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## REDISCOVERY OF *SANDERIA MALAYENSIS* AND REMARKS ON *RHOPILEMA NOMADICA* RECORD IN PAKISTAN (CNIDARIA: SCYPHOZOA)

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### ABSTRACT

*In this report, we record the rediscovery of Sanderia malayensis in Pakistani waters since the John Murray Expedition (1933-34) who collected two small specimens off-Karachi, Pakistan. The specimens were described and we discuss the shape of gastric pouches contour. We also comment upon the newly recorded Rhopilema nomadica jellyfish from the region, and assume it to be previously recorded as Rhopilema hispidum.*

KEY-WORDS: Scyphomedusae; *Sanderia*; *Rhopilema*; Karachi; Northern Arabian Sea.

### INTRODUCTION

*Sanderia* Goette, 1886 is a genus of scyphozoan jellyfishes that includes two species: *Sanderia malayensis* Goette, 1886 and *S. pampinosus* Gershwin & Zeidler, 2008. Members of the genus are characterized by having 32 marginal lappets, 16 tentacles alternating with 16 rhopalia, 32 radial stomach pouches (all alike) and exumbrella presenting numerous nematocyst warts (Kramp, 1961:330). *Sanderia malayensis* occurs in Indo-Pacific waters, while *S. pampinosus* is restricted to northwestern Australia (Kramp, 1961; Gershwin & Zeidler, 2008).

The knowledge of scyphomedusae from Pakistan is growing in the last years with several new records being reported (Gul & Morandini, 2013, 2015; Gul *et al.*, 2014, 2015a, b), and added to the cnidarian fauna (Gul *et al.*, 2015c). To date, there are nine scyphozoan jellyfishes recorded from Pakistani waters (Gul *et al.*, 2015b), a number that corresponds to less

than 5% of the total biodiversity of the class Scyphozoa (estimated in ~200 species by Daly *et al.*, 2007). Out of these records, the only ones of the family Pelagiidae Gegenbaur, 1856 are: *Pelagia noctiluca* (Forskål, 1775) and *Sanderia malayensis* Goette, 1886 (Stiasny, 1937; Gul & Morandini, 2013); interestingly the last report of *S. malayensis* was documented 79 years ago by Stiasny (1937). Our goal is to document a new record of the species in Pakistani waters. In addition, we also provided comments on the recently recorded *Rhopilema nomadica* Galil, 1990 (Tahera & Kazmi, 2015) from Pakistan and consider it to be erroneously identified *Rhopilema hispidum* jellyfish previously recorded from this area (Gul & Morandini, 2015).

### MATERIALS & METHODS

On 26 February 2015, 37 specimens of pelagiid scyphomedusa were collected as by-catch during sev-

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eral bottom trawlings (30 min, 12-80 m depth) off-Karachi (24°51'41.264"N, 67°0'35.779"E), Pakistan, northern Arabian Sea. All specimens were photographed, examined and then preserved in 4% formaldehyde solution. The specimens were studied in detail and deposited in the Museum of Department of Zoology, Jamia Millia Government Degree College (JMGDC MDZ), Malir, Karachi, Pakistan. Identification of the specimens followed Kramp (1961).

The specimens were compared to the holotype held at the Museum für Naturkunde (ZMB), Berlin (Germany), and also to young medusae reared in the laboratory from Japanese polyp cultures.

## RESULTS AND DISCUSSION

### Systematics

**Class Scyphozoa Goette, 1887**

**Subclass Discomedusae Haeckel, 1880**

**Order Semaestomeae L. Agassiz, 1862**

**Family Pelagiidae Gegenbaur, 1856**

**Genus *Sanderia* Goette, 1886**

***Sanderia malayensis* Goette, 1886**

(Figs. 1, 2)

### *Comparison material*

Holotype ZMB 2622; Singapore, 23 April 1884; 1 specimen sex undetermined, but gonads present; 2 cm bell diameter (original description mentions 2.5 cm). ZMB 2621; Singapore, no date specified; 1 specimen sex undetermined, but gonads present; 2.5 cm bell diameter. Unnumbered specimens (private collection of first author): 3 immature specimens reared in laboratory from polyp cultures (1, 1.5, and 1.7 cm bell diameter), strobilation occurred on 27 March 2013, preserved in 4% formaldehyde solution on 26 April 2013; 2 immature specimens reared in laboratory from polyp cultures (1.4 and 1.6 cm bell diameter), strobilation occurred on 29 September 2014, preserved in 4% formaldehyde solution on 05 November 2014.

### *Pakistani specimens*

JMGDC MDZ CN 23; off-Karachi, 26 February 2015; 37 specimens, sex undetermined, but gonads present; 5.5-13.5 cm bell diameter.

### *Description of Pakistani specimens*

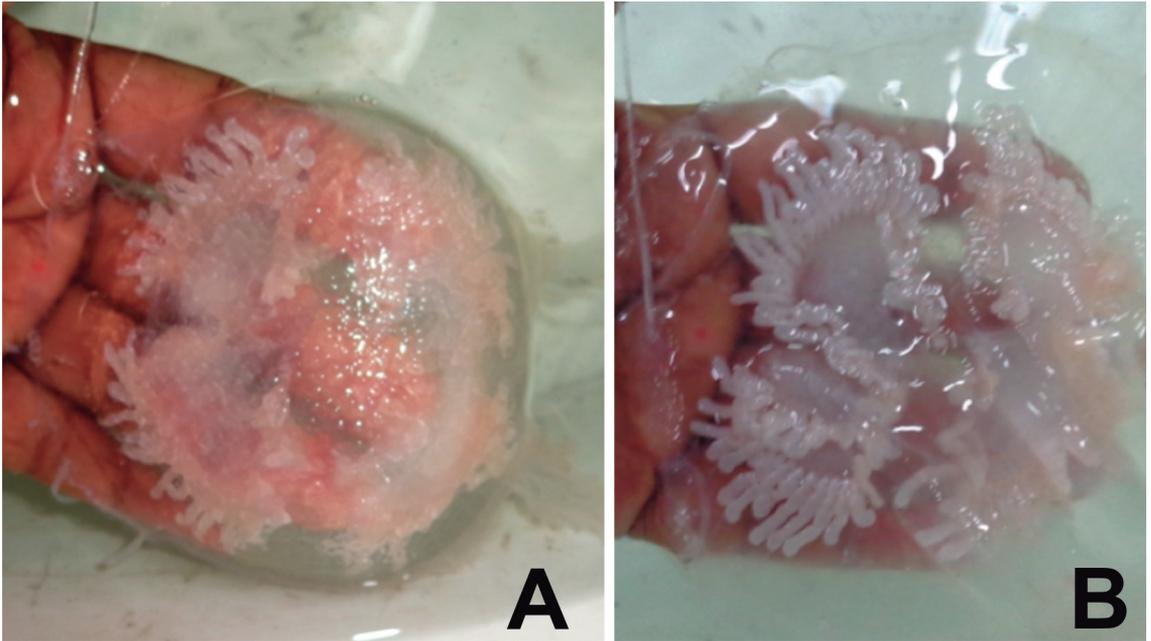
Medium sized pelagiid scyphomedusae of saucer-shaped, transparent umbrella with prominent

nematocysts warts on exumbrellar surface (Fig. 1A); some specimens with violet pigments. Tentacles 16, up to 29 cm long, ribbon-like, alternating with 16 rhopalia. Oral arms up to 16 cm long, bearing violet shade pronounced on edges. Gastric pouches contour horseshoe to heart-shaped; bordered externally by up to 35-40 long, light violet, finger-like gonadal papillae (Fig. 1B).

### Remarks on *Sanderia* species

*Sanderia malayensis* Goette, 1886 was originally described from Singapore, Malayan Archipelago (Goette, 1886); later it was reported from several places like Japan (as *Neopelagia eximia* Kishinouye, 1910), Philippines and Suez Canal (Kramp, 1961). Stiasny (1937) reported the species from northern Arabian Sea (off-Karachi along Pakistani coast and Gulf of Oman), and Gulf of Aden. Two small specimens (1 and 1.5 cm bell diameter) wrongly stated as in *Pelagia*-stage were collected off-Karachi on 8 November 1933 during the John Murray Expedition (1933-34). According to Kramp (1961:331) the species has heart-shaped gastric pouches each bordered externally by about 24-30 finger-like gonadal papillae; but our specimens although agreeing with the description of the species, have more papillae (35-40) than stated, and the shape of the gastric pouches vary slightly. Vanhöffen (1902:38) while observing specimens from the Gulf of Aden mentioned the number of gonadal papillae to be 24, tentacles compressed laterally and nematocysts concentrated on the outer portion of tentacles. Browne (1926:110-112) observed specimens collected at the Suez Canal area ranging from 1.2-3.5 cm bell diameter and having variation in rhopalia number. Stiasny (1937:226) however, was not correct while identifying *Pelagia*-stage specimens of *Sanderia* from off-Karachi, Pakistan. Such specimens must correspond to a *Pelagia* species, based on the information about the life cycle of *Sanderia malayensis* (Uchida & Sugiura, 1975, 1978) and our own observations that *Sanderia* ephyrae are released with already 16 rhopalia and 32 lappets. For other specimens observed by Stiasny (1937:225-227), the author did not mention the number of gonadal papillae, but if we focus on his pl. 1, fig. 1, the two specimens are showing to have approximately 40 papillae on each gastric pouch, similar to our observations.

*Sanderia malayensis* has only one congener, *S. pampinosus*, which bears horseshoe-shaped gastric pouches with 34-44 gonadal papillae (Gershwin & Zeidler, 2008). For the authors, these are the main



**FIGURE 1:** Freshly collected specimen of *Sanderia malayensis* Goette, 1886 from Pakistani coast, off-Karachi. Bell diameter 11 cm: (A) Exumbrellar view showing transparent umbrella with numerous nematocyst warts, (B) Subumbrellar view showing gastric pouches in close-up, note the heart-shape contour of gastric pouches.

features that distinguish both species. However, by inspection of the holotype specimen (ZMB 2622, Fig. 2A) it is possible to observe that the contour of the gastric pouch is variable and the gonadal papillae are thicker than in other specimens. Additionally, another specimen observed by Goette (ZMB 2621, Fig. 2B) and in young specimens of *S. malayensis* we cultivated in the laboratory of the first author (Fig. 2C-D), it is possible to state that the gastric pouch contour is horseshoe-shaped while, horseshoe to heart-shaped with 35-40 gonadal papillae in the Pakistani specimens (Fig. 1C-D). These observations raise the question whether, the shape of the gastric pouch can pass through developmental changes during growth and that we might be dealing with a single species of the genus with a wider distributional area. Our suggestions, to solve this issue, are to cultivate this jellyfish species to maturity and perform comparative molecular studies with specimens from different areas.

#### **Remarks on *Rhopilema nomadica* record in Pakistan**

Currently the genus *Rhopilema* Haeckel, 1880 (Scyphozoa: Discomedusae: Rhizostomeae: Rhizostomatidae) is composed of five valid species which differ mainly in their exumbrella morphology (smooth/rough) and the kind of appendages on mouth arms

(Gul & Morandini, 2015). From these five species, only two have rough exumbrellar surface: (1) *Rhopilema hispidum*, with two kinds of warts: a) minute, blunt, colourless, and b) tiny, conical, pointed, reddish-brown warts (pronounced on marginal area); (2) *Rhopilema nomadica*, with only minute, blunt warts ("blunt tuberculation", Galil *et al.*, 1990:103) (Omori & Kitamura, 2004; Kitamura & Omori, 2010; Gul & Morandini, 2015). Recently, Tahera & Kazmi (2015, Figs. 1-3) surprisingly reported *R. nomadica* from Keti Bundar, Pakistan with rough exumbrellar surface bearing minute, blunt tuberculation and warts. However, the *Rhopilema* jellyfish in their figures is clearly showing presence of minute reddish-brown warts on marginal area of umbrella, which are however, characteristic only of *R. hispidum*. Moreover, the authors mentioned the presence of vermicular filaments terminal to the mouth arms in their specimens though, not visible in the figures.

According to the literature, although *Rhopilema nomadica* was described from the Red Sea (Galil *et al.*, 1990) no further records provide solid evidence of its presence in the Indian Ocean so far. In fact, the species is expanding its distribution into the Mediterranean Sea (Yahia *et al.*, 2013). In contrast, *Rhopilema hispidum* is widespread in Indo-Pacific waters (Gul & Morandini, 2015).

We consider that the jellyfish reported by Tahera & Kazmi (2015) as *R. nomadica* is possibly misiden-

tified *R. hispidum* previously reported from Pakistan (Gul & Morandini, 2015).

Although the life cycle of three *Rhopilema* species were formally described (Calder, 1973; Ding & Chen, 1981; Lotan *et al.*, 1992), none of these studies focused on the recognition of developmental changes in characters used for the systematics of the genus. That is the next step for a better understanding of morphology of the species in this genus, to clear if we are dealing with species that present a huge variation in general colour pattern and also in the shape of appendages.

### RESUMO

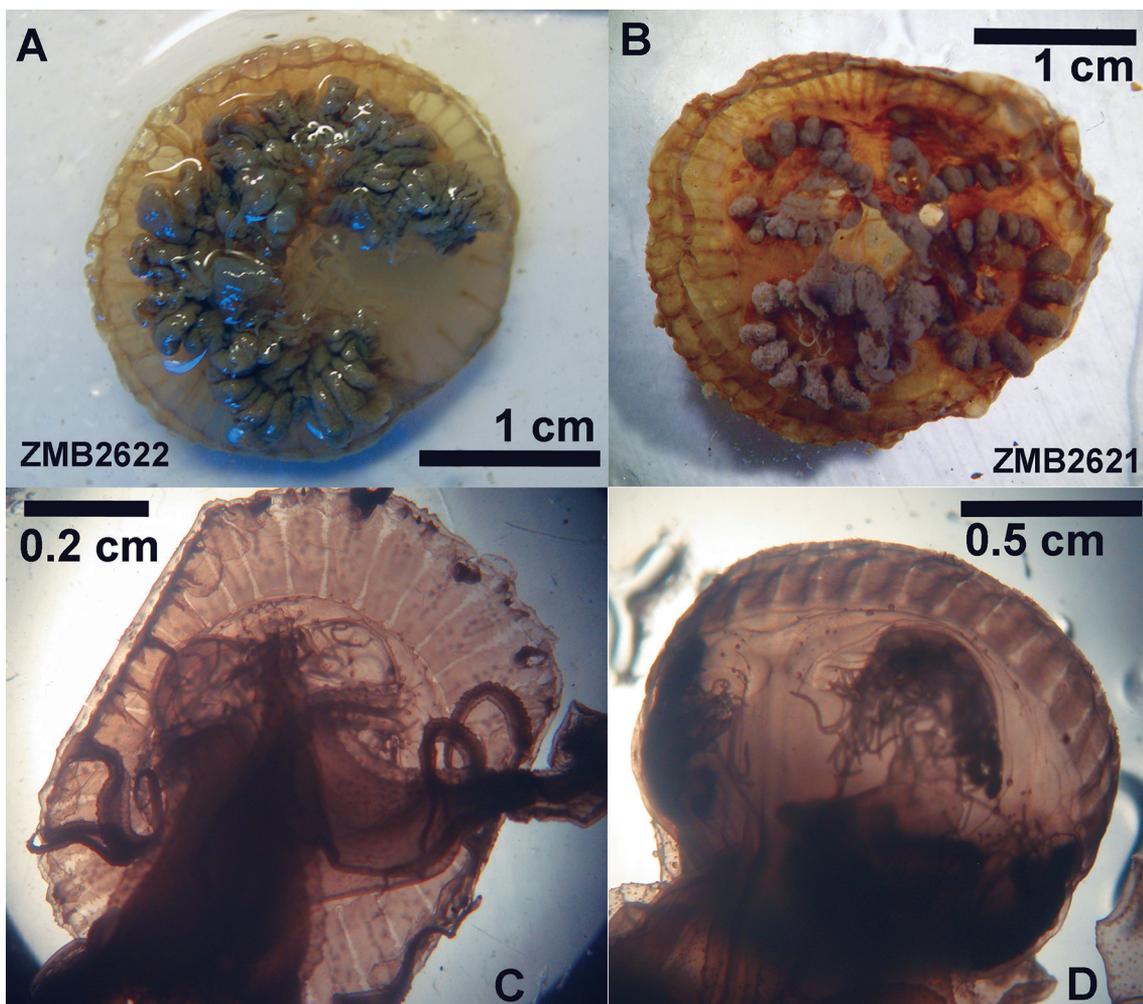
*Esta nota registra a redescoberta de Sanderia malayensis em águas paquistanesas desde a Expedição John Murray*

(1933-34) que coletou dois pequenos exemplares na costa de Carachi. Os espécimes foram descritos e nós discutimos a forma do contorno das bolsas estomacais. Nós também comentamos sobre a medusa *Rhopilema nomadica* recentemente registrada para a região, e acreditamos tratar-se de uma espécie do gênero previamente registrada, *Rhopilema hispidum*.

**PALAVRAS-CHAVE:** Scyphomedusae; *Sanderia*; *Rhopilema*; Carachi; Mar Árabe norte.

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**FIGURE 2:** *Sanderia malayensis* Goette, 1886 specimens in subumbrellar view: (A) Type specimen ZMB 2622, (B) Type specimen ZMB 2621, (C, D) Specimens cultivated from ephyra. Note the shape of gastric pouches in all individuals.

for providing living polyp specimens and Mr. Hamid B. Osmany (Marine Fisheries Department, Karachi, Pakistan) for help in photography of Pakistani specimens. We also thank anonymous reviewers and editors for additional comments on the manuscript. ACM was supported by Alexander von Humboldt Foundation, and grants 2010/50174-7, 2011/50242-5 São Paulo Research Foundation (FAPESP), and by CNPq (301039/2013-5). This is a contribution of NP-Bio-Mar, USP.

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