

## REVISION OF THE OCCURRENCE OF *ISOPHYA STYSI* ČEJCHAN, 1957, IN THE SLOVAK KARST NP (SE SLOVAKIA): A CASE OF POSSIBLE CONFUSION WITH THE ENDEMIC *I. BEYBIENKOI* MAŘAN, 1958

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### KEY WORDS

*Isophya*  
Plump Bush-cricket  
Identification  
Slovakia  
Central Europe

### ABSTRACT

Stys' Plump Bush-cricket (*Isophya stysi*) is an endemic species to the Carpathian Basin and is listed as a species of European importance (Annex II of the Habitats Directive 92/43/EEC 1992). Its westernmost range border was found in Aggtelek National Park (NP) in 1986–1996 and the neighbouring Slovak Karst NP in 2005–2014. In 2015–2020 an extensive and in 2021–2022 a detailed monitoring of the closely related Bei-Bienko's Plump Bush-cricket (*I. beybienkoi*) was conducted in the Slovak Karst NP to mitigate the extinction risk of this globally threatened species. In addition to the target species, several other specimens of the genus *Isophya* were identified, but without any findings of the Stys' Plump Bush-cricket. Research thus far conducted in 2021 and 2022 suggests possible confusion of Stys' Plump Bush-cricket with the previously little-known and endemic Bei-Bienko's Plump Bush-cricket. Finally, based on most recent data, we hypothesize that Stys' Plump Bush-cricket is unlikely to have occurred at sites with clear identification of Bei-Bienko's Plump Bush-cricket since 2015.

Bush-crickets of the genus *Isophya* include a large number of morphologically very similar species. The identification of specimens is often extremely difficult, and the validity of some species and their relative taxa is often doubtful (Guzik & Guzik 2022; Heller et al. 2004; Orci et al. 2005). Nowadays, many European species have become endangered, because the insects are brachypterous, and most of them are characterized by very low mobility and poor dispersal ability. They are thus vulnerable to human disturbance and live in small and isolated populations (Kenyeres & Bauer 2021; Kenyeres & Varga 2023; Orci et al. 2005; Nuhlíčková et al. 2021b, 2023b).

Stys' Plump Bush-cricket (*Isophya stysi*) is an endemic species to the Carpathian Basin. It is listed as a species of European importance (Annex II of the Habitats Directive 92/43/EEC 1992) and is under strict protection in many Member States of the European Union. The northern edge of its distribution reaches Slovakia and a small area of south-eastern Poland (Guzik & Guzik 2022). Core populations occur in the Carpathian area of Romania, the westernmost part of Ukraine and eastern Hungary (Chobanov et al. 2016b).

In Slovakia, Stys' Plump Bush-cricket survives as viable and abundant populations only in eastern Slovakia. The occurrence of this species has been

**Citation:** Svetlíková S & Krištín A, 2024. Revision of the occurrence of *Isophya stysi* Čejchan, 1957, in the Slovak karst NP (SE Slovakia): a case of possible confusion with the endemic *I. beybienkoi* Mařan, 1958. *Folia faunistica Slovaca* 29: 1–5.

**Language:** in English

e-ISSN 1336–4529 ISSN 1335–7522

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Received 19 June 2024

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Accepted 2 December 2024

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Published 27 December 2024



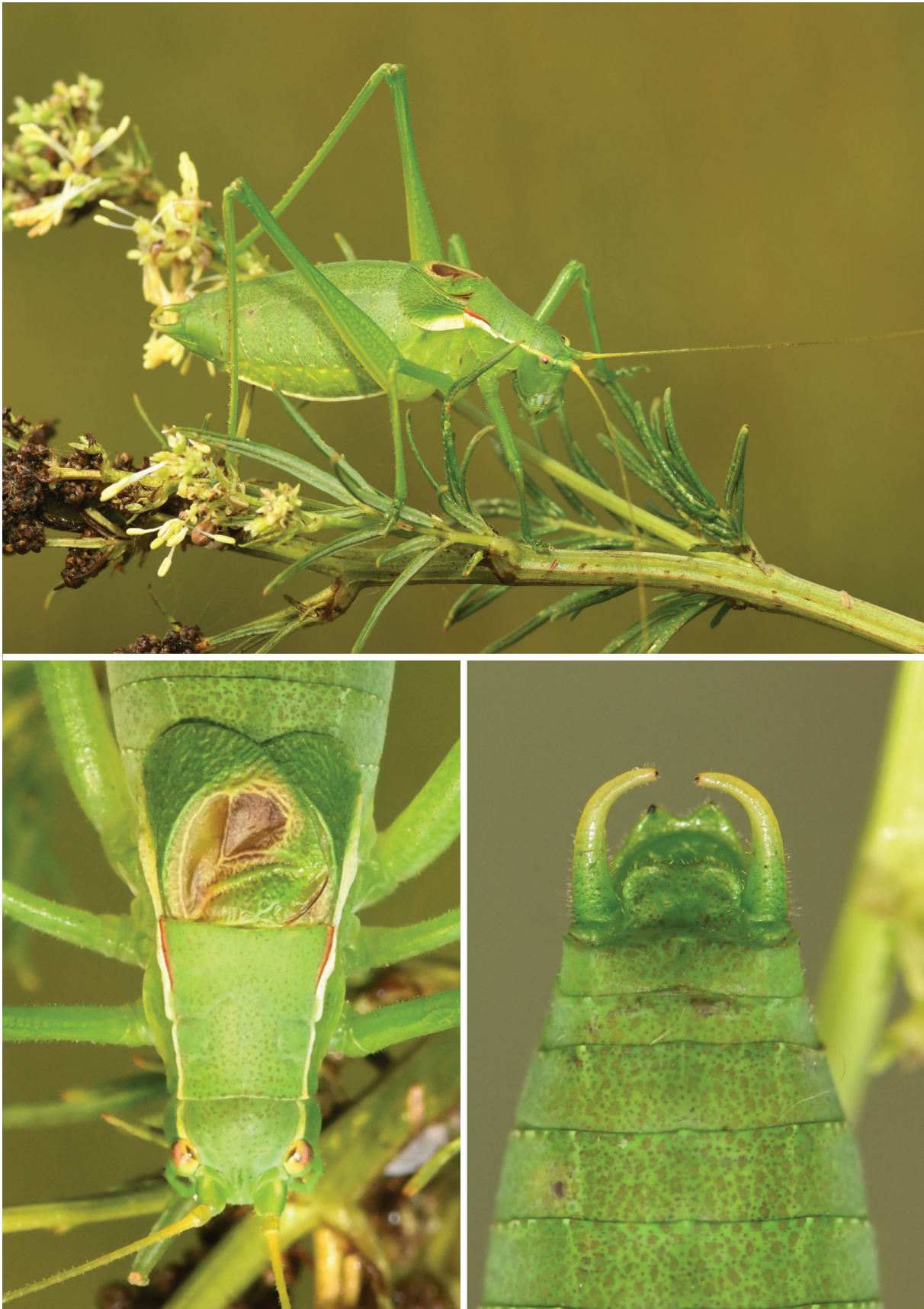


Fig. 1. Male *Isophya stysi* – view of the animal (top), pronotum and tegmina (left), cerci (right).



Fig. 2. Male *Isophya beybienkoi* – view of the animal (top), pronotum and tegmina (left), cerci (right).

confirmed thus far in almost all orographic units of eastern Slovakia, specifically in the Bukovské, Vihorlatské, Slánske, Zemplínske vrchy Mts, in the Čergov and Bachureň Mts, the Spišsko-Šarišské medzihorie (Spiš-Šariš Intermontane) and the Laborecká vrchovina Mts (Ambróz et al. 2011; Gavlás 2005; Krištín 2024; Krištín et al. 2020). In 2005 – 2008, the western-most occurrence of this species was also found in the Muránska planina plain and the Slovak Karst Mts. Both sites are also considered to be the westernmost known localities of the species in Europe (Kaňuch et al. 2006; Krištín et al. 2009).

The Slovak Karst National Park is located in the south of Slovakia near the border with Hungary and is adjacent to Hungarian Aggtelek National Park (48.598°N; 20.635°E). The area represents one of the most important sites for orthopterans in Central Europe (Krištín et al. 2009, 2019; Nagy 2008; Nagy et al. 1999). Between 1986 and 1996, Stys' Plump Bush-cricket was found in six localities in the karst area of the Hungarian Aggtelek National Park. Later, in 2005 – 2014, the species was also confirmed in the Slovak Karst NP, mostly near the Hungarian border (from 100 m to 4.5 km). This finding of the bush-cricket in the Slovak Karst was considered to be a confirmation of the species that was formerly observed in the Aggtelek Karst in Hungary (Kaňuch et al. 2006; Nagy et al. 1999). The insects were found in the contact zones of karst grassland formations rich in dicotyledonous flowering plants on the edges of oak-hornbeam forests. As a species of European importance (Annex II of the Habitats Directive 92/43/EEC 1992), the bush-cricket has been regularly mapped in the territory of the Slovak Karst NP and from 2013 to 2014 was reported as *I. stysi* (see Complex Information and Monitoring System (KIMS) operated by the State Nature Conservancy of the Slovak Republic (SNC SR). As a result, data on Stys' Plump Bush-cricket from the Slovak Karst NP have become a part of the reporting outputs for the European Union (Černecký et al. 2021; Saxa et al. 2015), including the National Management Plan of the Slovak Karst NP (Program starostlivosti o NP Slovenský kras) (Administration of Slovak Karst National Park in Brzotín 2024). However, in 2021 and 2022, extensive and detailed research for the closely related Bei-Bienko's Plump Bush-cricket (*I. beybienkoi*) was launched to mitigate the extinction risk to this globally threatened species (Chobanov 2016a; Nuhličková et al. 2021a, 2023a, b). A survey of *Isophya* species was conducted in all potential habitats, characterized mostly by fringe vegetation rich in broad-leaved flowering plants in transitional zones between forests edges and xerophilous grasslands. All sites, including potential as well suited sites, were intensively investigated by slowly walking through the respective habitats and sweeping the vegetation with the

support of a bat detector (Nuhličková et al. 2023b; Wagner 2015). Specimens found were regularly recorded and verified on the basis of the male calling song (Heller et al. 2004; Orci et al. 2001, 2005). The survey detected the presence of Bei-Bienko's Plump Bush-cricket on several remaining habitat patches of karstic plateaus (Nuhličková et al. 2021a). Apart from the endemic bush-cricket, four additional *Isophya* species were also found – Krauss's Plump Bush-cricket (*I. kraussii*), Pieninsky's Plump Bush-cricket (*I. pienensis*), the Modest Plump Bush-cricket (*I. modesta*) and the Curve-tailed Plump Bush-cricket (*I. camptoxypha*) (Chládek 1994; Krištín et al. 2009) – and our own unpublished results. However, the presence of Stys' Plump Bush-cricket was not confirmed at any expected site of the Slovak Karst NP, including several known sites (Kaňuch et al. 2006; KIMS 2013) between 2015 – 2022. In particular, we found that sites with core populations of endemic *I. beybienkoi* were without any presence of *I. stysi* in the main habitat as well as in the adjacent environment of these sites. Based on extensive research conducted in 2021 and 2022, the results so far indicate the possible confusion of Stys' Plump Bush-cricket (Fig. 1) with a previously little-known and endemic, Bei-Bienko's Plump Bush-cricket (Fig. 2). Therefore, we propose to exclude *I. stysi* from locations where the presence of endemic *I. beybienkoi* has been clearly identified and re-verified.

## ACKNOWLEDGMENTS

Our special thanks go to the Mohammed bin Zayed Species Conservation Fund for supporting this study. We thank the Slovak Karst National Park Administration for logistical support and permits. A big thank you also goes to our co-workers J. Svetlík, S. Pekárová, B. Jarčuška, P. Kaňuch, P. Tuček, V. Fabriciusová and V. Hruz, who helped us in the field provided photodocumentation of the species. This study was also partially supported by the Slovak Scientific Grant Agency VEGA (2/0019/24, 2/0097/23 and 2/0076/19).

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