

Aquatic Invasions Records

First record of *Phyllorhiza punctata* von Lendenfeld, 1884 (Cnidaria: Scyphozoa, Mastigiidae) in Mexico

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Abstract

The Australian spot jellyfish *Phyllorhiza punctata* has not been recorded previously for any coast of Mexico. A giant jellyfish was recorded for the first time in June 2006 in Laguna de Mandinga, southwestern Gulf of Mexico. Between 2007 and 2008, another three adult specimens were collected and later in May 2009 and April-June 2010 a great number of juveniles and adults were observed, of which 142 were collected. The presence of juveniles and adults throughout five consecutive years indicates that the species has a seasonal pattern. It migrates from the Sistema Arrecifal Veracruzano (SAV) into Laguna de Mandinga during the spring, aided by the tide that flows along the estuary of the Jamapa River. The population then decreases at the end of the summer, during the rainy season, when salinity decreases (10 psu). The recruitment area of the polyps is probably associated with the coral reefs in the SAV.

Key words: Australian spot jellyfish, invasive species, Laguna de Mandinga, southern Gulf of Mexico

Introduction

The spot jellyfish *Phyllorhiza punctata* von Lendenfeld, 1884 belongs to the family Mastigiidae, Order Rhizostomeae, and was initially described from specimens collected in Port Jackson, eastern Australia (Mayer 1910). It is distinguished mainly by the presence of eight J-shaped oral arms with three wings (in cross section), filaments and terminal clubs, eight rhopalia (four perradial and four interradial), exumbrellar surface with prominent white warts, background colour light brown due to the presence of zooxanthellae (Morandini et al. 2006), and a maximum size of 62 cm (Graham et al. 2003).

From the ecological point of view, it plays an important part in trophic chains. García and López (1989) and García (1990) observed a marked decrease in the abundance of non-gelatinous zooplankton associated with the period of high biomass of this species during the Winter in a coastal lagoon in Puerto Rico. Graham et al. (2003) mentioned that the species has caused a direct economic loss to the

commercial shrimping industry in the northern Gulf of Mexico through interference in fishing efforts due to clogging of the nets.

The spot jellyfish is an abundant tropical species in coastal areas such as estuaries, lagoons and bays. It is common in Australia, the Philippines and Japan (Kramp 1961). Cutress pointed out that it was accidentally introduced into Pearl Harbor, Hawaii, during 1941-1945 (Doty 1961). Devaney and Eldridge (1977) mentioned that it is common in Pearl Harbor, Honolulu Harbor and Kaneohe Bay. Later, Larson and Arneson (1990) recorded it in San Diego Bay and Mission Bay, California, in 1981, where it is considered a species that was probably introduced by transportation of the polyps on ship hulls arriving from Honolulu Harbor, and has apparently become established.

Phyllorhiza punctata was first recorded in the Mediterranean Sea, off the coast of Israel in 1965 (Galil et al. 1990). Çevick et al. (2006) believed it arrived through the Suez Canal. Bolton and Graham (2004) indicated that several decades after its introduction, the population has not persisted in the area. However, ephyrae and

adults have been recorded recently in Vlyho Bay, Greece, indicating that a population may be reproducing in the Central Mediterranean Sea (Abed-Navandi and Kikinger 2007). Recently, Galil et al. (2009) indicated that *P. punctata* reappeared near the Mediterranean coast of Israel (off Ashdod), and Boero et al. (2009) recorded the species along the coasts of Italy, in the Marine Protected Area of Tavolara Island, Sardinia.

This jellyfish has been observed in Brazil since the 1950s in abundant masses along the southern and southeastern coasts, and Moreira (1961) described it erroneously as a new species (*Mastigias scintillae* Moreira, 1961). Years later, Mianzan and Cornelius (1999) collected it from the southeastern coast of São Paulo and Rio de Janeiro, and from the northeastern coast off Bahia. More recently, Morandini et al. (2006) found it in Ceará (NE), and Haddad and Nogueira Jr. (2006) recorded it south of Paraná and Santa Catarina.

In the Caribbean Sea *Phyllorhiza punctata* was recorded for the first time in Laguna Joyuda, Puerto Rico by Cutress (1971), and it appeared in 1993 in the northern Gulf of Mexico in isolated bays along the Louisiana coast (Graham et al. 2003). This invasive species was observed in great quantities in the Mississippi Sound between the eastern coast of Louisiana and Mobile Bay, Alabama, USA. Graham et al. (2003) observed it in the summer with an estimated density of 5.37×10^6 jellyfish in Lake Borgne, Louisiana and its dispersion to the east coast of Florida was confirmed in the year 2001, as well as to Indian River Lagoon. This species has not been recorded previously for any coastal area of Mexico.

Materials and methods

Laguna de Mandinga lies at 19°00' -19°06'N and 96°02'-96°06'W in the state of Veracruz, southwestern Gulf of Mexico (Figure 1). It joins the Jamapa river 2 km upriver from the coast, and through this it communicates with the Veracruz Reef System (Parque Marino Nacional: Sistema Arrecifal Veracruzano, SAV). It has a N-S orientation, with the adjacent coast along a NW-SE orientation, with surface water temperatures of 22-33°C and salinities of 10-36 psu.

Sampling took place in June 2006, May 2007, June 2008, May 2009 and April-May-June 2010. A square 50×38 cm spoon net was used. An

abundant mass was collected and preserved with 4% formalin, neutralised with sodium borate. The umbrella diameter (size in mm) of the specimens and the sex of the adults (≥ 125 mm) were recorded. The specimens are deposited in the Colección de Invertebrados Planctónicos, Laboratorio de Ecología, Departamento de Zoología, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, in Mexico City.

Results and discussion

The *Phyllorhiza punctata* specimens collected in this study constitute the first record of the species, genus and family for Mexican waters, specifically the southwestern Gulf of Mexico. The specimens collected in 2006-2009 (Figure 1, Annex 1) were found exclusively in the northern area of the main body of Laguna de Mandinga. In 2010, they were collected throughout an extensive area of the lagoon system (Figure 2, Annex 1). The microscopic analysis of the gonads indicated that the specimens were mature females.

The greatest specimen size recorded for Laguna de Mandinga (Figure 3) in June 2006 (330 mm umbrella diameter) coincides with the greatest average sizes reported for southern Brazil of 300 mm during the warm season and 350 mm during March and April (Haddad and Nogueira Jr. 2006). Other records include up to 385 mm in April in Laguna Joyuda (García 1990) and 620 mm in the northern Gulf of Mexico (Graham et al. 2003). This last is the greatest size recorded to date.

The species was characterized by a light brown umbrella with whitish circular, ovoid or irregular spots, according to the scale established by Bolton and Graham (2004). The light brown colour may indicate the presence of zooxanthellae in the tissue, as has been observed in different populations of Australia, San Diego Bay and Laguna Joyuda by Bolton and Graham (2004), as well as in Brazil by Morandini et al. (2005) and Haddad and Nogueira Jr. (2006).

The juveniles and adults of the Australian spot jellyfish (Figures 3 and 4) were collected during 2006-2010 at temperatures of 28.5-33°C and salinities of 25-34 psu.

Throughout the year, Laguna de Mandinga presents hydrological conditions (22-33°C, 10-36 psu) very similar to those García and López (1989) recorded for Laguna Joyuda, Puerto Rico.



Figure 1. Laguna de Mandinga, Veracruz, Mexico, with all locations where *Phyllorhiza punctata* was collected: June 2006 (pink dot), May 2007 (yellow dot), June 2008 (red dots) and May 2009 (green dot).

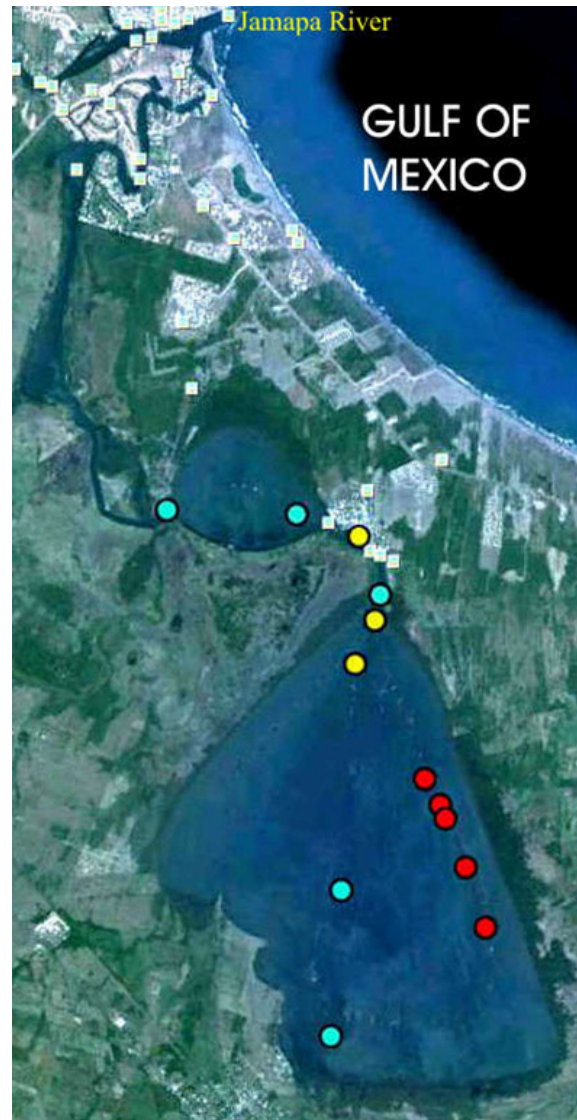


Figure 2. Laguna de Mandinga, Veracruz, Mexico, with all locations where *Phyllorhiza punctata* was collected during 2010: April (blue dots), May (yellow dot), June (red dots).

These authors recorded surface water temperatures of 24-32°C and salinities of 10-35 psu, while Haddad and Nogueira Jr. (2006) recorded temperatures of 24-32°C along the coast of southern Brazil. It seems these environmental conditions favour the establishment of *P. punctata* in Laguna de Mandinga, Veracruz. The presence of juveniles and adults throughout five consecutive years (2006-2010) indicates

that the species has a seasonal pattern. It is present during the Spring and Summer, and decreases during the rainy season at the end of the summer when salinity decreases (10 psu). It is very probable that specimens migrate from the SAV into Laguna de Mandinga at the end of Winter and beginning of Spring, aided by the tide that flows along the estuary of the Jamapa River.



Figure 3. Adult of *Phyllorhiza punctata*, Laguna de Mandinga, Veracruz. Southern Gulf of Mexico. June 2006. Photograph by A. Ocaña Luna.

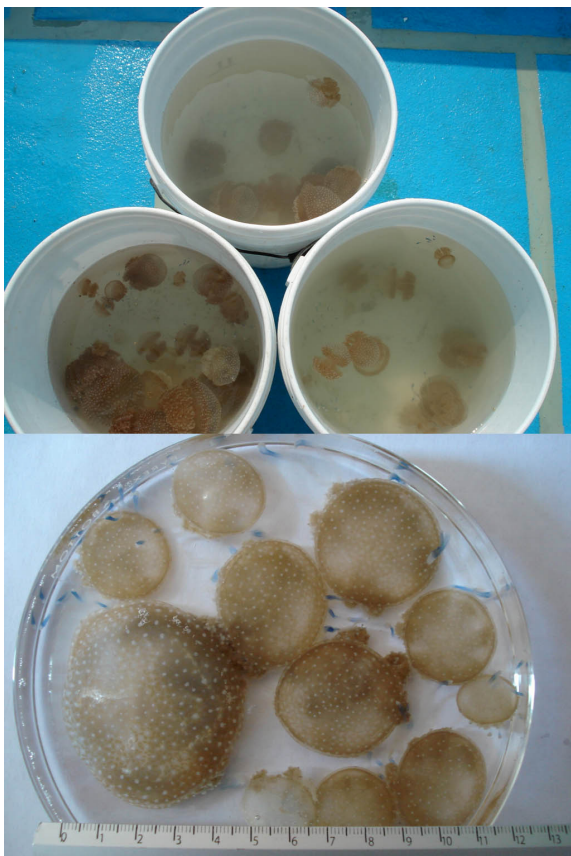


Figure 4. Juvenile of *Phyllorhiza punctata*, Laguna de Mandinga, Veracruz. Southern Gulf Mexico. May 2009. Photograph by A. Ocaña Luna.

The transportation of *P. punctata* in the ballast water of ships was suggested by Carlton and Geller (1993) to explain the species' invasion into Californian waters, and by Abed-Navandi and Kikinger (2007) in the case of Vlyho Bay, Greece. It is probable that this was one of the mechanisms of introduction into Laguna de Mandinga, as the lagoon has permanent communication with the port of Veracruz, which is located on the same coast as the commercial ports of Altamira, Tampico, Tuxpan and Coatzacoalcos. The southwestern Gulf of Mexico lies in the path of transoceanic shipping routes that maintain commercial communication among the eastern coast of the USA, northern Europe, the Mediterranean Sea, New Zealand/Australia, South America, the Caribbean Sea, South Africa and the Far East, according to the APIVER (2009) and API-ALTAMIRA (2009).

Another route could be natural transportation via ocean currents. Johnson et al. (2005) suggested that the *P. punctata* bloom of Spring 2000 in the Mississippi Sound may have travelled from the Caribbean Sea into the Gulf of Mexico through the Yucatan Strait on the Loop Current. In the case of the southwestern Gulf of Mexico, the species may be transported by the cyclonic gyres that spin off this same current along its southwestern front (northeastern Campeche Bank), as Zavala-Hidalgo et al. (2003a) have indicated, or by the seasonal circulation that occurs from September to March from Louisiana and Texas to Tamaulipas and Veracruz (Zavala-Hidalgo et al. 2003b) that may transport the jellyfish that invaded the Mississippi Sound.

This species is very abundant and widely distributed in Laguna de Mandinga, however the recruitment area of the polyps is still unknown, although it is quite probably associated with the coral reefs of the SAV.

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Annex 1. Records of *Phyllorhiza punctata* from Laguna de Mandinga, Veracruz, Mexico (2006-2010).

Geographic coordinates		Survey date	Temperature (°C)	Salinity (psu)	Number of specimens	Range of size (mm)	Average of size (\pm sd)
Latitude, N	Longitude, W						
19°02'20.05"	96° 04'11.25"	June 2006	30.0-32.0	30.0-31.0	1	330.0	
19°02'14.10"	96°04'15.84"	May 2007	30.0	31.0	1	190.0	
19°02'08.07"	96°04'1.64"	June 2008	*	*	1	210.0-260.0	235.0 \pm 35.4
19°01'53.86"	96°04'14.40"		*	*	1		
19°02'30.12"	96°04'15.66"	May 2009	31.0	34.0	52	21.0-110.5	65.8 \pm 63.3
18°59'36.00"	96°04'36.00"	April 2010	29.0	25.0	2	8.4-60.4	32.9 \pm 14.7
19°00'36.00"	96°04'12.00"		29.0	26.0	1		
19°02'30.00"	96°04'54.00"		29.0	25.0	28		
19°03'00.00"	96°04'54.00"		29.0	25.0	3		
19°02'54.00"	96°05'48.00"		28.5	26.0	1		
19°02'55.08"	96°04'26.94"	May 2010	31.0	30.0	1	43.0-225.0	90.6 \pm 39.8
19°02'23.34"	96°04'14.94"		31.0	30.0	31		
19°02'48.96"	96°04'20.40"		31.0	29.0	16		
19°00'30.00"	96°03'09.90"	June 2010	31.5	29.0	1	90.0-200.0	153.3 \pm 40.1
19°00'52.32"	96°03'21.90"		32.0	31.0	2		
19°01'10.14"	96°03'33.36"		32.5-33.0	30.0-31.0	2		
19°01'15.18"	96°03'36.30"		32.5	30.0	1		
19°01'24.42"	96°03'44.40"		32.0	30.0	1		

* not available