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A first record of *Taringa caudata* (Farran, 1905) (Nudibranchia: Discodorididae) from India

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Taringa caudata belongs to the family Discodorididae. Presently it is known only from western Indian Ocean. It was first described by Kelaart (1858) as *Doris luteola* and as *Thordisa caudata* by Farran (1905) from Ceylon. Both these species were considered to be similar by Eliot (1906) and he changed the generic placement of *Doris luteola* to *Trippa luteola* (Kelaart, 1858) and synonymised *Thordisa caudata* (Farran, 1905) with Kelaart's species. *Taringa caudata* (Farran, 1905) was considered to be the valid name over the junior homonym *Doris luteola* Kelaart, 1858 (see Schroedl 2000, 2003).

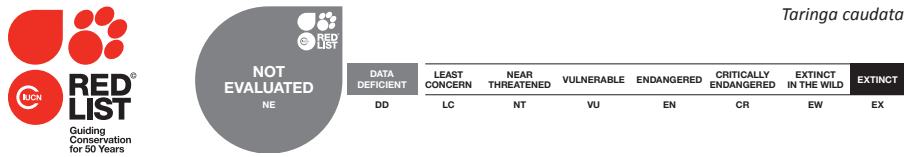
T. caudata is known only from western Indian Ocean, Sri Lanka (Kelaart 1858; Farran 1905), Madagascar (Eliot 1906), Tanzania (Gosliner & Behrens 1998), Chagos Archipelago (Yonow et al. 2002), Socotra Island (Sidorov 2006), Gulf of Oman (Claereboudt 2007) and Reunion Island (Flodrops 2009) comprise major records. The present work contributes to the first record of the genus and species from India.

Materials and Methods

The specimens were collected from Dwarka reef which is situated on the Saurashtra coast of Gujarat State (22°14'18.71"N & 68°57'27.61"E). The area is dominated by rocky substratum with tidal pools of various sizes (Image 1).

The present study was carried out between April and May 2013, as a part of the All India Co-ordinated Project on the Taxonomy of Mollusca, funded by the Ministry of Environment, Forest and Climate Change, Government of India. The specimens were manually collected from the intertidal area, and photographed in-situ using Canon D-10 camera with housing. The GPS readings were taken using a Garmin eTrex H Handheld GPS Navigator. The location map was prepared by using Quantum GIS (ver 1.8.0).

Live specimens were collected and measured on site. A few specimens were preserved in 100% ethanol for DNA extraction and a few in 4% formaldehyde



Taringa caudata

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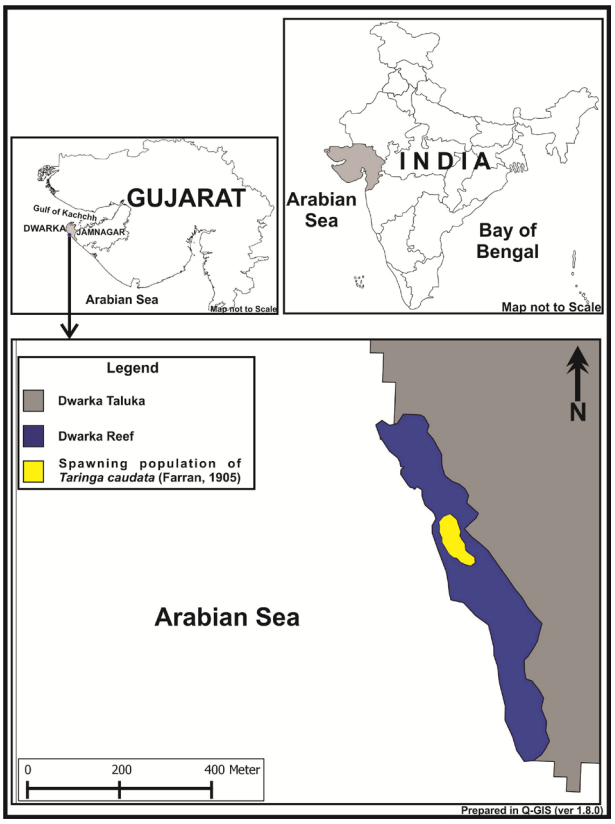

Image 1. Map showing location of recorded species from Dwarka, Gujarat, India.

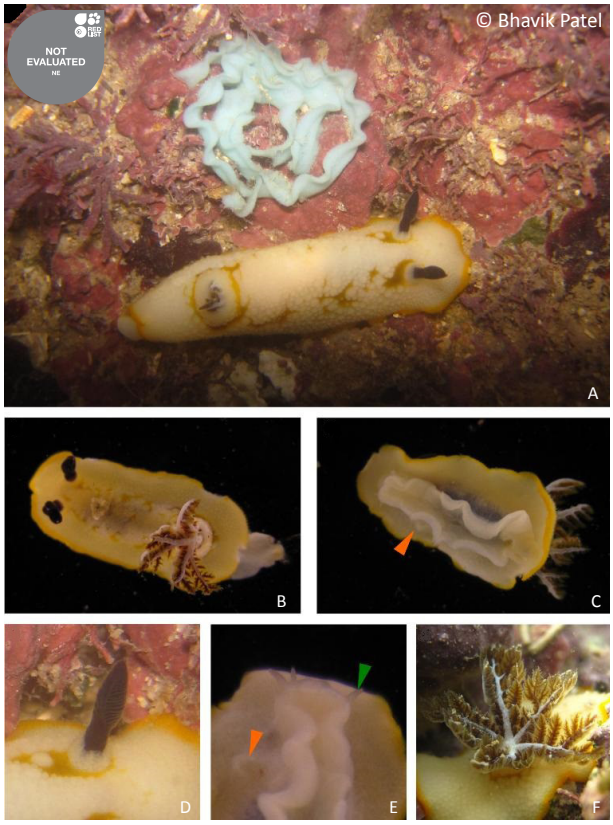

Image 2.*Taringa caudata* A -Adult specimen with greenish-blue egg case; B - Juvenile specimen showing extended foot; C - Ventral side showing foot, mantle and genital opening; D - Lamellate rhinophore; E - Oral tentacles; F - Gills

solution. The preserved specimens were deposited in the reference collection (BNHS-Opistho-963, 967, 968) of the Bombay Natural History Society. A specimen (of BNHS-Opistho-963) was dissected to study the radula, digestive system and reproductive system.

The total genomic DNA was extracted. Amplification was carried out using the protocol and PCR condition described elsewhere (Folmer et al. 1994). The successfully amplified product was sequenced bi directionally with respective primers. Sequences were deposited in the GenBank (www.ncbi.nlm.nih.gov/Genbank) databases for future references with Accession Number: KF834834.

Results

Morphology: Roughly rectangular body; off white to cream yellow body colour; irregular yellow patches arranged in two non-continuous lines and forming a circle around gills and rhinophores (not present in all specimens); many minute tubercles of various sizes on the dorsum; yellow mantle margin (Image 2A,B); rhinophores black with upper half lamellate and base covered with tiny white tubercles; 18(±2) lamellae; white bluntly pointed rhinophore tip (Image 2C). Elevated gill pocket with six long gills with brown-grey rachis; large gills (ratio to body) which cover whole posterior body part having brown pinnae and pinnules (Image 2D); foot and oral tentacles white in colour; extended foot behind mantle (Image 2E,F).

Digestive system: Buccal mass large and muscular with anterior end having thin chitinous labial cuticle. Stomach directly connected to the long and straight intestine with visible pale coloured digestive glands (Image 3A). It was noted that the stomach was full of the bluish-green haplosclerid sponge, suggesting it was the main food source. The anatomy showed a cerebral ganglion (Image 3B).

Radular morphology: Radula elongated, the radular formula is 34 X 35–37.0.35-37. Teeth are hook shaped with a small single denticle on the cusp mainly observed within mid lateral teeth. The middlemost teeth are smaller, their size gradually increase until the last 3–4 teeth; rachidian teeth absent; but median thickening (vestigial rachidean teeth) were observed between the middle rows of the radula (Image 3C,D,E,F).

Reproductive system: Ampulla is thick, elongate and

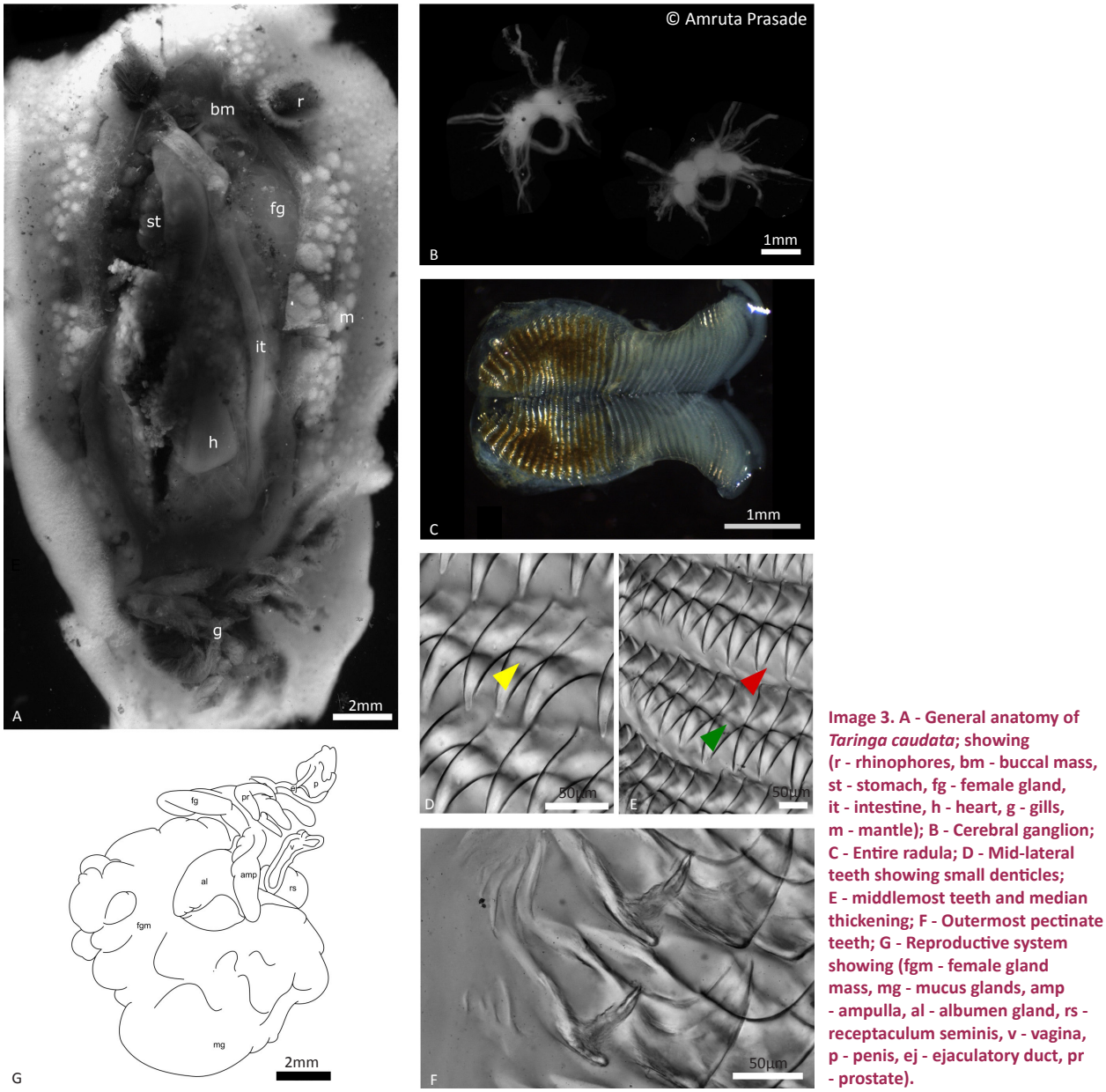

Image 3. A - General anatomy of *Taringa caudata*; showing (r - rhinophores, bm - buccal mass, st - stomach, fg - female gland, it - intestine, h - heart, g - gills, m - mantle); B - Cerebral ganglion; C - Entire radula; D - Mid-lateral teeth showing small denticles; E - middlemost teeth and median thickening; F - Outermost pectinate teeth; G - Reproductive system showing (fgm - female gland mass, mg - mucus glands, amp - ampulla, al - albumen gland, rs - receptaculum seminis, v - vagina, p - penis, ej - ejaculatory duct, pr - prostate).

tubular and narrows further and bifurcates into oviduct and vas deferens. Ejaculatory portion looped. Female gland with large soft mucus gland and orange albumen glands. Reproductive structure (Image 3G) matches with the description by Gosliner & Behrens (1998) which confirms the identification of the species.

Discussion and Conclusions

Overall morphological descriptions from previous literature (Kelaart 1858; Gosliner & Behrens 1998; Yonow et al. 2002), anatomical descriptions like the presence of denticles on radular teeth and presence of a vestigial row of rachidian teeth confirms the present species as *Taringa caudata*.

This species was found in a shallow intertidal pool of Dwarka reef, a similar habitat to that described by Kelaart (1858) in Sri Lanka. However, Yonow et al. (2002) found it at a depth of 6m. The present specimens were observed in varied ranges of length, from 15–50 mm (30 specimens) as compared to 28mm (Yonow et al. 2002) and 15–22 mm (Gosliner & Behrens 1998). Our specimens lacked a black line on the gills which was observed by Gosliner & Behrens (1998) but have an extended foot beyond mantle which was not mentioned by either Gosliner & Behrens (1998) or Yonow et al. (2002). Kelaart (1858) mentioned egg ribbon colour as

light green whereas we found it to be greenish-blue.

There were two distinct age groups of specimens observed in the present study. One, which was collected during April 2013, were juveniles measuring 15–21 mm and had a less intense marking of yellow colour (Image 2B). The collection made in May 2013, comprised adults (42–50 mm) and the specimens had a more intense yellow colour marking and were laying eggs (Image 2A).

In the present study, the new record of *Taringa caudata* from India makes a significant addition to the Discodorid fauna of the country. Although known only from the western Indian Ocean, the current record extends the distribution of this rare species up to the Indian subcontinent.

The DNA sequence has been uploaded on to the NCBI database for the first time for this species; which marks in a significant contribution to the global molecular studies on the family Discodorididae.

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