

Research articleSubmitted: September 5th, 2020 - Accepted: September 28th, 2020 - Published: November 15th, 2020**The praying mantises of the Maltese Islands: distribution and ecology (Mantodea)**

Thomas CASSAR

Department of Biology, Faculty of Science, University of Malta - Msida MSD 2080, Malta - thomas.m.cassar.19@um.edu.mt

Abstract

This study presents a species account of the mantises of the Maltese Islands, including notes on the ecology and distribution of each species. A total of three species are known to exist locally; *Ameles spallanzania* (Rossi, 1792), *Mantis religiosa* (Linnaeus, 1758) and *Rivetina baetica* Rambur, 1839. The presence of *Ameles decolor* (Charpentier, 1825) cannot be confirmed by any recently collected material, but the species is not excluded from the Maltese entomofauna. Two doubtful records are also discussed. All species present in the archipelago are typically found in Southern Europe and the Mediterranean basin.

Key words: mantids, Malta, Mediterranean.

Introduction

The Maltese archipelago is composed of a number of small, low islands situated in the centre of the Mediterranean Sea, aligned in a North-West to South-East direction. The total area of the archipelago amounts to 314 km², and they lie approximately 96 km to the south of Sicily (Italy, Europe) and some 350 km directly north of the Libyan coast (North Africa). The three largest islands of the archipelago are inhabited, namely Malta, Gozo and Comino, with a total population of 514,564. A number of uninhabited islets and rocks also occur along the coasts of these islands, such as St Paul's Islands, Cominotto, Filfla and Fungus Rock. The climate is typically Mediterranean, with hot, dry summers and mild, wet winters. Despite their small size, the Maltese Islands are home to an estimated 4,500 species of terrestrial and freshwater arthropods (Dandria & Mifsud 2017). Faunal and floral biodiversity is, however, intensely pressured by human activity, especially land-use (Schembri 1993).

The very first mention of praying mantises in the Maltese Islands comes from a series of lectures presented in Italian by the Maltese botanist Dr Gavino Gulia (1858) in San Antonio palace. When discussing the order Orthoptera in the archipelago, Gulia (1858) writes the following: “*The praying mantis belongs to this order, of which I have collected three local species. These bear the vernacular name of Debba ta l’Infern... I know Mantis oratoria, M. mendica, and another that so far I have not been able to determine.*”

A note on the vernacular name: both *Debba tal-Infern* and *Debba tax-Xitan* are used to refer to praying mantises in the Maltese language, the latter being more common nowadays, and they translate to “Hell’s mare” and

“Devil’s mare” respectively. Though Gulia (1858) mentions *Iris oratoria* and *Blepharopsis mendica*, much doubt can be cast on these identifications. Maltese mantises were not mentioned again in literature until the work of Valletta (1954), at that time including two species - *Mantis religiosa* and *Ameles spallanzania*, along with a list of Orthoptera. A year later, Valletta (1955) added another two species, *Rivetina baetica* and *Ameles decolor*, and since then, have been added to the Maltese entomofauna, though several authors have commented in brief on certain aspects of species’ distribution and/or ecology. The aim of the present work is to review the literature available on the praying mantises of the Maltese Islands and to add new observations on distribution, ecology and life history of the species occurring in the archipelago.

Material and Methods

The personal collection and field notes of the author were used to produce this annotated species list, including specimens collected by hand, malaise and UV/MV light trapping, sweep netting, and the rearing of wild-caught specimens in captivity. In addition, the collection of mantids housed at the National Museum of Natural History (NM-NH) in Mdina (Malta) was studied in order to establish the local distribution of species up to 70 years ago. Maltese mantid material was also examined from the following collections:

ACC Aldo Catania private collection
DMTCC David Mifsud & Thomas Cassar private collection
LFCC Louis F. Cassar private collection

Previous literature regarding the mantises of Malta and their distribution were referred to, including the doubtful records of Gulia (1858), the preliminary lists by Valletta (1954, 1955) as well as the observations published by various authors such as Cilia (1981), Sammut (1982), Valletta (1982) and Casha (1984). Specimens of *Ameles* were identified using the information provided by Fontana et al. (2002), Battiston & Fontana (2005) and Agabiti et al. (2010). The nomenclature used in this paper for species names follows Otte et al. (2020), and morphological terminology follows Brannoch et al. (2017).

Results

The present work compiles records from past publications, as well as several Maltese collections, and provides a check-list of the mantid fauna of the Maltese Islands. A total of four species were recorded from the Maltese Islands, all from the same family – Mantidae. For each species, a description of their distribution and ecology is here under included.

Mantis religiosa religiosa (Linnaeus, 1758) (Figs 1-6)

Material examined. MALTA: Gharghur, 15.XI.1959, leg. C. DeLucca, 1♀, [NMNH]; Madliena, 5.IX.1959, leg. C. DeLucca, 1♀, [NMNH]; Wied il-Kbir, 10.X.1964, leg. G. Lanfranco, 1♀, [NMNH]; Xemxija, 28.IX.1971, leg. G. Lanfranco, 1♀, [NMNH]; Sliema, 1965, leg. G. Lanfranco, 1♀ [NMNH]; H'Attard, 9.IX.1957, leg. G. Lanfranco, 1♂ [NMNH]; [loc?], 23.VIII.1952, leg. G. Lanfranco, 1♂ [NMNH]; Baħar iċ-Ċagħaq, 6.IX.1970, leg. G. Lanfranco, 1 nymph [NMNH]; Ġħajn Rihana, 11.VIII.1969, leg. G. Lanfranco, 1 nymph [NMNH]; Mtahleb, 9.X.1972, leg. M. Zammit, 1♀ [NMNH]; Dragunara, 9.IX.1982, leg. M. Zammit, 1♀ [NMNH]; Rabat, 17.X.2003, leg. P. Sammut, 2♂♂ [NMNH]; Rabat, 12.IX.2004, leg. P. Sammut, 1♂ [NMNH]; Żebbuġ, 27.XI.2013, leg. T. Cassar, 1♂ [DMTCC]; Bingemma, VIII.2014, leg. T. Cassar, 1♀ [DMTCC]; Birkirkara, 30.IX.2014, leg. T. Cassar, 1♂ [DMTCC]; Mellieħa (Marfa), 19.VIII.2015, leg. T. Cassar, 1♀ collected as last instar nymph and reared to adulthood [DMTCC]; Dingli, IX.2015, leg. T. Cassar, 1♀ [DMTCC]. COMINO: 23.II.2020, leg. T. Cassar, 1 ootheca [DMTCC]. GOZO: Sannat (Ta' Ċenċ), 8.II.2015, leg. T. Cassar, 1 ootheca [DMTCC]; Qbajjar, 3.XI.2019, videographed by S. Bonnici, 2♀; Nadur, 15.IX.2020, photographed by B. Grech, 1♂.

Distribution and habitat. *Mantis religiosa* is a very common and widespread mantid in the Maltese Islands (Fig. 1). In the archipelago, the species is not restricted to a particular habitat, breeding in garigue, grassland and clay steppe, field margins, gardens and disturbed ground with low grasses.

Oothecae. The ootheca is up to 30 mm in length, ovoid to oblong, white to pale yellow when freshly deposited, becoming a darker yellowish-brown when dry; the emergence area is paler and occupies about one-third of the dorsal oothecal area (Fig. 2). Oothecae are deposited on or under stones, on tree branches, under rocky overhangs and the walls of buildings. In Malta, the oothecae are known to be parasitized by at least one species of Torymid wasp, *Podagrion splendens* (Cassar 2016).

Nymphs and imagoes. *Mantis religiosa* is readily identified, as it is the only species in the Maltese Islands with a bold eyespot of white and black on the inner front coxae. Adults of both sexes are macropterous (Figs 3-4). Early instar nymphs appear in June, adults may begin to appear as early as August, but become abundant in September and October, and females may persist until December. Individuals may be yellow-ochre, grass green, grey-brown or brown-sepia and the latter three colours seem to be more common in individuals present later on in the year, possibly due to a change in vegetation colour after the first autumnal rains (Battiston & Fontana 2010). Adult *Mantis religiosa* have been observed to feed on a wide range of taxa in the Maltese Islands; lepidopterans such as *Pieris*, dipterans such as various Muscidae, Calliphoridae and Sarcophagidae, cicadas (*Cicada orni*), dragonflies such as *Sympetrum fonscolombii* (Degabriele 2013) and Maltese wall lizards, *Podarcis filfolensis* (Casha 1984), but especially grasshoppers such as *Eyprepocnemis plorans*, *Acrotylus patruelis*, *Oedipoda miniata*, *Sphingonotus caeruleans*, *Calliptamus* spp. and *Anacridium aegyptium* among others (Fig. 6). In September 2018, the author observed a nymph of *Mantis religiosa* remaining near domestic dog faeces in order to successively capture and devour multiple sarcophagids (Fig. 5). Deimatic display consists of spreading both pairs of wings and exposing the coxal eyespot by splaying the raptorial forelimbs horizontally in opposite directions.

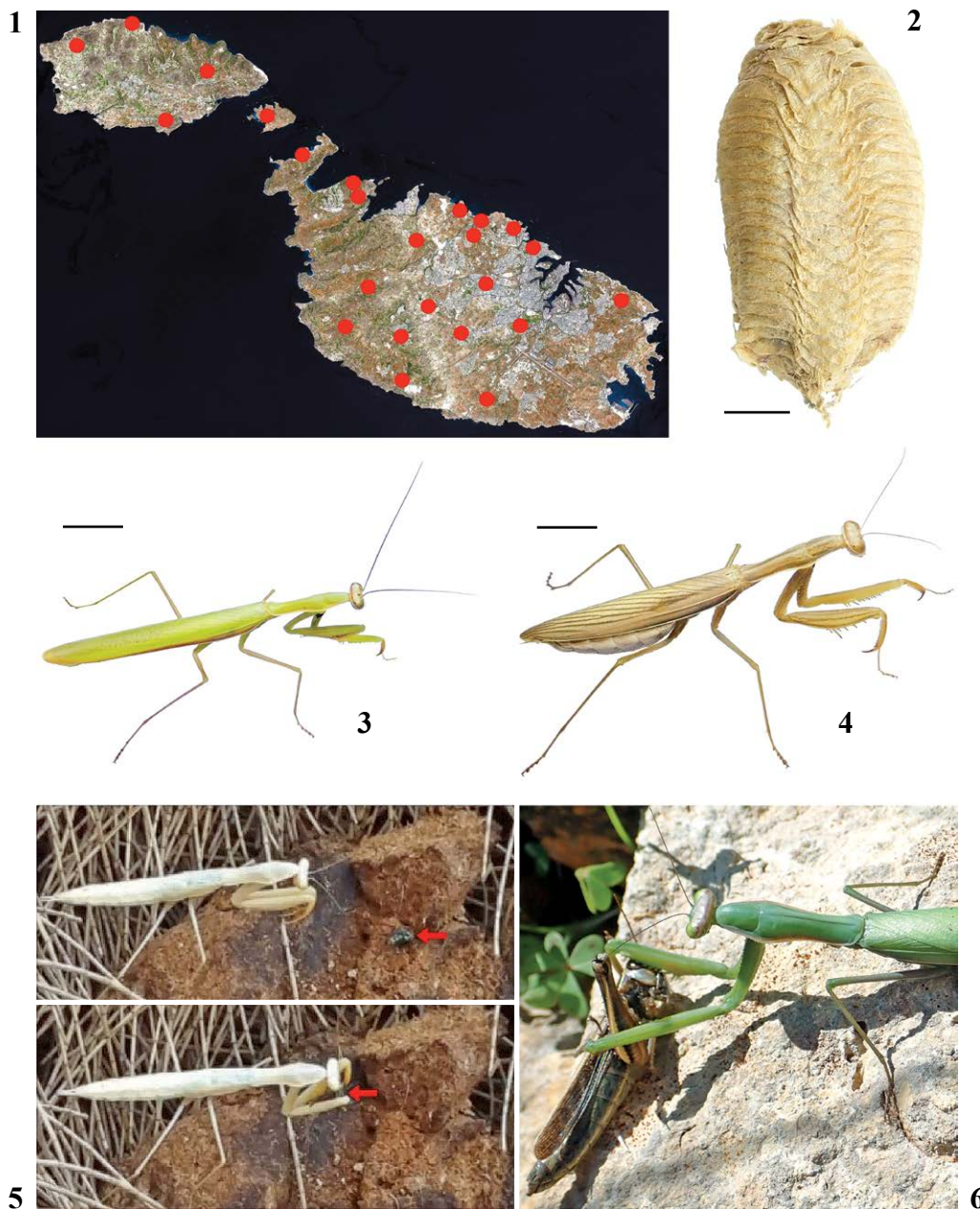
Rivetina baetica tenuidentata La Greca & Lombardo, 1982 (Figs 7-13)

Material examined. MALTA: Baħar iċ-Ċagħaq, 13.IX.1970, leg. G. Lanfranco, 1♂ [NMNH]; Baħar iċ-Ċagħaq, 7.VIII.1983, leg. M. Zammit, 1♀ [NMNH]; Rabat, 26.VI-II.1983, leg. P. Sammut, 1♂ [NMNH]; Bahrija, VIII.1994, leg. M. Zammit, 1♀ [NMNH]; Baħar iċ-Ċagħaq, 6.VI-II.1983, leg. S. Schembri, 1♂ [LFCC]; Mellieħa (Bajda Ridge), 24.VII.1977, leg. S. Schembri, 1♂ [LFCC]; Mellieħa (Ghadira), 3.VIII.1976, leg. L. Cassar, 1♂ [LFCC]; Baħar iċ-Ċagħaq, 17.VII.1969, leg. G. Lanfranco, 2♂♂ [LFCC]; Baħar iċ-Ċagħaq, 24.VII.1972, leg. G. Bonett, 1♂ [LFCC]; Baħar iċ-Ċagħaq, 8.VIII.1976, leg. S. Schembri, 1♂ [LFCC]; Mtahleb, 24.IX.1989, leg. P. Sammut, 1♀ [LFCC]; Mistra, 10.VIII.1952, leg. G. Lanfranco, 1♀ [LFCC]; Baħar iċ-Ċagħaq, 6.VIII.1983, leg. S.

Schembri, 1♀ [LFCC]; Mellieħa (Għajn Tuffieħa), 8.VI-II.1975, leg. L. Cassar, 2♀♀ [LFCC]; Mosta (Wied il-Għasel), 21.IX.1972, leg. S. Schembri, 1♀ [LFCC]; Baħar iċ-Ċagħaq, 8.VIII.1976, leg. S. Schembri, 1♀ [LFCC]; Baħar iċ-Ċagħaq, 4.VII.1972, leg. G. Bonett, 1♀ [LFCC]; Mellieħa (Għadira), 3.VII.1972, leg. G. Bonett, 1♀ [LFCC]; Baħar iċ-Ċagħaq, 9.VIII.1972, leg. G. Bonett, 1♀ [LFCC]; Pembroke, VIII.1991, leg. A. Catania, 2♂♂ to MV light [1 ACC, 1 DMTCC]; Pembroke, VIII.1992, leg. A. Catania, 1♀ [ACC]; Mellieħa (Marfa), 27-28.VIII.2015, leg. T. Cassar, 3♀♀ [DMTCC]; Mellieħa (Marfa), 29.VI-

II.2015, leg. T. Cassar, 1♂ [DMTCC]; Mellieħa (Rdum tal-Madonna), VIII.2015, leg. T. Cassar, 1♀ [DMTCC]; Mellieħa (Marfa), 3.VIII.2019, leg. T. Cassar, 1♀ & 1♂ [DMTCC]; Selmun (35°57'32.5"N 14°22'41.6"E), 23.VI-II.2020, leg. T. Cassar, 1♂ [DMTCC]; Mellieħa (Majjistral Nature & History Park - 35°56'23.9"N 14°19'57.5"E), photographed by A. Cunningham, 1♀.

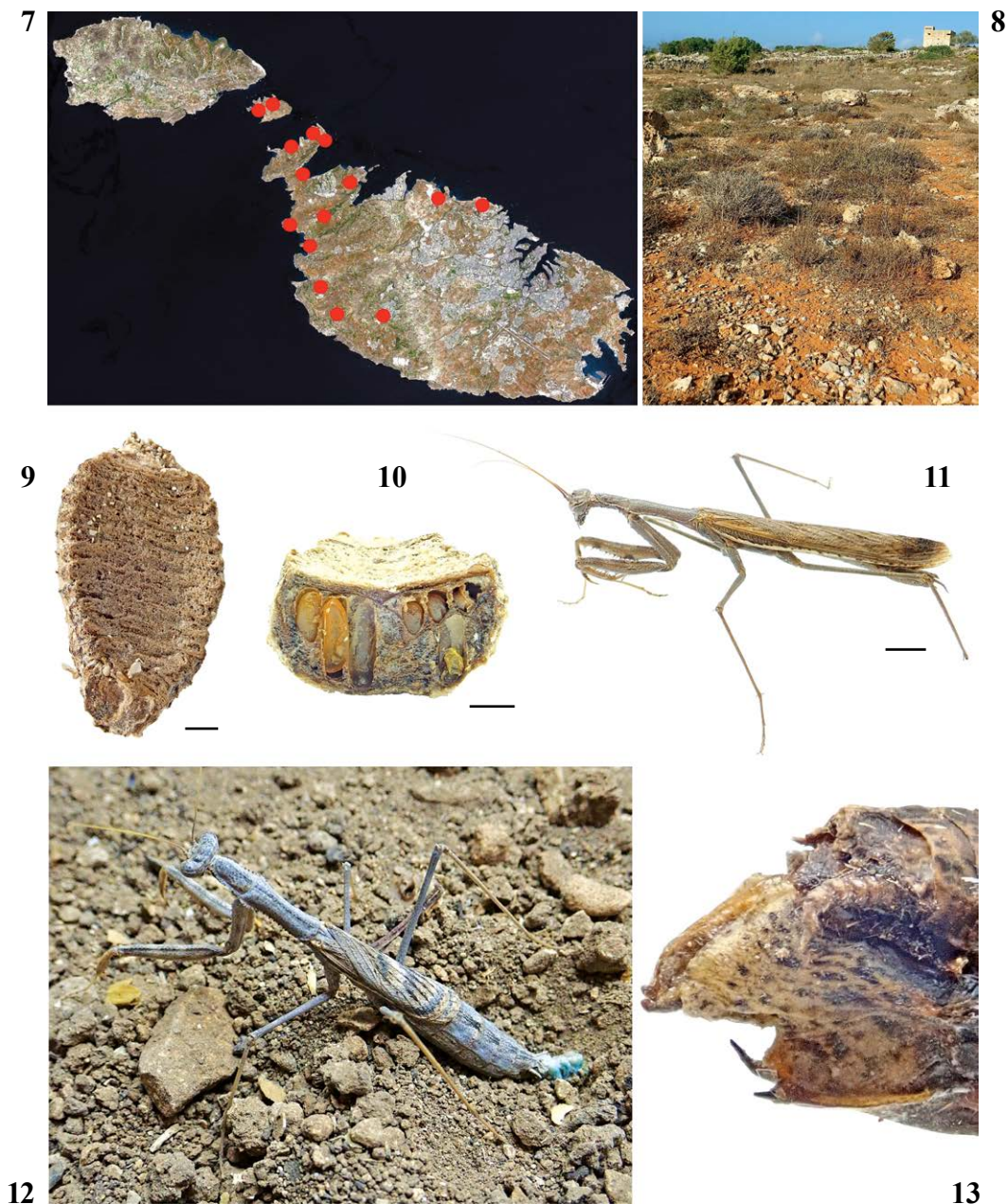
Distribution and habitat. *Rivetina baetica* is a rare mantis with a restricted distribution in the Maltese Islands; it has never been recorded from Gozo, though it is known



Figs 1-6 – *Mantis religiosa religiosa* (Linnaeus, 1758). **1**, distribution in the Maltese Islands; **2**, ootheca; **3**, ♂ from Birkirkara; **4**, ♀ from Mellieħa; **5**, nymph preying on sarcophagid (red arrow) attracted to dog faeces in Birkirkara; **6**, ♀ preying on *Eyprepocnemis plorans* from Selmun. Scale bar: 5 mm (Fig. 2); 10 mm (Figs 3-4).

from Comino, specifically St Marija Bay and Blue Lagoon (Fig. 7) (Cilia 1984; Valletta 1982). In Malta its distribution seems to be predominantly restricted to the North and North eastern coasts – Marfa, Mellieħa, Bahar iċ-Ċagħaq, Selmun, Mistra, Pembroke and Naxxar among others. A small number of specimens, however, have been taken from North western localities – namely Bahrija, Rabat and Lippija (Mġarr); the latter was mentioned by Valletta (1982), stating that he took several males and females from there, though no specimens have been found in repeated searches by the author. Valletta (1982) states that

the very first record of *Rivetina baetica* comes from a male specimen captured in Attard in 1951. This species is found almost exclusively in large, unfragmented swathes of garigue, characterised by shallow pockets of terra rossa soil in a karst landscape, with low-growing plants of a shrubby habit and often aromatic nature, with occasional tufts of long grasses (Fig. 8). Capture of specimens outside of such a habitat can be attributed to the long dispersal ability of the males, as they fly well, and in fact such records are most often male specimens attracted to UV/MV bulb moth traps.



Figs 7-13 – *Rivetina baetica tenudentata* La Greca & Lombardo, 1982. **7**, distribution in the Maltese Islands; **8**, typical garigue habitat in Selmun; **9**, ootheca; **10**, ootheca in cross section; **11**, ♂ from Selmun; **12**, ♀ producing ootheca in soil; **13**, subgenital plate of ♀ from Pembroke, with digging spines. Scale bar: 2 mm (Figs 9-10); 5mm (Fig. 11).

Oothecae. The ootheca is about 20 mm long, almost oblong in outline with a regularly sinuate margin when viewed dorsally; it is distinctly flattened, with its upper surface slightly concave (Figs 9-10). Upon being produced, the fresh ootheca is pale blue; upon drying it is dark brown. The author has observed egg laying of *Rivetina baetica* on three occasions, twice in 2015 and once in 2019, and in all cases from wild-caught gravid females placed in observation tanks supplied with branches, rocks and a deep layer of loose soil. On all three occasions, females chose to lay their eggs in a conical pit some 30-40 mm deep in the soil. The pit is dug by the side-to-side motion of the abdomen, which is apically curved in the direction of the abdomen sweep, shifting the substrate up and onto the ground's surface (Fig. 12). The two strong ventral spines on the subgenital plate of female *Rivetina baetica* in fact help in digging this pit, possibly also by providing more grip on larger stone fragments as earth is being moved (Fig. 13). Egg deposition was always observed to begin in the evening before sunset, and continued into the night. After the ootheca is produced, the female buries it by scraping back the loose soil (which it itself unearthed) by repeatedly swinging back the hind legs.

Nymphs and imagoes. *Rivetina baetica* is easily identified by its large size with respect to *Ameles*, and the absence of a coxal eyespot with respect to *Mantis*; both males and females are cryptically coloured in greyish-brown, but the hindwings are coloured black with a conspicuous eyespot of white and black. The females are brachypterous, with wings about 1-1.4 times as long as the pronotum, leaving 4-5 abdominal segments exposed, whilst males are macropterous (Figs 11-12). Almost all specimens in collections, and almost all records in the literature, consist of adults collected in the months of July and August; the dearth of nymph specimens, and information regarding nymphs, may be due to the difficulty in finding them, as they are cryptically coloured and well-hidden in the Mediterranean dry scrub. Adults may be collected in the late afternoon or evening, mostly walking across bare rock or on top of low-lying shrubs; some males have been taken by light trapping with mercury vapor bulbs. Adults feed on various orthopterans associated with their preferred coastal garigue environment, such as *Acrotylus patruelis* and *Sphingonotus caerulans*.

Ameles spallanzania (Rossi, 1792) (Figs 14-20)

Material examined. MALTA: Bingemma, 2.VI.1977, leg. A. Valletta, 1♀ [NMNH]; Qrendi (Haġar Qim), 19.VIII.1981, leg. M. Zammit, 1♂ [NMNH]; Birzebbuġa, 28.VII.1983, leg. M. Zammit, 1♂ [NMNH]; Mellieħa (Paradise Bay), 15.V.1999, leg. P. Sammut, 4♂♂ [NMNH]; Fomm ir-Riħ, 4.IX.2001, leg. P. Sammut, 1♂ [NMNH]; Bingemma, 31.VIII.2001, leg. P. Sammut, 1♂ [NMNH]; Rabat, 19.V.2003, leg. P. Sammut, 1♂ [NMNH]; Rabat,

20.VIII.2004, leg. P. Sammut, 1♂ [NMNH]; Wied Babu, 3.VII.2002, leg. D. Mifsud, 1♂ [DMTCC]; Mellieħa (Marfa), 23.VIII.2013, leg. T. Cassar, 1♀ [DMTCC]; Mellieħa (Marfa), 24.VIII.2013, leg. T. Cassar, 1♂ [DMTCC]; Mellieħa (Marfa), 5.IX.2013, leg. T. Cassar, 1♀ [DMTCC]; Dingli, VIII.2015, leg. T. Cassar, 1♀ [DMTCC]; Mellieħa, 20.VIII.2015, leg. T. Cassar, 1♀ [DMTCC]; Mellieħa (Marfa), 21.VII.2015, leg. T. Cassar, 1♂ [DMTCC]; Ġhajj Rihana, 15.XII.2019, photographed by T. Cassar, 1 nymph; Żebbuġ, V.2020, leg. T. Cassar, 1♀ [DMTCC]; Wied l-Imselliet, 19.VII.2020, leg. T. Cassar, 1 nymph [DMTCC]. GOZO: Qbajjar, 29.X.2002, leg. D. Mifsud, 1♀ [DMTCC]; Rabat (near Gozo General Hospital), 12.IX.2020, photographed by B. Grech, 1♀.

Distribution and habitat. *Ameles spallanzania* is a very common and widespread species in the Maltese archipelago (Fig. 14). Though this species is most abundant in garigue, maquis and clay steppe, it can be found in virtually any environment with minimal vegetation, such as field margins, countryside lanes, private and public gardens, disturbed ground and among vegetation used in road embellishment. Young nymphs are often swept from low grasses; adult males can be swept from long grasses during the day, whilst adult females roam open ground and bare rock.

Oothecae. The ootheca of *Ameles spallanzania* is about 10 mm in length, somewhat ovoid in shape; the emergence area is a pinched, raised longitudinal area along the dorsal surface (Fig. 15). Upon being produced, the fresh ootheca is pale yellow, which becomes amber-colored when dry. In the Maltese Islands, oothecae are almost always laid beneath stones, rocky overhangs and on the walls of buildings.

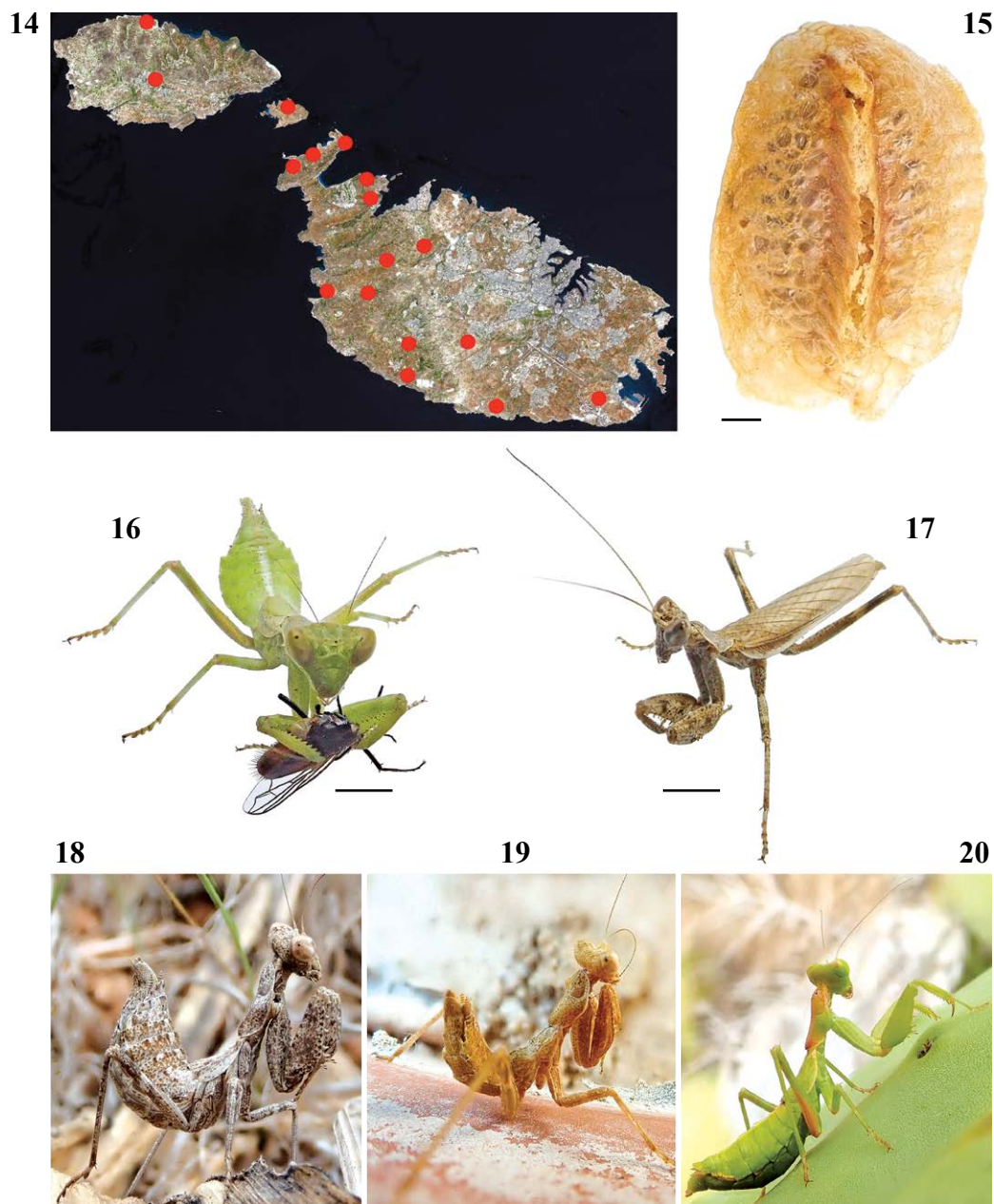
Nymphs and imagoes. *Ameles spallanzania* is the only species of mantis in the Maltese Islands known so far which overwinters both as dormant eggs as well as nymphs; there is more than one generation per year and the adults may appear as early as May and remain present as late as December. Females are brachypterous, with wings reduced to small pads about as long as the pronotum, just covering the first abdominal segment (Figs 16, 18-20). Males are fully winged and fly well, and many are taken at light traps (Fig. 17). Though males are either greyish-brown or grass green, females show astonishing variability in colour; from the Maltese islands, the following colours are known: yellow-ochre, yellow-grey, purple-brown and green (Figs 18-20). While the genus *Ameles* is instantly recognizable in the Maltese Islands due to its small size, there may be potential confusion between *A. spallanzania* (an extremely widespread and common species) and *A. decolor* (a species which has not been collected in 70 years, and may be locally extinct). *A. spallanzania*, however, has a more shield-like pronotum, about as wide as it

is long, whereas in *A. decolor* the pronotum is distinctly elongated; of course in the case of females the distinction is much more easily made as the abdomen is rhombic and held curled upwards in *A. spallanzania*, whereas it is cylindrical and held straight in *A. decolor*. In the Maltese Islands, *Ameles spallanzania* has been observed feeding predominantly on dipterans (various Muscidae, Sarcophagidae and Calliphoridae among others) (Fig. 16) and small lepidopterans, however, the nymphs and adults of small grasshopper species may also be taken, such as *Pyrgomorpha conica*.

Ameles decolor (Charpentier, 1825)

Material examined. None.

Notes. Valletta (1955) recorded this species from Mistra, Buskett and Dingli on the basis of three specimens (sex unspecified) collected in 1953 and 1954. No further specimens have been collected or seen since, and the material which formed the basis of Valletta's record was not available for study. This material may possibly be damaged beyond identification (Cassar, pers. comm.). For these rea-



Figs 14-20 – *Ameles spallanzania* (Rossi, 1792). **14**, distribution in the Maltese Islands; **15**, ootheca; **16**, ♀ preying on *Musca domestica*; **17**, ♂ from Żebbuġ; **18**, ♀ from Manikata; **19**, ♀ from Żebbuġ; **20**, ♀ from Mellieħa. Scale bar: 1 mm (Fig. 15); 3 mm (Fig. 16); 3.6 mm (Fig. 17).

sons, any further comments about this species' ecology in the Maltese Islands cannot be given by the author.

One year after Valletta (1954) recorded *Ameles spallanzania* for the first time from the Maltese Islands, then referring to it by its synonym *Ameles abjecta*, he recorded a second species from this genus: *Ameles decolor* (Charpentier, 1825). Though he did not state whether his specimens were males or females, at least one can be assumed to be a male, as he mentions that the Buskett specimen "was taken at light" (Valletta 1955). However, herein lies an issue to be raised about correct identification. Anthony Valletta was first and foremost a lepidopterist. Certainly, without any expert aid, his ability to distinguish between the males of *A. spallanzania* and *A. decolor* on the basis of external characters alone would leave substantial doubt on the validity of the record; *A. spallanzania* tends to show some pronotal variation, and without careful biometric consideration or – preferably – the examination of mounted genitalia, the males of the two species may possibly be confused. (Had Valletta stated that a female was collected, less doubt could be cast on his identifications, as female *A. decolor* have straight, cylindrical abdomens, while those of female *A. spallanzania* are rhombic and held curled up in life.) Anthony Valletta did, however, have some aid from the French orthopterist Dr Lucien Chopard himself, whom he thanks for "the great help he has given [Valletta] in determining the species". Again, the vagueness of this acknowledgment leaves doubt if Chopard himself examined Valletta's material (in which case there would be little if any doubt about the species' determination). Valletta's acknowledgment rather implies that he simply corresponded with Chopard, who advised him on how to make a correct determination, which Valletta may or may not have done. In any case, 18 years later, Dr Baccio Baccetti visited the Maltese Islands and had the opportunity to "see the Valletta collection in person", and he did not dispute Valletta's identification, including both *Ameles* species in his list (Baccetti 1973).

Therefore, the following situations may apply for *Ameles decolor* in the Maltese Islands. The first is that Valletta's original identification was incorrect, that his specimens were in fact *A. spallanzania*, and Baccetti did not actually see the three specimens of the purported *A. decolor*, nevertheless choosing not to exclude it - its presence in the Maltese Islands would not be surprising due to its Mediterranean distribution. The other possible situation is that Valletta's identification was correct, confirmed by the personal examination of Baccetti, and the species is, or was, present in the Maltese Islands. If *A. decolor* did indeed occur in the archipelago, it has not been collected since the 1955 record, and is most likely no longer present. Indeed, Agabiti et al. (2010) do not include the Maltese Islands in this species' distribution.

Gavino Gulia's records

Though *Iris oratoria* (= *Mantis oratoria*) and *Blepharop-*

sis mendica (= *Mantis mendica*) have never been collected in the Maltese Islands, their mention by Gulia (1858) raises questions. Did these species truly exist in the Maltese Islands in Gulia's time? Certainly, the habitats of the Maltese archipelago were far more intact in the mid-19th century than they are now, and could have possibly supported a greater diversity of mantids than at present. The possible past presence of *Iris oratoria* is not completely unimaginable as this species is present in both Sicily and North Africa. Therefore, *Iris oratoria* may have been mentioned by Gulia either because it was truly present in the Islands, but has since been extirpated, or because he misidentified it (*Iris oratoria* may appear somewhat similar to *Mantis religiosa* at first glance; he may also have confused it with another species with brachypterous females bearing bold markings on their hindwings – *Rivetina baetica*). This situation is perhaps more difficult to apply to his mention of *Blepharopsis mendica*, which is not comparable to any species currently present in Malta. Its present distribution in the Mediterranean consists solely of Cyprus, and thus its past presence in Malta can be doubted heavily. The most likely explanations for Gulia's mention of this species is that it was a complete misidentification, or that perhaps another empusid was present in Malta, such as *Empusa pennata* (found in Sicily and North Africa) - this could possibly have been misidentified as *B. mendica* by Gulia (1858), and has since been extirpated from the Islands. Unfortunately, the Maltese Mantodea were not discussed for another 96 years, and thus one cannot comment on the validity of Gulia's species records by comparing them to the works of his contemporaries or later authors, as can be done with relatively well-studied orders such as Coleoptera and Lepidoptera. In any case, Gulia's (1858) records should not be given great importance, as many are considered unreliable e.g. see Mifsud (2000).

Discussion

Mantis religiosa and *Ameles spallanzania* remain common and widespread in the Maltese Islands, retaining much the same distribution as data from older specimens indicates, and this is most likely thanks to their adaptability to the urban environment, no less because of the simple fact that their oothecae are deposited on a variety of substrates in an exposed manner. *Rivetina baetica*, however, has at present a much more restricted distribution in Malta than it had in the past, and this is almost certainly due to its requirement of unfragmented, relatively undisturbed areas of garigue and sandy coastal areas, where it makes use of loose soil in order to deposit its eggs. Since the 1950s, great areas of such habitat have been totally destroyed due to human land-use, and certainly those populations existing in central Malta can be considered no longer extant. Presently, *Rivetina baetica* faces intense human pressure not only due to the urban sprawl which continues to claim garigue,

but also to human activities which compact the soil or otherwise make it unsuitable for egg deposition, most notably rampant off-roading and illegal dumping of construction waste, as is the case, for example, at the Rdum tal-Madonna site in Mellieħa.

So far, no alien mantis species have established themselves in the Maltese Islands. However, many exotic species are being imported into the Maltese Islands to supply pet shops; the rearing of exotic arthropods, including mantises, has increased greatly in recent decades. Some 13 species of exotic praying mantis have been imported for these purposes in the Maltese Islands, and while many species are unlikely to establish themselves upon escape or deliberate introduction due to Malta's unsuitable climatic conditions, some have already been shown to be potential invaders elsewhere in the Mediterranean, such as *Miomantis paykulli* and *Hierodula patellifera* (Marabuto 2014; Battiston et al. 2020).

Acknowledgments – I am indebted to John Borg, senior curator at the National Museum of Natural History (Mdina, Malta) for granting me access to the museum's collection of mantises; I also thank Mr Aldo Catania (Żebbuġ) for providing me with material from his collection and allowing me to make use of his UV light trapping equipment; I thank Prof Louis F. Cassar (University of Malta) for allowing me to examine material from his collection; and I am also grateful to Prof David Mifsud (University of Malta) for providing me with additional material, as well as his helpful comments in writing the present work. I am grateful to the following people for providing me with data for their photographs of mantid species: Saviour Bonnici, Kimberly Gauci, Aisling Cunningham and Benjamin Grech.

References

- Agabiti B., Salvatrice I., Lombardo F. 2010. The Mediterranean species of the genus *Ameles* Burmeister, 1838 (Insecta, Mantodea: Amelinae), with a biogeographic and phylogenetic evaluation. *Boletín de la Sociedad Entomológica Aragonesa* (S.E.A.), 47: 1–20.
- Baccetti B. 1973. Notulae Orthopterologicae. XXX. Gli Ortotteroidei dell'Arcipelago Maltese. *Lavori della Società italiana di Biogeografia* (N.S.), 3: 605–608.
- Battiston R., Amerini R., Di Pietro W., Guariento L.A., Bolognin L., Moretto E. 2020. A new alien mantis in Italy: is the Indochina mantis *Hierodula patellifera* chasing the train for Europe? *Biodiversity Data Journal*, 8: e50779.
- Battiston R., Fontana P. 2005. A contribution to the knowledge of the genus *Ameles* Burmeister, 1838, with the description of a new species from Jordan (Insecta Mantodea). *Atti Accademia Roveretana degli Agiati*, a. 255, ser. VIII, vol. V, B: 173–197.
- Battiston R., Fontana P. 2010. Colour change and habitat preferences in *Mantis religiosa*. *Bulletin of Insectology*, 63(1): 85–89.
- Brannoch S. K., Wieland F., Rivera J., Klass K.-D., Béthoux O., Svenson G. J. 2017. Manual of praying mantis morphology, nomenclature, and practices (Insecta, Mantodea). *ZooKeys*, 696: 1–100, Doi: 10.3897/zookeys.696.12542
- Casha A. 1984. Praying mantis preying on lizards. *Potamon*, 2 (12): 52.
- Cassar T. 2016. *Podagrion splendens* (Spinola, 1811) (Hymenoptera, Chalcidoidea) – a new record of Torymidae from Malta. *Bulletin of the Entomological Society of Malta*, 8: 75–76. Doi: 10.17387/BULLENTSOCMALTA.2016.06
- Cilia J. L. 1981. On a specimen of *Rivetina baetica* from Comino. *Potamon*, 1(8): 105.
- Dandria D., Mifsud D. 2017. Towards a checklist of the terrestrial and freshwater Arthropoda of the Maltese Islands. *Bulletin of the Entomological Society of Malta*, 9: 71–72.
- Degabriele G. 2013. An overview of the dragonflies and damselflies of the Maltese Islands (Central Mediterranean) (Odonata). *Bulletin of the Entomological Society of Malta*, 6: 5–127.
- Fontana P., Buzzetti F.M., Cogo A., Odé B. 2002. Guida al riconoscimento e allo studio di cavallette, grilli, mantidi e insetti affini del Veneto – Blattaria Mantodea Isoptera Orthoptera Phasmatodea Dermaptera Embiidiina. *Museo Naturalistico Archeologico di Vicenza*, Vicenza, Italy, 592 pp.
- Gulia G. 1858. Corso elementare di entomologia maltese dato nel palazzo di St' Antonio. Malta, 82 pp.
- Marabuto E. 2014. The Afrotropical *Miomantis caffra* Saussure 1871 and *Miomantis paykullii* Stal 1871: first records of alien mantid species in Portugal and Europe, with an updated checklist of *Mantodea* in Portugal (*Insecta: Mantodea*). *Biodiversity Data Journal*, 2: e4117. Doi: 10.3897/BDJ.2.e4117
- Mifsud D. 2000. Present knowledge of the Entomofauna of the Maltese Islands. *Entomologica Basiliensia*, 22: 75–86.
- Otte D., Spearman L., Stiewe M.B.D. 2020. Mantodea Species File Online. Version 5.0/5.0. [Accessed 08/25/2020]. Available online at: <http://Mantodea.SpeciesFile.org>
- Sammut P. M. 1982. More on *Rivetina baetica*. *Potamon*, 1(9): 125.
- Schembri P.J. 1993. Physical geography and ecology of the Maltese Islands: a brief overview. In Busuttill S., Lerin F., Mizzi L. (Eds): *Malta: food, agriculture, fisheries and the environment* (pp. 27–39). Montpellier: CIHEAM.
- Valletta A. 1954. A list of the Orthoptera of the Maltese Islands. *The Entomologist*, 87: 11–15.
- Valletta A. 1955. Second contribution to a list of the Orthoptera of the Maltese Islands. *The Entomologist*, 91: 55–56.
- Valletta A. 1982. *Rivetina baetica* Rambur. *Potamon*, 1(9): 125.