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New records of four Aplousobranch ascidians in Indian waters from Andaman and Nicobar Islands

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Original Article

Abstract

Ascidians are exclusively marine creatures having a great evolutionary, ecological and economic importance. Present study reports four Aplousobranch ascidians *Rhopalaea circula* Monniot & Monniot, 2001, *Rhopalaea fusca* (Herdman, 1880), *Clavelina australis* (Herdman, 1899) and *Clavelina fecunda* (Sluiter, 1904) as new records to Indian waters from Andaman and Nicobar Islands with their distributional records.

Keywords: *Aplousobranch, anatomy, Andaman and Nicobar Islands, new records.*

Introduction

Aplousobranchia is one of the largest among the three orders of Ascidiacea. The order contains mostly colonial species although solitary species are also recorded (Shenkar *et al.*, 2016). Andaman and Nicobar Islands harbor diversified, fascinating marine lives along with astonishing reef environment which harbor a great number of ascidian species. Genus *Rhopalaea* belonging to the Diazonidae family had great confusion regarding its position in the systematics among the orders Aplousobranchia and Phlebobranchia (Moreno and Rocha, 2008; Shenkar, 2013) which was solved by Shenkar *et al.* (2016) as they confirmed the position under the order Aplousobranchia. Only 55 species of ascidians are reported from Andaman and Nicobar islands (Oka, 1915; Venkataraman *et al.*, 2012; Ananthan, 2014; Ananthan *et al.*, 2015; Jhimli *et al.*, 2015; Jhimli and Raghunathan, 2016; Jhimli *et al.*, 2016) whereas, about 400 species are reported from Indian waters (Meenakshi *et al.*, 2003; Meenakshi, 2005, 2009; Jaffarali *et al.*, 2009; Swami *et al.*, 2011; Meenakshi and Senthamarai, 2013a, b; Ananthan, 2014) out of 3,000 species from world oceans. Present paper deals with the morphological and anatomical characters along with the distributional pattern of four newly recorded ascidians *viz. Rhopalaea circula* Monniot and Monniot, 2001; *Rhopalaea fusca* (Herdman, 1880), *Clavelina australis* (Herdman, 1899) and *Clavelina fecunda* (Sluiter, 1904) in Indian waters from Andaman and Nicobar Islands.

Material and methods

Ascidians were collected during the undersea surveys from January to December, 2015 by employing SCUBA diving from Little Andaman and Nancowry group of islands (Fig. 1). The freshly collected specimens were washed in seawater, defecated with magnesium sulphate and narcotized using menthol

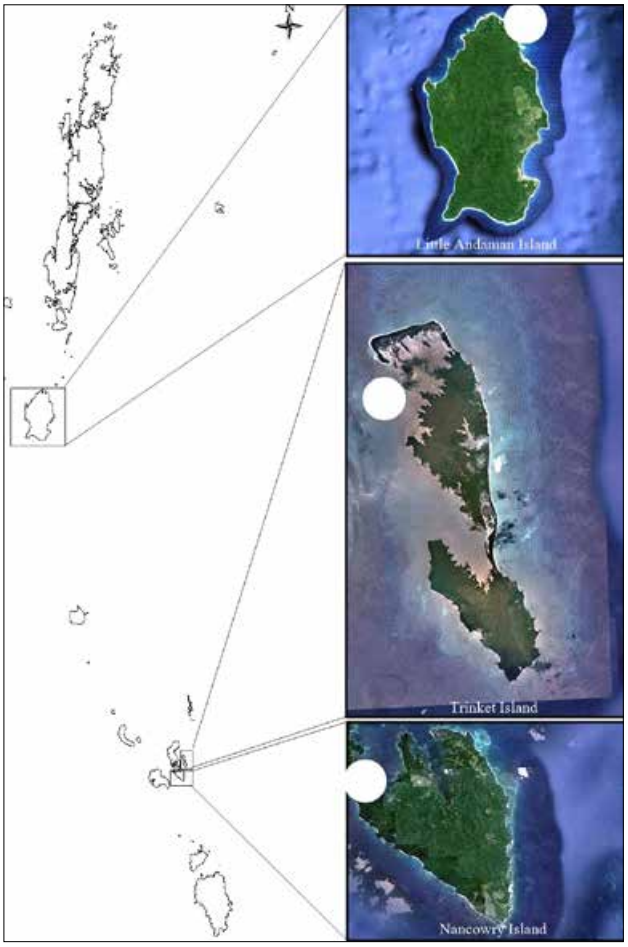

Fig. 1. Study areas of Andaman and Nicobar Islands

crystal following the method of Kott (1985) and Meenakshi *et al.* (2003). Underwater photographs were taken by using Cannon Power Shot G15. Specimens were dissected under dissecting microscope (Labomed CZM4) and the anatomical features were digitized by stereozoom microscope (Leica 205 A). The identification was made by following Monniot and Monniot (2001) and Kott (1990). Identified specimens were registered and deposited at the National Zoological Collections at the Zoological Survey of India, Port Blair.

Results and discussion

Descriptions along with distribution of four newly recorded species are given below.

Systematics

Phylum : Chordata Haeckel, 1874
Subphylum : Tunicata Lamarck, 1816
Class : Ascidiacea Nielsen, 1995
Order : Aplousobranchia Lahille, 1886
Family : Diazonidae Seeliger, 1906
Genus : *Rhopalaea* Philippi, 1843

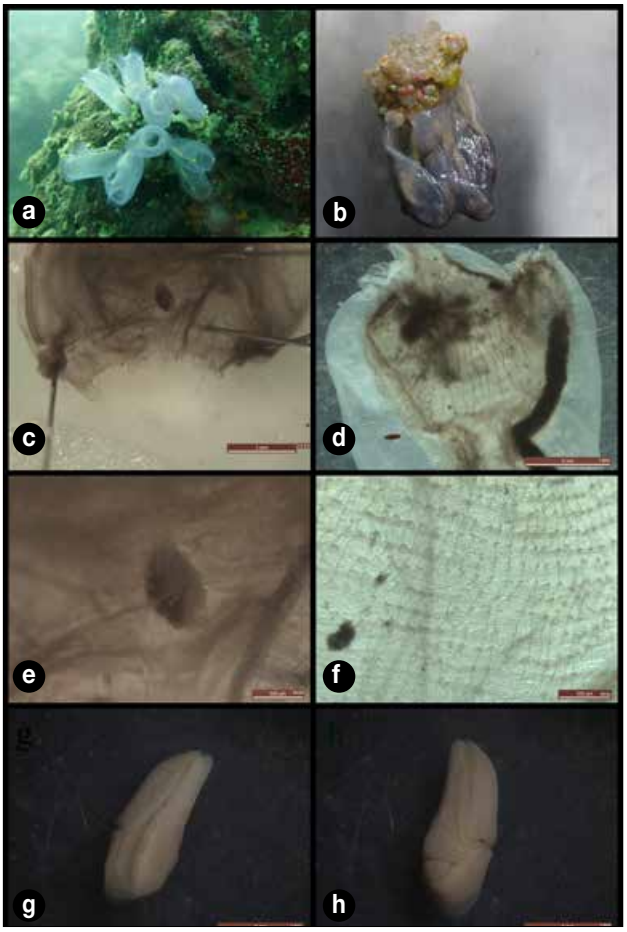

Fig. 2. *Rhopalaea circula* Monniot & Monniot, 2001: a- colony in-situ; b- preserved specimen; c- branchial lobes; d- musculature; e- dorsal tubercle; f- branchial sac with papillae; g- gut loop; h- gut loop with gonads

1. *Rhopalaea circula* Monniot & Monniot, 2001 (Fig. 2)

Material examined: Two colonies were sampled during underwater survey in December, 2015 at Trinket Island (Lat.: 07°59.842´N; Long.: 93°30.569´E) at a depth of 12 m, Reg. No.: ZSI/ANRC - 13604.

External morphology

Colonial species containing 9-12 zooids were sampled and observed. Colony contains mostly large zooids, united at the base. Base tunic with vascular ampullae. Underwater species with transparent blue color with 4 rings of deep purplish blue. As stated by Monniot and Monniot (2001) terminal branchial siphon and relatively smaller lateral atrial siphons are present. Six lobes are not clearly comprehensible underwater and pigmentation was present between lobes in addition to two yellow pigment spots in between two lobes and at the beginning of endostyle. These pigments are not found after fixation in formalin. Thoracic test was soft, thickened and hard around the abdomen as other species of *Rhopalaea*.

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Anatomical characters

Thorax length is 3.8 cm and gut loop is 2.1 cm. There are 18 longitudinal muscles which are more than Monniot and Monniot (2001) mentioned in the original description (as they mentioned 13 muscles). Thorax is wide at the anterior narrowed posteriorly. About 24 branchial tentacles are found in three orders. Dorsal tubercle is single slit. Dorsal lamina is with sharp languets and branchial sac with branchial papillae. There are 120 rows of stigmata with 46 longitudinal vessels present in the middle of the branchial sac. There are 4 stigmata per mesh. Stomach is more than half of one limb. Gonads are embedded in the gut loop. Long rectum opens by thick slightly lobed anal opening. Sperm duct is long and cross the annual boarder while oviduct opens in a small papilla.

Distribution

Federated States of Micronesia, Palau, Papua New Guinea and Mariana Islands (Monniot and Monniot, 2001).

Remarks

The characteristic feature of the species is circle like structure in the branchial sac as mentioned by the Monniot and Monniot (2001) which is present in the studied specimens along with the similarity with anatomical characteristics.

2. *Rhopalaea fusca* (Herdman, 1880) (Fig. 3)

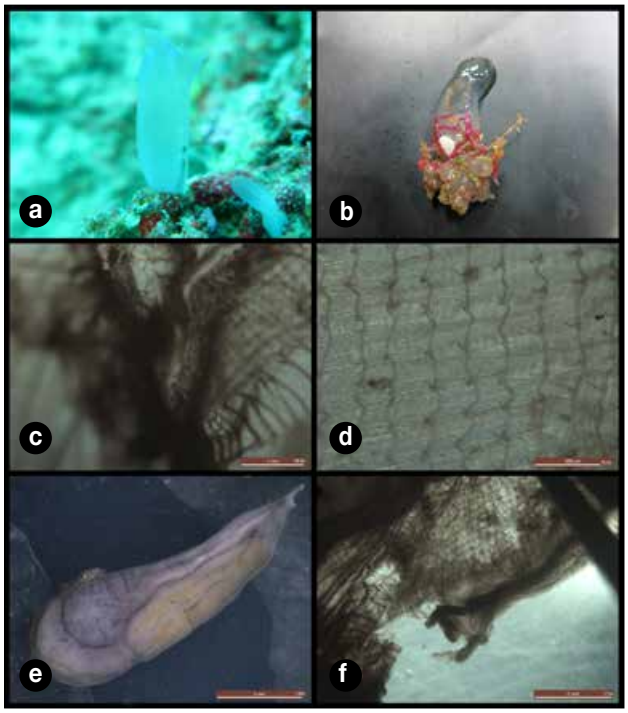

Fig. 3. *Rhopalaea fusca* (Herdman, 1880): a- species in-situ condition; b- preserved specimen; c- dorsal tubercle; d- branchial sac with papillae; e- gut loop with gonads; f- anal border with sperm duct.

Material examined: Part of one colony and a single zooid were sampled during underwater survey in December, 2015 at Nancowry Island (Lat.: 07°59.465´N; Long.: 93°30.210´E) at a depth of 28 m, Reg. No.: ZSI/ANRC - 13605

External morphology

Solitary zooids are found. Underwater, the species is not intense blue as stated by Monniot and Monniot (2001) but it is light blue like *R. circula* and not with the circular rings at the thoracic region. The branchial siphon is terminal and the atrial siphon smaller and lateral. Soft thoracic test found along with hard abdominal test covered with epibionts.

Anatomical characters

Thorax is 3.5 cm and the gut loop is 2 cm. Twelve thoracic muscles originate from the oral siphon and 6 from between the siphons. 20 branchial tentacles are found arranged in 2 orders. Dorsal tubercle is single slit. Dorsal lamina consists of sharp languets. Large branchial papillae are present. There are 110 rows of stigmata with 58 longitudinal vessels and 3-5 stigmata per mesh. Gut loop encloses the gonad. Anal border is thick and lobed. Sperm duct is prolonged and extend the anal border while oviduct opens below the anal border.

Remarks

Thoraces are not intense blue but as the anatomical characters matches with description of Monniot and Monniot (2001), the species is identified as *Rhopalaea fusca*.

Distribution

Banda Sea, Indonesia and Philippines (Monniot and Monniot, 2001).

Family : Clavelinidae Forbes and Hanley, 1848
Genus : *Clavelina* Savigny, 1816

3. *Clavelina australis* (Herdman, 1899) (Fig. 4)

Material examined: Part of three colonies were sampled during underwater survey in December, 2015 at Nancowry Island (Lat.: 07°59.465´N; Long.: 93°30.210´E) at a depth of 31 m, Reg. No.: ZSI/ANRC - 13741.

External morphology

Colonies are small with separated zooid attached at the base by a common basal plate-like test. Living colonies are bluish in colour with three bright blue patches in the median line; one over the anterior end of the endostyle, one in between the base of the siphons and another one at the posterior base of the atrial siphon. An additional blue patch is also present at the opening of the anus. Yet, no white spot has been found

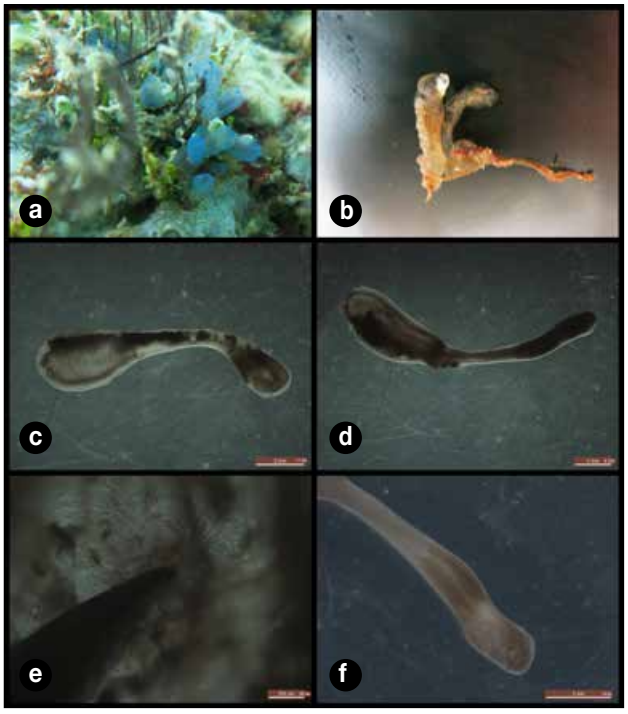

Fig. 4. *Clavelina australis* (Herdman, 1899): a- colony in-situ; b- preserved specimen; c & d- zooid; e- dorsal tubercle; f- gut loop with gonads.

in the anterior part of the test. Branchial and atrial siphon openings are smooth.

Anatomical characters

Zooids are 2.2 cm long with 5 mm thorax and 4 mm gut loop. There are 11 thoracic muscles extending up to the end of the gut loop. Eight short and stumpy branchial tentacles are observed as stated in Kott, 1990. Dorsal tubercle is slit like. About 20 rows of stigmata are observed. No branchial papillae are observed. Stomach has no folds from outside. Gut loop encloses the gonads. No mature larva found but there are some immature larvae.

Distribution

Australia (Victoria, New South Wales, Queensland) (Kott, 1990).

Remarks

The colour of the underwater specimens mentioned by Kott (1990) was yellowish to yellowish blue but the colour of the specimens collected during the present study is bluish but as the anatomical and other morphological characters are matched with the specimen studied the specimens are identified as *Clavelina* auatralis.

4. *Clavelina fecunda* (Sluiter, 1904) (Fig. 5)

Material examined: Part of one colony was sampled during

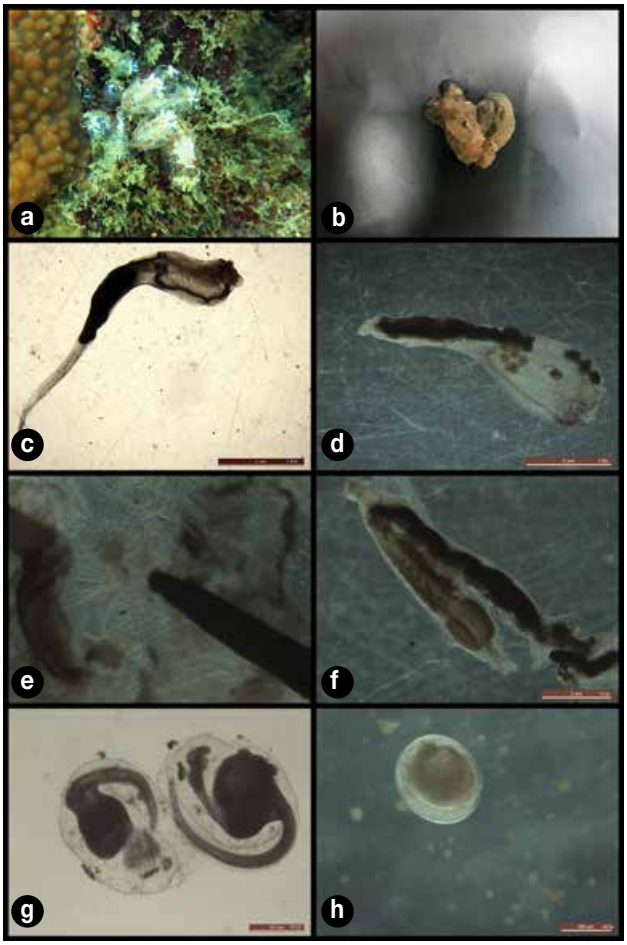

Fig. 5. *Clavelina fecunda* (Sluiter, 1904): a- colony in-situ; b- persevered specimen; c & d- zooid; e- dorsal tubercle; f- gut loop with gonads; g & h- larvae.

underwater survey in January, 2015 at Pathar Nallah (Lat.: 10°53.200´N; Long.: 92°32.009´E), Little Andaman Island at a depth of 8 m, Reg. No.: ZSI/ANRC - 13740.

External morphology

Colonies are medium to large. Zooids are attached at the base by a common test. They are yellowish in colour having orange patches with dark blue dots on each side of the thorax. This pattern of patches also found over the anus and on the atrial siphon. A blue coloured non-continuous ring surrounds the branchial siphon containing patch over the endostyle, in between two lobes and at both side of the siphon. Lower part of atrial siphons has a continuous blue patch line. In preservative this blue colour is not found but the dark blue spots were transformed into brownish purple colour and persists. Both the apertures have smooth border.

Anatomical characters

Zooids of the colony are about 3 cm long with 0.8 cm thorax and gut loop is 0.7 cm long. There are 14 thoracic muscles.

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These extend to the posterior end of the gut loop. 14 large branchial tentacles are present alternating with minute ones. Dorsal tubercle is slit like. Dorsal languets with sharp languets and no branchial papillae are observed. 16 rows of stigmata are present. No branchial papillae are present. Gut loop enclosed the gonads. 5-6 mature and immature larvae are found in the peribranchial cavity.

Distribution

Australia, Philippines, Northern Territory, New Caledonia, Indonesia and Palau Island (Kott, 1990).

Remarks

The species was earlier reported as *Podoclavella fecunda* Sluiter, 1904 by Oka (1915) from the collected specimens of Indian Museum of Andaman and Nicobar Islands. However, Oka (1915) in his description, could not confirm the identity of the specimen due to contractions of the preserved specimen. Further no report was made on the availability of the species in Indian waters. The identity of the presently studied species was confirmed based on the key morphological features with live and fresh specimens. As Kott (1990) mentioned its characteristics such as underwater yellow colour with blue patches, short stumpy zooids and incubating larvae are matched with the presently studied specimens.

Ascidians have a great ecological role due to its filter feeding behaviours. These fouling species are indicator of polluted (Naranjo *et al.*, 1996) as well as pristine (Su *et al.*, 2013) marine environment. As they act as bio-fouler, they cause a great economic loss worldwide (Rocha and Kremer, 2005; Shenkar, 2008; Rocha *et al.*, 2009). Being bio-fouler they spread very easily and become invasive species (Lambert, 2002; Lambert and Lambert, 2003). The presently reported four species will enhance the number of ascidian faunal database of Andaman and Nicobar Islands as well as India. Further exploration on ascidian taxonomy and ecology are required from Andaman and Nicobar Islands for better understanding of their diversity and distribution.

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