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NOTE

NEW RECORDS OF APLOUSBRANCH ASCIDIANS TO INDIAN WATERS FROM ANDAMAN ISLANDS

Jhimli Mondal, C. Raghunathan & K. Venkataraman

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Andaman & Nicobar Islands are a chain of 572 islands surrounded by Coco Channel in the north, Great Channel in the south, Andaman Sea in the east and the Bay of Bengal in the west. These islands are biologically diverse with extensive fringing reefs around the continental shelf in the east, while a barrier reef is also found in the western region which is 350km away from the coast (Venkataraman et al. 2003). The fascinating marine biodiversity of Andaman & Nicobar Islands emphasises the scope of a wide range of faunal communities to work with. Studies on corals, fishes, molluscs, crabs, sea anemones and planktons of Andaman & Nicobar Islands have been carried out from a very early date, while the ascidians are least studied from these areas. The ascidians are well known primitive chordates, common in the coral reef ecosystem, and the only group of chordate to represent retrogressive metamorphosis as a developmental pattern (Ruppert et al. 2004). Ascidians exhibit an ample range of habitat from intertidal zone to greater depth of ocean up to 6,500m (Kott 1969). Ascidians are studied worldwide due to their fouling and invasive nature (Lambert 2002; Minchin et al. 2006; Lengyel et al. 2009; Locke 2009) and for their phylogenetic importance (Wada 1998; Corbo et al. 2001; Monero & Rocha 2008). The taxonomical studies on Indian ascidians were mainly based on the coast of the Indian peninsula and a total of 388 species were also recorded (Meenakshi et al. 2003). Seven non-indigenous species were reported from Thoothikudi Port, India (Jaffarali et al. 2014). Till 2012, only seven species of ascidians, i.e.,

NEW RECORDS OF APLOUSOBANCH ASCIDIANS TO INDIAN WATERS FROM ANDAMAN ISLANDS

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Clavelina moluccensis, *Atriolum robustum*, *Botrylloides leachi*, *Perophora modificata*, *Didemnum molle*, *D. sp.*, *Phallusia arabica* were reported from Andaman & Nicobar Islands (Venkataraman et al. 2012). In 2014, Ananthan reported another 15 species, i.e., *Ascidia virginea*, *Ascidella aspera*, *Clavelina oblonga*, *Didemnum fulgens*, *D. vexillum*, *D. granulatum*, *D. albidum*, *D. candidum*, *Trididemnum cyanophorum*, *Diplosoma simile*, *D. spongiforme*, *Aplidium fuscum*, *Synoicum castellatum*, *Pycnoclavella diminuta* and *Styela sp.* from Great Nicobar Island (Ananthan 2014). The present paper deals with the taxonomic characters and distribution of two newly recorded aplousobranch ascidian species under two families from Indian waters, of which the family Diazonidae is reported for the first time from Indian waters.

Material and Methods

Ascidians were collected using self contained underwater breathing apparatus (SCUBA) diving gear during June to October, 2014 in Andaman group of islands (Image 1). Defecation of collected samples were

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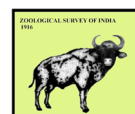
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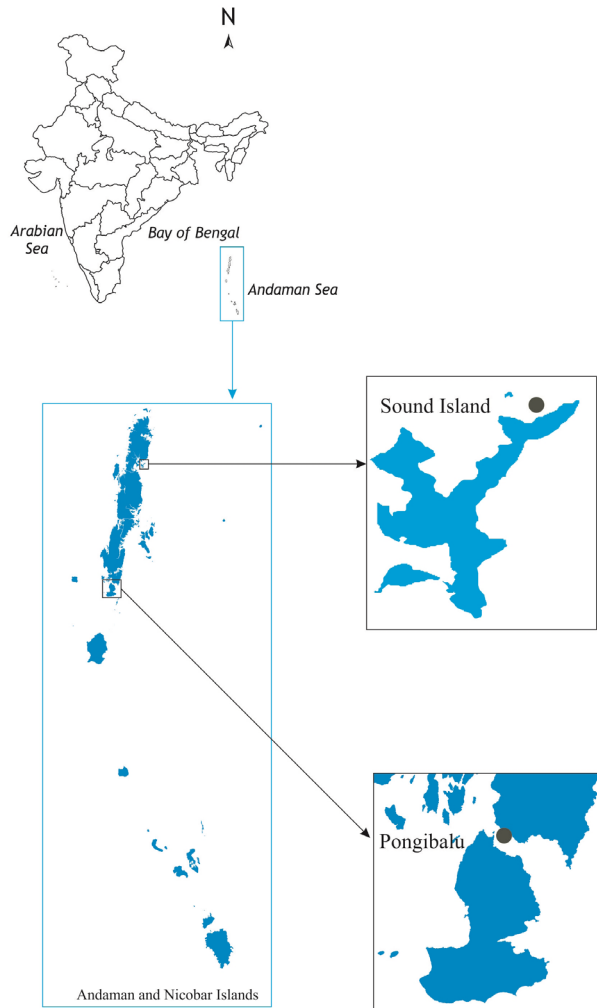


Image 1. Study areas in Andaman Islands

carried out with magnesium sulphate crystals and then narcotized with menthol crystals following Meenakshi et al. (2003) and preserved with 4% formaldehyde-seawater solution. Dissection was carried out under Labomed CZM4 microscope and digitization of detailed anatomy was carried out under Leica M205A stereo zoom microscope. Identification of the specimens was made in conjunction with Tokioka (1953), Monniot & Monniot (2008), and Kott (1990) following the taxonomic characters described by them. The specimens were registered and deposited in the National Zoological Collections of Zoological Survey of India, Port Blair.

Results

Two species of ascidians were recorded as new to Indian waters from around Andaman Islands. The taxonomical details with distributional pattern are illustrated below.

Class: Ascidiacea Blainville, 1824
 Order: Aplousobranchia Lahille, 1886
 Family: Diazonidae Seeliger, 1906
 Genus: *Rhopalaea* Philippi, 1843

Rhopalaea macrothorax (Herdman, 1880) (Image 2)

Material examined: A total of 10 specimens were sampled and examined during June 2014 at Pongibalu Jetty (11°30.956'N & 92°39.206'E), South Andaman at a depth of 12m (Image 1) for taxonomical characterization. All the specimens were deposited in the National Zoological Collection (Reg. No.: ZSI/ANRC - 11418 (1 specimen); ZSI/ANRC - 16554 (9 specimens)). The same species has also been recorded from the Peacock Island (13°33.692'N & 93°03.119'E) of North Andaman and Riflemen Island (11°30.837'N & 92°38.767'E) of South Andaman. All the specimens were collected from the reef area, collection depth varies from 8–26 m.

Description: External morphology: Only thorax part is clearly visible during in situ condition like the individuals of other species under the genus *Rhopalaea* (Image 2a). Zooids are solitary, finger-like about 3–4.5 cm (Image 2a,b). Thoracic part of the body is 1.5–2 cm (Image 2c). Test is delicate anteriorly but became firm posteriorly, with many irregular protuberances on the test surface (Image 2b). Basally the test produced ramified root-like extensions to adhere to the sand surface, sometimes sands are embedded in the posterior part of the test. The embedded sands, shell fragments and coral rubbles are hard to remove from these extensions. Didemnid ascidians and other organisms are attached with the abdominal test. Collected specimens have completely transparent thoracic test along with translucent abdominal test. Both the branchial and atrial apertures have six lobes. Yellow coloured ocelli between each lobe in both the branchial and atrial apertures are clearly visible underwater and also persist in the preserved state (Image 2c). Terminal branchial aperture and antero-dorsal atrial aperture are directed upwards. A blue ring-like structure is also noticeable surrounding the branchial aperture though it is interrupted at the mantle over peritrabecular area and at the end of the endostyle (Image 2a), a blue line runs along the endostyle and both are found in situ as well as in the preserved state. No conspicuous yellow spot was found in the test. A yellow coloured pigment spot was clearly visible on the mantle over the peritrabecular area and at the end of endostyle while a yellow coloured ring like structure was found surrounding the anal border, traces were also found in the preserved specimen. A pinkish abdomen which is situated entirely posterior to

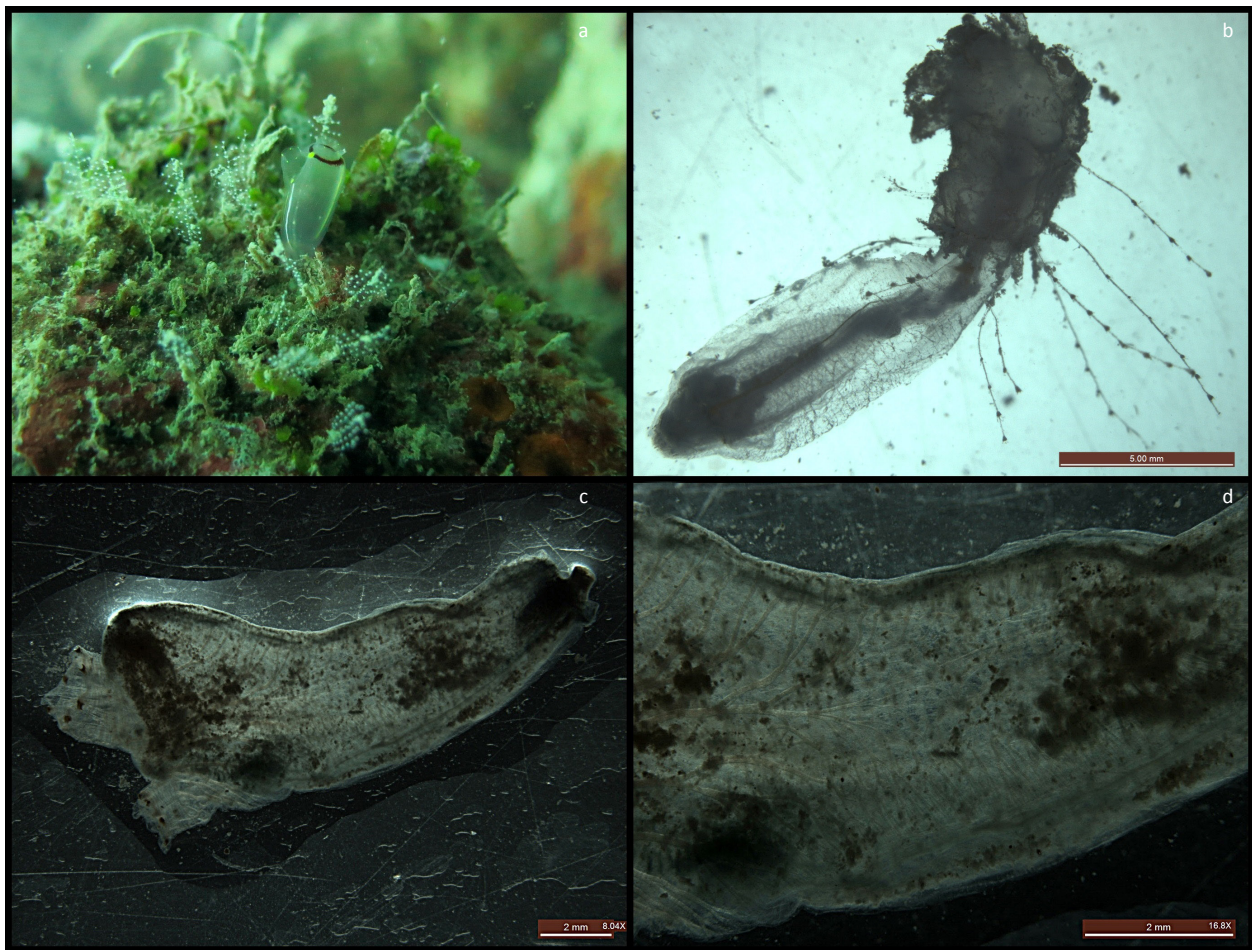


Image 2. *Rhopalaea macrothorax* Tokioka, 1953.

a - Specimen at in situ condition; b - Irregular protuberances on the test (scale: 5mm); c - Whole branchial sac, both the aperture have six lobes and six stigmata present in each aperture (scale: 2mm; 8.04X); d - Musculature of pharynx (scale: 2mm; 16.8X).

the branchial sac (colour faded in the preservatives) was clearly seen through the test.

Internal structures: The specimens have a large thorax gradually narrower posteriorly and a narrow oesophageal neck. The branchial siphons have evenly spaced eight circular muscle bands. About 26 tentacles surrounding the branchial siphons are recorded. The Pharynx has about 11 longitudinal muscles on each side and more branching towards the endostyle (as stated in Shenkar 2013) and the muscles do not run upto the end of the branchial sac as shown in Monniot & Monniot (2008), not like *R. crassa* (as depicted in Monniot and Monniot 2001) (Image 2d). About 42 longitudinal vessels are present on each side of the pharynx. The longitudinal vessels are supported by papillae. Secondary papillae is absent. Imperfect longitudinal vessels are also found. There are about 2–4 stigmata per mesh (Image 3a,b) and about 60 rows of stigmata are present. Trace of the yellow colored spot is easily detectable on the

mantle over the peritrabecular area. Dorsal tubercle is a longitudinal slit (Image 3c); dorsal lamina contains triangular languets. A vertical gut loop is embedded in the test (Image 3d). The loop encloses the gonads. The anal border is smooth and thick (Image 4a), the sperm duct is a little curved behind the anal border (not as shown in Monniot and Monniot, 2008) and the sperm duct extends beyond the anal border (Image 4b,c). The posterior abdominal test vessel branches extend into the basal root-like projections.

Distribution: India: Andaman Islands; Japan (Tokioka 1953); Indonesia; Malaysia; Australia; and Hong Kong (Monniot & Monniot 2008).

Family: Clavelinidae Forbes & Hanley, 1848

Genus: *Clavelina* Savigny, 1816

***Clavelina robusta* Kott, 1990 (Image 3)**

Material examined: Two colonies containing 30

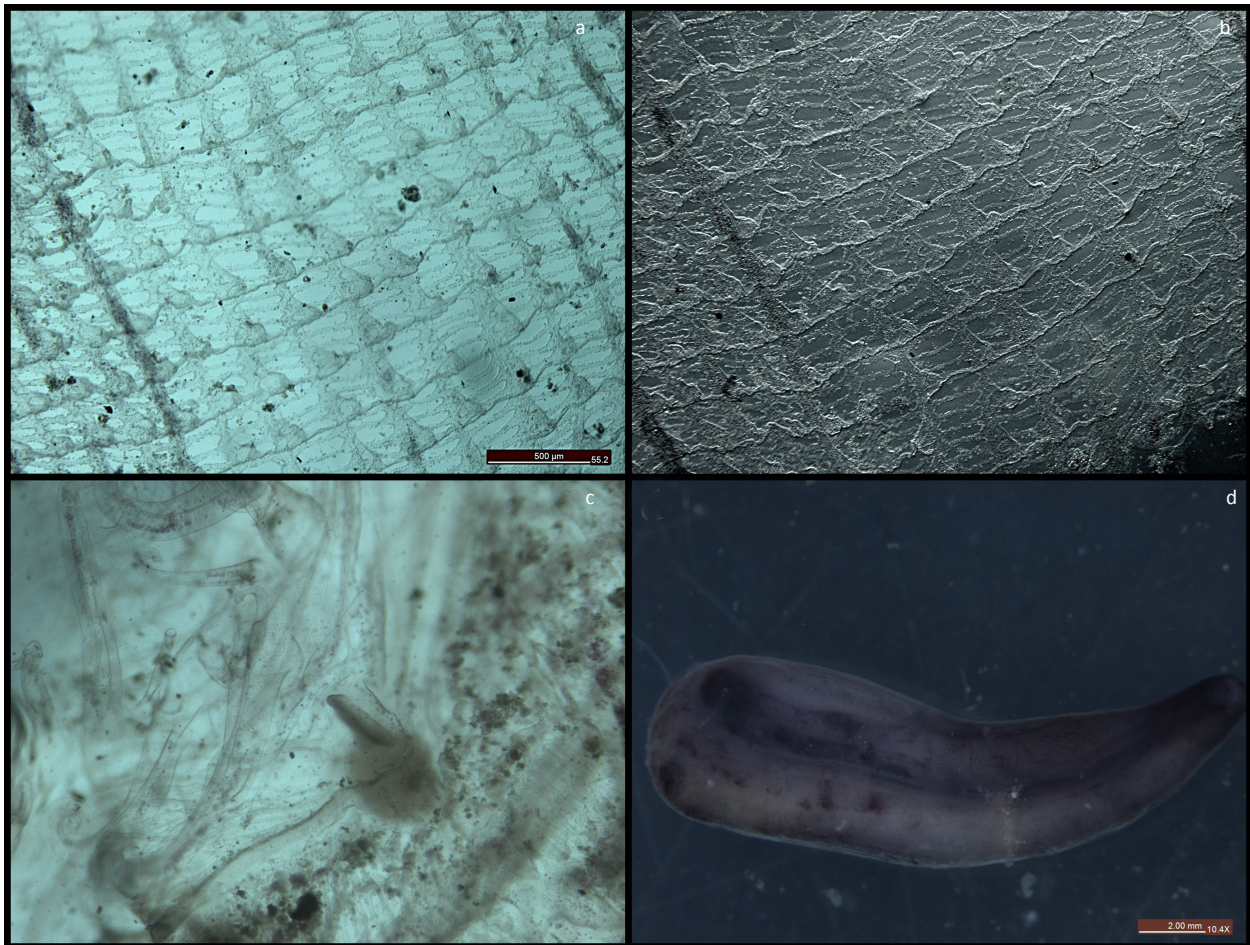


Image 3. *Rhopalaea macrothorax* Tokioka, 1953

a & b- Rows of stigmata with longitudinal vessel (scale: 500µm; 55.2X); c - Dorsal tubercle (scale: 500µm); d - gut loop (scale: 2mm).

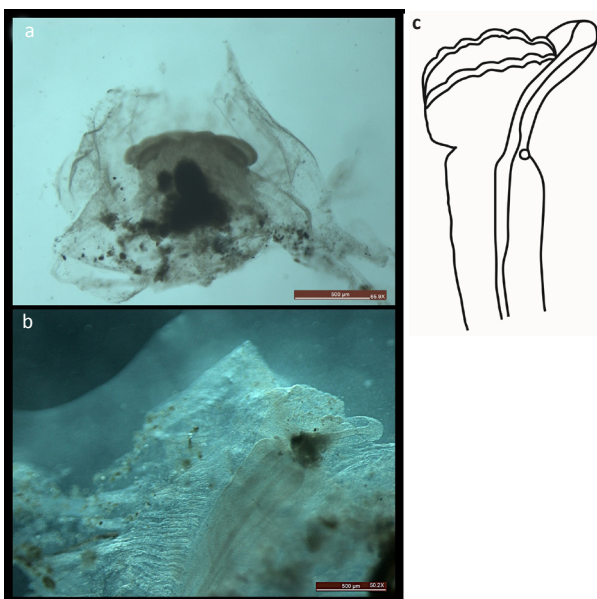


Image 4. *Rhopalaea macrothorax* Tokioka, 1953

a - Anal border (scale:500µm; 65.9X); b & c - Anal border and genital papilla (scale: 500µm; 50.2X).

zooids were observed and collected from Sound Island (12°58.926'N & 92°57.211'E) of Middle Andaman during October, 2014 at the depth of 8m (Image 1). Samples were examined for taxonomic investigation while one sample was registered (Reg. No.: ZSI/ANRC - 11427) and rest of two colonies containing 29 zooids was registered (ZSI/ANRC - 16555). This same species was also found from the Rutland Island (11°30.119'N & 92°37.112'E) and Pongibalu (11°30.956'N & 92°30.206'E) of South Andaman, and Oliver Island (13°00.038'N & 92°59.216'E) of Middle Andaman. All the specimens were collected from the reef area, although in Sound Island specimens were collected from dead reef covered with thick muddy structure, collection depth varies from 6m to 13m.

Description: External morphology: Large colonies have large light blue zooids with a yellow band surrounding the branchial aperture in in situ conditions (Image 5a). The band is interrupted at the endostyle narrowing at the dorsal tubercle. No band is found surrounding the atrial aperture. Yellow coloured ring-

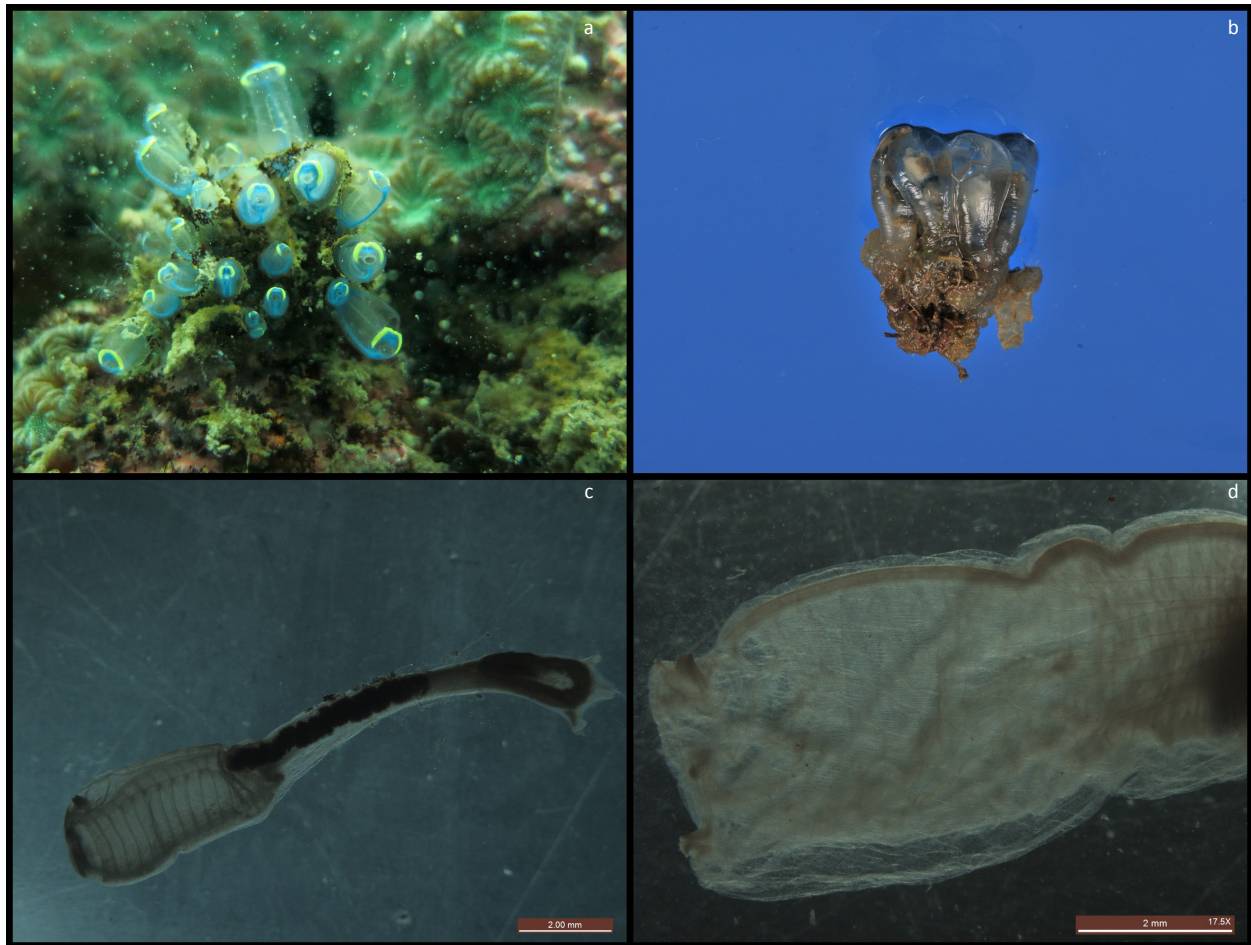


Image 5. *Clavelina robusta* Kott, 1990

a - Specimens at *in situ* condition; b - Preserved specimen; c - Whole zooid without test (scale: 2mm); d - Branchial sac showing musculature (scale: 2mm; 17.5X).

like structure surrounding the branchial aperture does not persist in the preserved specimen (Image 5b). Both the apertures have a smooth border. The branchial sac is clearly visible through the translucent test (Image 5a,b). Test is more transparent in the upper region than the abdominal region but never glassy as stated by Kott (1990). A blue band is observed which runs along the endostyle. Basally test forms massive stalks. Stalks of zooids adhere to each other.

Internal structures: Zooids are mostly 2.5cm long with about 1cm thorax and 0.7cm abdominal loop (Image 5c) with 11 longitudinal thoracic muscles, extends along the length of gut loop (as stated by Kott 1990) (Figs. 5d; 6a–d). About seven large tentacles are found around the branchial aperture forming an outer row, the inner row contains 18 smaller tentacles all about same size (Image 7a). The dorsal tubercle is a vertical slit like structure. There are about 15–21 rows (Image 5c) containing about 60 stigmata (62 stigmata

and 68 stigmata found on rows which are counted) on each side of the branchial sac. Transverse vessels form a non-serrated smooth membrane like structure between the rows of stigmata. No internal longitudinal vessels are found. Vertical gut loop enclosed in the gonads (Image 7b). Ovary contains more than 10 ova. No brood pouch containing embryos are found as stated by Kott (1990). Larvae are found in the peribranchial cavity (Image 7c). A mature larva was found similar with the depiction given by Kott (1990) (Image 7d,e).

Distribution: India: Andaman Islands; Australia; Indonesia; Japan; Palau Islands; Philippines (Kott 1990); and Solomon Islands.

Discussion

Most of the species under *Rhopalaea* are tropical in nature except *Rhopalaea cloneyi*, *Rhopalaea neapolitana* and *Rhopalaea nordgardi* (Kott 2006). *Clavelina robusta* also exhibit tropical western pacific distribution. These

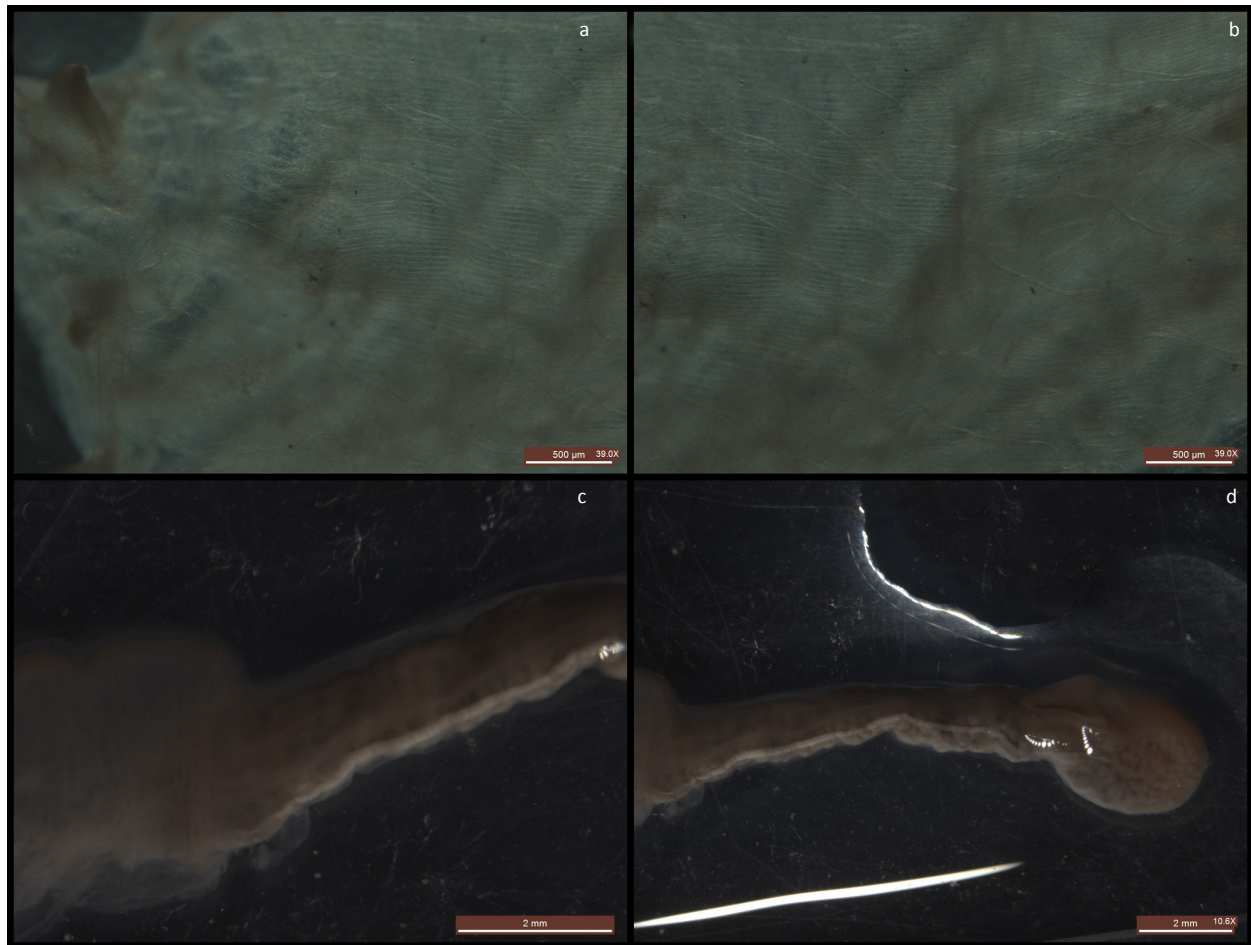


Image 6. *Clavelina robusta* Kott, 1990.

a & b - Detailed muscle arrangement in pharynx (scale: 500μm; 39.0X); **c & d** - Muscles on the gut loop (scale: 2mm).

newly recorded two species will increase the database of ascidian fauna of Andaman Islands, as well as from India. More extensive studies are required in future to document additional species of ascidians from Indian waters.

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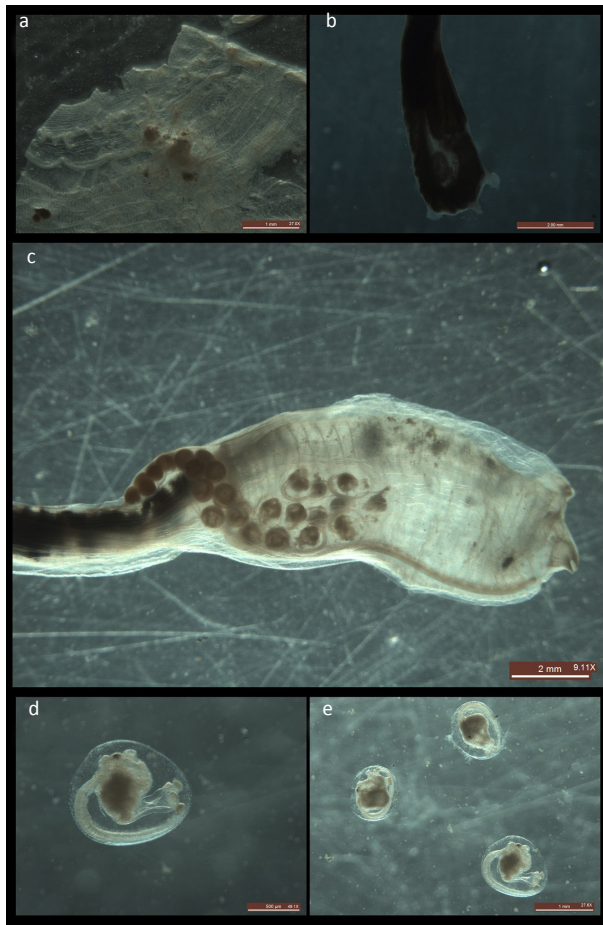


Image 7. *Clavelina robusta* Kott, 1990.
 a - Arrangement of tentacles (scale: 1mm; 27.0X); b - Gut loop with gonads (scale: 2mm); c - Larvae in peribranchial cavity (scale: 2mm; 9.11X); d & e - Larvae (scale: 500µm; 49.1X; scale: 1mm; 27.6X).

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Article**Flora richness as an indicator of desert habitat quality in Kuwait**

-- Yahya Al-Shehabi & Kevin Murphy, Pp. 9777–9785

Communications**Distribution of *Cryptopotamon anacoluthon* (Kemp, 1918) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong**

-- David John Stanton, Michael Robertson Leven & Tommy Chung Hong Hui, Pp. 9786–9794

Moths of the family Limacodidae Duponchel, 1845 (Lepidoptera: Zygaenoidea) from Bhutan with six new generic and 12 new species records

-- Jatishwor Singh Irungbam, Meenakshi Singh Chib & Alexey V. Solovyev, Pp. 9795–9813

Odonates of Coimbatore District, Tamil Nadu, India

-- M. Suhirtha Muhil & P. Pramod, Pp. 9814–9828

Twenty-three new records of mantodea (Insecta) from some states of India

-- Tushar Kanti Mukherjee, Geetha Iyer & Parbati Chatterjee, Pp. 9829–9839

Short Communications**On the feeding habit of the Guiana Dolphin *Sotalia guianensis* (van Benedèn, 1864) (Mammalia: Cetartiodactyla: Delphinidae) in southeastern Brazil (~220S): has there been any change in more than two decades?**

-- Ana Paula Madeira Di Benedetto, Clara da Cruz Vidart Badia & Salvatore Siciliano, Pp. 9840–9843

Additions to the scorpion fauna (Arachnida: Scorpiones) of Kerala, India, with an illustrated key to the genera

-- K. Aswathi & P.M. Sureshan, Pp. 9844–9850

Diversity of two families Libellulidae and Coenagrionidae (Odonata) in Regional Institute of Education Campus, Bhubaneswar, Odisha, India

-- Priyamvada Pandey & Animesh Kumar Mohapatra, Pp. 9851–9857

A report on occurrence of aphidophagous predators of *Aphis odinae* (van der Goot) (Hemiptera: Aphididae) in cashew ecosystem from Goa, India

-- Ramasamy Maruthadurai & Narendra Pratap Singh, Pp. 9858–9861

Notes**A new critical habitat for conservation of the White-bellied Heron *Ardea insignis* Hume, 1878 (Aves: Ardeidae) from Bhutan**

-- Karma Wangdi, Tashi Dhendup & Tsethup Tshering, Pp. 9862–9863

First report of the parasitoid wasp *Piestopleura Förster* (Hymenoptera: Platygastroidea: Platygasteridae) from India

-- Kamalanathan Veenakumari, Peter Neerup Buhl, Anandhan Rameshkumar & Prashanth Mohanraj, Pp. 9864–9865

A century later the Manipur Argus *Callerebia suroia* Tytler, 1914 (Lepidoptera: Nymphalidae: Satyrinae) recorded in its type locality in Manipur, India

-- Jatishwor Singh Irungbam, Harmenn Huidrom & Baleshwar Singh Soibam, Pp. 9866–9869

First record of the predatory stinkbug *Eocanthecona concinna* (Walker, 1867) (Pentatomidae: Asopinae) from India

-- Sadashiv Hanumant Waghmare & Sunil Madhukar Gaikwad, Pp. 9870–9873

New records of Aplousobranch ascidians to Indian waters from Andaman Islands

-- Jhimli Mondal, C. Raghunathan & K. Venkataraman, Pp. 9874–9880

Additions to the flora of Coimbatore hills, Tamil Nadu, India

-- K. Kiruthika, M. Sulaiman & R. Gopalan, Pp. 9881–9884