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Note

Record of the sea slug, *Kalinga ornata* Alder & Hancock, 1864 from the inshore waters of Bay of Bengal along Chennai coast

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ABSTRACT

Sea slugs were caught in the trawl net operated off north Chennai at a depth of around 100-150 m during early hours of 24 June 2011. The specimens were classified and identified as *Kalinga ornata* and deposited in the Marine Biodiversity Museum of the Central Marine Fisheries Research Institute, Kochi (Accession code: DB. 40.1.1.). Although sea slugs have been found in these waters, there are limited studies on identification to the species level. *Kalinga ornata* was reported in India during 1936 from Kolkata and further there are no published reports on occurrence of this species along the east coast of India.

Keywords: Bay of Bengal, Chennai, *Kalinga ornata*, Sea slugs

Nudibranchs are lesser-known molluscan group, commonly called "sea slugs," which display fascinating variety of colors and body forms. A nudibranch feature that is unique to molluscs in general is the presence of radula, which is used to feed on sponges, corals, anemones, hydroids, bryozoans, tunicates, algae and sometimes other nudibranchs. The word nudibranch means "naked gill," as they have external gills. Some nudibranchs have gills towards the rear end, others have rows of respiratory projections called cerata situated along the body. Anterior end of the body of nudibranchs has a pair of rhinophores which are sensory organs that sense chemicals in the water. Both the gills and the rhinophores are also specialized organs for protection. Nudibranchs which belong to the subclass Opisthobranchia are among the least studied molluscs in India. The earlier works date back to 1880s by Alder and Hancock (1864) and Kelaart (1883). In recent times, Apte (2009), Apte *et al.* (2010), Apte and Bhawe (2011), Raghunathan *et al.*, (2010), Ramakrishna *et al.* (2010), Sreeraj *et al.* (2010) and Apte and Salahuddin (2011) studied opisthobranch fauna of India. The present study reports on the sea slugs collected from the inshore waters of Bay of Bengal along north Chennai coast, and its identification to the species level for the first time from the east coast India. The specimens are deposited in the Marine Biodiversity Museum of the Central Marine Fisheries Research Institute, Kochi (Accession code: DB.40.1.1.).

Sea slugs were caught among the bycatch in trawls operated along the coast of north Chennai at a depth of around 100-150 m during the early hours of 24 June 2011. The specimens were identified as belonging to the species, *Kalinga ornata*. It is the only species in the genus *Kalinga*. *Kalinga ornata* is a species of large, colorful nudibranch. The collected specimens were preserved in 70% (v/v) ethanol. Cross examination of the specimen was done by Garry Cobb, Australia (garry@nudibranch.com.au). For photographic documentation and detailed study, digital Kodak 6.2 Megapixel camera was used.

Two hundred specimens of sea slugs, *Kalinga ornata* were examined from Kasimedu Fishing Harbour, Chennai.

Description of the specimen

All the sea slugs collected belonged to a single species and were identified as *Kalinga ornata* (Fig. 1 and 2). The taxonomic position of the species is as follows:

Order/Clade : Nudibranchia
 Super family : Polyceroidea
 Family : Polyceridae
 Subfamily : Kalinginae
 Genus : *Kalinga*
 Species : *Kalinga ornata* (Alder & Hancock, 1864)

Broad body with rough dorsal side, the mantle skirt is reduced to form a tuberculate ridge which is continuous around the frontal margin. The tubercles are often

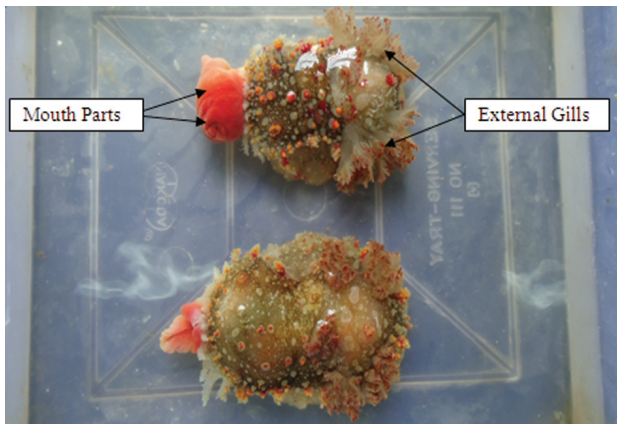


Fig. 1. Live specimen of *Kalinga ornata* (Alder & Hancock, 1864) : dorsal view.

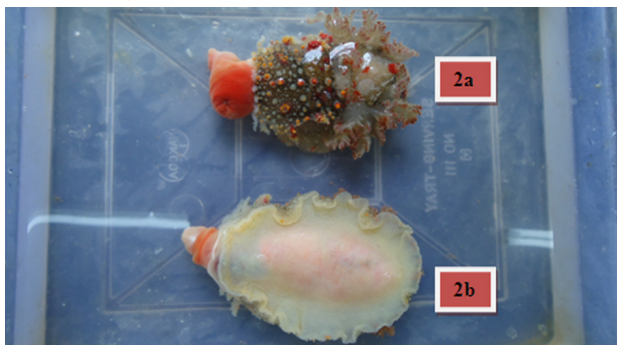


Fig. 2. Live specimen of *Kalinga ornata* (Alder & Hancock, 1864): dorsal (2a) and ventral view (2b)

arborescent and complex. Similar protrusions are also sometimes found on the sides of the body and on the dorsum. The rhinophores are lamellate and have low simple sheath. Oral tentacles form semicircular lobes. The

bipinnate or tripinnate gills form an arch in front of the anal papilla. The species was originally described by Alder and Hancock from Coromandel, India (Alder and Hancock, 1864). It has been found sporadically from isolated localities ranging from South Africa to the Hawaiian Islands. It is usually an inhabitant of subtidal waters at depth ranges from 16-36 m. *Kalinga ornata* is nocturnal, reaching about 130 mm and prefers sandy or silty substrate. It resides in the deep coastal waters of the Indo-West Pacific (though it has also been reported from Hawaii) from South Africa to China and Japan. The list of sea slug species reported from the Indian coast is presented in Table.1.

Sea slugs or nudibranch, are hermaphroditic, possessing both female and male sex organs, and reproduce by cross-fertilization. When nudibranchs reach maturity, they find a partner. Shortly after mating, they lay their eggs in a ruffled ribbon-like strand or in a cluster. The young may develop indirectly, hatching as free-swimming planktonic or pelagic larvae called veligers (the only time they have a shell); or they may develop directly into small, crawling, adult-like juveniles (Florida Fish and Wildlife Conservation Commission (FWC), USA).

Materials examined

The average total length and total weight of the specimens were 107.53 ± 3.93 mm and 48.73 ± 4.27 g respectively. The total mantle length and body width was 86.5 ± 3.58 and 60.8 ± 2.71 mm respectively (Table 2). Maximum and minimum lengths of the collected specimens were 146 and 55 mm respectively and weight ranged from 11 to 95 g. The gut content of the specimens comprised sand particles, sponge spicules, small bivalves and fish

Table 1. List of sea slugs/nudibranchs species reported from the Indian Coast

Species	Distribution	References
<i>Phyllidiella zeylanica</i>	Pirotan Island, Gulf of Kutch, Gujarat, India	Kelaart (1859), Narayanan (1968) Matwal and Joshi (2011)
<i>Kalinga ornata</i>	Coromandel Coast, India	Alder and Hancock (1864) Rao, K. V. (1936), Present Authors
<i>Chromodoris</i> sp., <i>Glossodoris</i> sp., <i>Phyllidia varicosa</i> , <i>Phyllidiella zeylanica</i> , <i>Thorunna australis</i> , <i>Elysia ornata</i> , <i>Pseudobiceros</i> sp.	Netrani Island off Karnataka, India	Zacharia <i>et al.</i> (2008)
<i>Phidiana militaris</i>	Bhandarpule, Maharashtra, India	Bhave (2009a)
<i>Phidiana militaris</i>	Arabian Sea/Indian Ocean; Kovalam Kerala, India	Kumar (2009a)
<i>Aplysia oculifera</i>	Arabian Sea/Indian Ocean; Kovalam, Kerala, India	Kumar (2009b)
<i>Aplysia oculifera</i>	Alawa, Mirya, Ratnagiri Maharashtra, India	Bhave (2009b)
<i>Thuridilla undula</i>	Nancowry Island, Andaman and Nicobar, India, Andaman Sea	Sreeraj <i>et al.</i> (2010)
<i>Thuridilla moebii</i>	Nancowry Island, Andaman and Nicobar, India, Andaman Sea	Sreeraj (2010)

Table 2. Morphometric characteristics of sea slug, *Kalinga ornata*

Serial number (N)	Total length (mm)	Total weight (g)	Total mantle length (mm)	Body width (mm)
1	70	10	42	32
2	55	7	43	26
3	73	11	53	33
4	82	19	60	38
5	120	47	98	55
6	120	92	98	90
7	147	95	127	80
8	130	65	105	74
9	115	76	91	80
10	130	85	107	80
11	146	65	111	75
12	130	71	102	72
13	128	57	104	70
14	105	45	85	62
15	90	34	72	53
16	95	49	77	60
17	125	60	100	70
18	120	50	100	65
19	95	40	70	62
20	112	53	92	60
21	110	57	90	66
22	120	56	100	60
23	100	46	80	58
24	113	47	93	60
25	115	67	93	65
26	95	36	80	55
27	90	24	72	50
28	100	22	80	58
29	95	21	80	50
30	100	55	90	65
Mean \pm SE	107.53 \pm 3.93	48.73 \pm 4.27	86.5 \pm 3.58	60.8 \pm 2.71

scales. The specimens are classified into one group and identified as a single species of the genus *Kalinga*.

The outer part of the mouth is red and can be seen through the mantle as a pink area. The inner part of the mouth is a white tube-like structure that project beyond the red part while feeding. Dorsal side is beautifully coloured with red spots and whitish background and ventral side is whitish (Fig. 2a, b). *K. ornata* possess both female and male sex organs. Internal ink gland is orange/yellowish and stomach grey in colour (Fig. 3a, b).

Although sea slugs are not consumed as food in India, they are known to possess anti-cancer, anti-tumor and anti-viral compounds useful in the pharmacological industry. Dolastatin-10, ILX651, Cemadotin and Kahalalide F are marine natural anti-cancer compounds derived from sea slugs which are under various stages of clinical trials (Haefner, 2003). However in India the sea slugs are considered as a low value bycatch and hence discarded or used for manure and fish feed production.

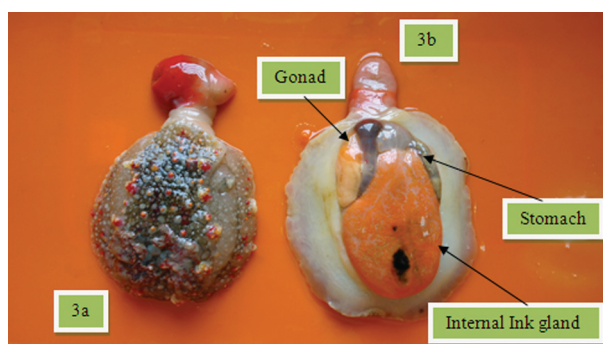


Fig. 3. Internal Organs of *Kalinga ornata* (Alder & Hancock, 1864): dorsal (3a) and ventral (3b) views.

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