





First records of *Ameles spallanzania* (Rossi, 1792) with new data on the distribution of *Hierodula tenuidentata* Saussure, 1869 in Bulgaria (Insecta: Mantodea: Mantidae)

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Abstract: The praying mantis *Ameles spallanzania* (Rossi, 1792) is reported for the first time from Bulgaria, as well as for the Black Sea Region. New data on the current distribution in Bulgaria of an alien mantis species, *Hierodula tenuidentata* Saussure, 1869, is also presented.

Keywords: alien species, Balkans, Black Sea coast, citizen science, *Hierodula transcaucasica*, praying mantis

Introduction

Five mantis species belonging to five genera and two families were previously known from Bulgaria: *Empusa fasciata* Brullé, 1832 from Empusidae and *Ameles heldreichi* Brunner von Wattenwyl, 1882, *Hierodula tenuidentata* Saussure, 1869, *Iris oratoria* (Linnaeus, 1758) and *Mantis religiosa* (Linnaeus, 1758) from Mantidae (Battiston et al., 2010; Schwarz & Ehrmann, 2018). Of these, *H. tenuidentata* is an alien species, only recently reported for the country, with a native range extending from India and Central Asia to the Caucasus region (Battiston et al., 2018).

Ameles spallanzania (Rossi, 1792) is a small mantis species with a Mediterranean–Maghrebian distribution. It is reported from Albania, Algeria, Croatia, France, Greece, Hungary, Italy, Libya, Malta, Morocco, Portugal, Spain and Tunisia (Agabiti et al.,

2010; Battiston et al., 2010; Szinetár, 2020). The species reaches between 18 and 40 mm in body length, with a triangular head and conical compound eyes (Battiston et al., 2010; Szinetár, 2020). The sexual dimorphism is evident, with males being longer and slenderer, with fully developed wings, and the females with shorter body length, large and curled up abdomen, stocky and brachypterous (Battiston, 2011). The species is thermophilic and inhabits arid meadows and environments open with sparse herbaceous vegetation and sclerophyllous bushes (Fontana et al., 2002).

Hierodula tenuidentata is a large mantis species (up to 70–80 mm in body length) with a 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. Hyaline wings generally exceed the length of the abdomen and have whitish stigma on the tegmina (Battiston et al., 2019). The *H. tenuidentata*

oothecae are variable in size, rounded, with proximal and distal edges almost straight in lateral view. The residual process is situated in the upper part of the distal end, the colour of the ootheca is dark brown with the emergence area whitish after laying but turning dirty yellow in time (Pintilioaie et al., 2021). Previously described as *H. transcaucasica* Brunner von Wattenwyl, 1878, now it is considered by some authors as a synonym of *H. tenuidentata* Saussure, 1869 (Ehrmann, 2011; Battiston et al., 2018). The first record of the presence of *H. tenuidentata* in the Bulgarian fauna was published by Schwarz & Ehrmann (2018), where two juvenile specimens were observed in southern Bulgaria in the year of publication. An earlier finding of two females in 2017 was subsequently reported by Romanowski et al. (2019). Since then, the species has expanded its range throughout the country (Zlatkov et al., 2020; Langourov et al., 2022; present paper).

In this paper we provide a comprehensive review of the current distribution of *H. tenuidentata*, discuss its expansion in Bulgaria and report the first observations of *A. spallanzania* for the country.

Materials and methods

Ameles spallanzania in Bulgaria was discovered in posts on a citizen science group on the social network Facebook, where photos of four specimens from four locations were independently published for identification. The determination of the species was done by examining the original photos in detail and from the field description provided by the authors of the observations. One specimen was collected and kept in captivity for identification purposes.

The distribution of *H. tenuidentata* in Bulgaria was determined by reviewing the already existing literature regarding the species. The new locations were a result of the combination of purposeful investigation, citizen science and fortuitous observations. The specimens were either observed and photographed or collected and preserved in 70% ethanol and stored in the private collections of the authors.

During this investigation, the species was registered with 307 separate observations, falling into 113 10x10 km UTM squares. The alignment of the observations according to the source of information is as follows: 49 of the observations, falling into 37 UTM squares were made by visual observation from the authors of this study; 9 observations in 5 UTM squares

were from already published records; 249 observations, falling into 71 UTM squares, were examined from social media ([Facebook.com](https://www.facebook.com)) and public database ([iNaturalist.org](https://www.inaturalist.org)) reports.

All observations of *H. tenuidentata* between 21.VII.2016 and 10.XII.2022 (6 years and 4 months) were included in the study.

The photos of *A. spallanzania* specimens were edited with Adobe Photoshop 24.0 2023. To present the distribution of *H. tenuidentata*, a 10x10 km UTM grid map was prepared, using the open-source software QGIS 3.24.1 (QGIS.org., 2022).

Results

Mantidae

Ameles Burmeister, 1838

Ameles spallanzania (Rossi, 1792)

Material examined: 1 adult ♀ (Fig. 1), LG89, Stara Zagora (42.4401°N, 25.6274°E), 258 m a.s.l., 24.IX.2021, N. Kolev obs. & photo; 1 adult ♀ (Fig. 2), NH30, Burgas (42.5134°N, 27.4495°E), 9 m a.s.l., 17.X.2022, R. Tavitiyan obs. & photo; 1 adult ♀ (Fig. 3), NH78, Varna (43.2165°N, 27.8701°E), 20 m a.s.l., 25.X.2022, D. Borisov obs. & photo; 1 adult ♀ (Fig. 4), FN92, Sofia (42.6139°N, 23.3998°E), 594 m a.s.l., 10.XII.2022, I. Teofilova leg.

Hierodula Burmeister, 1838

Hierodula tenuidentata Saussure, 1869

According to our results, *Hierodula tenuidentata* appears to be widespread throughout the country, being more common in South Bulgaria (Thracian Lowland, along Struma River, Eastern Rhodopes Mts), along the Black Sea Coast and in North-east Bulgaria (Fig. 5). It appears to be distributed mainly in locations with low altitude – between 0 m (Pomorie) and 1013 m (Koprivshitsa). Approximately 60% of the observations were below 200 m, 30% between 200 and 500 m and 10% between 500 and 1000 m a.s.l.

Almost all of the sightings (about 97%) were from urban or semi-urban environments (towns, villages, gardens, yards). The species was registered only nine



Figs 1–4. *Ameles spallanzania*, observed in Bulgaria, adult females – in Stara Zagora, photo by N. Kolev (1), in Burgas, photo by R. Tavitiyan (2), in Varna, photo by D. Borisov (3), and in Sofia, photo by I. Teofilova (4).

times in non-urban areas, which are the protected areas “Besaparski Hills”, “Chaya River”, “Shablenska Tuzla”, “Durankulak Lake” and North “Atanasovsko Lake”, and in the vicinity of Yagodovo Village near Plovdiv, Momchilovo Village, Taushan Tepe and Frangensko Plateau.

The number of observations per year is as follows: 2016 – 1; 2017 – 3; 2018 – 20; 2019 – 33; 2020 – 40; 2021 – 94; 2022 (as of 10.XII.2022) – 116.

The known distribution of *Hierodula tenuidentata* is visualised on Fig. 5. The species (specimens or oothecae) was registered in the following localities

(only the first unpublished observation from every UTM square is presented).

Published records

Schwarz & Ehrmann, 2018: FL89, Kozhuh Hill, VII.2018; FL89, Ribnik, 13.VII.2018; Romanovski et al., 2019: KG77, Pazardzhik, 14.XI.2017; Zlatkov et al., 2020: GP34, Oryahovo, 9.VI.2019; FL99, Novo Konomladi, 8.IX.2020; FL89, Rupite, 12.X.2020; Langourov et al., 2022: FM72, Kresna Gorge – Kresna Inn and near Oshtava crossroad, 8.VII.2022.

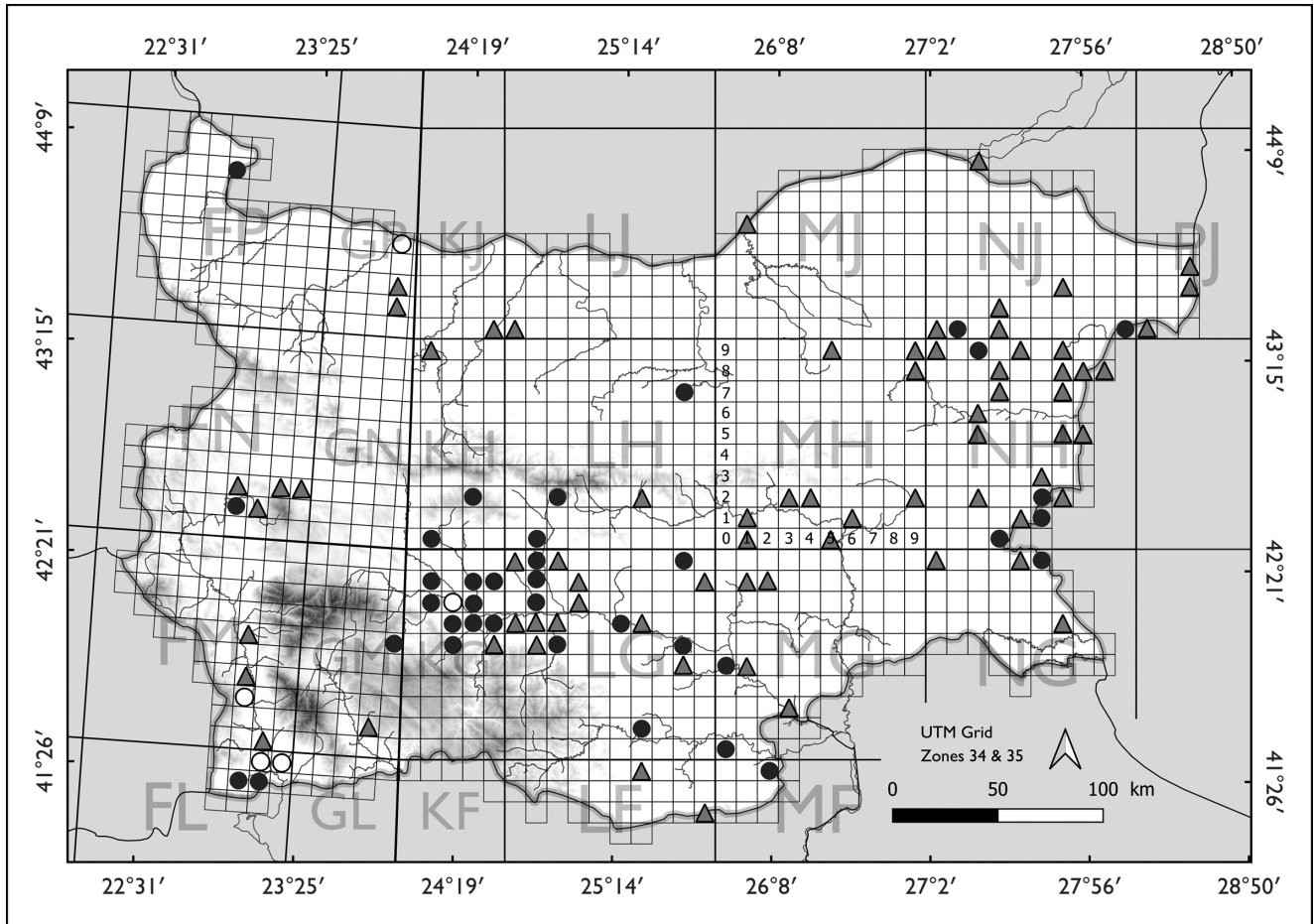


Fig. 5. Distribution of *Hierodula tenuidentata* in Bulgaria from the published records (white circles), personal observations (black circles) and social media/open database reports (grey triangles).

Unpublished data

2016: LG15, Palm Center – Plovdiv Nursery, 42.0638°N, 24.8195°E, 21.VII.2016.

2017: LG16, Plovdiv, 30.VII.2017.

2018: NH30, Burgas, 10.VII.2018; MG00, Madzharovo, 14.VII.2018; MG04, Harmanli, 14.VII.2018; MF29, Ivaylovgrad, 16.VII.2018; NH52, Nesebar, 11.VIII.2018; NH65, Rudnik, 30.VIII.2018; NH67, Zdravets, 3.IX.2018; FM72, Kresna, 16.IX.2018; PJ00, Kavarna, 27.IX.2018; NH26, Dalgopol, 1.X.2018; MH32, Gavrailovo, 13.X.2018; LG26, Yagodovo, 14.X.2018; NJ90; Balchik, 23.X.2018; FL88, Petrich, 31.X.2018.

2019: FM80, Sandanski, 24.III.2019 (ootheca); LG19, Kaloyanovo, 28.IV.2019; KG75, Peshtera, 5.V.2019; KG86, Ognyanovo, 11.V.2019; KG67, Septemvri, 30.V.2019; KG68, Kalugerovo, 2.VI.2019;

NH51, Pomorie, 30.VI.2019; LG61, Kardzhali, 4.VII.2019; LG89, Stara Zagora, 10.VII.2019; GM45, Velingrad, 18.VII.2019; NJ31, Stefan Karadzha, 24.VII.2019; NH78, Varna, 29.VIII.2019; LG25, Asenovgrad, 17.IX.2019; LH10, Hisarya, 20.IX.2019; NH46, Dobroplodno, 20.IX.2019; MG18, Radnevo, 23.IX.2019; LG56, Parvomay, 24.IX.2019; KH60, Panagyurishte, 3.X.2019; KH82, Koprivshtitsa, 19.X.2019; NJ00, Pliska, 6.XI.2019; KG98, Stamboliyski, 12.XI.2019; LG18, Graf Ignatievo, 14.XI.2019.

2020: NH38, Provadiya, 15.VI.2020; FN62, Meshtitsa, 4.VII.2020; FN92, Sofia, 20.VII.2020; KH69, Cherven Bryag, 2.VIII.2020; MH10, Nova Zagora, 20.VIII.2020; MH96, Divdyadovo, 8.IX.2020; LJ00, Pleven, 15.IX.2020; NH68, Ezerovo, 25.IX.2020; LG36, Rakovski, 30.IX.2020; FN71, Rudartsi, 1.X.2020; MH99, Shumen, 1.XI.2020; PJ23.

2021: PJ23, Krapets, 5.II.2021 (ootheca); NH75, Shkorpilovtsi, 11.IV.2021 (ootheca); NH25, Dobromir, 3.VI.2021; LG84, Haskovo, 4.VII.2021; NH49, Suvorovo, 18.VII.2021; MG32, Svilengrad, 19.VII.2021; NG59, Sozopol, 23.VII.2021; LG85, Dimitrovgrad, 25.VII.2021; MH42, Sliven, 25.VII.2021; LH62, Kazanlak, 26.VII.2021; KG95, Krichim, 29.VII.2021; NG66, Tsarevo, 12.VIII.2021; NJ62, Dobrich, 12.VIII.2021; LH87, Veliko Tarnovo, 16.VIII.2021; NH88, Sveti Konstantin i Elena, 25.VIII.2021; NJ28, Silistra, 5.IX.2021; NH22, Aytos, 9.IX.2021; NH37, Tutrakantsi, 9.IX.2021; PJ22, Shablenska Tuzla, 11.IX.2021; NH09, Madara, 13.IX.2021; MH92, Karnobat, 19.IX.2021; MJ15, Ruse, 21.IX.2021; FM75, Blagoevgrad, 25.IX.2021; FN61, Radomir, 2.X.2021; LF69, Momchilgrad, 11.X.2021; FP57, Vidin, 14.X.2021; FM73, Polena, 23.X.2021; NH69, Aksakovo, 18.XI.2021 (ootheca).

2022: LG29, Borets, 25.IV.2022 (ootheca); MH50, Yambol, NH29, Taushan Tepe, 2.VI.2022; 4.VI.2022; NG49, Atiya, 20.VI.2022; NJ30, West of Momchilovo, 28.VIII.2022; KG88, Chernogorovo, 23.VI.2022; KG76, Besaparski Hills, 14.VII.2022; LG98, Yastrebovo, FL78, Samuilovo, 15.VII.2022; 30.VII.2022; MH11, Korten, 2.VIII.2022; NH62, Sveti Vlas, 11.VIII.2022, MG14, Dositeevo, 3.IX.2022; LG66, Dobri Dol, 7.IX.2022; NH53, Kosharitsa, 24.IX.2022; FN82, Sofia, 25.IX.2022; MH61, Zavoy, 25.IX.2022; LG09, Nedelevo, 25.IX.2022; LH22, Karlovo, 28.IX.2022; NG09, Suhodol, 2.X.2022; GP32, Galiche, 2.X.2022 (ootheca); LG37, Belozem, 10.X.2022; KJ90, Dolni Dabnik, 14.X.2022; NJ22, Pet Mogili, 20.X.2022; NJ10, Pliska, 20.X.2022; LG06, Brestovitsa, 25.X.2022; KG89, Malo Konare, 27.X.2022; NH41, Sarafovo, 29.X.2022; GM31, Marchevo, 21.11.2022.

Discussion

Our paper presents the first documented observations of *Ameles spallanzania* from Bulgaria and for the Black Sea Region and outlines the northeasternmost limit of the known range of the species. The presence of *A. spallanzania* in the Bulgarian fauna is likely an example of accidental transportation. The number of alien and allochthonous mantis species has increased in Europe in the last two decades. There are several ways of invasion, but the major two are: 1) the natural expansion of their native ranges, and 2) an introduction

due to human transportation activities (Schwarz, 2018). Most observations of *A. spallanzania* in Bulgaria were from large airport and harbour cities, with Burgas and Varna situated on the Black Sea coast and Sofia in the central part of western Bulgaria. The female observed in Stara Zagora was found in a garden centre with decorative plants imported from Italy. The absence of records in the southern parts of Bulgaria seems to exclude a natural expansion of its native range. The specimen from Varna was recorded at the same location for a period of 43 days after its first discovery (between 25.X.2022 and 7.XII.2022). On 7.XII.2022 it was observed laying an ootheca. The specimen from Sofia laid an ootheca while in captivity the day after its discovery. It is possible that the females were brought to their respective locations already fertilised or that the fertilisation occurred in the area of the observation from a male transported together with the female. Another possibility is that the eggs have been laid unfertilised. Accidentally introduced fertilised females or oothecae could potentially establish populations in favourable habitats, which are similar to the ones preferred by the commonly spread *Mantis religiosa*. The oothecae can resist snow, ice and temperatures as low as -9°C (Battiston & Galliani, 2011).

Hierodula tenuidentata is a mantis species which is rapidly spreading in the Balkan Peninsula and South and Southeast Europe (Cianferoni et al., 2018; Van der Heyden, 2018; Romanowski et al., 2019; Pintilioaie et al., 2021; Vujić et al., 2021; Kulijer et al., 2022; Martinović et al., 2022). The first published records of the species in Bulgaria were from the Thracian Lowland in 2017 (Romanowski et al., 2019) and from the Struma Valley in 2018 (Schwarz & Ehrmann, 2018). Two nymphs (one of them being eaten by the other), photographed in a nursery near Plovdiv (Thracian Lowland), were later identified in a social media post from 2016 and this seems to be the earliest observation of this species in Bulgaria. Plovdiv is an import hub for Mediterranean decorative plants, thus it is quite possible that these specimens (or oothecae) have been transported to the locality accidentally with imported plants.

The early presence of *H. tenuidentata* along Struma River and Eastern Rhodopes Mts in 2018 might be due to natural expansion from the South, where the species was already established. However, it is more likely that the rapid invasion in Bulgaria is due to a few independent accidental introductions, rather than

natural spreading, especially considering the great number of records from urban and sub-urban areas compared to those from natural habitats.

The impact of *H. tenuidentata* on the native fauna, particularly other mantises, is still unknown. Further surveys are needed in order to monitor the species expansion and possible negative influence on the local fauna.

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