

Diversity of Tonnoidea (Mollusca: Gastropoda) from Kerala, with new species records to the west coast of India

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ABSTRACT

The superfamily Tonnoidea, encompassing frog shells, tuns, tritons, and helmet shells, constitutes a diverse assemblage of marine predatory gastropods within the order Caenogastropoda. This study records the presence of 27 Tonnoidean gastropod species along the coastline of Kerala. *Malea pomum* (Linnaeus, 1758), *Korrigania awatii* (Ray, 1948), *Guttarium muricinum* (Roding, 1798), *Ranularia sarcostoma* (Reeve, 1844), *Tutufa tenuigranosa* (E. A. Smith, 1914), and *Distorsio muehlhaeusseri* Parth, 1990 emerge as new records for the west coast of India. Additionally, five species, namely *Bufo naria granosa* K.Martin, 1884; *Dulcerana granularis* (Röding, 1798); *Distorsio anus* (Linnaeus, 1758); *Monoplex parthenopeus* (Salis Marschlin, 1793), and *Gyrineum perca* (Perry, 1811), represent new records for the Kerala coast. The family Cymatiidae takes precedence in species representation with 10 identified species, followed by Bursidae with 8 species. Notably, Sakthikulangara and Neendakara exhibit the highest species diversity with 13, closely followed by Azheekkal with 11 species. The diversity indices underscore the ecological significance of tonnoidean gastropods along the Kerala coast, with a Simpson Dominance Index of 0.8512, Shannon Weiner diversity index of 2.185, and an evenness index of 0.3293, indicating a relatively high diversity, with a few species dominating the area.

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1. Introduction

The superfamily Tonnoidea, commonly recognized as frog shells, tuns, tritons, and helmet shells, comprises a well-established and diverse assembly of moderate to large-sized predatory marine gastropods within the order Caenogastropoda. This family plays a crucial role in supporting inshore fisheries resources in tropical and subtropical waters (Zhong et al., 2020). Tonnoidea members are highly sought after by shell collectors globally due to the allure of their elegant shells (Strong et al., 2019). Moreover, these gastropods are not only prized for their aesthetic value but are also consumed as food. Notably, shells of *Bufo naria rana* find use in traditional Chinese medicine for treating ulcers (Ahmad et al., 2018).

Tonnoideans are predatory gastropods with a preference for feeding on echinoderms and various other invertebrates, including polychaetes, sipunculans, barnacles, ascidians, and sponges, among others (Houbrick and Fretter, 1969; Riedel, 1995; Andrews et al., 1999; Morton, 1991, 2012). According to Strong et al. (2019), the global representation of the Tonnoidea superfamily encompasses 360 valid species distributed across nine families: Bursidae Thiele, 1925, Cassidae Latreille, 1825, Charonidae Powell 1933, Cymatiidae Iredale 1913 (1854), Laubierinidae Warén & Bouchet, 1990, Personidae Gray, 1854, Ranellidae Gray, 1854, Thalassocyonidae F. Riedel 1994, and Tonnoidea Suter, 1913 (1825). One distinguishing feature of Tonnoidea members is their exceptionally long larval stages known as ‘teleplanic larvae’ (Scheltema, 1971). This characteristic contributes to their extensive transoceanic distribution (Sanders et al., 2017).

In Indian waters, the Superfamily Tonnoidea is represented by members from all families except Laubierinidae and Thalassocyonidae. Efforts to chronicle the diversity of Tonnoidean fauna in Indian waters commenced with Smith

(1895) and progressed through subsequent studies by Ray (1949), Satyamurthi (1952), Menon et al. (1961), Sundaram et al. (1969), Gopalakrishnan (1970), Unnithan (1976), Rajagopal and Mookherjee (1982), Mookherjee (1985), Tikader and Das (1985), George et al. (1986), Tikader et al. (1986), Appukuttan et al. (1989), Pinn (1990), Rao and Rao (1991), Nagabhusanam and Krishnan (1993), Rao et al. (1991, 1994), Rajagopal et al. (1998), Beu (1998), Rao and Dey (2000), Jaiswar and Kulkarni (2001), Fernando and Fernando (2002), Hylleberg and Kilburn (2002), Raganathan et al. (2003), Subbarao (2003), Dholakia (2004), Appukuttan and Joseph (2005), Raut et al. (2005), Samuel et al. (2005), Zacharia et al. (2008), Mascaranhas and Ingole (2009), Ramesh et al. (2009), Harzhauser et al. (2009), Datta et al. (2008, 2010), Mohanraj et al. (2010), Pati et al. (2011), Tripathi et al. (2012), Venkatraman and Venkataraman (2012), Venkatraman et al. (2012), Chelladurai et al. (2013), Elaiyaraja et al. (2013), Murugesan et al. (2013), Prabhu et al. (2013), Puri (2013), Apte (1998, 2004, 2014), Vadher et al. (2014), Mahapatro et al. (2015), Tudu et al. (2018), Tudu & Mohapatra (2020), and Edward et al. (2022).

A review of the existing literature focused on Tonnoidea from the Kerala coast reveals a scarcity of information, with notable exceptions in the works of Cheriyan (1968), Philip and Appukuttan (1995, 1997), Pillai et al. (1999), Biju Kumar (2008), Franklin and Laladhas (2014), and Ravinesh and Bijukumar (2015). The present study addresses this gap by documenting the diversity of twenty-seven Tonnoidean gastropod species from the Kerala coast. Additionally, it provides a systematic account of seven species that are new records for the west coast of India.

2. Materials and Methods

Gastropods examined in the current study were sourced from a variety of habitats encompassing fishing harbors,

fish landing centers, rocky intertidal and subtidal zones, artificial sea walls, mangroves, and sandy beaches along the extensive 590 km coastline of Kerala from 2017 to 2022. The primary study locations chosen included Mulloor (08° 22' N., 77° 00' E.), Vizhinjam (08° 22' N., 76° 59' E.), Kovalam (08° 23' N., 76° 58' E.), Sakthikulangara (08° 55' N., 76° 32' E.), Neendakara (08° 56' N., 76° 32' E.), Thoppumpady (09° 56' N., 76° 15' E.), Munambam (10° 10' N., 76° 10' E.), Ponnani fishing harbour (10° 46' N., 75° 54' E.), Beypore (11° 10' N., 75° 48' E.), Puthiyappa (11° 18' N., 75° 44' E.), Chompal (11° 39' N., 75° 32' E.), Thalassery fishing harbour (11° 44' - 56' N., 75° 18' - 29' E.), Azhikkal (9° 08' N., 76° 27' E.), Madakkara (11° 56' N., 75° 17' E.), Dharmadam (11° 46' N., 75° 27' E.), Muzhuppilangad (11° 46' N., 75° 26' E.), Hosdurg fish landing centre (12° 18' N., 75° 04' E.) and Manjeshwaram (12° 43' N., 74° 52' E.). The shells were photographed using Olympus TG-5 and Nikon D90 digital cameras. Morphological measurements of the shell were made using a digital vernier calliper by orienting the shell with the spire up and the aperture facing the viewer and identified through conventional taxonomic methods (Satyamurthi, 1952; Beu, 1981; Apte, 1998, 2012; 2015; Rao, 2003; Robin, 2008; Franklin and Laladhas, 2014; Edward *et al.*, 2022). Species diversity indices such as the Shannon-Wiener index (H), Simpson Dominance Index (D) and Evenness index (E) (Magurran, 1988), were calculated using PAST software (Hammer *et al.*, 2001). The collected specimens are deposited at the museum collections of Department of Aquatic Biology and Fisheries, University of Kerala, India.

3. Results and Discussion

The research, spanning 17 distinct sites along the Kerala coast, documented the presence of 27 gastropod species within the Superfamily Tonnoidea. Among these, six species represent new records for the west coast of India, while five species are newfound in Kerala. The family Cymatiidae exhibited notable species dominance with ten identified species, followed by Family Bursidae with eight species. Families Cassidae, Tonnididae, and Personidae each contributed three species (Table 1; Fig. 1).

Upon scrutinizing species distribution across various study sites, Sakthikulangara fishing harbour yielded the highest number of species, followed by Neendakara (13) and Azheekkal (11). Additional study sites, including Ponnani (9), Puthiyappa (8), Madakkara, and Hosdurg (7 each), contributed to species diversity. Beypore (6), Chompal (5), Thoppumpadi, and Vizhinjam (4 each) exhibited moderate diversity, while Kovalam (3), Mulloor (2), and Thalassery, Dharmadam, and Manjeshwaram (1 each) contributed to species variation (Fig. 2). The considerably higher population density observed in Sakthikulangara, Neendakara, and Azheekkal fishing harbors is attributed to the impact of bottom trawling on benthic communities.

Currently, the total number of gastropods belonging to the superfamily Tonnoidea from east coast and adjacent waters is estimated to be 57 species (Edward *et al.*, 2022). Amongst the 27 species of gastropods collected in the present

study, *Bufonaria crumena* (Lamarck, 1816) (Bursidae) was the most dominant species, followed by *Bufonaria echinata* (Link, 1807) (Bursidae) and *Phalium glaucum* (Linnaeus, 1758) (Cassidae). The study also recorded the presence of six species, *Malea pomum* (Linnaeus, 1758), *Korrigania awatii* (Ray, 1948), *Gutturium muricinum* (Roding, 1798), *Ranularia sarcostoma* (Reeve, 1844), *Tutufa tenuigranosa* (E. A. Smith, 1914) and *Distorsio muehlhaeusseri* Parth, 1990) as new records to the west coast of India and five species namely *Bufonaria granosa* K.Martin, 1884, *Dulcerana granularis* (Röding, 1798), *Distorsio anus* (Linnaeus, 1758), *Monoplex parthenopeus* (Salis Marschlin, 1793), and *Gyrineum perca* (Perry, 1811) as new records to Kerala coast.

A detailed description of the 6 species new to the west coast of India is given below.

3.1. Systematic Account

Superfamily Tonnoidea

Family: Tonnididae Suter, 1913 (1825) (Tun Shells)

Genus: *Malea* Valenciennes, 1832

3.1.1. *Malea pomum* (Linnaeus, 1758) (Fig. 3 a-e)

Common names: Pacific Grinning Tun, Apple Tun, Grinning Tun

Distribution: Indo-West Pacific

Material examined: 02

Measurements: Shell length: 66.11-65.13mm; Shell width: 49.54- 47.33mm; Aperture length: 43.28- 42.15mm; Aperture width: 10.64-9.76mm; Spire height: 20.52-18.92mm

Description: Shell medium-sized, ovate, solid; spire short; apex pointed; whorls seven; body whorl moderately large, inflated; sutures weakly incised; surface sculpture composed of twelve strong rounded ribs separated by shallow grooves; aperture narrow; outer lip thick, reflected, widening posteriorly, with strong inwardly pointing teeth, anteriorly forming outwardly radiating spine like structures; columella plicate on either side, slightly concave at the base; parietal callus closing umbilicus. Colour white, columella cream in colour.

Remarks: *Malea pomum* is characterised by its small size, thick, polished shell, low spire, low, wide, smooth spiral cords, concave interspaces, and thick and strongly dentate outer lip. Sundaram *et al.* (1969) recorded the presence of this species from Kilakkarai along the east coast of India. Appukuttan *et al.* (1989) and Rao and Rao (1991) recorded the presence of this species from Lakshadweep. Rao *et al.* (1994), Rao and Dey (2000) and Rao (2003) recorded the presence of this species from the Andaman and Nicobar Islands. Apte (2014) recorded the presence of this species from the Gulf of Mannar on the east coast of India and the Andaman and Nicobar Islands. This is the initial report of the species from the west coast of India.

Family: Bursidae Thiele, 1925 (Purse shells)

Genus: *Korrigania* M. T. Sanders, Merle, Laurin, Bonillo & Puillandre, 2020

Table 1. List of Tonnoidea (Mollusca: Gastropoda) documented from Kerala coast, India

Sl No	Taxonomic Status	Locality	No. of specimens	Habitat	Remarks
1	Superfamily: Tonnoidea Family: Bursidae <i>Bufonaria crumena</i> (Lamarck, 1816)	AZ, BY, CH, HO, MD, MU, NE, PO, PU, SA, TP	429	Sandy, muddy substrates	
2	<i>Bufonaria echinata</i> (Link, 1807)	AZ, BY, CH, HO, MD, MU, NE, PO, PU, SA, TP	419	Sandy, muddy substrates	
3	<i>Bufonaria granosa</i> K.Martin, 1884	AZ PO, SA	06	Continental Shelf; deep muddy substrates	New record to Kerala
4	<i>Bufonaria rana</i> (Linnaeus, 1758)	PO	01	Continental shelf	
5	<i>Dulcerana granularis</i> (Röding, 1798)	AZ, NE, PU, SA.	07	Shallow subtidal	New record to Kerala
6	<i>Korrigania awatii</i> (Ray, 1948)	SA, NE	4	Deep water	New record to west coast of India
7	<i>Tutufa rubeta</i> (Linnaeus, 1758)	SA	06	Continental shelf	
8	<i>Tutufa tenuigranosa</i> (E. A. Smith, 1914)	SA	01	Continental shelf	New record to West coast
9	Family: Cassidae <i>Cassis cornuta</i> (Linnaeus, 1758)	SA	1	Continental Shelf	In Schedule I-Par IV-B of WPA of India
10	<i>Phalium glaucum</i> (Linnaeus, 1758)	AZ, BY, CH, HO, MD, MU, NE, PO, PU, SA, TP.	213	Intertidal, shallow subtidal, sandy substrates	
11	<i>Semicassis bisulcata</i> (Schubert & Wagner, 1829)	AZ, BY, CH, HO, MD, MU, NE, PO, PU, SA, TP.	152	Continental shelf, subtidal	
12	Family: Cymatiidae <i>Gutturium muricinum</i> (Röding, 1798)	SA	01	Intertidal	New record to west coast
13	<i>Linatella caudata</i> (Gmelin, 1791)	AZ, HO, KO, MU, PO, SA, VZ	67	Sandy substrates in mesolittoral zone	
14	<i>Lotoria triangularis</i> (Perry, 1811)	KO, ML, VZ	15	Intertidal Rocky Shore	
15	<i>Monoplex parthenopeus</i> (Salis Marschlin, 1793)	VZ	01	Intertidal	New record to Kerala
16	<i>Monoplex pilearis</i> (Linnaeus, 1758)	SA, VZ	05	Continental shelf, Intertidal	
17	<i>Ranularia sarcostoma</i> (Reeve, 1844)	SA	02	Subtidal	New record to west coast
18	<i>Ranularia tripus</i> (Lamarck, 1822)	NE	01	Subtidal.	
19	<i>Gyrineum bozzettii</i> Beu, 1998	AZ, NE, PU SA	44	Continental shelf	
20	<i>Gyrineum natator</i> (Röding, 1798)	AZ, DH, HO, KO, MJ, ML, NE	150	Continental shelf; sandy substrates; intertidal	
21	<i>Gyrineum perca</i> (Perry, 1811)	SA	02	Continental shelf	New record to Kerala
22	Family: Personidae <i>Distorsio anus</i> (Linnaeus, 1758)	NE	01	Continental shelf	New record to Kerala
23	<i>Distorsio muehlhaeusseri</i> Parth, 1990	SA	01	Continental shelf	New record to West coast
24	<i>Distorsio reticularis</i> (Linnaeus, 1758)	AZ, BY, HO, MD, NE, PO, PU, SA.	89	Sub littoral; Continental shelf, Subtidal; Rocky shores	
25	Family: Tonnididae <i>Malea pomum</i> (Linnaeus, 1758)	SA, TY	02	Deep Sandy substrates	New record to west coast of India
26	<i>Tonna canaliculata</i> (Linnaeus, 1758)	MD. NE, SA	26	Sandy substrates	
27	<i>Tonna tessellata</i> (Lamarck, 1816)	AZ, BY, CH, MD, NE, PO, PU, SA	167	Sandy substrates; sublittoral	

Abbreviations: ML- Mulloor, KO- Kovalam, VZ- Vizhinjam, SA- Sakthikulangara, NE- Neendakara, TP- Thoppumpadi, MU- Munambam, PO- Ponnani, PU- Puthiyappa, BY- Beypore, CH- Chombal, TY- Thalassery, DH- Dharmadam, AZ- Azheekal, MD- Madakkara, HO- Hosdurg, MJ- Mancheswaram; WPA: Wildlife (Protection) Act of India

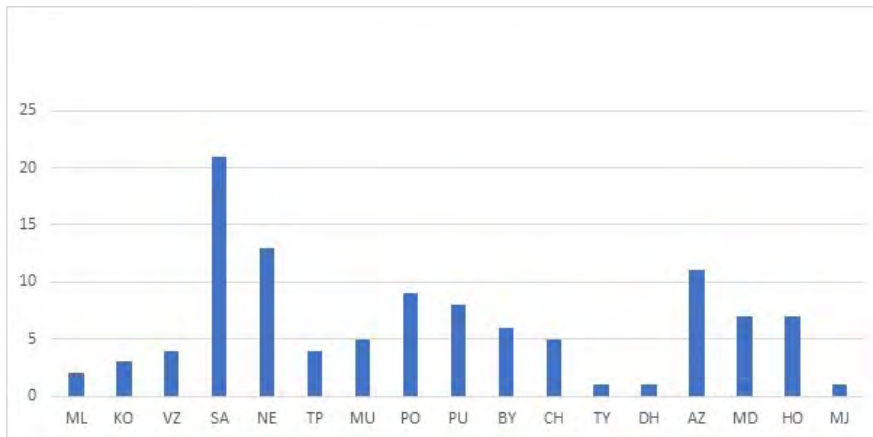


Fig. 1. Number of gastropod species recorded from different localities along Kerala coast. Abbreviations as in Table 1

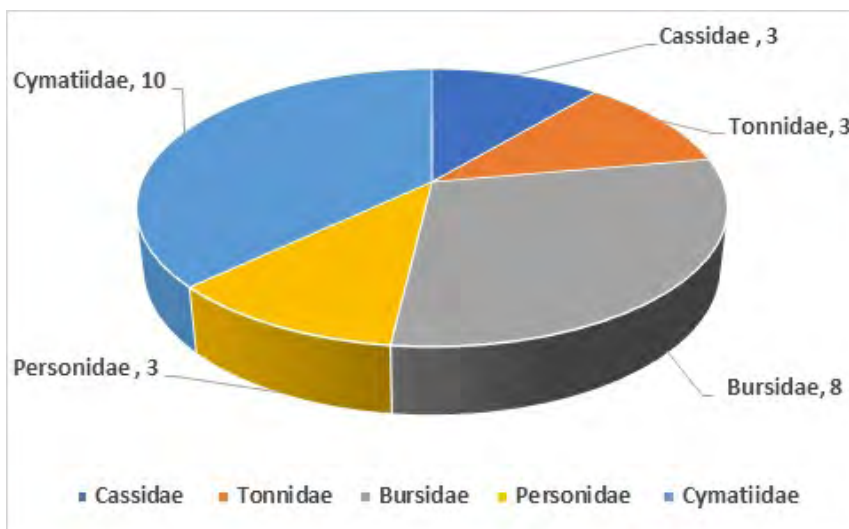


Fig. 2. Family-wise representation of species diversity under superfamily Tonnoidea from Kerala coast



Fig. 3. *Malea pomum* (Linnaeus, 1758)

Table 2. Diversity Indices of gastropods belonging to Superfamily Tonnoidea from Kerala

Category	TOTAL
Taxa_S	27
Shannon_H	2.185
Simpson_1-D	0.8512
Evenness_e^H/S	0.3293

3.1.2. *Korrigania awatii* (Ray, 1948) (Fig. 4 a-f)

Common names: Bohol Frog Shell, Awati's Frog shell

Distribution: Bay of Bengal, Somalia, Philippines, Indian Ocean; Tropical Indo-West Pacific: Central and East Indian Ocean; Eastern Indian Ocean: India; East Africa: Somalia; Indo-Malaysia.

Materials examined: 4

Measurements: Shell length: 39.39- 48.09mm; Shell width: 25.34- 29.07mm; Aperture length: 14.38-17.94mm; Aperture width: 8.72- 11.43mm.

Description: Shell medium-sized, thin; solid, elongate; spire elevated; pointed; dorsoventrally compressed; sculpture composed of spirally arranged close-set rows of beaded granules; sutures prominent; strong prominent varices on body whorl and whorls adjacent to body whorl; aperture ovate, interior strongly toothed; inner margin of outer lip frilled; columella plicate with concave margin. Ground colour white with extremities of varix near the aperture tinged with brown. Operculum oval in shape with paucispiral nucleus.

Remarks: The record of this species from the east coast is provided in the works of Ray (1949), Rajagopal and Mookherjee (1982) and Das (2003). This is the initial report of the species from the west coast of India.

Genus: *Tutufa* Jousseaume, 1881**3.1.3. *Tutufa tenuigranosa* (E. A. Smith, 1914)** (Fig. 5 a-f)

Common name: Frog Shell

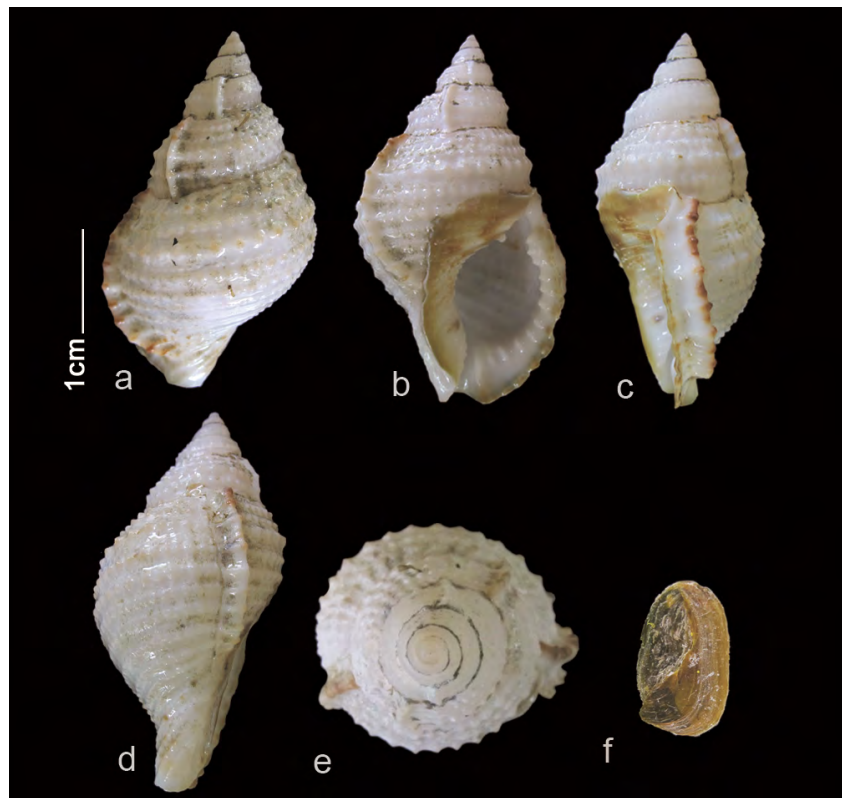
Distribution: Off Hong Kong, South China Sea; Taiwan; Philippines; Australia; North West Oceanic; Indo Malaysia; Indo China: China, Taiwan.

Material examined: 01

Measurements: Shell length: 139.37mm; Shell width: 77.76mm; Aperture length: 49.59mm; Aperture width: 25.50mm

Description: Shell very large, solid, stout and ovately conical; spire tall; apex pointed; shape narrow; surface finely sculptured with varices and spiral cords covering numerous small granules all over; peripheral row of nodules narrow; clearly defined rows of small granules seen over the shell surface; peripheral nodules are uniformly wide and bifid; one prominent nodulose spiral cord encircling the middle region of body whorl; aperture white; outer lip thick and thrown into irregular flares; interior margin of outer lip toothed, anterior and posterior canals are formed anteriorly as a narrow tube; columella with plications at anterior region getting more prominent towards the base. Colour creamy white with a few scattered pale brown flecks. Aperture pure white.

Remarks: The species is unique with its tall spire, narrow shape, narrow peripheral row of nodules and finely sculptured surface, bearing narrow, prominent rows of small granules over the entire teleoconch, becoming even more prominent on the concave sutural ramp. The tall spire and narrow shape of *T. tenuigranosa* make it different from *T. rubeta*. Outer lip is more flared and irregular than in *T.*

**Fig. 4.** *Korrigania awatii* (Ray, 1948)

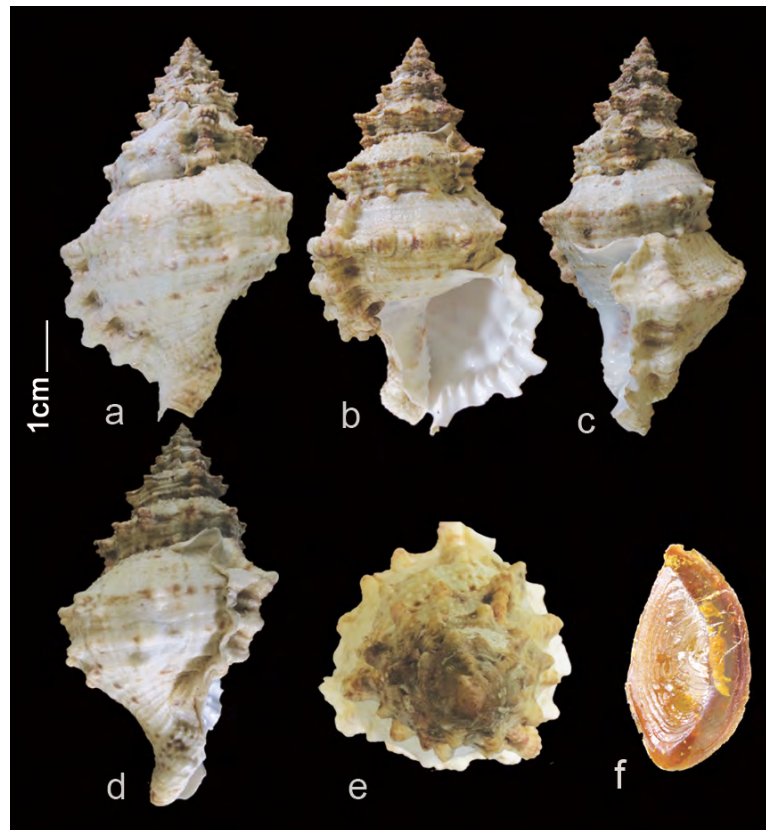


Fig. 5. *Tutufa tenuigranosa* (E. A. Smith, 1914)

rubeta. Shell more elongated and an elevated spire when compared to *T. rubeta*. Sculpture is also less dense than in *T. rubeta*. *T. tenuigranosa* was initially recorded in Taiwan, the Philippines, and Indonesia by Beu (2005). This species was recorded by Edward et al. (2022) from east coast and the present report marks the initial record of the species from west coast of India.

Family: Personidae Gray, 1854 (Distorted tritons)

Genus: *Distorsio* Röding, 1798

3.1.4. *Distorsio muehlhaeusseri* Parth, 1990 (Fig. 6 a-e)

Common name: Nil

Distribution: Tropical Indo-West Pacific: Indo Malaysia; Philippines: Visayan: Cebu: Bantayan Island, Mactan, Bohol, Central Philippines.

Material examined: 01

Measurements: Standard length: 57.56mm; Standard Width: 34.32mm; Aperture Length: 7.19mm; Aperture width: 5.01mm; Spire height: 31.9mm.

Description: Shell moderately large; slightly distorted; protoconch composed of two whorls; spire slightly raised with pointed apex; teleoconch with eight whorls; spiral sculpture composed of three spiral cords on initial teleoconch whorls, secondary spiral cord visible on fourth and sixth whorls; varices ten; axial cords forming small nodules at the region of intersection of spiral cords; eight spiral cords on body whorl; seven on siphonal canal; secondary riblets seen between primary cords; interior of aperture denticulate, nine teeth on inner margin of outer lip extending as ridges on outer lip; margin of outer lip slightly convex, serrated; siphonal canal moderately long,

curved towards dorsum; columella straight, denticulate, with thin parietal callus; a small parietal nodule seen below a ridge running towards the aperture. Colour pure white throughout; periostracum absent.

Remarks: This species was initially described by Kronenberg (1994). The species can be differentiated from *D. perdistorta* in having a more regular shape and lower shoulder (Kronenberg, 1994). The specimen was collected from trawlers operating off Kollam district. Information about the operculum is not known. The species was previously recorded from east coast of India by Edward et al. (2022).

Cymatiidae Iredale, 1913

Family: Cymatiidae Iredale, 1913 (Triton shells/Tritons)

Genus: *Guttarium* Mörch, 1852

3.1.5. *Guttarium muricinum* (Röding, 1798) (Fig. 7a-e)

Common names: Knobbly Triton, Short Necked Triton, White Mouthed Triton, Knobbed Triton

Distribution: Tropical Indo-West Pacific: East Africa; Central and East Indian Ocean: Indo Arabia: Yemen; Indo China; Red Sea; Indo Arabia: Oman; Persian Gulf; Indo Malaysia: Australia; Oceania; Eastern Indian Ocean: India; Philippines

Material examined: 01

Measurements: Shell length: 36.8mm; Shell width: 21.3mm; Aperture length: 10.72mm; Aperture width: 5.92mm; Spire height: 12.54mm

Description: Shell medium sized; solid, stout; conical ovate in shape; spire moderately raised; protoconch

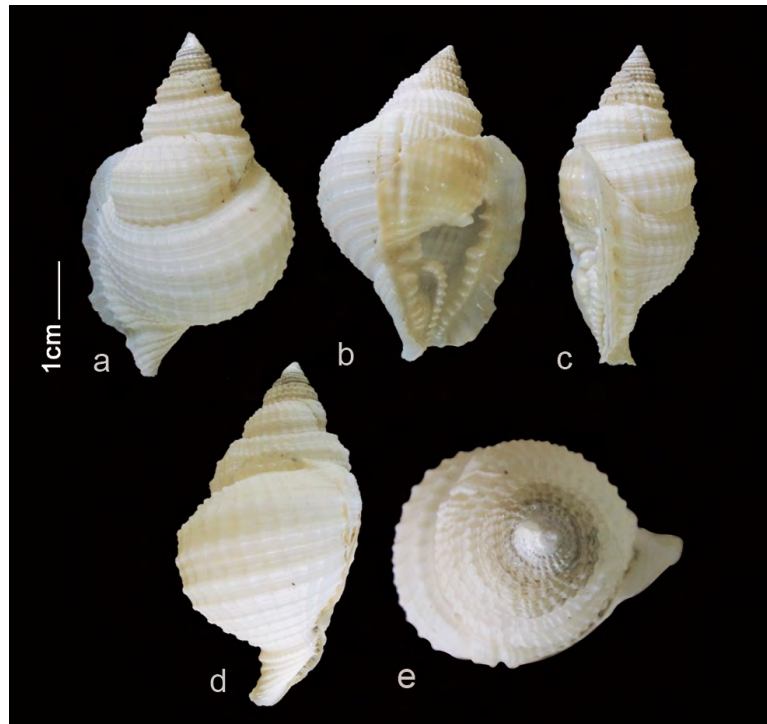


Fig. 6. *Distorsio muehlhaeusseri* Parth, 1990

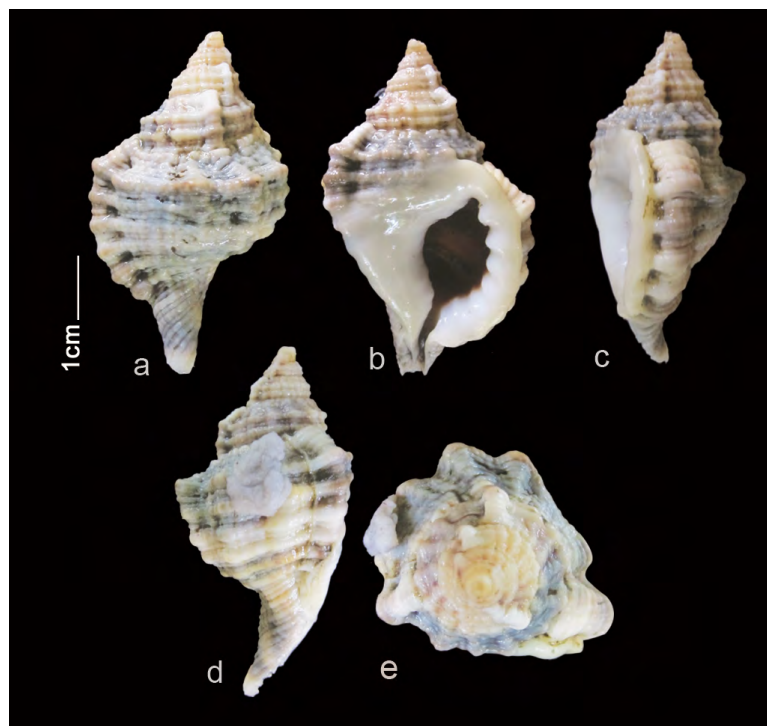


Fig. 7. *Gutturium muricinum* (Röding, 1798)

wide, sutures less deeply impressed; body whorl inflated, higher than broad; body whorl reaching same height as that of spire; sculpture composed of moderately raised axial folds and spiral cords; six spiral cords seen on body whorl, three on penultimate whorl; granulose spiral striae seen intersecting axial folds; aperture large, widely ovate, calloused at periphery; outer lip strongly denticulate, teeth arranged in two rows separated by shallow groove; outer lip and columella glazed; columella and inner lip heavily calloused; callousity extending to parietal wall; parietal

wall wrinkled towards base; few weak folds anteriorly; anterior canal narrow, slightly recurved; siphonal canal long, tubular. Colour light brownish grey with brown blotches; dark brown; aperture, columella and lip white in colour; white spiral band around centre

Remarks: *G. muricinum* is characterised by its moderately low spire, long anterior canal, rounded and inflated body whorl, thick aperture, smooth reflected lips and rough exterior. It has a sparse fossil record (Beu, 2005). Rao (2003)

recorded the presence of this species in the Andaman and Nicobar Islands. Hylleberg and Kilburn (2002) reported the occurrence of this species along the east coast, while Apte (2014) recorded the presence of this species from Lakshadweep and Andaman and Nicobar Islands. This is a new report on the species on the west coast of India.

Genus: *Ranularia* Schumacher, 1817

3.1.6. *Ranularia sarcostoma* (Reeve, 1844) (Fig. 8 a-e)

Common names: Flesh Coloured Hairy Triton, Flesh-tinted Mouth Triton, Yellow lip Triton

Distribution: Widely distributed throughout the western Pacific region and Northern Indian Ocean; Tropical Indo-West Pacific: Central and East Indian Ocean; Eastern Indian Ocean; Oceania: Indo China: Taiwan; Indo Malaysia: Philippines; Papua New Guinea; Australia

Materials examined: 02

Measurements: Shell length: 63.34mm to 68.29mm; Shell width: 33.92mm to 34.36mm; Aperture length: 19.01mm to 22.65mm; Aperture width: 11.81mm to 11.94mm; Spire height: 19.3mm to 22.51mm.

Description: Shell medium-sized; body whorl large, inflated; spire slightly raised, apex blunt; sculpture composed of strong raised round spiral ridges, inter spaces between spiral ridges with minute riblets; axial varices forming small nodules at region of intersection with spiral ridges; varices on either side of aperture strong, prominent; aperture elongately ovate; outer lip strong; inner margin of outer lip with five pairs of strong teeth arranged in two rows,

columella strongly plicate; anterior canal long. Colour light brown, interior of aperture fleshy pink in colour; varices dark brown with light brown transverse ridges.

Remarks: According to Beu (2005), it is one of the least commonly occurring *Ranularia* species throughout the world. The species was initially reported from the east coast of India by Pinn (1990). The present record marks the preliminary report of the species from the west coast of India.

3.2. Species Diversity Indices

The diversity indices of gastropods of the superfamily Tonnoidea collected from different study sites on the Kerala coast were found to be significant and are represented in Table 2.

The Simpson index of dominance shows a value of 0.8512, indicating dominance of few species in diversity, as indicated by the low evenness index (0.3293). According to Odum (1971), the Dominance index of 0.50 indicates that no species dominates, a dominance index 0.50 - 0.75 indicates moderate dominance, while 0.75 - 1 indicates high dominance. The evenness index value (E) is limited between 0 - 1, where getting closer to 1 indicates an even abundance of all species (Odum, 1971). The Shannon Weiner diversity index presented a value of 2.185, indicating a relatively high diversity of gastropods along Kerala coast of India. This can be due to the diversity of habitats available for the gastropods in the coast. Evenness Index was found to be 0.3293, indicating lesser evenness in the distribution of species.

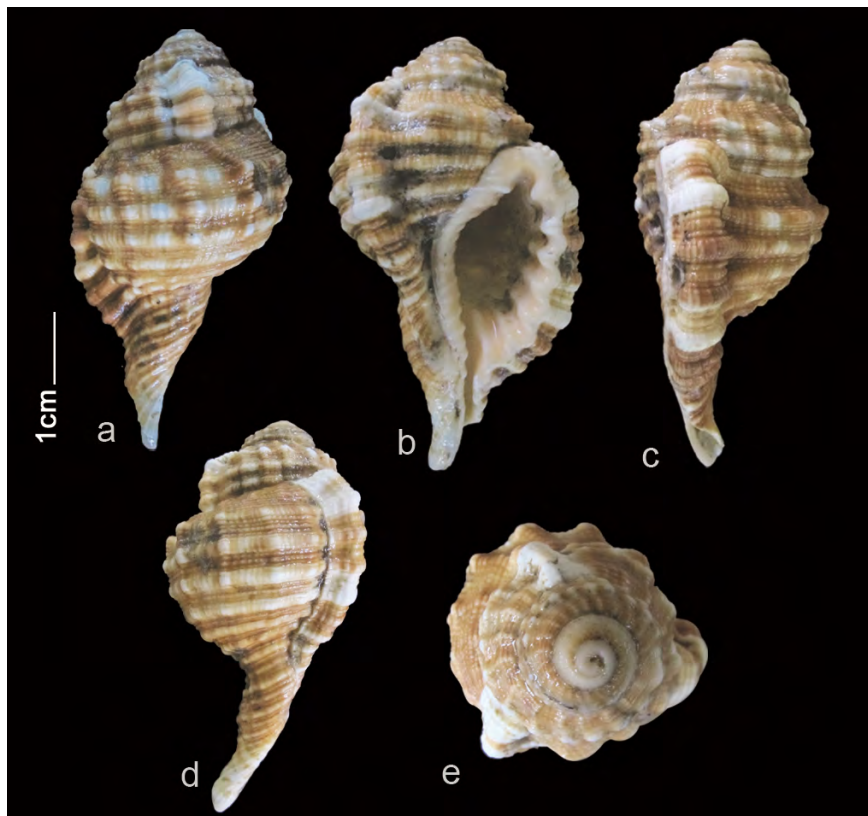


Fig. 8. *Ranularia sarcostoma* (Reeve, 1844)

4. Conclusion

In conclusion, this study, conducted across seventeen diverse sites along the Kerala coast, has documented the presence of 27 species of Tonnoidean gastropods. Among these, six species mark new records for the west coast of India. Additionally, five species are reported as new records for the Kerala coast. The findings of this study reveal variations in Tonnoidea diversity along the Kerala coast, emphasizing the need for an extensive survey to gather comprehensive data and document the biodiversity and distribution of lesser studied gastropods in India.

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