Article

New records of sea slugs (Heterobranchia: Opisthobranchia) from India

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Received 4 April 2017; Accepted 10 May 2017; Published online 1 September 2017

Abstract

Opisthobranchs, are marine molluscs which take a top notch at being brilliantly coloured. They are known for their intriguing patterns and variety of forms and shapes. The present paper reports 8 species of opisthobranchs (*Costasiella usagi*, *Halgerda formosa*, *Dendrodris guttata*, *Dendrodoris elongata*, *Miamira magnifica*, *Ceratosoma tenue*, and *Phyllidia exquisita*) as new records to Indian waters while *Dermatobranchus fortunatus* as a new record to Andaman and Nicobar Islands. Description, geographic locations and photographs of live specimens are given.

Keywords Opisthobranchs; new record; India; Andaman.

Proceedings of the International Academy of Ecology and Environmental Sciences
ISSN 2220-8860
URL: http://www.iaees.org/publications/journals/piaees/online-version.asp
RSS: http://www.iaees.org/publications/journals/piaees/rss.xml
E-mail: piaees@iaees.org
Editor-in-Chief: WenJun Zhang
Publisher: International Academy of Ecology and Environmental Sciences

1 Introduction

There are about 3000 described species of opisthobranchs from all over the world (Gosliner et al., 2008) and 40% from these have been found exclusively from Indo- Pacific region. The infra-class Opisthobranchia, falling under class Gastropoda of Phylum Mollusca consists of shelled as well as non-shelled animals commonly called as sea slugs. These are named so because of their slow and sluggish behaviour and are known for their striking shapes, colours and patterns. Despite of being so colourful, these animals are rare and cannot be easily seen due to their small size. Andaman and Nicobar Islands, which are situated in Bay of Bengal provides an ideal environment for existence of these animals to live and proliferate. But studies regarding these worms are still meagre from Andaman and Nicobar Islands as well as mainland coast of India.

The first study on Opisthobranchs in Indian waters was initiated in 1864 when Alder and Hancock published a work from south east coast of India. Some other major contributions of Eliot (1906, 1909, 1910 and 1916) in early nineties while in mid-nineties Narayana (1968 and 1969) made some reports on these animals. In recent past extensive works have been made especially in major reef areas of India i.e. Andaman

and Nicobar Islands and Lakshadweep by Apte (2009, 2012, 2014), Raghunathan et al. (2010), Apte et al. (2010) and Sreeraj et al. (2010, 2012a, b, c & 2013). A new species by the name of *Anteaeolidiella poshitra* was recently described from Gujarat (Carmoma et al., 2014).

2 Material and Methods

Specimens were hand-picked from the intertidal and sub tidal areas upto 35 meters on the reefs of Andaman and Nicobar Islands (Fig. 1) by employing Scuba diving. Specimens were photographed in-situ using Cannon G-15 with housing, collected in separate containers and brought to laboratory. Specimens were narcotised using MgCl2 and then fixed in 5% formalin and seawater and later preserved in 95% ethanol for further studies. The morphological features and measurements [length (mm) × width (mm)] of fixed specimens were examined using a stereo zoom microscope (Lecia, DFC-500). Identification was carried out based on the external morphology following Eliot (1910), Brunckhorst (1993), Gosliner et al. (2008); and two web-based portals, Nudi Pixel (http://www.nudipixel.net) and the Australian Museum's Seaslug Forum (http://www.seaslugforum.net/). All the identified materials were deposited in the National Zoological Collections at Zoological Survey of India, Andaman and Nicobar Regional Centre.

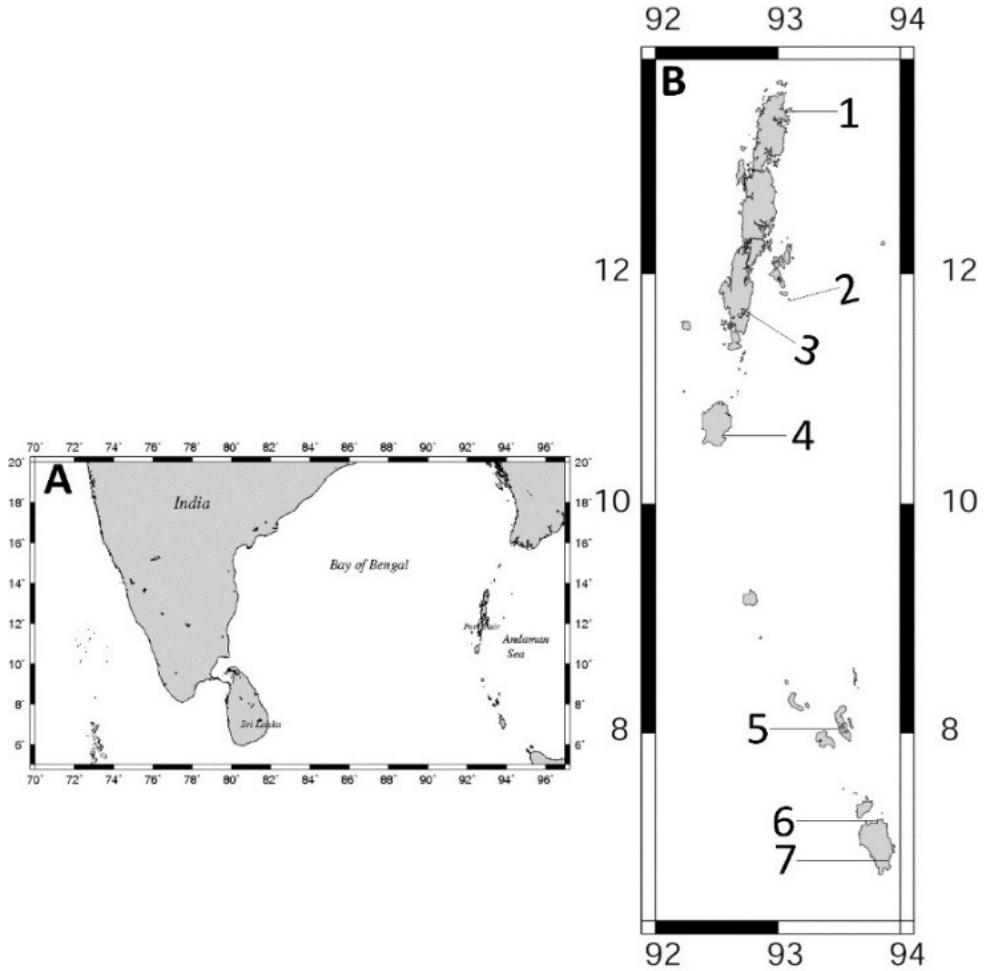

Fig. 1 (A) Position of Andaman and Nicobar Islands; (B) Collection sites: 1. Oliver Island; 2. Neil Island; 3. North Bay; 4. Hut Bay; 5. Kamorta Island; 6. Afra Bay; 7. Joginder Nagar

3 Results

SYSTEMATICS:
Phylum: Mollusca
Class: Gastropoda
Subclass: Heterobranchia
Infraclass: Opisthobranchia
Order: Sacoglossa
Family: Costasiellidae
Genus: *Costasiella* Pruvot-Fol, 1951

3.1 *Costasiella usagi* Ichikawa, 1993 (Fig. 2 a, b & c)
Material examined: Two specimens, ~ 3mm in length, found at Neil Island, South Andaman (11°50.792'N, 093°03.697'E), date: 18th August 2015, coll. by Sudhanshu Dixit, Registration no. ZSI/ANRC-12502
Diagnosis: Body small with non-pigmented head and tail; rhinophores black (black pigment starting slightly above from base). Dorsally covered with numerous cerata of variable colors. Centre cerata light green to white at apices; dark green cerata on sides; all with white apices. White striations easily visible on light coloured cerata. Small black eye spot present in middle of cerebral region.
Remarks: New record to India. Found crawling on sandy substratum. Previously recorded from Australia, Malaysia, Papua New Guinea, Philippines and Japan.

Order: Nudibranchia
Family: Discodorididae
Genus: *Halgerda* Bergh, 1880

3.2 *Halgerda formosa* Bergh, 1880 (Fig. 2 d, e & f)
Material examined: one specimen, ~ 5mm in length, found in intertidal area at Neil Island, South Andaman, (11°50.002'N, 093°00.889'E), date: 21st August 2015, coll. by Sudhanshu Dixit, Registration no. ZSI/ANRC-12511
Diagnosis: Body small and translucent with orange pigment on dorsal ridges. Some black spots of variable sizes were present near marginal area. Some small spots also present on middle dorsum. Rhinophores with black club and a tinge of black at base.
Remarks: New record to India. This species can be easily confused with *Halgerda toliara* which possess same colour ridges but lack black spots. The species has a wide range of distribution with records from South Africa, Comoro Islands, Tanzania, Mauritius, Reunion Islands, Western Australia and Thailand.

Family: Dendrodoridae
Genus: *Dendrodoris* Ehrenberg, 1831

3.3 *Dendrodoris guttata* (Odhner, 1917) (Fig. 3 i)
Material examined: One specimen, ~ 7 mm in length, found at Oliver Island, North Andaman, (13°00.038'N, 92°59.216'E), date: 12th October 2015, coll. by Sudhanshu Dixit, Registration no. ZSI/ANRC-12854
Diagnosis: Background body colour orange with numerous spots surrounded by white giving a halo appearance. Margin highly ruffled and rhinophores with half balck and half white tips.

Remarks: New record to India. Found underside of a *Porites* sp. coral. Previously recorded from Philippines, Australia, Japan and Indonesia.

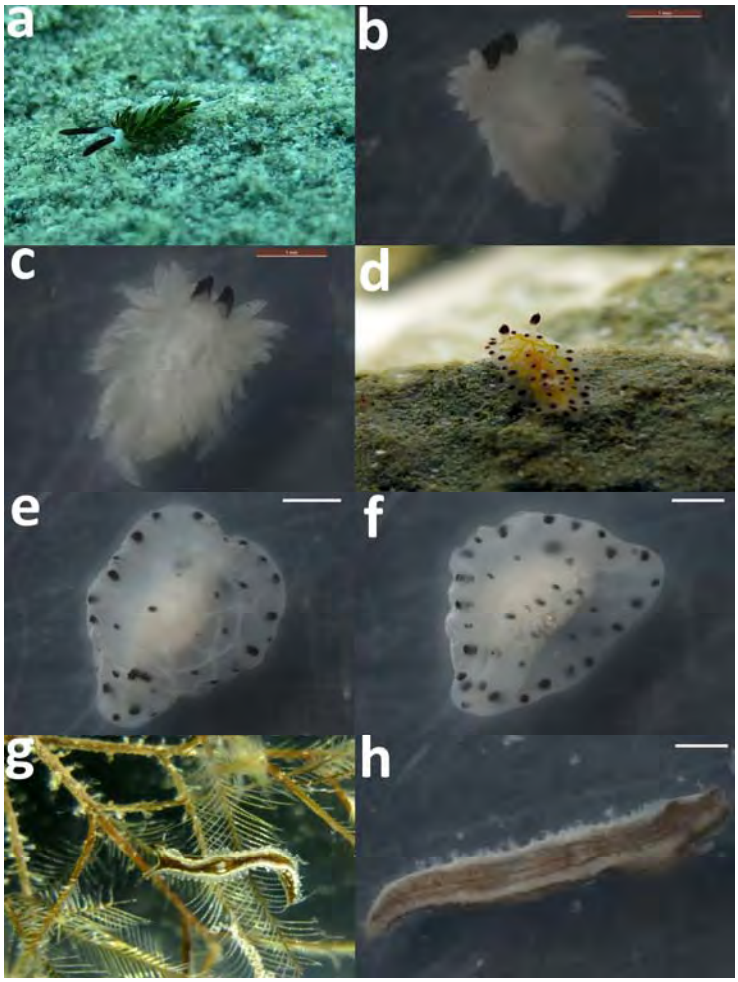

Fig. 2 (a) *Costasiella usagi*; (b) *C. usagi*- Dorsal view; (c) *C. usagi*- Ventral view; (d) *Halgerda Formosa* (e) *H. formosa*- Dorsal view; (f) *H. formosa*- Ventral view; (g) *Lomanotus vermiformis* (h) *L. vermiformis*- Dorsal view. Scale bar- b, c, e, f & h : 1 mm.

3.4 *Dendrodoris elongata* Baba, 1936 (Fig. 3 j)

Material examined: One specimen, ~ 20 mm in length, found at Kamorta Island, Nicobar, (13°00.038'N, 92°59.216'E), date: 16th December 2015, coll. by Sudhanshu Dixit, Registration no. ZSI/ANRC-13801

Diagnosis: Translucent body with light brown colour. Numerous dark brown spots and white stellate are present on dorsum. Body surface not smooth instead numerous small tubercles are present. Rhinophores thick and translucent with light brown clubs and white tips.

Remarks: New record to India. Previously recorded from Philippines, Australia, Japan, Fiji, Papua New Guinea, New Caledonia, Hawaii and Pacific coast of North America.

Family: Chromodorididae

Genus: *Miamira* Bergh, 1874

3.5 *Miamira magnifica* Eliot, 1910 (Fig. 3 k & l)

Material examined: One specimen, size 50 mm, Hut Bay, Little Andaman, India (10°37.789'N, 92°33.873'E), date: 19th November 2015, coll: Sudhanshu Dixit; Registration no.: ZSI/ANRC-13619

Diagnosis: Body large with numerous ridges. Three elevations between gills and rhinophores with smallest near rhinophore and highest near gills. Two small pustules also present before rhinophores. Body colours consists of light blue, dark blue, bright orange, yellow and pink. Dorsum spotted with big orange spots while mantle edge and foot spotted with yellow and yellowish orange spots. A dark blue broken line runs on both the sides of mantle. Rhinophores pockets raised slightly bordered with orange. Rhinophores stalk blue while clubs are orange. Gills large with a pinkish tinge.

Remarks: New record to India. Previously recorded from Australia, Indonesia, Papua New Guinea, Malaysia, the Philippines and Marshall Islands.

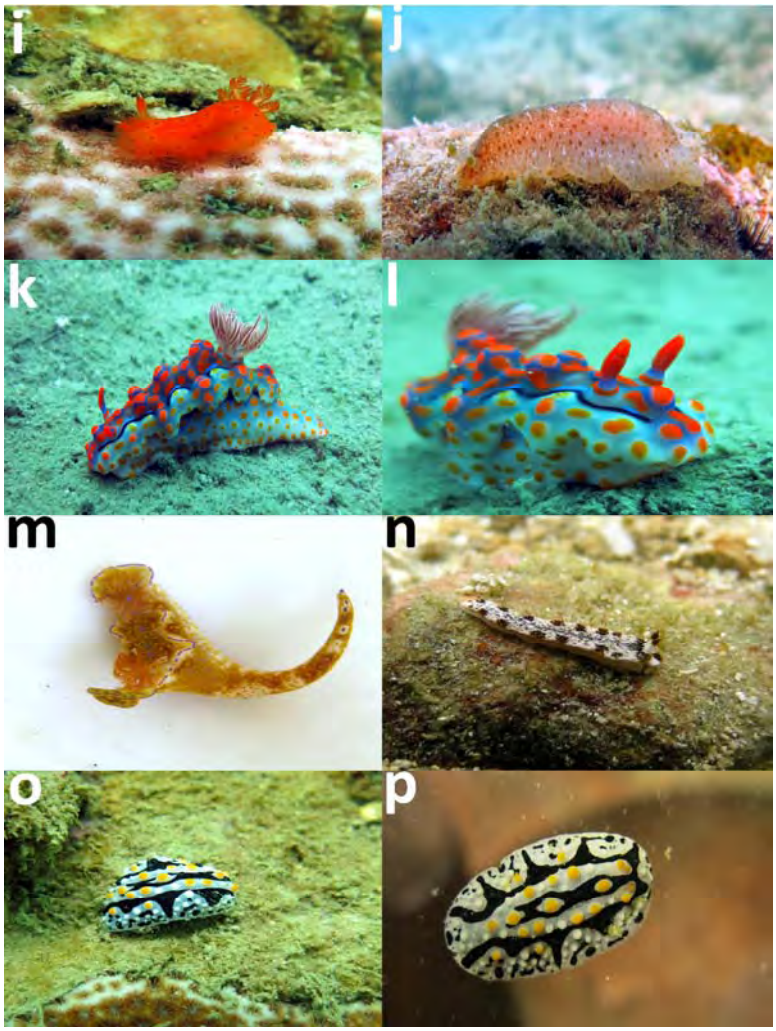

Fig. 3 (i) *Dendrodris guttata*; (j) *Dendrodoris elongata*; (k) *Miamira magnifica*; (l) *M. magnifica* – rhinophores; (m) *Ceratosoma tenue*; (n) *Dermatobranchus fortunatus*; (o) *Phyllidia exquisita*; (p) *P. exquisita*

Genus: *Ceratosma* A. Adams & Reeve, 1850

3.6 *Ceratosoma tenue* Abraham, 1876 (Fig. 3 m)

Material examined: One specimen, size 60 mm, Hut Bay, Little Andaman, India (10°37.789'N, 92°33.873'E), date: 19th November 2015, coll: Sudhanshu Dixit; Registration no.: ZSI/ANRC-13620

Diagnosis: Background colour cream with numerous dense orange spots; many purple spots also present at tail region and on dorsum. Three mantle lobes on each side of body and no mariginal lines between the lobes.

However, the lobes and remaining area is bordered by broken purple line. Purple tipped rhinophores and tail. Gills yellowish orange in colour.

Remarks: New record to India. This species is usually confused with *C. trilobatum* which possesses two lobes and a continuous purple line around the mantle. Previously recorded from Australia, Malaysia, Japan, South Africa, Mozambique, Tanzania, Indonesia, Papua New Guinea, New Caledonia, Hawaii and Korea.

Family: Phyllidiidae
Genus: *Phyllidia* Cuvier, 1797

3.7 *Phyllidia exquisita* Brunckhorst, 1993 (Fig. 3 o & p)

Material examined: One specimen, size 22 mm, Afra Bay, Great Nicobar Island, India (07°12.442'N, 93°46.324'E), date: 15th February 2016, coll: Sudhanshu Dixit; Registration no.: ZSI/ANRC-13960

Diagnosis: Background colour white with granulated appearance. Two median longitudinal white area on both sides of median black line with 3 big yellow pustules. Small poustules white in colour and mostly present on sides. Many black longitudinal swirls touching margins at equal intervals; smaller black swirls and spots also present near margin. Rhinophores yellow.

Remarks: New record to India. This is relatively smaller species than other Phyllids and was described with a yellow tinge on front mantle portion which is absent in the present specimen. Previously recorded from Australia, Malaysia, Japan, Indonesia, Papua New Guinea, Marshall Islands, Thailand and Palau.

Family: Lomanotidae
Genus: *Lomanotus* Vérany, 1844

3.8 *Lomanotus vermiformes* Eliot, 1908 (Fig. 2 g & h)

Material examined: One specimen, size 8 mm, 8 metres depth at North Bay, South Andaman , India (07°12.442'N, 93°46.324'E), date: 20th July 2015, coll: Sudhanshu Dixit; Registration no.: ZSI/ANRC-13958

Diagnosis: Body elongated and worm like; tapering towards end. Background colour brown with many longitudinal, curved and broken white lines on sides. Numerous transparent continuous cerata with white tips are present on ridges on either sides. .

Remarks: New record to India. As stated in earlier literature, this species was also found on stinging hydroid *Macrophynchia* sp.; was well camouflaged and moved wildly when detached from hydroid. Previously recorded from Red Sea, Indonesia, Papua New Guinea, Thailand and Philippines.

Family: Arminidae
Genus: *Dermatobranchus* van Hasselt, 1824

3.9 *Dermatobranchus fortunatus* (Bergh 1888) (Fig. 3 n)

Material examined: One specimen, size 5 mm, intertidal at Joginder Nagar, Great Nicobar Island, India (06°56.215'N, 93°55.007'E), date: 10th February 2016, coll: Sudhanshu Dixit; Registration no.: ZSI/ANRC-13956

Diagnosis: Body elongated and tapering towards end. Background colour cream with series of brown patches along the mantle edges. Orange pigment present on mantle edge along brown patches and oral covering. Mottling of cream and brown on dorsum. Bulbous rhinophores with brown apical part with white tips.

Remarks: New record to Andaman and Nicobar Islands. Unlike other members of Arminidae family, this species is devoid of any longitudinal ridges. Found under algae covered stone in intertidal area. Previously recorded from Gujarat, India; Red Sea; Indonesia; Papua New Guinea; Thailand, Singapore and Philippines.

4 Discussion

The Andaman and Nicobar Islands, situated in the Bay of Bengal possesses very bio-diversed coral reefs. This archipelago consists of 572 islands but only few are inhabited. As most of the areas are still untouched and unexplored, there is a whole lot of scope to conduct scientific studies and research in these islands. Likewise the unexplored area, the flora and fauna of these islands are also understudied. Opisthobranchs, despite being colourful and soundly studied from other parts of the world are still one of the lesser known marine fauna from Indian context. Therefore more number of intensive and taxonomic based surveys are to be conducted in order to discover new species and to reveal more about ecology of opisthobranchs from these islands.

Acknowledgement

The authors thank the Ministry of Environment, Forests and Climate Change, Government of India for providing the necessary facilities for carrying out the work.

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