

Hierodula tenuidentata Saussure, 1869 (Mantodea: Mantidae) has settled down in Bosnia and Herzegovina

Prvi nalaz bogomoljke *Hierodula tenuidentata* Saussure, 1869 (Mantodea: Mantidae) u Bosni i Hercegovini

Dejan Kulijer^{1*}, Adla Kahrić², Damjan Vinko³

¹National Museum of Bosnia and Herzegovina, Zmaja od Bosne 3, 71000 Sarajevo, Bosnia and Herzegovina

²Center for marine and freshwater biology Sharklab ADRIA, Paromlinska 16, 71 000 Sarajevo, Bosnia and Herzegovina

*Corresponding author E-mail address: dejan.kulijer@gmail.com (D. Kulijer)

Abstract

In this paper the first record of the alien mantis species *Hierodula tenuidentata* for Bosnia and Herzegovina is provided. This large mantis has considerably expanded its distribution range in Europe in the last years, particularly in Balkan Peninsula. We found several adult specimens on 22nd and 23rd of August 2021 in urban area of Mostar city in the south of the country. This finding confirms the species' establishment in the western part of Balkan Peninsula and fills the distribution gap along the eastern Adriatic Sea coast.

Key words: alien species, distribution, Balkan Peninsula, expansion, first record, invasive species

Sažetak

U ovom je radu dan prvi nalaz alohtone bogomoljke *Hierodula tenuidentata* u Bosni i Hercegovini. Ova velika bogomoljka posljednjih je godina znatno proširila svoj areal u Europi, osobito na Balkanskom poluotoku. Veći broj odraslih primjeraka ove vrste registrirane su 22. i 23. kolovoza 2021. godine u urbanom području grada Mostara. Ovaj nalaz potvrđuje da se *H. tenuidentata* naselila u zapadnom dijelu Balkanskog poluotoka i nadopunjuju saznanja o njejoj rasprostranjenosti duž istočne obale Jadranskog mora.

Ključne riječi: strane vrste, rasprostranjenost, Balkanski poluotok, širenje, prvi nalaz, invazivne vrste

Introduction

Hierodula tenuidentata Saussure, 1869 is large robust green (rarely brown) mantis species (body length: 5 to 7 cm in males and 6 to 8 cm in females) with short and wide pronotum, three darker bands on the ventral side of the thorax and four to five prominent yellowish spines on the front coxae. On front femora the spines are variable in color, black completely or only on tips. Hyaline wings generally exceed the length of the abdomen and have whitish stigma on the tegmina (Battiston et al., 2019).

The unclear taxonomic status of *Hierodula tenuidentata* Saussure, 1869 and *H. transcaucasica* Brunner von Wattenwyl, 1878 has made some confusion in recent reports of these taxa from Europe and raised the question of the taxonomic affiliation of specimens found in several European countries (e.g., Ehrmann, 2011; Battiston et al., 2018; Cianferoni et al., 2018; Schwarz et al., 2018). In this paper we follow the opinion of Battiston et al. (2018) that *H. transcaucasica* is a synonym of *H. tenuidentata*. Accordingly, the natural range of *H. tenuidentata* combines the ranges of both taxa and extends from India to the Mediterranean basin (Battiston et al., 2019). Apart from one old isolated record from Crimea on eastern margin of the continent (Werner, 1916), only recently the species started to spread in Europe. According to Schwarz & Ehrmann (2018) the first “modern” record from Europe seems to be a juvenile male collected on Crete, Greece in 2008. From 2015 onwards many new data became available and known range of the species expanded considerably, mostly along the northern Mediterranean and Black Sea coast (e.g., Cianferoni et al., 2018; Van der Heyden, 2018; Romanowski et al., 2019; Pintilioaie et al., 2021; Vujić et al., 2021; Martinović et al., 2022). The distribution of the species in the region is given in Fig. 1a, where Slovenia is excluded as the only record (Van der Heyden, 2021) is based only on the photo of a nymph for which we believe that it is impossible to identify to the species level with certainty.

Materials and methods

The survey was conducted between 22nd and 24th August 2021 in the old city center of Mostar and the southern Herzegovina region. Mostar is one of the largest and touristically most attractive cities in the country, located in the Neretva River valley that connects it with the Adriatic Sea coast, app. 45 km to the southwest (Figure 1). The specimens were visually observed and collected by hand on 22nd and 23rd August. They were identified based on keys provided in Battiston et al. (2019; 2020).

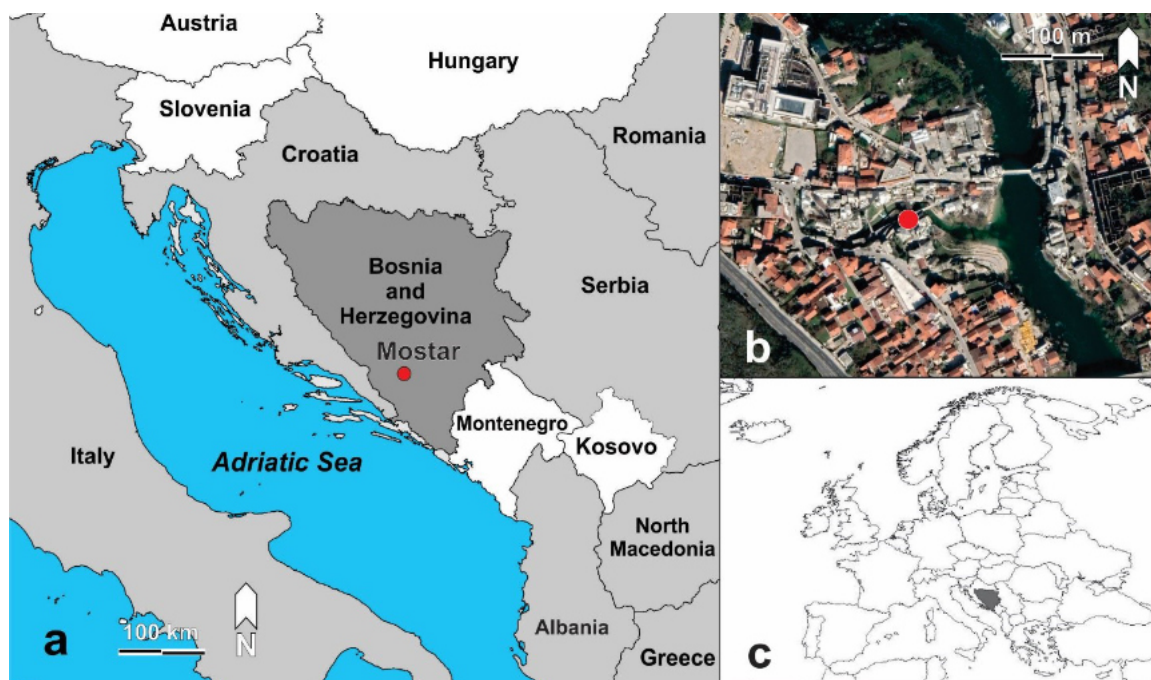


Figure 1. The study area and the location of the first observation of *Hierodula tenuidentata* Saussure, 1869 in Bosnia and Herzegovina (red dot): a) the location of the finding site within the country and the region (the countries with confirmed observation of the species in grey color, while the countries without records are shown in white color); b) the finding site within the Mostar city center near touristic attraction Old Bridge and c) the position of the country within Europe.

Results and Discussion

Material examined: Bosnia and Herzegovina, Mostar, Kriva ćuprija, 43.336833° N, 17.813585° E, 55 m a.s.l.: 22. 08. 2021, 7 adults, leg. D. Kulijer, A. Kahrić; 23. 08. 2021, 10 adults, leg. D. Kulijer, A. Kahrić, D. Vinko.

Alien mantid *H. tenuidentata* is recorded for the first time for Bosnia and Herzegovina. In the late evening (10 min before midnight) of 22nd August 2021 seven adult specimens were observed preying on small turfs of various, largely dry herbaceous plants (Figure 2a) on a stone wall under the street light in the old city center of Mostar, near Kriva ćuprija bridge (Figure 2b). The following morning, between 10 and 11 AM, a total of 10 adults were found at the same location – seven at the same wall as previously (Figure 2c) and additional three at the opposite side of the walking path: one flying from the vegetation below the path towards the wall, the second flying to the canopy of *Platanus* sp. and the

third standing on a branch of *Robinia pseudoacacia* L. tree growing by the path. The same place was surveyed on two occasions in the following days, in the evening of 24th August, as well as during the next day, but *H. tenuidentata* was not found and only one specimen of *Mantis religiosa* (Linnaeus, 1758) was observed on 24th August on the same wall (Fig. 2d).

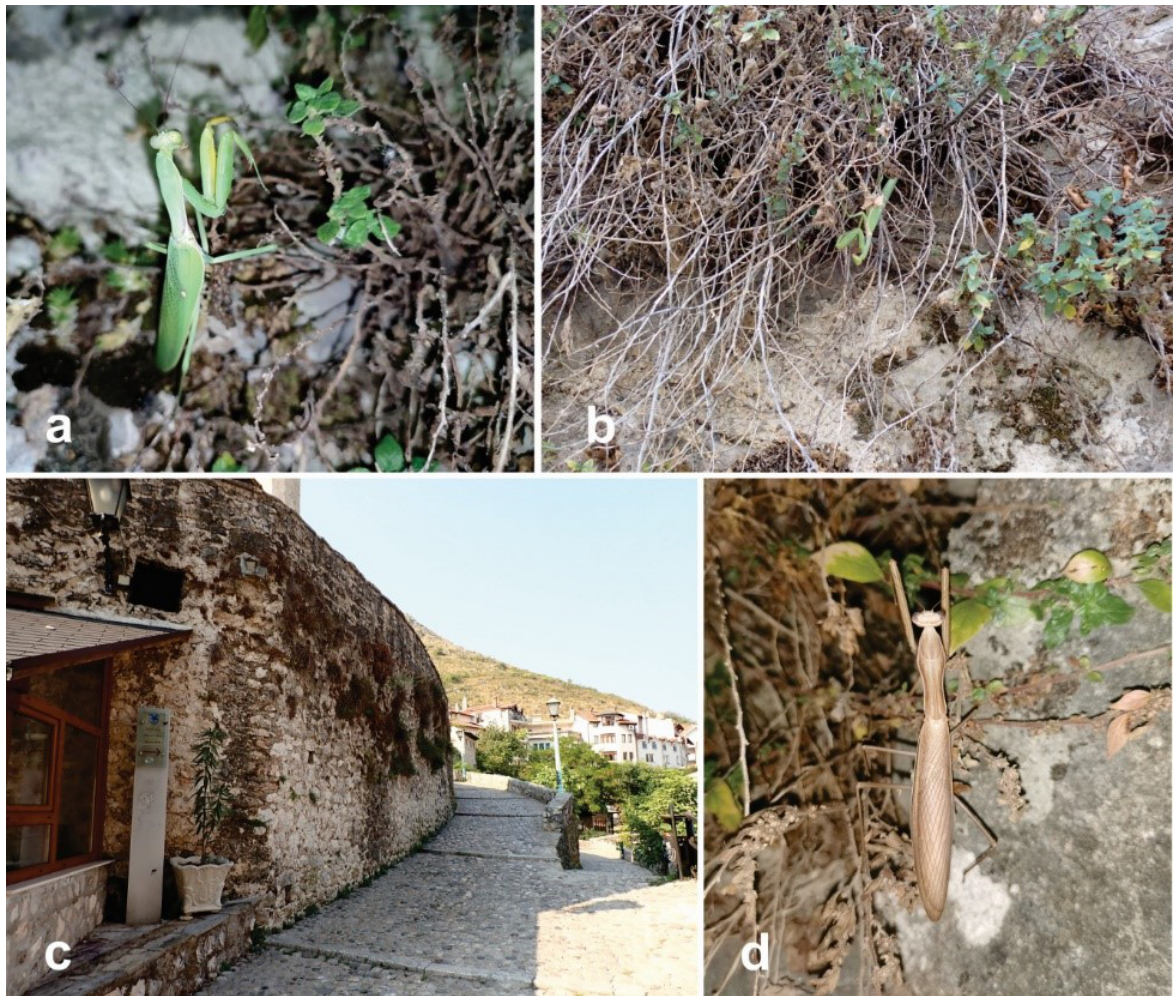


Figure 2. *Hierodula tenuidentata* Saussure, 1869 preying on dry vegetation on 22nd August (a) and 23rd August (c) on a stone wall in the old town Mostar (b). Single specimen of *Mantis religiosa* (Linnaeus, 1758) recorded at the same locality on 24th August (d) (Photo: a – Damjan Vinko, b&c – Dejan Kulijer, d – Adla Kahrić).

All our specimens were found on vertical surfaces, wall or trees, which corresponds to the more arboreal habits of *Hierodula* mantises (Battiston et al., 2018; 2019; 2020).

The absence of any individuals after the first two days could be due to changes in weather conditions, namely the wind became slightly stronger and the weather less sunny, although these changes were not significant. Surveys on other locations in the city did not result with any additional specimens. We assumed

that it is possible that *H. tenuidentata* could arrive to Mostar from the Adriatic coast in the south, considering that the species prefers areas with warmer climate (e.g., Pintilioaie et al., 2021) and that this is the closest area where the species has been recorded (Martinović et al., 2022). In the following days short stops were made at several locations south of Mostar city along the Neretva River, including old city Počitelj with many stone walls and a fortress, but no additional *Hierodula* specimens were found so this assumption could not be confirmed (while *M. religiosa* was commonly observed).

In total, three specimens were collected and examined, two males (60 and 63 mm while alive, excluding wings) and one female (63 mm after the preservation in ethanol, excluding wings) (Figure 3a–e). All three specimens are stored at the National Museum of Bosnia and Herzegovina; the female in 70% ethanol in museum's entomological collections, while two males are kept alive in terrariums.

From other large green Mantidae species known from Europe – *Hierodula patellifera* Serville 1839, *Mantis religiosa* Linnaeus, 1758; *Sphodromantis viridis* (Forskål, 1775) – *H. tenuidentata* can be separated by combination of the following characters: 1) the presence of white stigmas on tegmina (Figure 3a); 2) the absence of black or black-ringed spots on the inner side of the front coxae (Figure 3b); 3) short pronotum without an evident narrowing before the supracoxal dilation (Figure 3b–e); 4) inner margin of front coxae with large yellowish spines that are lacking yellow basal plates (Fig. 3b) and 5) the morphology of male genitalia (Battiston et al., 2019; 2020).

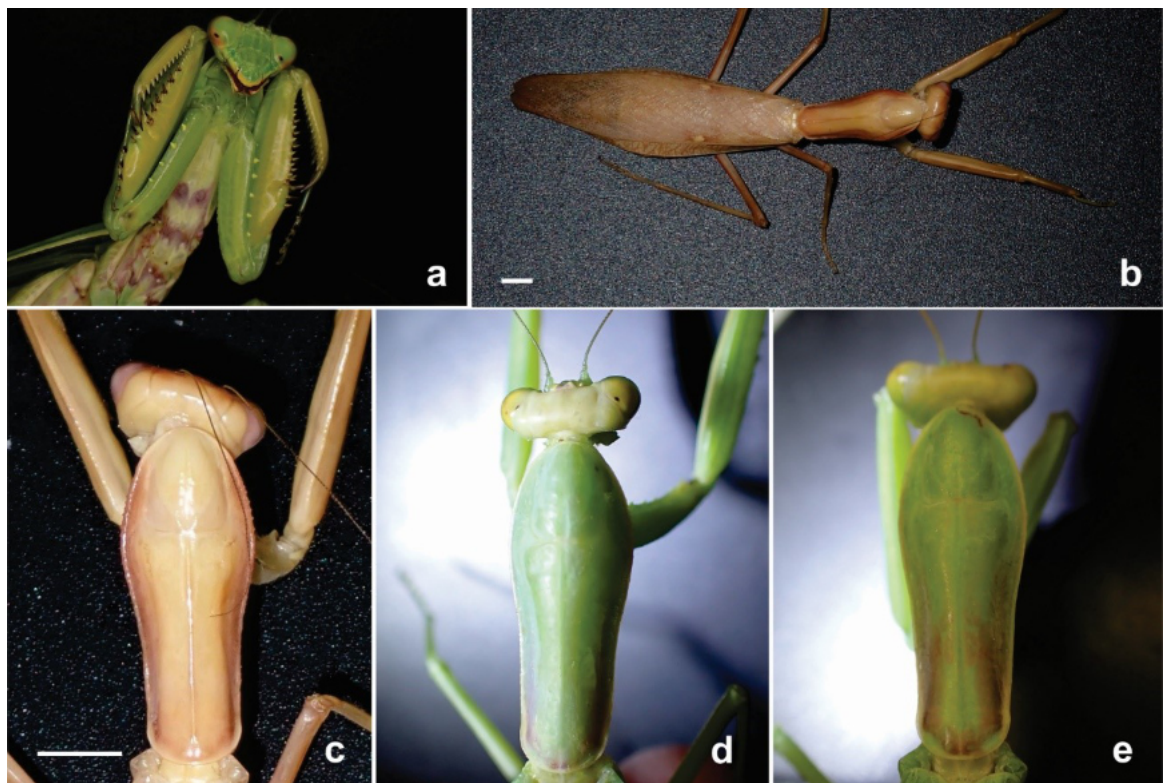


Figure 3. *Hierodula tenuidentata* Saussure, 1869 from Mostar: a) dorsal view of the female preserved in ethanol; b) ventral view of a live male; c–e) pronotum of the three collected specimens (scale 5 mm) (Photo: Dejan Kulijer).

The discovery of the species in Bosnia and Herzegovina was expected considering the evidence of rapid species spread in recent years in the Balkan Peninsula and also wider in the South and Southeastern Europe (Cianferoni et al., 2018; Van der Heyden, 2018; Romanowski et al., 2019; Pintilioaie et al., 2021; Vujić et al., 2021; Martinović et al., 2022), but the origin of these specimens is unknown. Due to the lack of research in the country and the species' similarity to locally widespread and abundant *M. religiosa* (Linnaeus, 1758), it could easily stay undetected for some time. If it spread from neighboring countries, the closest area from which the species could arrive is southern part of Croatia, but the species was found there quite recently and still not known to be established (Martinović et al., 2022) or northern Serbia from where more than 30 records are known in recent years (HabiProt 2021; Vujić et al., 2021). Due to the proximity and the similar time of discovery in Bosnia and Herzegovina and Croatia it could be that both records have the same origin, but there is no proof of this. The species could arrive as a "hitchhiker" to this very popular touristic city or transported with goods or ornamental plants.

Based on available studies (e.g., Battiston et al., 2018; 2019), the impact of this species on native fauna in Europe, particularly other mantises, is still unknown. Due to the ecological and systematic proximity of these two species, they suggest a possibility of competition with *M. religiosa* for space and resources and interference with its reproduction, as sexual cannibalism and attraction through pheromones is present in both species and possibly not species-specific. Both are well adapted to man-made habitats and their life cycles are overlapping, with overwintering oothecae and activity of adults from August to October (Battiston et al., 2019). On the other hand, it is possible that they could coexist in the same areas as both species have slightly different habitat preference – *H. tenuidentata* prefers more forest-like habitats while preferences of *M. religiosa* are more towards grassland habitats. There is also a possibility of *M. religiosa* being predated on by larger *H. tenuidentata*, but *H. tenuidentata* has more arboreal behavior compared to *M. religiosa* (Battiston et al., 2018; Romanowski et al., 2019; Pintilioaie et al., 2021). They also differ in ootheca deposition sites – *M. religiosa* prefers hard surfaces such as stones or walls, while *H. tenuidentata* typically chooses vegetation (Battiston et al., 2019; Pintilioaie et al., 2021).

Based on numerous observed individuals we believe that the species has already established its population in the country, although this should be confirmed with further research, particularly with the research of ootheca during winter time in Mostar and the vicinity. Further surveys are also important in order to monitor the species expansion and possible negative influence on local fauna.

Acknowledgments

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