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15/289a

NATURHIST. MUSEUM WIEN
SCHRIFTENTAUSCH

ENTOMOLOGISCHE MITTEILUNGEN

aus dem
Zoologischen Museum Hamburg

HERAUSGEBER: PROF. DR. H. STRÜMPER,
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SCHRIFTFÜHRUNG: DR. H. DASTYCH



ISSN 0044-5223

Hamburg

15. Band

1. Dezember 2011

Nr. 186

Unrecognized museum specimen expands distribution of *Mantoida* (Insecta: Mantodea) into the central Caribbean

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(with 4 figures)

Abstract

We report a specimen of the praying mantis genus *Mantoida* Newman, 1838, which we discovered among the undetermined Mantodea material in the collection of the Zoological Museum of the University of Hamburg. According to the label, the specimen was collected in 1902 on Isla de la Mona (Mona Island) in the Caribbean Sea. The recognized distribution of *Mantoida* is South and Central America as well as Florida. The new location expands the currently known distribution of the genus into the central Caribbean. We furthermore report the first findings of *Mantoida* on Isla de Margarita off the coast of Venezuela as well as the first observations of dry habitat use and biology for this genus, including a previously unknown unique egg-laying behavior.

Keywords: Mantodea, *Mantoida*, biogeography, habitat, egg-laying behavior, Isla de Margarita, Mona Island, Caribbean.

Introduction

The insect collection of the Zoological Museum of the University of Hamburg (ZMH) houses more than two million specimens. The praying mantises (Dictyoptera: Mantodea) are represented by nearly 2,800 specimens in about 540 of the approximately 2,450 described species, including 52 type specimens (Weidner 1964).



Fig. 1a-c. *Mantodea* sp. specimen found among the undetermined Mantodea material in the collection of the ZMH. **a.** dorsal view; **b.** label (not to scale); **c.** lateral view. Most of the pin was retouched using Photoshop CS5 software. - Scale bars = 2 mm.



Fig. 2. Map of the Caribbean Sea and adjacent areas. *Mantoida* has been recorded from South and Central America with a disjunct population in Florida. *M. maya* has been recorded from the Florida Keys, *M. schraderi* has been listed for Trinidad. An undetermined *Mantoida* species was observed on Isla de Margarita (Materna and Schulze, pers. comm. 2010). Inset: Outline of Mona Island. Names of islands from where *Mantoida* has been recorded are set in bold type.

Among the undetermined Mantodea material we discovered a specimen belonging to the neotropical genus *Mantoida* Newman, 1838 (Fig. 1). Although the relationships at the basal nodes of the mantodean phylogenetic tree are still discussed, *Mantoida* has been found to be the sister-group of all remaining extant Mantodea in several morphological and molecular studies (e.g., Klass 1995, 1997, Klass & Meier 2006, Ware *et al.* 2008, Yager & Svenson 2008, but see Svenson & Whiting 2009). Therefore, *Mantoida* is a key taxon for studies of mantodean phylogeny.

Materials and Methods

The newly discovered *Mantoida* specimen is housed in the Mantodea-section of the entomological collection of the Zoological Museum of the University of Hamburg. Pictures were taken with a Canon EOS 5D digital camera mounted on a Visionary Digital™ 'The Passport Storm' digital imaging system. Focus stacks were assembled with the Zerene™ Stacker software (version 1.04). The images were finished with the Photoshop CS5 software. The greater part of the insect pin in Fig. 1c was removed using the stamp tool in Photoshop.



Fig. 3. Habitat in which an undetermined *Mantoida* species has been observed on Isla de Margarita off the coast of Venezuela (T. Schulze & S. Materna, pers. comm. 2010). Picture courtesy of Sören Materna.

Results and Discussion

Mantoida currently comprises 10 species (Ehrmann 2002, Roy 2010), all of which are small insects of about 10–25 mm body length (compare data in Giglio-Tos 1927). The distribution (see Fig. 2 for overview of the region) encompasses South and Central America with an autochthonous population of *Mantoida maya* Saussure & Zehntner, 1894, in the Florida peninsula including the Florida Keys (e.g., Hubbell 1937, Deyrup 1986, Ehrmann 2002). The northernmost collecting site we could identify in Central America is the Mexican state of Sinaloa with several locations (“Venvidio” in Hebard 1923; “Baviri” and “Microondas la Muralla” for three specimens housed in the collection of the San Diego Natural History Museum, P. Horsley, pers. comm. 2011). The only locality records from the Gulf of Mexico and the Caribbean are the Florida Keys in the north (Rehn & Hebard 1914, Peck & Beninger 1989) and Trinidad off the coast of Venezuela in the south (Beebe *et al.* 1952, Crane 1952).

The specimen we discovered in the ZMH collection lacks the abdomen, therefore the sex of the specimen cannot be unequivocally determined, and the left hind leg is missing. Otherwise, the specimen is largely intact. Identification of the species is currently not possible due to the lack of an accurate key and the missing abdomen.

The ZMH specimen was collected by Oscar Scheibner on Mona Island (“Insel Mona”) in the Caribbean Sea on the 15th of September in 1902 (Fig. 1b). The islet is located between Hispaniola and Puerto Rico (18°05'N / 67°53'W; Fig. 2) and is politically affiliated with the latter. It is about 11 kilometers long and 7 kilometers wide. Mona Island covers an area of 55 km² (González *et al.* 1997; Martinuzzi *et al.* 2008). Today the island is an ecological reserve (Mona Island Natural Reserve) and it is uninhabited except for reserve rangers. In the literature, only a single species of Mantodea has been recorded from Mona Island: *Callimantis antillarum* (Saussure, 1859) (e.g. Ramos 1946; Wolcott 1948; two female specimens from Mona Island are present in the ZMH collection, collected in 1891 and 1894).

It might be assumed that *Mantoida* is dependent on humid habitats, as it has been primarily found in humid rainforest (e.g. Westwood 1889: 28: “... Banks of the Amazons; in the forests on low trees”; Dantas *et al.* 2008). The population in Florida is also exposed to a hot and humid climate (e.g. Black 1993). In contrast, the climate on Mona Island is semi-arid (González *et al.* 1997, Martinuzzi *et al.* 2008, Franz *et al.* 2009) and it is unlikely that the climate on the island was considerably moister a century ago when the ZMH *Mantoida* specimen was collected. Apparently, there are *Mantoida* species that do prefer dryer habitats (e.g. Westwood 1889: 28: “... On trees in dry woods and herbage”). The ability of *Mantoida* to live in hot and arid habitats is also supported by the observation of *Mantoida* specimens of an undetermined species in hot and very dry, almost desert-like conditions on Isla de Margarita off the coast of Venezuela (Schulze and Materna, pers. comm. 2010; see Fig. 3 for picture of habitat and Fig. 4 for picture of specimen). Hence, the presence of the genus on the semi-arid Mona Island is not unlikely. It is unclear if the presence of *Mantoida* species in different climates represents the use of different ecological niches or if individual populations of the same species may have a high tolerance to very different climatic conditions.

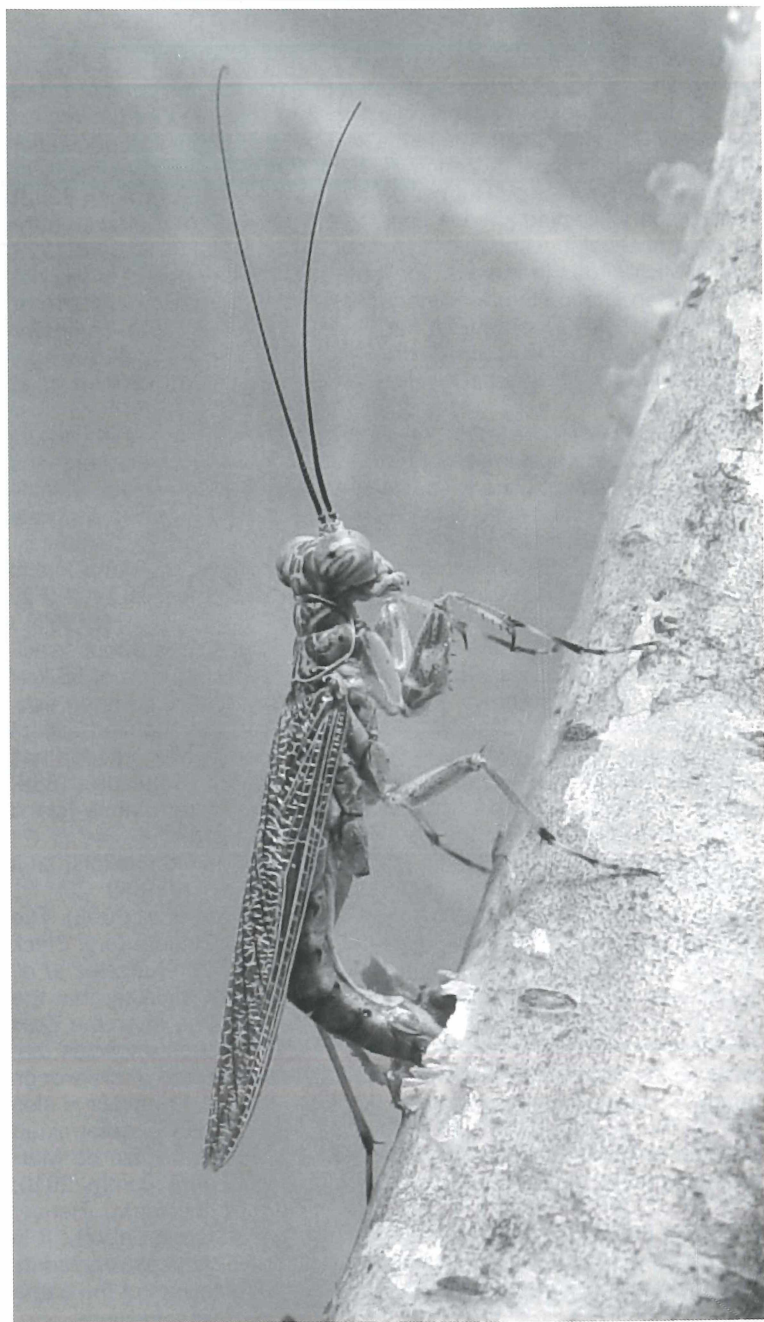


Fig. 4. Female of undetermined *Mantoida* species from Isla de Margarita in captivity, laying its ootheca into a hole in a branch. Picture courtesy of Tobias Schulze.

As mentioned above, *Mantoida* has not been recorded from any islands other than the Florida Keys and Trinidad and Isla de Margarita in the Caribbean. It has neither been recorded from Hispaniola (Lombardo & Perez-Gelabert 2004, Perez-Gelabert 2008) nor from Puerto Rico (Rehn 1903, Ramos 1946, Wolcott 1948), Cuba (e.g. Rehn 1909), Barbados (e.g. Caudell 1925), Antigua (e.g. Caudell 1925), the Bahamas (e.g. Morse 1905, Rehn 1906), or (much farther north) from the Bermudas (Kevan 1980). Additionally, the entomological collection of the Department of Biology, University of Puerto Rico (Mayagüez campus) does not hold any specimens of *Mantoida* (Girón, pers. comm. 2011).

In view of the unusual collecting site of the ZMH specimen we have considered the possibility of incorrect locality information. Therefore, we attempted to gather information on Scheibner (the collector of the specimen) and his collecting activities. Although we could not find any data on Scheibner himself, we were able to find a publication mentioning him and Mona Island: Bohart & Stange (1965) listed the male paratype of the wasp subspecies *Zethus rufinodus monensis* Bohart & Stange, 1965, which is deposited in the collection of the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland. According to Bohart & Stange (1965: 147) the specimen was collected on "Insel Mona" on the 15th of September in 1902 by Oscar Scheibner, which is the same date as recorded on the label of the ZMH *Mantoida* specimen, thus corroborating Scheibner's collecting trip to Mona in 1902. Therefore, we assume that the locality data is correct.

Interestingly, Mona Island is rather young, such that ancient origins of *Mantoida* on Mona Island is less likely (5-7 my; e.g. González *et al.* 1997, Franz *et al.* 2009). This raises the question of whether *Mantoida* only occurs on Mona or if it is also present on the older surrounding Caribbean islands and has simply been overlooked on these islands. This is not unlikely because species of this genus are small and inconspicuous and most likely live on the bark of trees and shrubs (e.g. Hubbell 1925, Strohecker 1939, Salazar 2005, Schulze and Materna, pers. comm. 2010) where they are well camouflaged (e.g. Rehn 1950: 368) and difficult to collect.

Furthermore, there is the possibility that tropical storms may have transported wood with oothecae or even living specimens to the island. *Mantoida* has been observed in captivity to preferably deposit its oothecae in small holes directly into wood (Schulze, pers. comm. 2011; Fig. 4). Although the holes were artificial bore holes, such openings do frequently occur in nature, for instance in form of emergence holes of several insects including cerambycid beetles. Transport of mantodean oothecae via driftwood has been described before (e.g. Werner 1909, 1915; Beier 1939, Ehrmann 2002, Harris 2007). Therefore, dispersal of *Mantoida* via hurricanes or driftwood carrying its oothecae or the insects themselves would provide a plausible explanation. Aerial transport of insects is a well-known phenomenon that could have also played a role for *Mantoida* (e.g. Darlington 1938; see Holzapfel & Harrell 1968 for an overview).

Conclusions

The specimen found in the ZMH collection expands the known distribution of *Mantoida* into the central Caribbean. We demonstrated that a labeling mistake is unlikely and provided potential explanations for how the species may have reached Mona Island. Nonetheless, it would be an important task to confirm the presence of *Mantoida* on the island by new findings and to identify the species, thus getting more information on the origin of the Mona Island population.

The autecology of *Mantoida* is virtually unknown. Therefore, future studies on its actual distribution in the Neotropics, especially on the Caribbean islands, and its biology are indispensable for improving our knowledge of this interesting praying mantis genus.

Zusammenfassung

Im unbestimmten Mantodea-Material der entomologischen Sammlung des Zoologischen Museums der Universität Hamburg haben wir ein zuvor unbearbeitetes Exemplar der Gattung *Mantoida* Newman, 1838 entdeckt, welches im vorliegenden Beitrag beschrieben wird. Den Fundortdaten nach wurde das Tier im Jahr 1902 auf der Insel Mona in der Karibik gesammelt. *Mantoida* ist in Zentral- und Südamerika sowie in Florida verbreitet. Der neue Fundort erweitert die bisher bekannte Verbreitung der Gattung in die zentrale Karibik. Des Weiteren führte der Nachweis von *Mantoida* auf der Isla de Margarita vor der Küste Venezuelas zu neuen Beobachtungen zur Biologie der Gattung. Dazu zählen das Vorkommen in trockenen Habitaten sowie das bisher unbekannte Eiablageverhalten.

Acknowledgements

We would like to thank Sören Materna and Tobias Schulze (Erlangen, Germany) for providing their valuable observations on *Mantoida* in the field and in captivity, as well as for providing the pictures of the egg-laying *Mantoida* specimen and the habitat on Isla de Margarita. We are grateful to Julia Goldberg (University of Göttingen, Germany) and to Gavin J. Svenson (University of New Mexico, USA) for their helpful comments on the manuscript, and to Nico Franz, Jennifer Girón (both University of Puerto Rico, Puerto Rico), Stephanie Boucher (Lyman Entomological Museum, Canada), and Susan C. Jones (Ohio State University, USA) for their help with literature and data on Puerto Rican Mantodea. We would also like to thank Franziska Schmid (ETH Zurich, Switzerland) for confirming the information on the label of the *Zethus rufinodius* specimen collected by Oscar Scheibner. Frank Wieland is grateful to Pamela Horsley (San Diego Natural History Museum, USA) for granting access to the entomological collection in December 2010 and for providing the data of the *Mantoida* specimens housed in the SDNHM collection. We would like to thank Gavin J. Svenson for providing access to the Visionary Digital™ imaging system.

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Zeitschrift/Journal: [Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg](#)

Jahr/Year: 2011

Band/Volume: [15](#)

Autor(en)/Author(s): Wieland Frank, Schütte Kai

Artikel/Article: [Unrecognized museum specimen expands distribution of Mantoida \(Insecta: Mantodea\) into the central Caribbean 305-315](#)