



Corythucha arcuata (Say, 1832) (Hemiptera, Tingidae) an invasive pest, with a review of the recent invasion of alien species to Kosovo

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ABSTRACT. This study reports the discovery of *Corythucha arcuata* (Say), a species previously unrecorded in the Republic of Kosovo. Nine individuals of this species were collected from an Oak tree during the investigation. The findings presented in this study enhance our knowledge of the distribution of *C. arcuata* within the Balkan region. This discovery underscores the importance of further research to elucidate the factors governing the presence or absence of this species in specific areas. Also, herein we made a list of all known alien-invasive species to Kosovo.

Key words: Balkan, distribution, national park, oak lace bug, *Quercus* spp.

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INTRODUCTION

There are numerous definitions for invasive alien species, but one of the most fitting descriptions is provided by the Convention on Biological Diversity (CBD, 2009): "Invasive alien species are plants, animals, pathogens, and other organisms that are not native to an ecosystem and may cause economic or environmental harm or adversely affect human health". The issue of invasive species is increasing worldwide. In fact, North America alone harbours over 3,200 species of non-native insects (Liebhold et al., 2018). Kosovo, a small country landlocked in the Western Balkan even with little knowledge of its native biodiversity is facing the problem of alien invasive species and recent research has led to an increase in our knowledge of alien-invasive species in Kosovo (Gashi et al., 2015; Maxhuni & Ibrahim, 2016; Kulijer & Ibrahim, 2017; Geci & Ibrahim, 2018; Geci et al., 2020; Geci & Naumova, 2021; Geci et al., 2022; Ibrahim et al., 2022). As of now, the number of known animal alien-invasive species in Kosovo stands at 14. Among these, nine are invertebrates, and five are vertebrate species (see Table 1).

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The feeding activities in *Corythucha arcuata* of both nymphs and adults on the undersides of leaves cause a discolouration of the host tree's foliage, primarily affecting *Quercus* spp. Due to the crucial economic and ecological importance of oak ecosystems in Europe, this species attracted significant interest. Recognizing its potential for causing harm and spreading invasively, it was included in the European and Mediterranean Plant Protection Organization (EPPO) Alert List in March 2001, where it stayed until 2007. It became clear during this timeframe that phytosanitary measures were inadequate to prevent its expansion (EPPO, 2001). This study aims to document and report the discovery of *Corythucha arcuata* (Say) in the Republic of Kosovo and to compare the number of alien-invasive species.

MATERIAL AND METHODS

During this investigation, nine specimens of *C. arcuata*, the oak lace bug were collected by hand, along with the leaves, and these specimens were preserved in 75% alcohol. The collected materials have been deposited in the Laboratory of Zoology, Department of Biology, University of Prishtina. The specimens were collected from a *Quercus* sp. in Rashince village, Shtime municipality. Identification of the species level and terminology is done after Golub & Soboleva (2018). The map (Fig. 1) was created using QGIS 3.22 and is based on a topographic map layer retrieved from Kosovo Geoportal under a Creative Commons license. Table 1 is arranged chronologically based on the time of species reporting, rather than in taxonomical order.

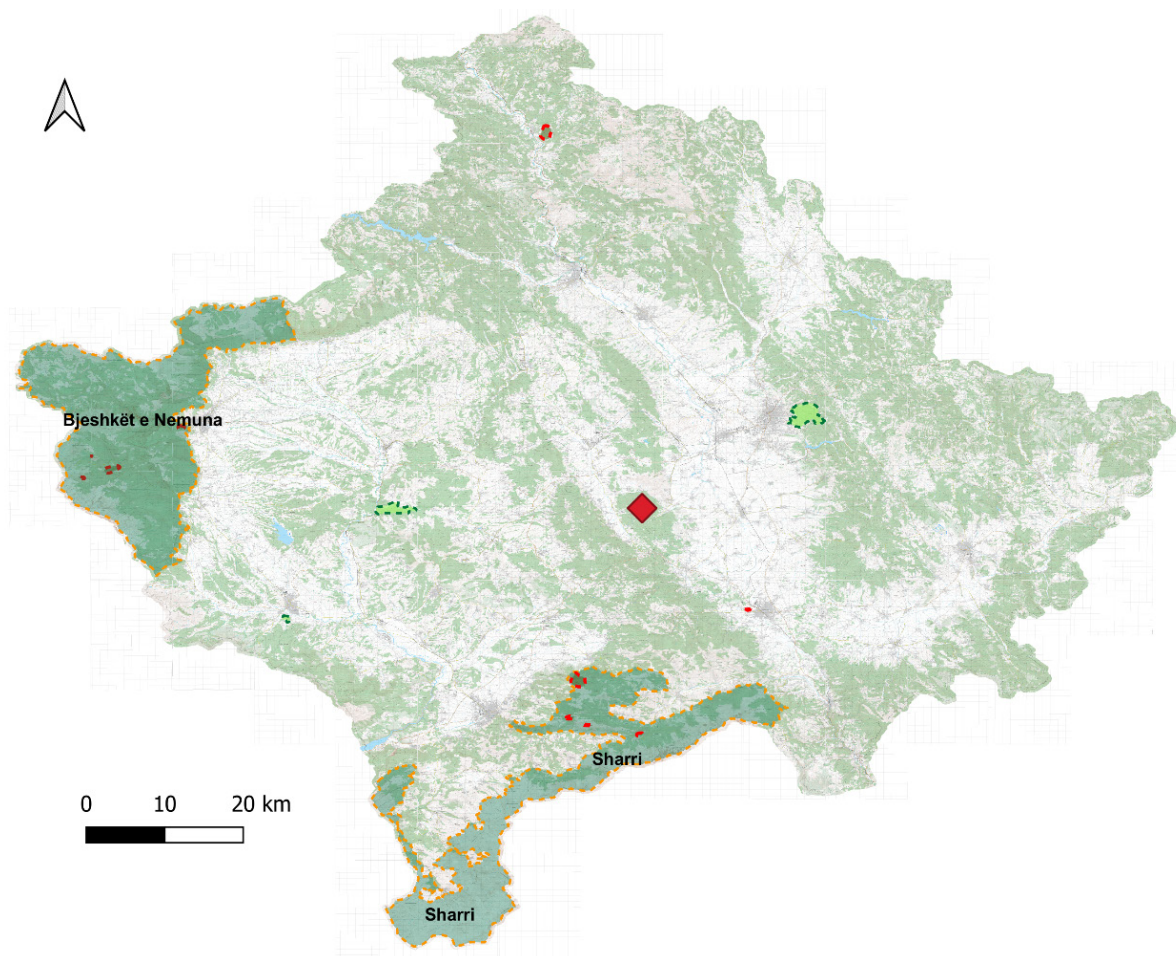


Figure 1. Map of Kosovo indicating the site where *Corythucha arcuata* (Say, 1832) is found (Red diamond). Green dots specifically denote protected landscapes, while red dots signify natural heritage monuments. Orange strips on the map represent the borders of national parks.

RESULTS

Corythucha arcuata (Say, 1832) (Fig. 2)

Material examined. 4♂♂, 5♀♀, KOSOVO, Rashince village, Shtime municipality, 42°26'36.9852"N, 21°4'37.8804"E, on *Quercus* sp., 10.10.2023, Coll. Milaim Musliu.

Distribution. Native to North America and introduced to Europe and Anatolia (Roques et al., 2009).

Diagnosis. *Corythucha arcuata* is distinguished from other species of the same family by its general habitus. It differs from the other species of the same genus having the lateral pronotal carinae low and very short, anteriorly not or barely extending on convex pronotal disc. Lateral margins of paranota distinctly convex along their entire length. Elevation on hemelytra as well as anterior part of costal area with distinct blackish spots; some veins of pronotal hood, paranota and apical part of hemelytra dark (Golub & Soboleva, 2018).

The alien-invasive species in Kosovo. The number of recently recorded animal alien-invasive species in Kosovo is 14, encompassing various taxa (Table 1). Additionally, this count of non-native species has been increasing annually.



Figure 2. *Corythucha arcuata* (Say, 1832), male. Dorsal view in alcohol.

Table 1. The list of animal alien-invasive species recorded from Kosovo.

No.	Species	Order: Family	References
1	<i>Perillus bioculatus</i> (Fabricius, 1775)	Hemiptera, Pentatomidae	Protić & Živić (2012)
2	<i>Oncorhynchus mykiss</i> (Walbaum, 1792)	Salmoniformes: Salmonidae	Maxhuni & Ibrahim (2016)
3	<i>Carassius gibelio</i> (Bloch, 1782)	Cypriniformes, Cyprinidae	Maxhuni & Ibrahim (2016)
4	<i>Pseudorasbora parva</i> (Temminck & Schlegel, 1846)	Cypriniformes, Cyprinidae	Maxhuni & Ibrahim (2016)
5	<i>Ctenopharyngodon idella</i> (Valenciennes, 1844)	Cypriniformes, Cyprinidae	Maxhuni & Ibrahim (2016)
6	<i>Lepomis gibbosus</i> (Linnaeus, 1758)	Centrarchiformes, Centrarchidae	Maxhuni & Ibrahim (2016)
7	<i>Leptoglossus occidentalis</i> Heidemann, 1910	Hemiptera, Coreidae	Kulijer & Ibrahim (2017)
8	<i>Cydalima perspectalis</i> (Walker, 1859)	Lepidoptera, Crambidae	Geci & Ibrahim (2018) Geci et al. (2020)
9	<i>Pholcus phalangoides</i> (Fuesslins, 1775)	Araneae, Pholcidae	Geci & Naumova (2021) Geci et al. (2020)
10	<i>Parasteatoda tepidariorum</i> (C. L. Koch, 1841)	Araneae, Theridiidae	Geci et al. (2022)
11	<i>Ostearius melanopygius</i> (O. Pickard-Cambridge, 1880)	Araneae, Linyphiidae	Geci et al. (2022)
12	<i>Spermophora senoculata</i> (Dugès, 1836)	Araneae, Pholcidae	Geci et al. (2022)
13	<i>Harmonia axyridis</i> (Pallas, 1773)	Coleoptera, Coccinellidae	Ibrahim et al. (2022)
14	<i>Corythucha arcuata</i> (Say, 1832)	Hemiptera, Tingidae	Current study

DISCUSSION

Corythucha arcuata is a species from North America and Europe it was first recorded in Italy in 2000 (Bernardinelli & Zandigiacomo, 2000) and has since been reported in various other countries (Paulin et al., 2020). However, in the Balkan Peninsula, the first report of this species was from Bulgaria (Dobrev et al., 2013). In this study, we report the presence of this species for the first time in the Republic of Kosovo. It is noteworthy that Montenegro is currently the only country in the Balkans where this species remains unknown. Several reports prove the defoliation and leave discolouration effect of *C. arcuata* in *Quercus* spp. (Bracalini et al., 2023, Simov et al., 2018). As in many other species, there are no adequate methods to combat *C. arcuata*. The use of pesticides is effective only in the short term, while in the long-term battle against this species, pesticides seem to be ineffective (Bălăcenoiu et al., 2021). Another important thing worth mentioning is that this species is found on a protected heritage tree with botanical value. The fauna of lace bugs in Kosovo is poorly known with only eight species that belong to Tingidae (Baymak, & Kiyak, 2022, while in the Balkan Peninsula, there are many species that belong to this family. The highest number of known species was found in Bulgaria with a total of 67 species (Simov & Ljubomirov, 2020), Serbia with 50 species (Protic, 2005), Montenegro with 45 species (Protic, 2016), Greece with 53, Albania with 18, and Bosnia and Herzegovina 2 species (UkrBIN, 2017). This finding contributes to our understanding of the distribution of *C. arcuata* in the Balkan region and highlights the need for further research to ascertain the factors influencing its presence or absence in specific areas.

In Kosovo, *Harmonia axyridis* (Pallas, 1773), *Pholcus phalangioides* (Fuesslins, 1775), and *Parasteatoda tepidariorum* (C.L. Koch, 1841) are found widely, showcasing their adaptability across various ecosystems (Ibrahimi et al., 2022; Geci & Naumova, 2021; Geci et al., 2022). *Cydalima perspectalis* (Walker, 1859), in contrast, exhibits a more moderate distribution, hinting at a controlled presence with potential implications for local flora (Geci & Ibrahimi, 2018; Geci et al., 2020). Notably, *Leptoglossus occidentalis* Heidemann, 1910, *Perillus bioculatus* (Fabricius 1775), *Spermophora senoculata* (Dugès, 1836), and *Ostearius melanopygius* (O. Pickard-Cambridge, 1880) are exclusively documented in a single locality (Protić & Živić, 2012; Kulijer & Ibrahimi, 2017; Geci et al., 2022)

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: M.M: Fieldwork and sampling of specimens; A.B. and D.G.: Fieldwork, photography and writing; H.I.: Fieldwork, identification of specimens, writing, and reviewing. All authors approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina "Hasan Prishtina", Prishtinë, Kosovo under the name 'invasive species collection, 2023' and are available, upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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گزارش سنک بلوط، *Corythucha arcuata* (Say, 1832) (Hemiptera, Tingidae) به عنوان یک آفت مهاجم در کوزوو و مرور تهاجم اخیر گونه‌های وارداتی

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چکیده: در این تحقیق، حضور یک گونه سنک، به نام *Corythucha arcuata* (Say) که پیش از این در کشور جمهوری کوزوو ثبت نشده بود، گزارش شد. طی بررسی صورت گرفته، تعداد ۹ نمونه از این گونه از روی یک درخت بلوط جمع‌آوری شدند. یافته‌های ارائه شده در این تحقیق، منجر به افزوده شدن داده‌های ما در مورد انتشار گونه *Corythucha arcuata* در منطقه بالکان شد. این یافته‌ها بر اهمیت پژوهش‌های بیشتر برای روشن شدن حضور یا عدم حضور این گونه در مناطق خاص دیگر تأکید دارد. علاوه بر این، فهرستی از تمام گونه‌های جانوری غیربومی و مهاجم شناخته شده در کوزوو طی سال‌های اخیر ارائه شد.

واژگان کلیدی: بالکان، انتشار، پارک ملی، سنک، بلوط