

***Hierodula transcaucasica* continues its invasion of Western Europe (Mantodea, Mantidae)**

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Abstract. – *Hierodula transcaucasica* Brunner von Wattenwyl, 1878, is here reported for the first time in France. A well settled and probably widespread population of this species is discussed. Some considerations of the potential impacts on the local ecosystems and its future spreading in Europe as an invasive species are given.

Résumé. – *Hierodula transcaucasica* continue son invasion de l'Europe occidentale (Mantodea, Mantidae). *Hierodula transcaucasica* Brunner von Wattenwyl, 1878, est ici signalée pour la première fois en France. Une population bien établie et probablement répandue de cette espèce est discutée. Quelques considérations sur les impacts potentiels dans les écosystèmes locaux et sa propagation future en Europe en tant qu'espèce envahissante sont données.

Keywords. – Human transport, distribution, France, invasive species, new record.

Hierodula transcaucasica Brunner von Wattenwyl, 1878, is an invasive species of Mantodea which has recently become established in the Mediterranean and the Balkans (EHRMANN, 2002; BATTISTON & MASSA, 2008; EHRMANN, 2011; CAESAR *et al.*, 2015; BATTISTON *et al.*, 2018; CIANFERONI *et al.*, 2018; SCHWARZ & EHRMANN, 2018; ROMANOWSKI *et al.*, 2019; BATTISTON *et al.*, 2020; ZLATKOV *et al.*, 2020; DI PIETRO & BATTISTON, 2021; PINTILIOAIE *et al.*, 2021; VAN DER HEYDEN, 2021; VUJIĆ *et al.*, 2021). Described from North of Iran, Astrubad (BRUNNER VON WATTENWYL, 1878), it is a species widespread in many European and Middle East countries: Afghanistan, Armenia, Austria, Azerbaijan, Bulgaria, Croatia, Georgia, Greece, Hungary, Italia, Moldavia, North Macedonia, Romania, Serbia, Slovenia, Spain, Turkestan, Turkey, Ukraine; and Central Asia.

On 26 August 2022, the second author found, after having seen a photo taken in a garden, an adult female of Mantodea and several oothecae in trees (about two meters high) along the Mosson River in Juvignac, west of Montpellier in France. We discussed its identity and searched for additional data on the Citizen Science website, inaturalist.org. The results of this research are presented here, highlighting the presence of a new Asian mantid species in France since at least 2020: *Hierodula transcaucasica*.

MATERIAL AND METHODS

Observed specimens were identified using the key published in BATTISTON & MASSA (2008) on Caucasian Mantodea. The morphological characters (shape of the pronotum, spines on the forelegs, ...) were also checked with the data published in GIGLIO-TOS (1927) and BEIER (1953).

From a taxonomic point of view, a synonymy with *H. tenuidentata* Saussure, 1869, is yet to be confirmed (SCHWARZ *et al.*, 2018; VAN DER HEYDEN & SCHWARZ, 2021). Here, we use *H. transcaucasica* as suggested for the European populations (VAN DER HEYDEN & SCHWARZ, 2021) because the types of the two taxa would have to be compared and a considerable number of specimens would need to be studied.

RESULTS

Four localities have been highlighted, near Toulouse, Lyon, Montpellier, and in Corsica.

Corsica. – Currently, there are two known localities in Corse-du-Sud: near Ajaccio and in Serra-di-Ferro. On 18 September 2020, an adult female was observed in Ajaccio. The observation was published on iNaturalist.org. The visible morphological criteria allow the identification of the specimen as *H. transcaucasica*. On 17 August 2022, an adult male was attracted by the light diffused in a veranda in Serra-di-Ferro.

Colomiers (Haute-Garonne). – On 25 June 2022, in Colomiers, west of Toulouse, a sub-adult female was observed. Even if the photographed specimen is not yet adult, there is no doubt about the identification (callous spots on the anterior coxae and shape of the pronotum). The specimen does not correspond to the native French species, nor to *Hierodula patellifera* (Audinet-Serville, 1838) which is already installed in the south-east of France. It was observed on garden furniture.

Juvignac (Hérault). – At the end of August 2022, a photo of an adult female was presented to the second author (fig. 1-4). It seemed obvious to him that it was not a native species. After comparison with the illustrations of *Hierodula patellifera*, already encountered in France (MOULIN, 2020), the second author did field research in order to find other specimens. Along a path, alongside the Mosson River at Juvignac (west of Montpellier), eight oothecae and an adult female were observed within 300 meters. After discussions, there remained no doubts about the identification of the specimens as *H. transcaucasica*. At the beginning of September, several trees were pruned along the path. The destination of the cut branches is not specified because a green space management company took charge of them.



Fig. 1-4. – *Hierodula transcaucasica* (Brunner von Wattenwyl), from Juvignac (2022, August). – **1**, Adult female. – **2**, Ootheca on a long-leaved ash. – **3**, Path along the Mosson River, in Juvignac. – **4**, Branches cut by a green space management company, whose destination is unknown (Photograph J. Rouard).

Frontonas (Isère). – On 26 October 2021, an adult female was observed at Frontonas, south-east of Lyon. The visible morphological criteria allow the identification of the specimen as *H. transcaucasica*.

Presumably as the result of a human-assisted introduction, today *H. transcaucasica* occurs in France in Corse-du Sud, Hérault, Isère and Haute-Garonne (fig. 5). Mantodea Species File Online (OTTE *et al.*, 2022, <http://Mantodea.SpeciesFile.org/>) and INPN (GARGOMINY *et al.*, 2022, <https://inpn.mnhn.fr>) will be updated with all these observations.

DISCUSSION

Hierodula transcaucasica increased its range in southern Europe, in the Mediterranean basin and on the Balkan Peninsula (VAN DER HEYDEN, 2021; VAN DER HEYDEN & SCHWARZ, 2021). We can state today that this mantid also occurs in South of France, based on these records. The arrival in France must have been before 2020, because 2020 is the date of the oldest data currently known. Several oothecae and adults have been observed, particularly near Montpellier. As observed in Juvignac, the agencies maintain the green spaces, cut the branches of trees and shrubs that protrude on the paths. It is these branches that carry the oothecae. The destination of the cut branches is often not specified. The dispersal of the mantids is therefore facilitated by human activities and to regions where climate is suitable for mantid establishment and reproduction, as happened with *H. patellifera* and other species in Mediterranean countries (SCHWARZ & EHLMANN, 2018; MOULIN, 2020). According to current data, we expect the invasive species to exert no severe competitive effects on native mantids. Members of the *Hierodula* genus, at the adult stage, occupy arbusticolous to arboricolous

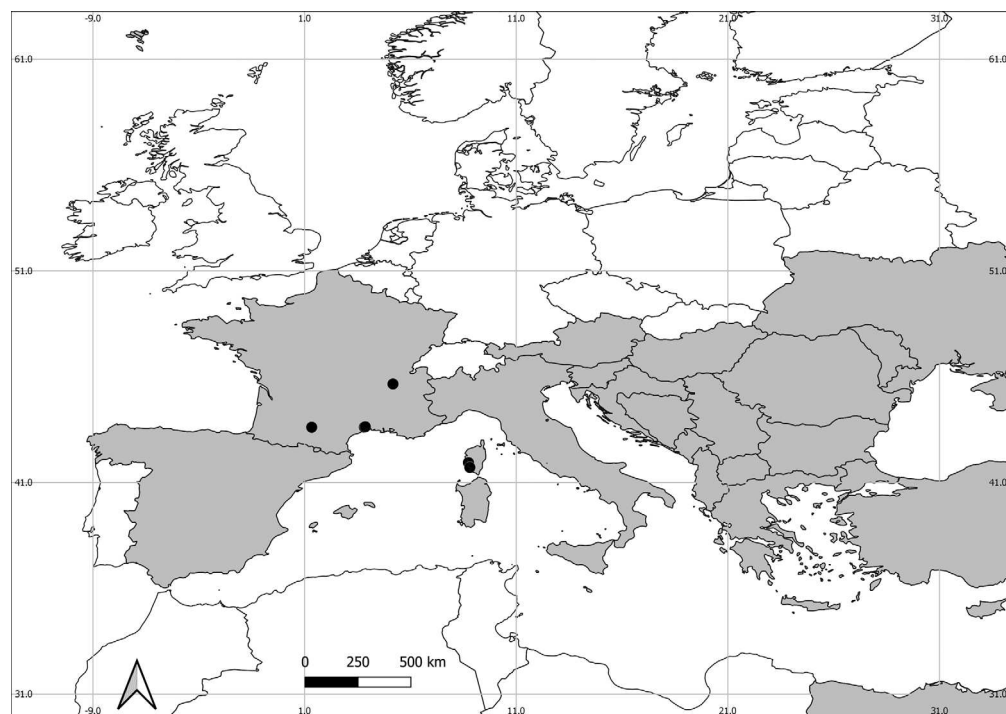


Fig. 5. – Distribution map of *Hierodula transcaucasica* in Europe. Black spots: localities in France. Grey: countries where the species is present, according to the bibliography.

niches, while autochthonous species like *Mantis religiosa* (Linnaeus, 1758) or *Empusa pennata* (Thunberg, 1815) occupy herbaceous strata. It is probable that there is no competition at the adult stage but, at the nymph stage, this is less certain. Young *Hierodula patellifera* had been found in herbaceous strata (MOULIN, 2020). In Italy, Mantodea specialists believe these alien species may represented a potential obstacle to the reproduction of the native *M. religiosa* and therefore a concrete threat for it (BATTISTON *et al.*, 2019). Predatory insects are among the most successful and prolific of invasive species, but the specific mechanisms by which they affect native species are poorly understood (FEA *et al.*, 2013). Monitoring of these invasive alien species should be implemented in order to follow their expansion and their possible pressure on native species.

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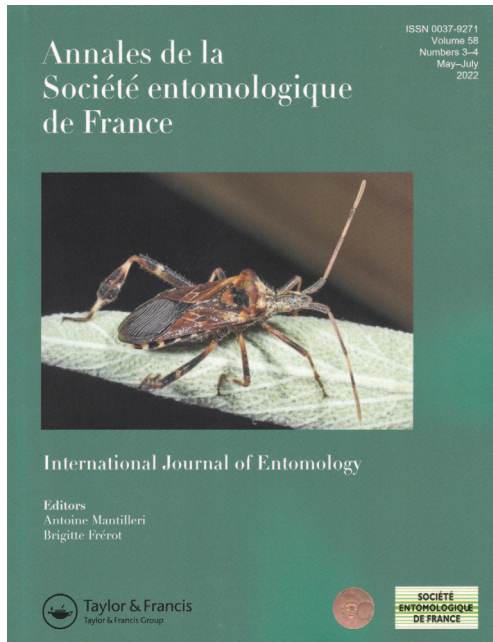
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