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New distribution record of *Janolus flavoanulatus* Pola & Gosliner, 2019 (Nudibranchia: Janolidae) from India

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Short communication

Abstract

The present study reports two species of nudibranch, *Janolus flavoanulatus* Pola & Gosliner, 2019 and *Janolus toyamensis* Baba & Abe, 1970 from Gulf of Kachchh, Gujarat. *J. flavoanulatus* was earlier reported from few localities in the Indo-Pacific region. The present record of this species from Goose reef extends its distribution to Gulf of Kachchh, Gujarat. *J. flavoanulatus* was found rare and sparsely distributed in the undisturbed lower intertidal zone of Goose reef. *J. toyamensis* was earlier described from the Gujarat coast during 1909 as *Antiopella indica*. After a century, this species is redescribed here. *J. toyamensis* was found rare and sparsely distributed in the lower intertidal zone of Sikka coastal belt of Gulf of Kachchh, Gujarat

Keywords*: First record, Gulf of Kachchh, Janolus flavoanulatus, J. toyamensis, nudibranchs*

Introduction

Nudibranchia is the largest order of Opisthobranchia (Ramakrishna *et al*., 2010), approximately 6000 nudibranchs species were reported worldwide (Gosliner *et al*., 2015) that includes 2,000 species recorded from the Indo-Pacific region (Gosliner *et al*., 2008) and 194 species reported from India (Bhave and Apte, 2013). They are cosmopolitan in distribution such as in coral reef, rocky and sandy shores, mangroves, seagrasses and mudflats (Apte and Desai, 2017). The nudibranchs are exclusively marine and carnivorous animals (Mcdonald and Nybakken, 1997, 1999; Ramakrishna *et al*., 2010; Zhukova, 2014).

They feed upon ascidians, sea anemones, soft corals (Ramakrishna *et al*., 2010; Cheney and Wilson, 2018), sponges, bryozoans (Ramakrishna *et al*., 2010; Gosliner *et al*., 2015; Cheney and Wilson, 2018), other Opisthobranchs (Gosliner *et al*., 2015), jellyfishes, hydroids, sea pens (Ramakrishna *et al*., 2010) and tunicates (Ramakrishna *et al*., 2010; Gosliner *et al*., 2015). The genus *Janolus* was first described by Bergh (1884) from the Arafura Sea, Pacific Ocean (Bergh, 1884). *Janolus* can be distinguished from its congeners *Antiopa* by the absence of denticulate jaws. They have pustules on the outer side of cerata whereas *Antiopella* has smooth cerata (Pola *et al*., 2019). *Janolus* comprises only 19 valid species worldwide (Mollusca Base, 2020). In Gujarat, single species of *Janolus* was reported and described from the Gulf of Kachchh. *viz. J. toyamensis* Baba and Abe, 1970 (Eliot, 1909; Parasharya,

2012; Apte and Desai, 2017) and listed (Venkataraman *et al*., 2015; Raghunathan *et al*., 2016).

Recently, Vadher *et al*., 2020 compiled an annotated checklist of 95 species belonging to 62 genera in 29 families from Gujarat waters. In the present study, we are adding these two rare species of genus *Janolus* in the Gulf of Kachchh. *viz*., *J. flavoanulatus* and *J. toyamensis*. *J. flavoanulatus* is reported for the first time from the Indian coast.

Material and methods

The present study was carried out in the Gulf of Kachchh, Gujarat, India. The Authors carried out an extensive survey for nudibranchs in coastal areas of Goose reef (22°30′14.9″N 69°48′28.4″E) and Sikka reef (22°26′38.8′′N 69°47′50.6′′E) in the southern coast of Gulf of Kachchh, Gujarat, India as this reef is ideally suited for the distribution of nudibranchs. Goose reef is located in the vicinity of Sikka reef which encompasses a variety of habitats such as coral reefs, sandy, muddy and rocky areas which provide an ideal niche for these two nudibranchs. Specimens from Goose reef were collected during the lowest low tide. Sikka reef comprises mixed type of habitats where the upper intertidal zone is rocky with cobbles, the middle and lower intertidal zone is sandy-muddy with rubbles harbouring diverse macrofauna. The specimens were observed at the lower intertidal zone of the Sikka reef which is exposed only during lowest low tide.

Four specimens of *J. flavoanulatus* were collected and observed (22°29′42.1″N 69°48′14.3″E) from Goose reef (Fig. 1). Two specimens were found in the rocky-sandy zone and one specimen was found attached on flowerpot coral (*Goniopora* sp.) and one specimen was found attached to bryozoans. Two live specimens of *J. toyamensis* were collected and observed (22°26′48.0″N 69°48′10.5″E) from Sikka reef (Fig. 1). One specimen was collected from the muddy area and one specimen was found attached to hydroids.

Specimens of *J. flavoanulatus* and *J. toyamensis* were collected and deposited in the Museum of Fisheries Research Station, Junagadh Agricultural University, Sikka. Detailed morphological characters were examined under the microscopes (LABOMED LX-500 LED Binocular Microscope). They were measured using standard Vernier callipers. Specimens were measured from front of the mantle to the end of the tail as tl=total length. Present specimens were identified using standard literature (Gosliner *et al*., 2015; Apte and Desai, 2017; Pola *et al*., 2019) and through expert communication.

Results and discussion

Systematics

Phylum : Mollusca
Class : Gastropoda
Super class : Heterobranchia
Order : Nudibranchia
Family : Janolidae
Genus : *Janolus*

Janolus flavoanulatus Pola & Gosliner, 2019 (Fig. 2)

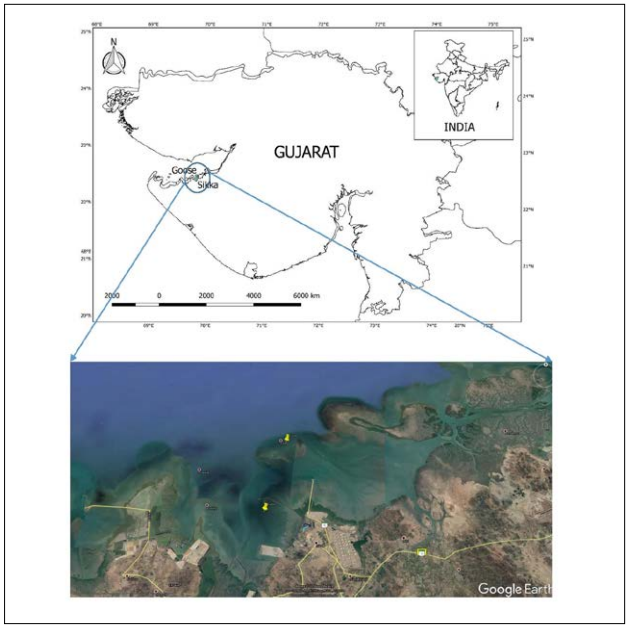

Fig. 1. Map of the study area

Fig. 2. *J. flavoanulatus* Pola and Gosliner, 2019

Synonymy

Janolus sp. 1 Debelius and Kuiter, 2007: 283.
Janolus sp. 7 Gosliner *et al*., 2008: 319.
Janolus sp. 7 Gosliner *et al*., 2015: 307.

Materials examined: 04 specimens (1) tl: 35 mm (2) tl: 35 mm, (3) tl: 38 mm, (4) tl: 40 mm intertidal zone of Goose reef, coll. by Piyush Vadher, 14 December, 2018.

External morphology: The live specimens measured up to 35-40 mm in length. Animal body broader anteriorly and tapering behind to foot, extended to notum. Rhinophores dark purple colour, broader at the base and tapering anteriorly; they are with approximately 20-25 complete and incomplete transverse lamellae. Rhinophores tapering to form sharp-tipped, long with creamish white colour. Pale yellowish colour coruncle well developed between rhinophores. Eyes black, small as a mustard seed, present behind the rhinophores. A pair of short oral tentacles present either side of the head. Cerata extended and covered all over the body, it is elongated, basally globose, pointed anteriorly. The middle portion of cerata covered with few small light yellowish tubercles, which forms round yellowish ring. Basal portion of ceras translucent white, anterior apex ceras with light purple pigment and prominent white tubercles on bulbous region.

Habitat: Generally, it is found in the lower intertidal zone of muddy-sandy substratum, sometimes found in association with bryozoan and flowerpot coral (*Goniopora sp.*) in Goose reef.

Distribution: Indonesia (Debelius and Kuiter, 2007), Philippines (Gosliner *et al*., 2008; Pola *et al*., 2019), Solomon Islands, Vanuatu, Red Sea, Japan, Indonesia (Gosliner *et al*., 2008), Papua New Guinea (Coleman, 2008), Indian and Western Pacific Oceans (Gosliner *et al*., 2015).

India: We reported this species for the first time from Goose reef, Gulf of Kachchh, Gujarat India.

Remarks: The detailed description of the species is well agreed with Pola *et al*., 2019. *J. flavoanulatus* was found attached to flowerpot corals (*Goniopora* sp.) and bryozoans whereas Pola *et al*., 2019 reported this species associated with bryozoan and among coral rubbles and also stated that this species feed on bryozoan beds.

J. flavoanulatus resembles *J. tricellariodes* Pola & Gosliner, 2019, but can be distinguished from it by various characters such as coloration of rhinophores, cerata, digestive systems and by phylogenetic analysis (Pola *et al*., 2019).

Janolus toyamensis Baba & Abe, 1970 (Fig. 3)

Synonymy

Antiopella indica Eliot, 1909, Eliot, 1909: 143.
Janolus indica (Eliot, 1909), Eliot, 1909: 143.
Janolus indicus (Eliot, 1909), Gosliner, 1981: 30.

Materials examined: 02 specimens (1) tl: 40 mm, lower intertidal zone of Sikka reef, coll. by Piyush Vadher, 19 April 2019. (2) tl: 40 mm, lower intertidal zone of Sikka reef, coll. by Avinash Makvana, 19 April 2019.

External morphology: The live specimen measured up to 40 mm in length. Entire body transparent, with numerous slender cerata. Animal body broader evenly, tapering at the tail region. Rhinophores opaque in the base, white line, and tip light orange in colour. Rhinophores papillate, broader at the base and tapering anteriorly, with white lines. Apical region yellow color, followed by dark orange and white tip. Rhinophores possess tuberculation on the apex region, without lamellae. Coruncle well developed between rhinophores and perforated. Cerata covered all over the body. Cerata opaque with greenish spots inside and faint white stripes running towards the apical region. Basal portion of ceras transparent white with greenish spots, apical region with white tip. Eyes black, small as a mustard seed, present behind the rhinophores. Anal papilla large and genital orifice conspicuous. The sole brownish yellow with dark brown spots and an opaque white network.

Habitat: Generally, this species is found in the muddy lower

Fig. 3. *J. toyamensis* Baba and Abe, 1970

intertidal zone of Sikka, sometimes found in association with hydroids.

Distribution: Japan (Baba and Abe, 1970; Baba, 1986), Hawaii (Gosliner, 1981), Western and Central Pacific (Gosliner *et al*., 2015).

India: *J. toyamensis* recorded from Indian waters especially in Gulf of Kachchh (Eliot, 1909; Parasharya, 2012; Apte and Desai, 2017). Presently, it is reported from Sikka coast, Gujarat.

Remarks: The description of *J. toyamensis* agrees well with the detailed description of *A. indica* Eliot, 1909. James Hornell collected nudibranchs from Okhamandal Kattiawar during 1905-06, which were identified by Eliot (Eliot, 1909). Eliot (1909) described *A. indica* Eliot, 1909 from Okhamandal, which quite resembles *J. toyamensis* (Baba and Abe, 1970). Baba (1986) described both the species (*J. toyamensis* and *J. indica*) from Japan, but Eliot's specimen is quite identical to *J. toyamensis.* Eliot 1909 described the specimen with small collection from Hornell, but description of colour pattern was lacking. As, detailed morphological description of *J. indicus* is lacking so the existence of *J. indicus* in Okha, Gujarat cannot be confirmed until the specimen can be re-examined. Our specimen's coloration resembles with the description of Apte and Desai (2017) as they described few dark brown spots on the sides of the body and edge of the foot. Cerata are shaded off instantly with the slightest disturbance (Eliot, 1909), it may drop off its cerata while attacked by predators.

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