Acta Entomologica Serbica, 2021, 26(1): 1-7

UDC: 595.725(497.11)
DOI: 10.5281/zenodo.4621135

A FIRST RECORD OF THE ALIEN MANTIS SPECIES *HIERODULA TENUIDENTATA* (MANTODEA: MANTIDAE) IN SERBIA

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Abstract

An alien mantis species, *Hierodula tenuidentata*, has expanded its areal in Europe in the last few years. It was registered in several European countries, including some on the Balkan Peninsula. Herein are presented for the first time records of *H. tenuidentata* on the territory of Serbia, several from the capital city of Belgrade, and one from Novi Kneževac, a town in the northern part of country. The species was recognized for the first time in photos posted in a Facebook group of insect lovers and enthusiasts in 2019, but positive identification only took place in 2020 after group members collected specimens. Social networks can be a very important tool for the monitoring of invasive species in general, and invasive mantids in particular, especially due to their size and attractiveness.

KEY WORDS: citizen science, Facebook, invasive species

Introduction

Hierodula tenuidentata Saussure, 1869 is a mantis species originally found in Asia that in the last few years has expanded its distribution towards Europe (Battiston *et al.,* 2018). The species was recently registered in many European countries, such as Albania, Bulgaria, Greece including its islands, Italy, North Macedonia, Russia, Ukraine, but was often reported under a possible synonym, *Hierodula transcaucasica* Brunner von

Wattenwyl, 1878 (Cianferoni *et al.,* 2018; Van der Heyden, 2018a; Van der Heyden, 2018b; Romanowski *et al.,* 2019). The taxonomic statuses of these species are not entirely clear and more detailed analyses are needed. Cianferoni *et al.* (2018) suggested several possible scenarios for the species and provided identifying characters for both of them. In addition to these species, another alien *Hierodula* has established its populations – *H. patellifera* Serville, 1839, but has so far only been recorded in northern Italy and southern France (Battiston *et al.,* 2020). *Hierodula* species can be separated from other Mantodea living in Europe by a combination of the following characters: white stigmas on the tegmina and the shape of pronotum, as per the key and figures provided in Battiston *et al.* (2019).

To date, two families of Mantodea species have been recorded in Serbia: two Mantidae (*Ameles heldreichi* Brunner von Wattenwyl, 1882 and *Mantis religiosa* (Linnaeus, 1758)) and one Empusidae (*Empusa fasciata* Brullé, 1832) (Vujić, 2020).

Material and methods

The first specimens of allochthonous *Hierodula* species were identified after photos were posted on Facebook by members of a group of insect lovers and enthusiasts called "Insekti Srbije (Insects of Serbia)". The authors of the paper requested group members to collect questionable specimens for identification, but for more than a year, no specimens were collected. Finally, in September and October of 2020, three *Hierodula* were collected and delivered to the first author for identification. All three specimens were identified as *H. tenuidentata* according to the description, keys and figures given by Battiston *et al.* (2019, 2020). Specimens were preserved in 70% ethanol or prepared by standard procedure in dry conditions, and stored in the private collections of the authors (MV and TR). All the data were entered into the Alciphron database (database on insects of Serbia), both data on examined and only photographed specimens (HabiProt, 2020). The distribution map was made in Alciphron database and QGIS 3.16.0, using data stored in Alciphron.

Results and discussion

Three specimens of *Hierodula* were examined and all three were identified as *H. tenuidentata*. Data about findings, notes and map are presented.

***Hierodula tenuidentata* Saussure, 1869** (Fig. 1)

Material examined: Central Serbia: Belgrade, Vase Čarapića Street (44˚49'04'' N, 20˚27'32'' E), 30.09.2020, 1 ♂, legs. G. Vekić Krstić & D. Krstić; Belgrade, Old Mercator (44˚49'40'' N, 20˚24'40'' E), 27.10.2020, 1 ♀, leg. A. Kubíček. AP Vojvodina: Novi Kneževac (46˚02'27'' N, 20˚05'31'' E), 19.10.2020, 1 ♀, leg. T. Rekecki.

Notes: This allochthonous species was registered in the capital city of Serbia – Belgrade, and in Novi Kneževac in the Autonomous Province of Vojvodina in the north of the country. All records except that from Novi Kneževac came from urban parts of Belgrade, where specimens were observed and photographed on tree bark, cars, walls, terraces and inside apartments. Given that Belgrade is the largest city in Serbia with the most intensive trade activity, a large number of allochthonous and invasive insects have been registered in and around the city (Protić, 2008; Ćetković *et al.,* 2011; Šeat, 2015; Protić & Šeat, 2016; Šeat *et al.,* 2019; Petrović-Obradović *et al.,* 2020; Šeat *et al.,* 2020). The first photos of *Hierodula* on the Facebook group date from 2019. Maps of the current distribution of *H. tenuidentata* in Serbia and Belgrade are presented in Fig. 2.

Figure 1. *Hierodula tenuidentata* Saussure, 1869, female (photo by M. Vujić).

This species is probably already more widespread in Serbia, and it is expected to expand its range in the country over the next few years, especially in urban and suburban environments. Occurrence in these habitats may be apparent due to limited observations in these habitats. Another possible reason is that the spread in urban and suburban areas is faster due to intensive trade activities, fewer predators and higher temperatures, which can all positively affect the survival of more individuals. Battiston *et al.* (2019) noted that the impact of the species on Italian and European ecosystems is unknown, but that it might pose a threat to autochthonous mantid species, such as the widely distributed *Mantis religiosa*. The number of records and area involved are still small in Serbia, so it is too early to estimate potential influence on ecosystems here. In order to examine these possible influences, it is necessary to collect data not only on *H. tenuidentata*, but also on *M. religiosa*, and to monitor both species over the coming years.

The second *Hierodula* species that occurs in Europe is *H. patellifera*, which has established populations only in central and northern Italy and southern France (Battiston *et al.,* 2020). Battiston *et al.* (2020) noted that the oothecae of this species successfully survived winters in Italy and they expect *H. patellifera* will expand its areal towards central Europe and northern Italy. It is reasonable to expect the appearance of this species in Serbia in the next few years. Despite existing taxonomic problems between *H. transcaucasica* and *H. tenuidentata*, Cianferoni *et al.* (2018) provided characters for the separation of these species: discoidal and internal spines of fore femora are entirely black in *H. transcaucasica* and black only on the tip in *H. tenuidentata*. *H. tenuidentata* can be mistaken for other green mantids reported in Europe, such as *M. religiosa*, *H. patellifera* or *Sphodromantis viridis* (Forskal, 1775). A reliable identification can be made using the keys, descriptions and figures provided in Battiston *et al.* (2019, 2020). Combinations of the following characters are important for the identification: the presence of white stigmas on tegmina and absence of the black or eye-like spots at the base of the first coxae, on the inner side (unlike *M. religiosa*)

(Fig 3B), shape of pronotum (unlike *S. viridis*) (Fig. 3A), characters of male genitalia and strong spines without basal plates on the inner side of the first coxae (unlike *H. patellifera*) (Fig. 3B).

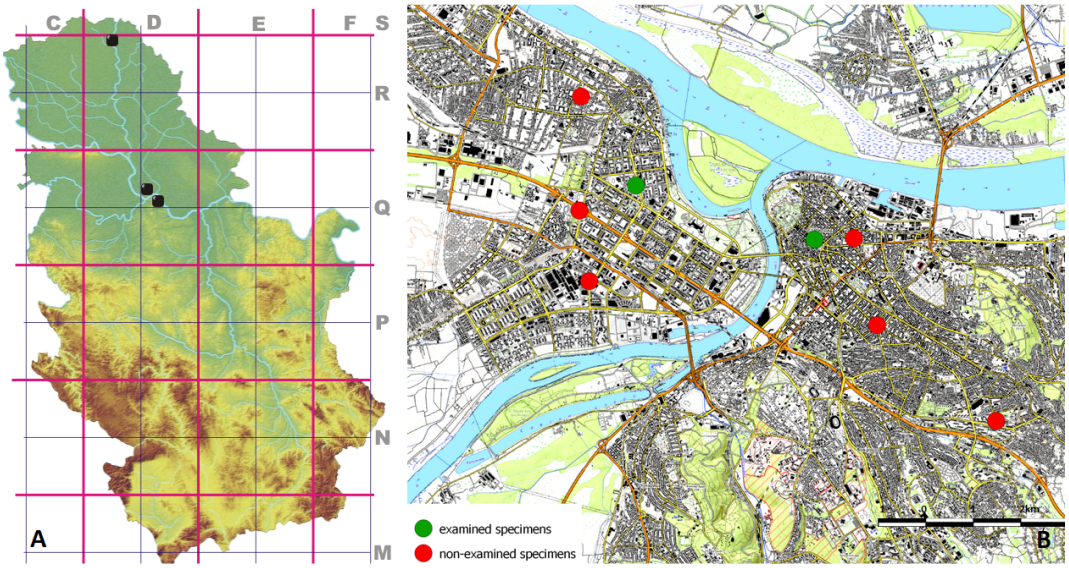

Figure 2. Map of current distribution of *Hierodula tenuidentata* in Serbia; A – UTM fields (10 × 10 km) on map of Serbia where *Hierodula tenuidentata* was registered (from Alciphron database); B – Map of Belgrade with localities where *Hierodula tenuidentata* was registered.

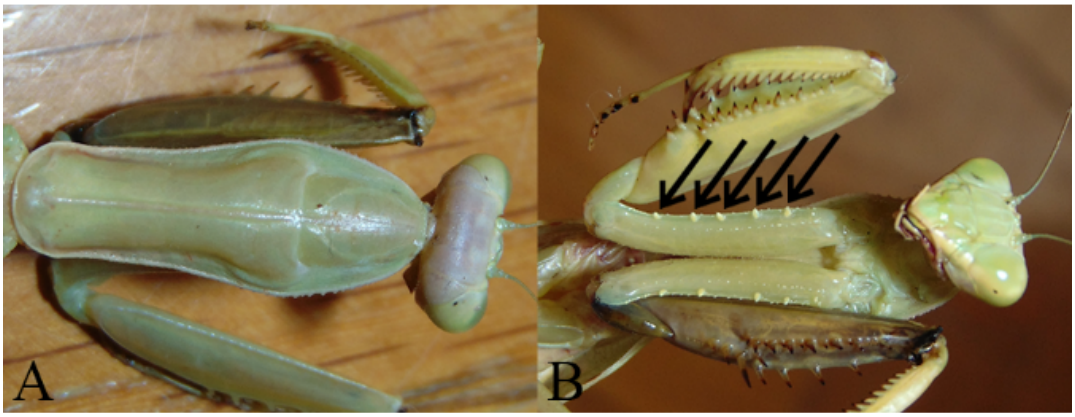

Figure 3. Identification characters for *Hierodula tenuidentata*; A – pronotum, dorsal view; B – first legs, absence of black or eye-like spots in base of the coxae and spines without basal plates (black arrows) (photos by M. Vujić).

Social networks have in recent times played a very important role in detecting and monitoring invasive and allochthonous, as well as newly discovered species. Examples of this are the discovery of new plant and insect species via social networks, and the registering of an invasive butterfly species, the Geranium bronze

Cacyreus marshalli Butler, 1898 in Serbia in the autumn of 2020 (Gonella *et al.,* 2015; Skejo *et al.,* 2016; Rahayu & Rodda, 2019, Milojković *et al.,* in prep.). Facebook groups and other popular social networks can be very important in monitoring invasive mantid species in Europe and Serbia, since they are large and attractive insects for insect lovers, amateurs, photographers and enthusiasts.

Acknowledgment

The authors are thankful to Andrej Kubíček and Gordana Vekić Krstić for collecting the specimens.

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ПРВИ НАЛАЗИ СТРАНЕ ВРСТЕ БОГОМОЉКЕ *HIERODULA TENUIDENTATA* (MANTODEA: MANTIDAE) У СРБИЈИ

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Извод

Страна врста богомољке, *Hierodula tenuidentata*, проширила је свој ареал у Европи претходних неколико година. Регистрована је у неколико европских земаља, укључујући неке на Балканском полуострву. У овом раду представљамо прве налазе ове врсте на територији Србији, неколико налаза из Београда и један из Новог Кнежевца. Врста је први пут препозната на фотографијама постављеним на Фејсбук групу љубитеља инсеката и ентузијазиста 2019. године, а сигурна идентификација је извршена тек након што су чланови групе прикупили јединке, 2020. године. Друштвене мреже могу бити веома важна алатка у праћењу инвазивних врста, посебно инвазивних богомољки, због њихове величине и атрактивности.

Received: December 7th, 2020
Accepted: March 10th, 2021