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PRESENCE OF *MANTIBARIA SEEFELDERIANA* (DE STEFANI) (HYMENOPTERA: SCELIONIDAE) IN CROATIA: A PSEUDOPARASITOID OF PRAYING MANTIS

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Abstract

Herein we present the first record of a very rare species of parasitoid wasp, *Mantibaria seefelderiana*, in Croatia, with the basic elements of its unusual biology. The most precise categorization of its trophic interaction would be pseudoparasitoid, because the larva of this species feeds on a larger number of mantis embryos in the ootheca in a way that is more representative of predatory diet and behavior, without any regulation by its host's behavior. Additionally, adult females of this pseudoparasitoid live as ectoparasites attached to the body of female mantises, where they feed on hemolymph. The combination of an unusual predatory and parasitic lifestyle is extremely atypical for the predominantly parasitoid character of most other members of the family Scelionidae.

KEY WORDS: parasitoid, *Mantis religiosa*, oophagy, phoretic behavior

Introduction

Mantibaria Kirby, 1900 represents a genus of tiny parasitic wasps whose adult females behave as typical ectoparasites of adult mantids, feeding on hemolymph, while in the larval stage they act as predators, feeding on mantid eggs in oothecae. The genus name comes from its trophic connection with mantids (Masner, 1976; Mineo & Szábo, 1978). To date, four valid species have been reported in the world: *M. seefelderiana* (De Stefani-Perez, 1891) in several European countries (will be listed later), *M. mantis* (Dodd, 1913) and *M. kerouaci* Veenakumari & Rajmohana, 2012 in India and *M. solygiea* Risbec, 1950 in Senegal, although there are numerous disputes about this (Oliveira & Schoeninnger, 2017).

Like other *Mantibaria* species, *M. seefelderiana* has a very unusual biology and life cycle. The adults show phoretic-like behavior, attaching to females of the European mantis, *Mantis religiosa* (L.). The usual place of attachment is between the host's tergites, in the manner of typical ectoparasites. If the mantis is a male, the parasitoid must transfer to the female during the act of copulation (Vinson, 1998). It is not unusual that parasitoid females remove their wings so as not to be bothered by them when hiding under the wings of the host, or during later oviposition (Chopard, 1923; Couturier, 1941). There they will stay until the fertilized female mantis starts laying eggs in the form of ootheca.

M. seefelderiana females then move towards the top of the mantis' abdomen and start to oviposit in mantid eggs until the mantid female covers them with a substance that will harden, becoming a kind of protection (Veenakumari *at al.*, 2012). The larvae of this wasp do not behave as real parasitoids (unlike most of its hymenopteran relatives) by synchronizing their own and the parasitized host's life activities. They act like a specific predator, feeding on the bodies of mantis embryos within the ootheca. Because the larvae of these wasps do not behave as true parasitoids but as predators, we suggest a more adequate term, pseudoparasitoid, which in similar cases of parasitic wasp biology can be sporadically found in use in the literature (e.g., Fitton et al.,1988; Dubois et al., 2002; Korenko & Di Giovanni, 2019). Also, since *Mantibaria* is the only known wasp species whose adults feed on hemolymph, the proposed colloquial name is the vampire wasp (Cassar, 2020).

This is very rarely collected species for which there are only a few publications in scientific journals. The only known species in Europe is *M. seefelderiana*, which was described from Sicily in Italy (De Stefani-Perez, 1891). The holotype was lost, but Mineo & Szabó (1978) reported a subsequent finding of specimen/s from Sicily that morphologically fully correspond to the holotype. Other rare reports include: (1) a finding from Portugal, posted on the web page of the Naturdata – Biodiversidade Online (https://naturdata.com/especie/Mantibaria-manticida/38200/0/) under the synonymous name *M. manticida* Kieffer, 1910 (unknown date of finding); (2) a report from France, also as *M. manticida* (Masner, 1976), two reports from Spain (3) by Antonio Robledo (2011), published on www.biodiversidadvirtual.org, (4) Collected by I. Jusibol on 2020 (https://snsb-zsm.pictures/photo/1729?lang=en) and (5) Malta (Cassar, 2020).

Therefore, since most records of this rarely collected parasitic wasp come from the western Mediterranean area in Europe, we looked for the possible presence of *M. seefelderiana* in the vicinity of Pula in Croatia.

Material and Methods

The examined material was collected by R. Maglić: Croatia, Pula, Valsaline, 44°84'78''N, 13°83'87''E, from 10.10.2018 to 01.11.2018, 2 ♀♀; Croatia, Pula, Veruda, 44°84'77''N, 13°83'88''E, from 02.10.2019 to 01.11.2019, 7 ♀♀; Croatia, Pula, Veruda, 44°84'77''N, 13°83'88''E, 20.10.2020, 1♀. The investigated areas (mainly meadows) are about 500 m apart, with a total area covering approximately 20 km^2. We examined about 100 common praying mantis females. In addition to host adults, we found several oothecae of mantis attached to vegetation in the same area during the period of 10.10-01.11.2018, of which two were infected, 10 ♀♀, 2 ♂♂ (Valsaline) emerged on 20.07.2019, and the two more oothecae on 02.10.2019 to 01.11.2019 where 18 ♀♀, (Veruda) emerged from them on 25.07.2020.

To collect pseudoparasitoids we used a sweep net. We also used a camera to record the act of parasitoid oviposition in the ootheca. The female mantises were reared and fed in 20x20x20 cm plastic boxes until the laying of eggs, forming oothecae. The oothecae were kept in smaller plastic boxes, resembling shallow cups with perforated lids. Oothecae collected in the field were transferred in small boxes kept under outdoor temperature conditions. In summer, among newly hatched mantid nymphs, there were many *M. seefelderiana* specimens in the boxes.

Results and discussion

At two investigated sites, among the ~100 checked specimens of praying mantis we found ten females infected by *M. seefelderiana*. The female adults of *M. seefelderiana* were attached between the tergites just below the proximal part of the wings of praying mantis on the thorax, but also on the abdomen (Fig. 1). Nine of the ten mantises carried one parasitoid each, while only one specimen had two.

Since *Mantibaria seefelderiana* is very small insect with the specific biology described above, in most cases it goes unnoticed, but also, many entomologists are unaware of its existence. To this should be added the difficulty in detecting pseudoparasitoids on the body of the mantis. The reason for this is because the mantis has a black dot under the wing, just at the place where the pseudoparasitoids usually climb.

In searching a fairly large area, surprisingly, the wasp was found only in two meadows that were close to each other (separated by a road and a garden), while no wasps were found in the surrounding meadows, or elsewhere in the vicinity of Pula. Another important observation is that we did not find any wasps on the nymphs or males of the mantises inspected in the field. Our attempts to find some *M. seefelderiana* on vegetation using a sweep net were unsuccessful, so we cannot say anything about them outside of their hosts, such as when feeding, flying, mating, etc. Therefore, our parasitoid samples come only from under the wings on the thorax and abdomen of mantis females (Fig. 1A-C). We did not find any data in the literature regarding the life of the parasitoid prior to it finding an adequate host.

While keeping the female mantises infected with *M. seefelderiana* in the plastic boxes, we were able to follow the mantis oviposition and the simultaneous parasitism of the newly formed ootheca (Fig. 2A) which we recorded by video. Figure 2B shows the exit holes of the pseudoparasitoids on the ootheca (openings are indicated by arrows). On the longitudinal section through the ootheca (Figure 2C), it can be seen that the upper row of eggs in the ootheca is infected with pseudoparasitoids, dark exuviae of the parasitoid larvae and some dead adults. From the lower row of eggs, mantis nymphs emerged.

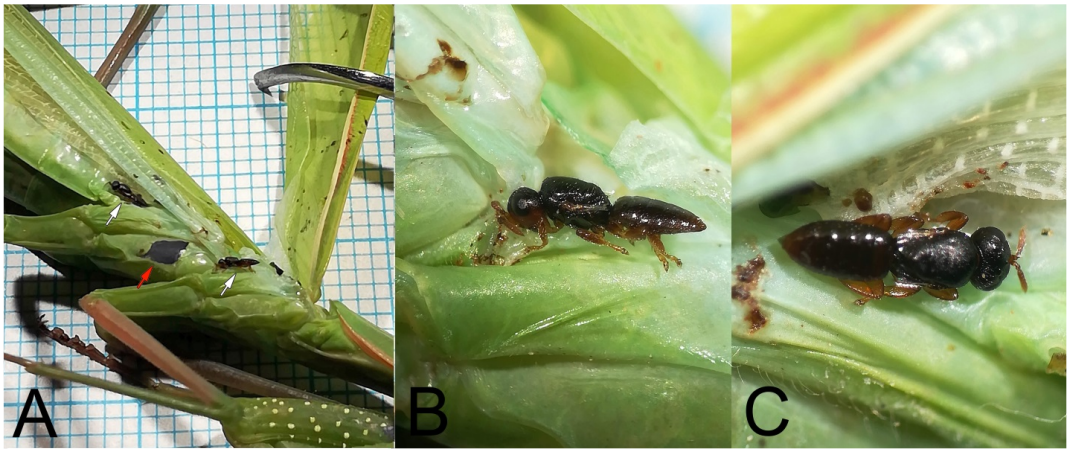

Figure 1. The adults of *M. seefelderiana* parasitizing the European mantis externally: A – two pseudoparasitoids on the same host (marked by white arrows) and the black dot on the host body (marked by a red arrow), B and C – enlarged pseudoparasitoids and the traces of damages on the host body due to pseudoparasitoid feeding.

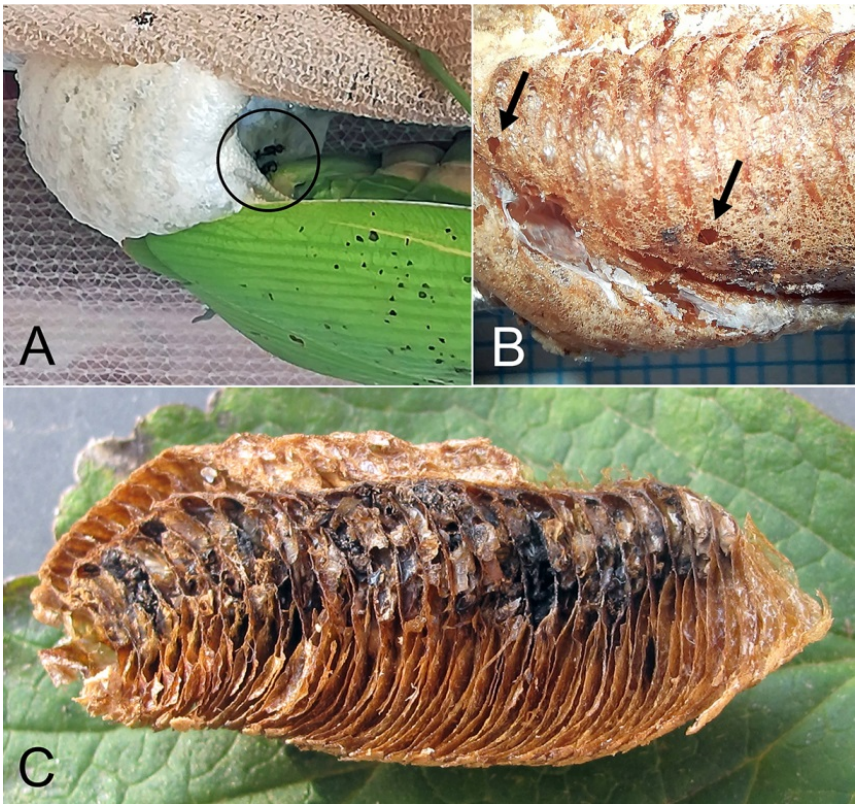

Figure 2. The ootheca of the European mantis: A – the act of oviposition of the host and the pseudoparasitoid, B – exit openings of *M. seefelderiana* on the ootheca, C – the longitudinal section through the ootheca (parasitized upper row of mantis eggs).

It should be noted here that there was no multiparasitism in the oothecae, i.e., simultaneous parasitisation of eggs by *Podagrion* Spinola (Torymidae) wasps, which has a somewhat similar biology to *Mantibaria*, as reflected in the parasitisation of the ootheca, inside of which *Podagrion* larvae eat mantis eggs.

Short description: ♀ Body length 2.3-2.5 mm, flattened, dorsally dark brown, mesosoma almost black (Fig. 3). Head laterally rounded, slightly granulate frontally brownish. Antennae brownish, 11-segmented, flagellar segments compactly connected. Ocelli large. Mandibles short, dark brown, apically black, 3-toothed. Maxillary and labial palps reduced. Legs highly modified to parasitism, short, all parts brownish, with pronounced claws on the metatarsus. Femora and tibiae flattened. Both fore- and hindwings hyaline, transparent, with dense short setae. No wing venation. Metasoma short, shorter than thorax, dark brown ventrally. ♂ Coloration of body parts same as in female. Flagellar segments slightly spaced.

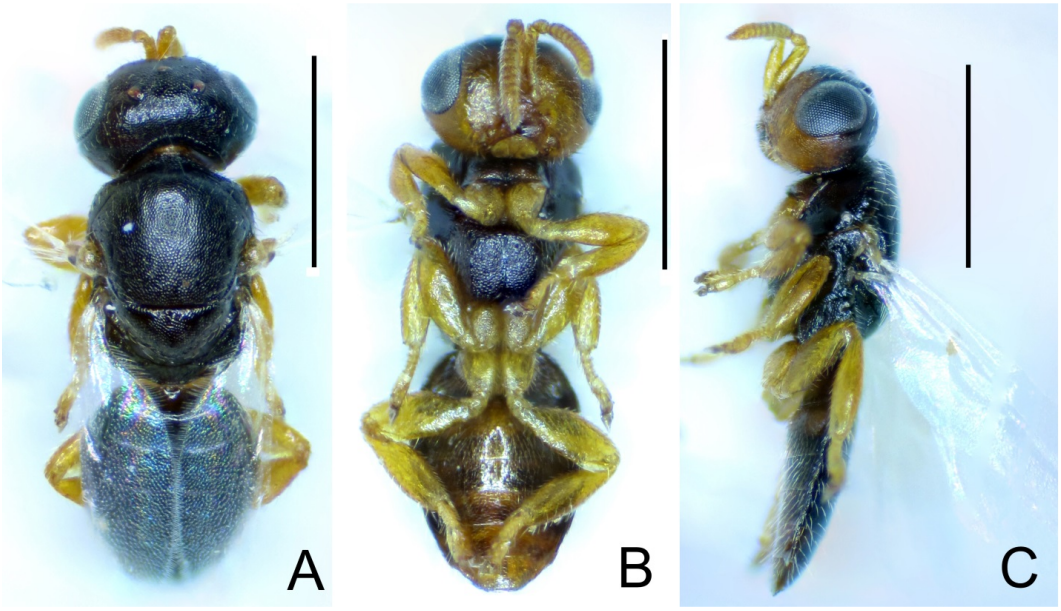

Figure 3. The general habitus of *M. seefelderiana* (♀): A – dorsal view, B – ventral view, C – lateral view. Scale bar = 1 mm.

We hope that this paper will encourage further research and provide relevant insights into the relationship between the mantis and the presented pseudoparasitoid.

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References

Cassar, T. (2020). First report of Scelioninae (Hymenoptera: Platygastridae) from the Maltese Islands with a new record for Europe and notes on its biology. *Bulletin of the Entomological Society of Malta*, *11*, 27-31.

Chen, H., Johnson, N. F., Austin, A. D., Polaszek, A., Talamas, E. J., Taekul, C., & Valerio, A. (2017). Reassessment of the phylogeny of the superfamily Platygastroidea (Hymenoptera). *Unpublished*.

Chopard, L. (1922). Les parasites de la mante religieuse. *Annales de la Société Entomologique de France*, *91*, 249-272.

Couturier, A. (1941). Nouvelles observations sur *Rielia manticida* Kief. Hyménoptére (Proctotr. Scelion.) parasite de la mante religieuse, II. Coportement de l'insecte parfait. *Revue de Zoologie Agricole et Appliquée*, *40*, 49-62.

De Stefani-Perez, T. (1891): De duobis novis hymenopteris Siciliae. *Naturalista Siciliano*, *10*(6), 117-119.

Delvare, G. (2005). A revision of the West-Palearctic *Podagrion* (Hymenoptera: Torymidae), with the description of *Podagrion bouceki* sp. nov. *Acta Societatis Zoologicae Bohemicae*, *69*, 65-88.

Dubois, J., Rollard, C., Villemant, C., & Gauld, I. D. (2002). The phylogenetic position of parasitoids of spiders within Pimplinae (Hymenoptera, Ichneumonidae). In *Proceedings of the 20th European Colloquium of Arachnology* (pp. 27-35). Budapest: Plant Protection Institute and Berzsenyi College Press.

Fitton, M. G., Shaw, M. R., & Gauld, I. D. (1988). *Pimpline ichneumon-flies. Hymenoptera, Ichneumonidae (Pimplinae)*., *7*(1), 110 pp.

Korenko, S., & Di Giovanni, F. (2019). Spider Parasitoids of the Tribe Ephialtini (Hymenoptera: Ichneumonidae: Pimplinae) in Italy and their Host Association. *Acta Zoologica Bulgarica*, *71*(4), 473-486.

Masner, L. (1976). Revisionary notes and keys to world genera of Scelionidae (Hymenoptera: Proctotrupoidea). *The Memoirs of the Entomological Society of Canada*, *108*(S97), 1-87.

Mineo, G., & Szabó, J. B. (1978). On the species of *Mantibaria seefelderiana* (De Stefani-Perez, 1891) (Hymenoptera, Scelionidae). *Annales historico-naturales Musei nationalis hungarici*, *70*, 303-305).

Oliveira, B. G. D., & Schoeninnger, K. (2017). First record of *Mantibaria* Kirby, 1900 (Hymenoptera, Scelionidae, Scelioninae) in the New World: a probable case of accidental introduction. *Zootaxa*, *4237*(3), 575–577.

Veenakumari, K., Rajmohana, K., & Prashanth, M. (2012). Studies on phoretic Scelioninae (Hymenoptera: Platygastridae) from India along with description of a new species of *Mantibaria* Kirby. *Linzer Biologische Beiträge*, *44*(2), 1715-1725.

Vinson, S. B. (1998). The general host selection behavior of parasitoid Hymenoptera and a comparison of initial strategies utilized by larvaphagous and oophagous species. *Biological control*, *11*(2), 79-96.

ПРИСУСТВО *MANTIBARIA SEEFELDERIANA* (DE STEFANI) (HYMENOPTERA: SCELIONIDAE) У ХРВАТСКОЈ, ПСЕУДОПАРАЗИТОИДА ОБИЧНЕ БОГОМОЉКЕ

РОМАН МАГЛИЋ и ВЛАДИМИР ЖИКИЋ

Извод

Приказали смо прво документовано присуство у Хрватској и основне елементе необичне биологије једне врло ретке врсте паразитоидне осе, *Mantibaria seefelderiana*. Најпрецизније категорисање њене трофичке интеракције било би псеудопаразитоид, из разлога што се ларва ове врсте храни већим бројем ембриона богомољке у оотеци, на начин који више одговара предаторском начину исхране и понашања, а без било каквог успостављања регулације понашања свог домаћина. Додатно, адултне женке овог псеудопаразитоида живе као ектопаразити прикачени на телу женки богомољке, где се хране хемолимфом. Комбинација необичног предаторског и паразитског начина живота изузетно је нетипична за претежно паразитоидни карактер већине осталих чланова породице Scelionidae.

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