

Zelus renardii (Hemiptera: Reduviidae), the first record for Bosnia and Herzegovina and the earliest occurrence in Croatia

Zelus renardii (Hemiptera: Reduviidae), prvi nalaz za Bosnu i Hercegovinu i najranija opažanja u Hrvatskoj

Dejan Kulijer^{1,*}, Dubravko Dender², Matea Martinović³

¹ Mehmed paše Sokolovića 16, 71 000 Sarajevo, Bosnia and Herzegovina, e-mail: dejan.kulijer@gmail.com

² Association Biom, Čazmanska ul. 2, 10000 Zagreb, Croatia, e-mail: dubravkodender@gmail.com

³ Dubrovnik Natural History Museum, Androvićeva 1, 20000 Dubrovnik, Croatia, e-mail: matea.martinovic@pmd.hr

* Corresponding author / Autor za korespondenciju: dejan.kulijer@gmail.com (D. Kulijer)

Abstract

Zelus renardii is a Nearctic invasive species expanding its range worldwide. In less than 15 years following its discovery in Europe, it spread to most of the northern Mediterranean countries. In this paper, we report the first observation of the species in Bosnia and Herzegovina and the earliest occurrence records from Croatia. New observations on the species' habitat and overwintering in the region are briefly discussed.

Keywords: alien species, allochthonous species, biocontrol, expansion, Heteroptera, invasive species

Sažetak

Zelus renardii Kolenati, 1857 nearktička je invazivna vrsta koja širi svoj areal diljem svijeta. U manje od 15 godina nakon prvog otkrića u Europi ova se vrsta proširila na većinu zemalja sjevernog Sredozemlja. U ovom radu donosimo prvo opažanje vrste u Bosni i Hercegovini i najranije podatke o pojavljivanju u Hrvatskoj. U radu se kratko raspravljaju nova opažanja o staništu i prezimljavanju vrste u regiji.

Ključne riječi: strana vrsta, alohtona vrsta, biokontrola, ekspanzija, Heteroptera, invazivna vrsta

Introduction

The Leafhopper Assassin Bug, *Zelus renardii* Kolenati, 1857, is a Nearctic invasive species native to parts of North and Central America that has been introduced to South America, Asia, and Europe (Kment and van der Heyden 2022, Zhang et al. 2016). In Europe, it was recorded for the first time in 2010, almost simultaneously at opposite sides of the northern Mediterranean coast, in Greece (Davranoglou 2011, Petrakis and Moulet 2011) and Spain (Baena and Torres 2012, Vivas 2012) and since then spread rapidly along the European part of the Mediterranean (Kment and van der Heyden 2022). In less than 15 years, it was reported from most European countries along the Mediterranean coast: Portugal, Spain, France, Italy, Croatia, Montenegro, Albania,

Greece, and Turkey, as well as Germany, United Kingdom, Denmark, Czech Republic and Romania in continental Europe, and Izrael in the eastern Mediterranean (Kment and van der Heyden 2022).

Zelus renardii is a zoophagous species and generalist predator that feeds on various groups of insects and other small arthropods (Kment and van der Heyden 2022). Body length in males ranges from 10.6 to 13 mm, and up to 14.25 mm in females. The body surface is greenish, corium reddish and the humeral angle with small sub-tuberculate projection. The scutellum and pronotum are yellowish-brown to brown, apex is lighter in color. The coloration of legs is yellowish-brown (Zhang et al. 2016).

In this paper, we report the first observation of this species from Bosnia and Herzegovina (BiH) and the earliest known records from Croatia.

Materials and Methods

The study area includes the southern regions of Bosnia in Herzegovina and Croatia. In Croatia, all new findings originate from Dubrovnik-Neretva County, the southernmost region of the country. They were gathered between 21.ix.2019 and 4.xi.2023. The record from BiH was collected on 3rd February 2024. In both countries, visual inspection of plants was used as a collecting method.

For data collection in the field, a Biologer application was used (Popović et al. 2020). Observed specimens were either collected or photographed, and the information about habitat, plants where possible, coordinates, date, and altitudes was recorded. The specimens from Bosnia and Herzegovina are deposited in the entomological collections of the National Museum of Bosnia and Herzegovina (NMBiH) while six specimens collected in Croatia are deposited in the Heteroptera collection of the Dubrovnik Natural History Museum (DNHM).

Results

Material examined

Bosnia and Herzegovina: Loc. 1: Čapljina, Tasovčići, 43.116552 N, 17.713195 E, 10 m a.s.l., 3.ii.2024, 1 nymph under the bark of *Platanus* L. (NMBiH collections), leg. & det. D.Kulijer; 18.ii.2024, 1 adult under the bark of *Platanus* L. (NMBiH collections), leg. & det. D.Kulijer.

Croatia, Dubrovnik-Neretva County: Loc. 2: Dubrovnik, Trsteno, 42.71091123 N, 17.97629329 E, 35 m a.s.l., 21.ix.2019, 1 adult obs. & det. M. Martinović; Loc. 3. Dubrovnik, Pile, 42.64231044 N, 18.10614817 E, 20 m a.s.l., 7.xi.2019, 1 adult on *Platanus orientalis* L., obs. & det. Dubravko Dender; 22.x.2020, 1 adult on *P. orientalis* (DNHM collection), leg. & det. M. Martinović; 13.xi.2020, eggs on *P. orientalis*, obs. & det. M. Martinović; 13. i.2021, 1 adult under the bark of *P. orientalis*, obs. & det. M. Martinović; 4.xi.2023., 1 adult under the bark of *P. orientalis* (DNHM collection), leg. & det. M. Martinović; Loc. 4. Dubrovnik, Solitudo, 42.66099865 N, 18.07545355 E, 20 m a.s.l., 3.ix.2020, 1 adult, obs. & det. M. Martinović; 11.x.2020, 1 nymph, obs. & det. M. Martinović; 2.xi.2020, 1 nymph, obs. & det. M. Martinović; Loc. 5. Dubrovnik, Montovjerna, 42.64967245 N, 18.08428513 E, 40 m a.s.l., 9.vii.2021, 3 adults (DNHM collection), leg. & det. M. Martinović; Loc. 6. Mljet Island, Sobra, 42.738546 N, 17.621725 E, 5 m a.s.l., 27.viii.2021, 1 adult (DNHM collection), leg. & det. M. Martinović.



Figure 1 New data and the distribution of *Zelus renardii* Kolenati, 1857 in Bosnia and Herzegovina, Croatia and Montenegro (new data – red color, published data – yellow color).

On 3rd February 2024 during the inspection of tree trunks of *Platanus* sp. near the main road in Tasovčići (Figure 2a), one nymph of *Z. renardii* (Figure 2b) was found under the bark. This is the first observation of this allochthonous species in Bosnia and Herzegovina. During the second visit to the same locality on 18th February an adult specimen feeding on *Arocatus longiceps* Stål, 1872 (Figure 2c) was observed under the bark of another sycamore tree nearby. Additionally, some other insects and spiders were also found under the bark of the same trees, including several Hemiptera, namely: *Nezara viridula* (Linnaeus, 1758), *Arma custos* (Fabricius, 1794), *A. longiceps* (numerous), *Dictyla echii* (Schrank, 1782), *Dufouriellus ater* (Dufour, 1833) and *Corythucha ciliata* (Say, 1832) (numerous).

Zelus renardii in Croatia was for the first time detected on 21st September 2019 in a private garden in Trsteno near Dubrovnik. Two months after it was recorded at Pile in Dubrovnik on *Platanus orientalis* L. The same location was visited in November 2020 resulting in unhatched egg batch discovery (Figure 2d), while in January 2021 and November 2023 adult specimens were present under the bark of the same tree. In 2020 and 2021 it was recorded at two additional localities in Dubrovnik and one on Mljet Island.



Figure 2 The finding site (a), nymph (b), and adult (c) of *Zelus renardii* Kolenati, 1857 in Bosnia and Herzegovina (Čapljina, Tasovčići, 3.ii.2024; 18.ii.2024; photo: D.Kulijer); and the egg batch on *Platanus orientalis* L. from Croatia (Dubrovnik, Pile, 13.xi.2020; photo: M.Martinović).

Discussion

Zelus renardii spreads fast along the northern Mediterranean coast (Kment and van der Heyden 2022), and our records from the Mediterranean region of Bosnia and Herzegovina and Croatia are not unexpected. Although it was already reported from Croatia (Kment and van der Heyden 2022), we provided evidence of its presence in the country almost two years earlier than previously known.

Based on available knowledge of the species distribution in the region (Kment and van der Heyden 2022) and our data, it is most probable that the species spread to BiH from Croatia where it was found 4 years earlier. Particularly as the earliest observation sites in Croatia are less than 5 km from the state border. Although we don't have data to confirm if the species settled in Bosnia and Herzegovina, we assume that it already established local population(s) and that due to the proximity of the Croatian localities, it was at least near the time of the first observations in southern Croatia. The later discovery in Bosnia and Herzegovina can be attributed to the low research intensity in the country, as confirmed by the mostly accidental discoveries of several other alien species in the past (e.g. Kulijer 2010; Kulijer and Miljević 2016, Kulijer et al. 2022).

Most of the species records in Europe and Chile originate from urban and suburban habitats, including agricultural areas (Curkovic et al. 2004, Lahbib et al. 2022; Rodríguez Lozano et al. 2018) and records from natural habitats seem to be rare (Simov et al. 2017). Our observations confirm this as all the data were gathered within or at the margins of settlements. The predominant occurrence in urban and suburban habitats in Europe is probably a result of passive spread through human activities (Lahbib et al. 2022; Rodríguez Lozano et al. 2018; van der Heyden 2021), although the species' pref-

erence for anthropogenic and disturbed habitats is also reported from its native range (Weirauch et al. 2012). In Europe, it can also mean that these habitats provide more suitable overwintering sites for the species that needs a warm climate for its survival.

It seems that the species observations outside of its natural range are limited to the areas with a Mediterranean-like climate, e.g. Mediterranean Europe (Kment and van der Heyden 2022), Chile (Curkovic et al. 2004), Black Sea region (Dursun and Fent 2020). This suggests that California could be the source of these invaders as it has a climate similar to the Mediterranean (Weirauch et al. 2012). Our data as well as the published records from Croatia also supports this. In Croatia, all observations originate from the coastal area or islands, while the single records from BiH originated from the area close to the Adriatic coast and under the strong influence of the Mediterranean climate.

In invaded areas, *Z. renardii* has been reported from numerous plant species, both native and alien (Kment and van der Heyden 2022). According to Lahbib et al. (2022), it prefers honeydew-contaminated plants hosting their preferable prey, aphids, leafhoppers, and psyllids. However, most of our findings are from *Platanus* sp., the trees that were not mentioned so far (e.g. Kment and van der Heyden 2022, Lahbib et al. 2022). This can be related to the fact that our findings are mainly from the autumn and winter periods, when *Z. renardii* is seeking shelter from low temperatures. Sycamore trees are common ornamental plants in the urban and suburban areas of BiH and Croatia that are known as suitable overwintering habitats to many arthropods, including several Hemiptera species (e.g. Kulijer and Miljević 2016, this paper). They can provide a good food supply for *Z. renardii* during winter months, as suggested by the observed feeding on *A. longiceps* in Tasovčići, Čapljina (Figure 2c), the hemipteran that can be found in significant numbers under the tree bark during cold season.

The data on the overwintering of this species in European countries and the number of generations per year are scarce. According to Davranoglou (2011) it probably has 2 to 3 generations per year, and mostly overwinter as eggs or nymphs, while Petrakis and Moulet (2011) suggest that in Europe it has only one generation. There are some reports on the species overwintering in human dwellings available (Dioli 2013), but our data suggest that at least some individuals in this area overwinter sheltered outdoors, and this includes all tree life stages, eggs, nymphs, and adults.

Although it is unknown when, how, and from where the species invaded Europe, based on several almost simultaneous discoveries in 2010 it is believed that the invasion happened at least some years earlier (Rodríguez Lozano et al. 2018). Particularly as it is estimated that the species spreads about 35-40 km a year (Curkovic et al. 2004, Rodríguez Lozano et al. 2018) and that in little more than 10 years it invaded almost the whole northern Mediterranean coast (Kment and van der Heyden 2022). Passive transport probably had the main role in the species' fast expansion in Europe (Lahbib et al. 2022, Rodríguez Lozano et al. 2018).

Some studies confirm the leafhopper assassin bug is a good biocontrol agent for several pest species (Lahbib et al. 2022) but the species' generalistic predatory behavior raises a question of its suitability as it could be also a threat to native biodiversity, some natural enemies of pests or other biological control agents, e.g. some Aphelinidae, Coccinellidae and Crysopidae (Cisneros and Rosenheim 1997, Petrakis and Moulet 2011, Rodríguez Lozano et al. 2018). Due to this reason, Pinzari et al. (2018) do not recommend its use as a biocontrol agent. Our observation confirms that *Z. renardii* feeds on native hemipteran species *A. longiceps* during its overwintering period (Figure 2c).

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