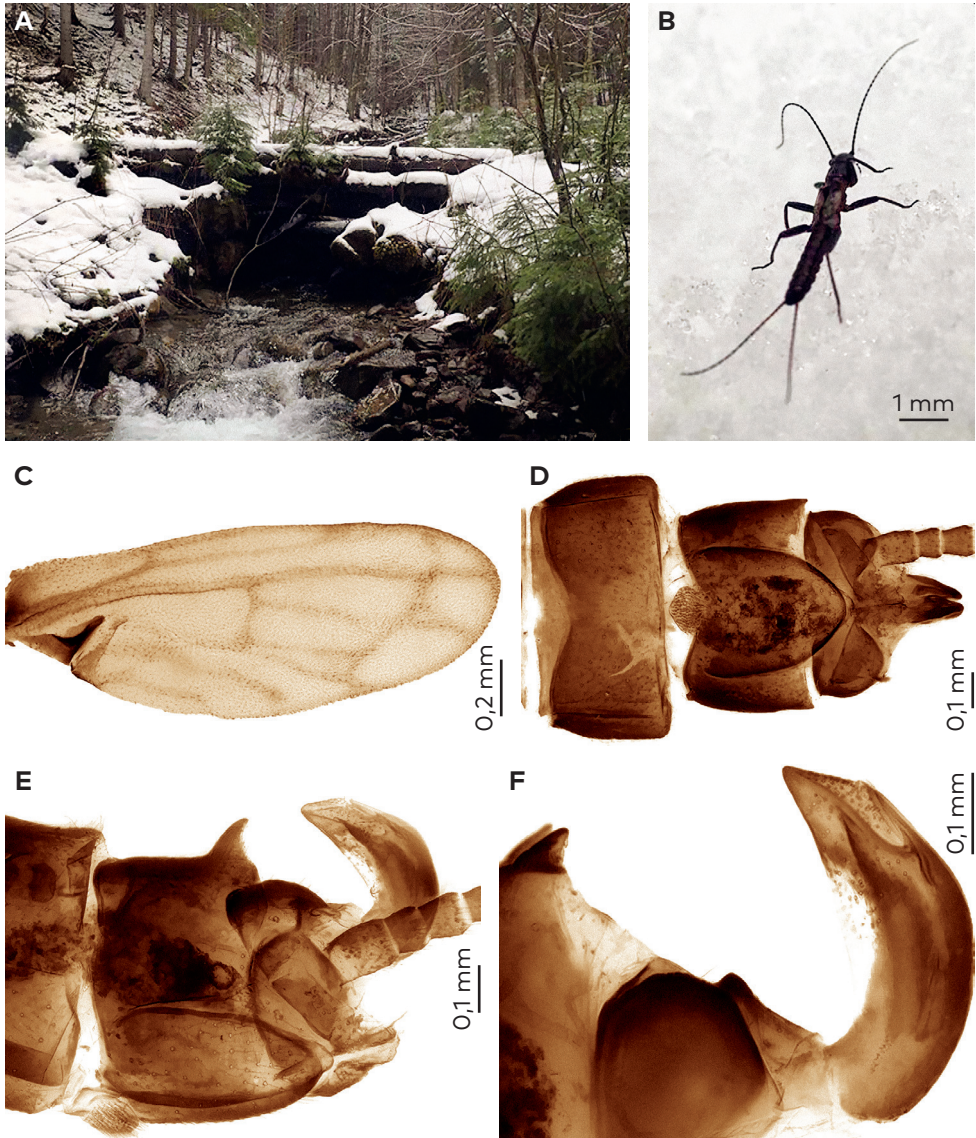
Zwicknia Murányi, 2014*Zwicknia acuta* Murányi and Orci, 2014*Zwicknia bifrons* (Newman, 1838)*Zwicknia kovacsi* Murányi and Gamboa, 2014

Figure 2. *Zwicknia kovacsi* Murányi and Gamboa, 2014, male: **A** Habitat of the species, Drahoblat, Eastern Carpathians, Ukraine; **B** Male habitus; **C** Male forewing; **D** Male terminalia, ventral view; **E** Male terminalia, lateral view; **F** Main epiproct sclerite, lateral view.

Key to adult males of *Capniidae* from Romania

Adult Capniidae have the following discriminating morphological characters: last tarsal segment at most as long as two basal segments together, the second tarsal segment shorter than the first or the third segment; cubital area of the forewings with no more than three transversal nerves; cerci with several segments, with the exception of the genus *Capnioneura*.

- 1 – Cerci with more than 8 segments. Wings reduced, but with anal field present. 2
 - Cerci with 6–8 segments. Wings well developed, but the anal field absent *Capnopsis* – *Capnopsis schilleri* (Rostock, 1892)
- 2 – Tergit 9 with a median projection, ventral vesicle present (*Zwicknia*) 3
 - Tergit 9 without median projection, ventral vesicle missing (*Capnia*) 5
- 3 – Main epiproct sclerite medially swollen. Process of tergite 9 very wide and distinctly bicornuated *Zwicknia kovacsi* Murányi and Gamboa, 2014
 - Main epiproct sclerite not swollen medially. Process of tergite 9 narrower and without distinct corns 4
- 4 – Tip of the main epiproct sclerite upcurved in lateral view. Spines present only on the membranous part of the epiproct apex. Process of tergite 9 high and perpendicularly elevated *Zwicknia bifrons* (Newman, 1838)
 - Tip of the main epiproct sclerite slightly curved and acute, in lateral view. Spines present also on the apical part of the main epiproct sclerite. Process of tergite 9 very high, rectangular and with indenting sides caudally *Zwicknia acuta* Murányi and Orci, 2014
- 5 – Main epiproct sclerite conical, narrows toward tip *Capnia nigra* (Pictet, 1833)
 - Male epiproct sclerite not conical, higher than wide 6
- 6 – Posterior margin of tergite 6 with paired posterior projection tergite 7 with a medial rounded posterior projection *Capnia vidua rilensis* Raušer, 1955
 - Posterior margin of the tergite 6 without projection, tergite 7 with two triangular projection: one at its anterior edge, and a single median projection at its posterior edge *Capnia atra* Morton, 1896

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