

## CONTRIBUTION TO THE KNOWLEDGE OF INDIAN MARINE MOLLUSCS WITH A NOTE ON THE NATIONAL ZOOLOGICAL COLLECTIONS FROM OTHER COUNTRIES: FAMILY - TURRITELLIDAE

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### INTRODUCTION

In this paper, we have made an attempt to update knowledge on marine molluscs of India of various individual families and to compile the collections present in NZC, both Indian and foreign specimens and presenting an account of the families with as much as details possible on them. This is the sixth in the series of our contributions, and the earlier five were done by Zoological Survey of India's malacologist on the families Mitridae (Subba Rao and Dey, 1984) and Donacidae (Subba Rao and Dey, 1986), Muricidae (Subba Rao and Surya Rao, 1993), Tellinidae (Dey, 2006), Terebridae (Venkitesan and Mukhopadhyay, 2011).

This family is a large family commonly known as Turret shell, which is elongate, slender, multi-whorled, ornamented with spiral ridges and usually brown or yellow. There is no umbilicus and the thin outer lip is seldom complete even in mature examples. Operculum is thin, chitinous and multispiral. There are many species worldwide, living as herbivores in sandy or muddy plans, but few occur in Indian subcontinent. Identification is difficult because shell vary greatly in ornament, colour pattern and spire angle, even at one locality.

### EARLIER WORKS

The genus *Turritella* has been some what neglected by Conchologists. Lamarck (1822)

described only 11 species and later another 6 species were dealt by Kiener (1839). Reeve (1960) reported about 65 species of Turritellidae in his Monograph in *Conchological Iconica*. Marwick (1957) work upon the generic revision of Turritellidae. Gerrad (1972) revised the Australian Turritellidae. In India two genera *Turritella* and *Haustator* belonging to the subfamily Turritellinae are reported. Subba Rao and Dey (2000) reported about 4 species of Turritellidae belonging to two genera *Haustator* and *Turritella* from Indian waters. Subba Rao (2003) described 5 species in his book Indian Sea shell. Venkitesan and Mukhopadhyay (2011) recorded one species from Indian waters for the first time.

### DIAGNOSTIC FEATURES AND GENERAL ACCOUNT OF THE FAMILY

Turritellidae, the tower shells, is a family of small to medium-sized marine gastropod mollusca. Shells of this family are elongate, many whorled shells, similar to the terebrids in general shape but distinguished by not having either an anterior or a posterior canal. The outer lip bears a large sinus, but the lip in the sinus area is very thin and usually broken, even in life. The shape of the sinus is best seen in the growth lines behind the growing edge. There is strong spiral sculpture, but axial sculpture is restricted to growth lines of the shape of the outer lip. The *turritella* shell shape

is somewhat variable and shells are thin, rough and not lustrous. The rounded mouth and complete absence of a siphonal canal at the anterior end of the aperture are the distinguishing features of Turritellidae. The shells have, in addition a very tall spire, numerous convex whorls, no umbilical opening, absence of folds on the columella, and a horny, flexible operculum that is supported by flexible bristles. The operculum can be withdrawn far inside the shell when the animal retreats.

The member of the family Turritellidae generally live sub-tidally, down to at least 1500 m from sea surface, but a few occur in the lower intertidal as well. Animals of this family are ciliary deposit feeders with limited crawling ability. They lay upon or are partly buried in the substrate, usually soft muddy-sand, and filter minute particles from the sea water as it is drawn over their gills. The particles are then fed in a mucous string to the mouth. Quite unlike the *Terebra* mollusca, the *Turritellids* lacks the venomous dart mechanism needed for an actively carnivorous life style. Many *Turritellas* make use of their gills to filter out fine food particles much as clams do. In this family some species are dioecious, meaning they exist as male or female throughout their life. Sperm may be transferred from male to female in packets, or broadcast into the water by males and captured by females in the inhalant water stream. In some species fertilized eggs are brooded in the mantle cavity of the female, with juveniles either being released into the plankton or released onto the substrate as crawling juveniles. Other species attach the egg mass to wood, rocks or other solid substrate, from whence they hatch (Subba Rao, 2003).

The family Turritellidae is worldwide in distribution, but more number of species found in temperate seas. It is a large family consisting of five sub-families embracing 18 genera and 150 species.

Similar families occurring in the area - Terebridae: General shape of the shell similar to Turritellidae, but with a well-marked, notched

siphonal canal at the anterior end; operculum ovate, with a terminal nucleus.

### SYSTEMATIC ACCOUNT

Family Turritellidae  
Subfamily Turritellinae

#### Family TURRITELLIDAE

Shell medium to large, thick, elongate, slender, sharply conical; numerous whorls and somewhat small to medium rounded aperture; Outer lip thin, inner lip smooth; Umbilicus absent; Whorls strongly sculptured with spiral ribs or keels; Anterior siphonal canal absent; operculum corneous and rounded with a central nucleus; border thin. They are mainly herbivores. Lot of species present in worldwide but India represent only a few.

#### Sub-family TURRITELLINAE

Outer lip of aperture arcuate, parasigmoid, or doubly sinused; columella curved or slightly twisted; operculum multispiral with central nucleus.

Turritellidae is a large family consisting of five subfamilies comprising 18 genera and an estimated 150 species. Two genera under the family Turritellidae are found in India. They are *Haustator* and *Turritella*.

#### Genus *Haustator*

Shell moderate, relative smaller than *Turritella*; suture indistinct, number of whorls 12-13, whorl acuminately turreted, aperture sub-quadrangular. Outer lip sinused; sculpture with three spiral ridges; concave intermediate groove and concentric. Colour brown with chestnut to deep brown maculation present around the shell. Apical portion of the fresh shell often seen tinged with violet or blue.

Globally there are 11 species reported under this genus. However, in India, the genus *Haustator* is represented by a single species *H. trisulcata*. This species was named by Lamarck (1822) and is an extant species.

#### 1. *Haustator trisulcata* (Lamarck)

1822. *Turritella trisulcata* Lamarck, *Hist. nat. Anim. Sans. Vert.*, (1)7: 58.

1906. *Turritella cerea*: Comber, *J. Bombay nat Hist. Soc.*, **17**: 209.
1906. *Turritella (Hasutator) vittulata* (Ad & RV): Comber, *J. Bombay nat Hist. Soc.*, **17**: 209.
1952. *Turritella cerea* = *bacillum*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21(3)**: 32, fig. 33.
1982. *Turritella trisulcata*: Rajagopal and Mookherjee, *Rec. zool. Surv. India, Occ. Paper No.*, **28**: 18.
2003. *Haustator trisulcata*: Subba Rao, *Rec. zool. Surv. India, Occ. Paper No.*, **192**: 141, pl. 23, fig. 4.
2012. *Turritella (Haustator) trisulcata*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p. 191. *Zool. Surv. India*.

**Material Examined:** i) 13 exs., shore coll, Mandapam camp, Coromandel coast, Coll. A.S.Rajagopal & H.P.Mukherjee, 31.1.1995, Regd. No. M21027/4; ii) 8 exs., shore coll., Verrapandian pattinam, Coromandel coast, Coll. A.S.R. & H.P.M., 27.1.1978, Regd. No. M21029/4; iii) 2 exs., shore collection in front of circuit house, Tuticorin, Coll. A.S.R. and H.P.M., 21.1.1978, Regd. No. M21028/4; iv) 1 ex., shore collection near port of New Tuticorin, Coll. A.S.R. and H.P.M., 22.1.1978, Regd. No. M20996/4; v) 10 exs., shore collection near Subramanium temple, Trichendur, Coll. A.S.R. and H.P.M., 25.1.1978, Regd. No. M20994/4; vi) 1 ex., Setukkarai, Gulf of Mannar, Coll. A.S.R. and Party, 19.1.1978, Regd. No. M21428/4.

**Measurement: (mm)**

Length	Width	Aperture Length
36.30-10.00	11.20-3.80	6.20-1.40

**Description:** Protoconch of 3 whorls, teleoconch 18 whorls in adult shells. Whorls convex, suture impressed. Whorls spirally ribbed; latter whorls sculptured with up to 18 spiral riblets, variable in size and spacing, some beaded. Axial sculpture of sparse growth lines conforming to shape of outer lip sinus. Inner lip of aperture reflected outwards at base; outer lip thin, with moderate sinus, lip usually broken. Aperture higher than wide. Base with numerous unequal threads. Colour off-white to pale brown, with deep chestnut band either above, or below, or on

both sides of suture. Operculum circular, corneous.

**Remarks:** The well rounded whorls, the riblets varying in size and spacing, allied with the chestnut band at the suture, separate this from other species of similar size. In this size range, *C. cordisimei* also has rounded whorls and numerous threads, but there is a rib at the bottom of whorls, and alternating brown and white markings on the ribs. Synonyms include *Turritella fascialis* Menke, 1830 and *Torcula parvus* Angas, 1877.

**Genus *Turritella* Lamarck**

1799. *Turritella* Lamarck, *Mem. Soc. Hist. nat. Paris*, p. 74.

**Characters:** Shell elongately turreted, lanceolately acuminate, never umbilicated, whorls numerous, mostly transversely ribbed or striated, never longitudinally sculptured. Sculpture consists of spiral striations, destitute of varices, never spined or prickly, aperture rather small, more or less rounded, margins disjoined, lip often sinuated in the middle, rounded or angle at the top, attenuated with 15-20 rounded whorls. Outer lip is thin with a convex outer margin. In some, whorl strongly keeled in the middle with sloping upper part, curved lower part; thin, circular chitinous operculum with a central nucleus.

The best characters for the discrimination of species reside in the first eight or ten whorls from the apex; beyond this point the sculpture varies slightly or becomes obsolete, as the shell approaches maturity. The *Turritella* have a wide range of habitation and dwell at a considerable depth as well as near the surface.

**KEY TO SPECIES**

There are more than 87 species under the genus *Turritella*. However, in India, only 11 species have been reported. Recently there is a new species recorded from the state of Karnataka in India (Venkitesan & Mukhopadhyay, 2012).

- No. of whorl 20 or more ..... *Turritella columnaris*
- No. of whorl less than 20.....2
- Presence of spiral striation with keels.....3
- Absence strong spiral striations or keels.....4

3. One no. prominent spiral striation or keel .....*T. attenuata*
- Two or more no. of prominent, median ridges/ keel.....5
4. Three prominent spiral striation from penultimate whorl to body whorl.....*T. monilifera*
- Two to more spiral striation present.....6
5. Two no. of sharp prominent spiral ridges/keel, in the middle of the whorl, 14-20 whorls, sides of the whorls sharply keeled without painting. ....*T. duplicata*
- Two No. of conspicuous swollen keel at the base of each whorl with bold style of painting below suture..... *T. bicingulata*
6. Numerous spiral ridges present along the body.....8
- Two prominent spiral ridges present along the body.....7
7. Two prominent spiral ridges present along the body, but not keeled with smooth outer lip, shell more or less glossy.....*T. fastigiata*
- Two no. of spiral ridges with brown maculation .....*T. maculata*
8. Body ornamented with reddish brown dots, whorls about 20, spiral striation with uniform pattern.....*T. infraconstricta*
- Body white ; each whorls encircled by strong ridges with lesser ridges between; fine straight or curved, axial striae between ridges.....*T. fultoni*

Genus: *Turritella*

1799. *Turritella* Lamarck, *Mem. Soc. Hist. nat. Paris*, p. 74.

2. *Turritella attenuata* Reeve

1869. *Turritella attenuata* Reeve, *Conch. Icon.*, 5: *Turritella* sp. No. 4, pl. 1, fig. 4.
1942. *Turritella attenuata*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, 5(2):22.
1952. *Turritella attenuata*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, 1(2):71, pl. 4, fig. 9.
1982. *Turritella attenuata*: Rajagopal and Mookherjee, *Rec. zool. Surv. India, Occ. Paper No.*, 28: 16.
1990. *Turritella attenuata*: Pinn, *Sea Shells of Pondicherry*, Nehru Science Centre, p.14, fig. 15.
1992. *Turritella attenuata*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, 3(9): 173, pl.4, fig. 10. *Zool. Surv. India*.

2003. *Turritella attenuata*: Subba Rao, *Rec. zool. Surv. India, Occ. Paper No.*, 192: 140, pl.23, fig.1.

2007. *Turritella attenuata*: Ramakrishna, Dey, Barua and Mukhopadhyaya, *Fauna of Andhra Pradesh, State Fauna series*, 5(7): 49, Pl. II, Figs. 15 & 16. *Zool. Surv. India*.

2008. *Turritella attenuata*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, 5: 125. *Zool. Surv. India*.

2010. *Turritella attenuata*: Mahapatra, *Fauna of Vamsadhara and Nagavali Estuary, Estuarine Ecosystem series*, 6: 57. *Zool. Surv. India*.

2010. *Turritella attenuata*: Raghunathan, Sivaperuman and Ramakrishna, In: *Recent Trends in Biodiversity of Andaman and Nicobar Islands*, pp. 255, 258, 262, 266. *Zool. Surv. India*.

2012. *Turritella attenuata*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p.191. *Zool. Surv. India*.

**Material Examined:** i) 2 exs., Coastal waters of Madras from High court to triplicane, Coll. A. S. Rajagopal & H.P. Mookherjee, 25.2.1975, Regd. No. M20972/4; ii) 13 exs., coastal waters of Madras, North of Harbour, Coll. A.S. Rajagopal & H.P. Mookherjee, 29.2.1975, Regd. No. M20971/4; iii) 2 exs., coastal area of Puducherry up to Nallamkuppam, Coll. A.S. Rajagopal & H.P. Mookherjee, 18.2.1975, Regd. No. M21000/4; iv) 1 ex., shore collection, Santhome beach, South upto the mouth of Adyar, Madras, Coll. A.S. Rajagopal & H.P. Mookherjee, 24.2.1975, Regd. No. M20998/4; v) 1 ex., river bank in front of Marine Biological Station, Madras, Coll. A.S. Rajagopal, 11.12.1968, Regd. No. M20970/4; vi) 1 ex., Colva beach, Goa, Coll. A.K. Das and party, Feb, 1975, Regd. No. M22407/4; vii) 1 ex., shore collection between Killai river mouth and chinnavayakal village, Madras (Chennai), Coll. A. S. R., 13.2.1968, Regd. No. M20968/4; viii) 1 ex., Plliots beach, opposite radio station, Madras (Chennai), Regd. No. M17333/3; ix) 1 ex., Cortalim, Goa, Coll. K.S. Pradhan and Party, 15.11.1967, Regd. No. M22455/4; x) 2 exs., shore collection, North of Fort, Tranquebar, Coll. A.S.R. and H.P.M., 12.12.1975, Regd. No. M20999/4; xi) 5 exs., shore collection opposite to Fort, Tranquebar, Coll. A.S.R. and H.P.M., 11.2.1975,

Regd. No. 21007/4; xii) 2 exs., Sea coast near Chinna tarangapatti, 3 miles north of Tranquebar, Coll. Dr. Menon and Ramakrishna, 20.2.1957; Regd. No. M20997/4; xiii) 1 ex., Digha, West Bengal, Coll. Mr. F.M.J. Pinn, Regd. No. M20524/4; xiv) 5 exs, Eastern Sea, Regd. No.1442; xv) 6 exs., Madras , Coromandal Coast, Regd. No. M18304/3; xvi) 1 ex., shore collection, from Cape Comorin, Coll. Mr. C.V. Kurian, Regd. No. M26441/5; xvii) 7 exs., Suratkal beach, Karnataka, Coll. K.V.S.R., M.K. Ghosh and S.K. Roy, 19.12.1970, Regd. No. M27081/5; xviii) 1 ex., Puri, Regd. No. M1631/1.

**Measurements: (mm)**

Length	Width	Aperture Length
108.65-37.20	20.30-13.15	22.25-7.25

**Description:** Shell sharply attenuated, nearer to the body whorl with 15-16 rounded whorls, gradually larger from the pointed apex to the anterior end; on later whorls from 12-16 middle striation becoming stronger and other gradually weak and obsolete making single distinct spiral cords and obscure few cords on each whorl; suture distinct; whorls strongly keeled in the middle with sloping upper part and curved lower part. Aperture nearly round and sinuate, colour light brownish to pinkish, upper part of the whorl tinged with blue.

**Remarks:** This species is a ciliary -suspension feeder, sexes separate, fertilization internal. Eggs are laid in a stalked capsule, attached to stones. Occurs in intertidal to offshore beyond the low tide mark. Used as decorative items in the shell craft industry. Common.

**Distribution:** India: Andhra Pradesh, Odisha, Tamil Nadu, West Bengal; Elsewhere: Eastern Seas.

**3. *Turritella columnaris* Kiener**

1844. *Turritella columnaris* Kiener, *Icon. Coq. Viv.*, **10**: 10, pl.7, fig.1.
1952. *Turritella columnaris*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21(3)**:32.
1961. *Turritella columnaris*: Menon, Datta Gupta and Das Gupta, *J. Bombay nat. Hist. Soc.*, **58(2)**: 481, pl.3, fig.31.

1982. *Turritella columnaris*: Rajagopal and Mookherjee, *Rec. zool. Surv. India, Occ. Paper No.*, **28**: 18.
1990. *Turritella columnaris*: Pinn, *Sea Shells of Pondicherry*, Nehru Science Centre, p.14, fig. 16.
1991. *Turritella columnaris*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1(3)**: 40. Zool. Surv. India.
1995. *Turritella columnaris*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka lake, Wetland Ecosystem series*, **1**:398. Zool. Surv. India.
2003. *Turritella columnaris*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192**: 140, pl.23, figs.2, 3.
2004. *Turritella columnaris*: Rao, Maitra, Barua and Ramakrishna, *Fauna of Gujarat, State Fauna series*, **8(2)**:289. Zool. Surv. India.
2007. *Turritella columnaris*: Ramakrishna, Dey, Barua and Mukhopadhyaya, *Fauna of Andhra Pradesh, State Fauna series*, **5(7)**:50. Zool. Surv. India.
2012. *Turritella columnaris*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p.191. Zool. Surv. India.

**Material Examined:** i) 1 ex., Chhatrapur, Coll; Unknown, Orissa, 24.11.1962, Regd. No.M22537/5; ii) 1 ex., Madeli, Odisha, Coll.N.V. Subba Rao, 1.3.1964, Regd No. M22522/4; iii) 1 ex., Sea Coast, Adirampattinam, Palk Bay, Coll. A.S. Rajagopal & H.P. Mookherjee; iv) 1 ex., sandy shore of South bar at the mouth Chilka, Coll. R.N. Manna, 21.9.1987, Regd. No. M23327/4, M23326/4; v) 4 exs, Adatara beach, Okha, Coll. K.V. Surya Rao, 10.8.1972, M26450/5; vi) 1 ex., Hanumandandi, Okha, Coll. K.N. Reddy, 8.4.1977, Regd. No. M26451/5; vii) 7 exs, Hanumandandi, Okha, Coll. H. C.Ray, 23.1.1953, Regd.No.M26452/5.

**Measurement : (mm)**

Length	Width	Aperture Length
95-66.30	16.25-12.35	4.30-1.15

**Description:** Solid, semi translucent, spire angle about 10°, very sharply lanceolately turreted with about 30 whorls, the first two-keeled, keels approximated, the rest rather flattened. Each whorl overhangs succeeding whorl to make suture deep; sometimes flattened in the middle, base strongly angulated; strong spiral ridges on

lower part of whorls, lesser ridges above. Thin-edged aperture squarish, columella straight.

Colour- Greyish-whitish heavily mottled with brown fading to orange brown.

**Remarks:** This species has the largest number of whorls, and is the most elongated forms of the genus. Occurs in muddy sand among stones in the intertidal to sub tidal; mostly beyond the low tide line. Plays an important role in the environment as detritus feeder. Sexes separate, fertilization internal, Eggs lay in clusters, attached to stones. Uncommon.

**Distribution:** India: Andhra Pradesh, Gujarat, Maharashtra, Odisha, Puducherry, Tamil Nadu; Elsewhere: Sri Lanka, Myanmar.

#### 4. *Turritella duplicata* ( Linnaeus )

1767. *Turbo duplicata* Linnaeus, *Syst. Nat.*, ed. **12**: 1239.
1898. *Turritella (Zaria) duplicata*: Melvill and Sykes, *Proc. malac. Soc. London*, **3**: 45.
1906. *Turritella (Zaria) duplicata* : Comber, *J. Bombay nat Hist. Soc.*, **17**: 209.
1940. *Turritella duplicata*: Crichton, *J. Bombay nat. Hist. Soc.*, **42**: 339.
1952. *Turritella duplicata*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21(3)**: 32, fig. 31.
1986. *Turritella duplicata*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p. 167.
1990. *Turritella duplicata*: Pinn, *Sea Shells of Pondicherry*, Nehru Science Centre, p. 14, fig. 14.
2000. *Turritella duplicata*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187**: 53.
2003. *Turritella duplicata*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192**: 141, pl. 23, figs. 7-9.
2004. *Turritella duplicata*: Rao, Maitra, Barua and Ramakrishna, *Fauna of Gujarat, State Fauna series*, **8(2)**: 289. Zool. Surv. India.
2007. *Turritella duplicata*: Ramakrishna, Dey, Barua and Mukhopadhyaya, *Fauna of Andhra Pradesh, State Fauna series*, **5(7)**: 50, Pl. II, Figs. 17 & 18. Zool. Surv. India.
2008. *Turritella acutangula*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5**: 124. Zool. Surv. India.

2010. *Turritella acutangula*: Mahapatra, *Fauna of Vamsadhara and Nagavali Estuary, Estuarine Ecosystem series*, **6**: 56. Zool. Surv. India.

2010. *Turritella duplicata*: Rao, *Field Guide to Corals and Coral Associates of Andaman and Nicobar Islands*, p. 212. Zool. Surv. India.

2012. *Turritella acutingula*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p. 191. Zool. Surv. India. (error for *Turritella acutangula*).

2012. *Turritella duplicata*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p. 191. Zool. Surv. India.

**Material Examined:** i) 2 exs., Colva beach, Goa, Coll. K.S. Pradhan, 11.11.1967, Regd. No. M22406/4; ii) 9 exs., Colva beach, Goa, Coll. K.S. Pradhan, 11.11.1967, Regd. No. M21941/4; iii) 1 ex., Cortalim, Goa, Coll. K.S. Pradhan, 15.11.1967, Regd. No. M21916/4; iv) 1 ex., Betul beach, Goa, Coll. A.K. Das and Party; 3.3.1975, Regd. No. M21942/4; v) 1 ex., shore collection in front of Karaikal medu village, Karaikal, Tamil Nadu, Coll. A.S.R. and H.P.M., 7.2.1975, Regd. No. M21006/4; vi) 2 exs., Colva beach, Goa, Coll. K.S. Pradhan, 4.4.1966, Regd. No. M21919/4; vii) 5 exs., Goa, Coll. K.S. Pradhan, Regd. No. M21917/4; viii) 7 exs., Madras, Regd. No. M26435/5; ix) 7 exs., Madras, Regd. No. M18311/3; x) 2 exs., Bombay, Regd. No. M18310/3; xi) 10 exs., Colva beach, Goa, 12.11.1967, Regd. No. M21223/4; xii) 1 ex., Port Sikka, Gulf of Kutch, Coll. H.C. Ray, 13.1.1953, Regd. No. M26453/5; xiii) 1 ex., Nayabandar, Bedi, K.V.S.R., 20.8.1972, Regd. No. M26454/5; xiv) 1 ex., Hanumandandi, Okha, Coll. K.N.R., 8.4.1977, Regd. No. M26455/5; xv) 3 exs., Gangolli beach harbor, Karnataka, Coll. K.V.S.R., 23.12.1970, Regd. No. M27267/5; xvi) 7 exs., Suratkal beach, Mysore, Karnataka, Coll. K.V.S.R. and Party, 19.12.1970, Regd. No. M27073/5; xvii) 1 ex., Porto Novo, Madras, Coll. A.S.R., 11.2.1968, Regd. No. M20942/4; xviii) 2 exs., between Killai River mouth and Chinnavayakal village, Madras, Coll. A.S.R., 13.2.1968, Regd. No. M20943/4; xix) 2 exs., Dammula Palem, Kakinada, A.P., 23.5.1955,

Regd. No. M21202/4; xx) 2 exs., Chilka Lake, Tip of South bar near mouth, Coll. R.N. Manna, Regd. No. M23676/4; xxi) 4 exs., Kovelong, Madras, Coll. A.S.R. and H.P.M., 28.1.1975; Regd. No. M20955/4; xxii) 2 exs., Vaithikuppam, 3.2 km North of Pondicherry, Coll. Dr. A.G.K. Menon, 8.2.1958, Regd. No. M20941/4; xxiii) 2 exs., Karaikal, Madras, Coll. A.S.R. and H.P.M., 7.2.1975, Regd. No. M20956/4; xxiv) 16 exs., Tranquebar, Madras, Coll. A.S.R. and H.P.M., 11.2.1975, Regd. No. M20957/4; xxv) 4 exs, Point Calimere, Coll. A.S.R., 16.2.1968, Regd. No. M20952/4; xxvi) 1 ex., Tuticorin, Coll. A.S.R., 25.2.1968, Regd. No. M20953/4; xxvii) 3 exs., rocky shore of Gulf of Mannar near quarantine camp, Mandapam, Coll. H.C. Ray, 11.5.1955, Regd. No. M20940/4; xxviii) 10 exs., Madras, north of harbor bottom, Coll. A.S.R. and H.P.M., 29.2.1975, Regd. No. M21005/4; xxix) 2 exs., Devgad, Coll. B.K. Tikadar, 14.11.1963, Regd. No. M17242/3; xxx) 1 ex., Adirampattinam, Palk Bay, Coll. A.S.R. and H.P.M. Regd. No. M20990/4; xxxi) 1 ex., Shore collection, Mallipattinam, Palk Bay, Coll. A.S.R. and H.P.M., 13.1.1978, Regd. No. M20989/4; xxxii) 3 exs., Virampattinam village, Puducherry, Coll. A.S.R. and H.P.M., 19.2.1975, Regd. No. M20992/4; xxxiii) 1 ex., shore collection, Madras, 27.2.1975, Regd. No. M20993/4; xxxiv) 1 ex., Rameswaram, Coll. H.C. Ray, 6.5.1955, Regd. No. M20938/4; xxxv) 2 exs., Kundugal Point, Madras, Coll. H.C. Ray, 8.5.1955, Regd. No. M20939/4; xxxvi) 8 exs., Colva beach, Goa, Coll. K.S. Pradhan, 11.11.1967, Regd. No. M2120/4; xxxvii) 2 exs., Tranquebar, Coll. A.S.R. and H.P.M., 12.2.1975, Regd. No. M20949/4; xxxviii) 1 ex., Tranquebar, Coll. A.S.R. and H.P.M., 14.2.1975, Regd. No. M20950/4; xxxix) 1 ex., Puducherry, Coll. A.S.R. and H.P.M., 17.2.1975, Regd. No. M20951/4; xxx) 1 ex., Puri, Odisha, Regd. No. 1466; xxxxi) 1 ex., Ganjam Coast, Odisha, Coll. Bengal fisheries, Regd. No. M4506/1; xxxxii) 1 ex., Ganjam Coast, Odisha, Coll. Bengal fisheries, Regd. No. M4507/1; xxxxiii) 1 ex., coastal water of Madras off Thandiyarpet on board "Chhota Investigator" (Bottom Trawl), Coll. A.S.R. and H.P.M., 25.1.1975, Regd. No. M20954/4.

**Measurement: (mm)**

Length	Width	Aperture Length
105.859.00	31.00-3.60	18.90-2.30

**Description:** Shell large, up to 107mm in height, elongate, sharply conical, about 18-20 whorls, the earlier whorls convex with many fine spiral ridges, on the other whorls two sharp ridges in the middle, after the first six whorls the central ridges becomes elevated into a strong keel, most of the others tending disappear, after about ten whorls another elevated ridge begins to appear, but less prominently, and over the last two or three whorls both of these gradually become less conspicuous. Whorls rounded at both ends, sharply angular in the middle. Operculum corneous, rounded, with many spiral coils and a central nucleus. Colour :The upper half of each whorl medium dark brown and the lower pale cream brown (Subba Rao, 2003).

**Remarks:** This species is a ciliary filter feeding animals drawing organic particles through the mantle cavity by means of ciliary water currents, sorted by the small tentacles and the tiny bristles of the operculum, trapped in mucuous sheets on their gills and transferred to the mouth. Sexes are separate, fertilization internal. Eggs are generally laid in cluster of spherical stalked capsules, attached to stones. A short planktonic larval stage usually present but some species brood their eggs and embryos to the crawling stage (Poutiers, 1998). Frequent synonyms / mis identifications: *Turritella acutangula* (Linnaeus, 1758); *Zaria duplicata* (Linnaeus, 1758). On sub-tidal sand and mud bottoms. Most common species.

**Distribution:** India: Andaman and Nicobar Islands, Andhra Pradesh, Goa, Gujarat, Maharashtra, Tamil Nadu; Elsewhere: Myanmar, Sri Lanka. in the Southeast Asian region. Indo-West Pacific, from Madagascar to Indonesia; north to the Philippines and south to northern Queensland.

**5. *Turritella fastigiata* Adams and Reeve**

1850. *Turritella fastigiata* Adams and Reeve, *Zool. Sammal. Moll.*, (7): 48, t 12, fig. 9.

1986. *Turritella fastigiata*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p.167.
2000. *Turritella fastigiata*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187**: 54.
2004. *Turritella fastigiata*: Venkataraman, Jeyabaskaran, Raghuram and Alfred, *Rec. zool. Surv. India, Occ. Paper No.* **226**: 325.
2010. *Turritella fastigiata*: Rao, *Field Guide to Corals and Coral Associates of Andaman and Nicobar Islands*, p. 213. Zool. Surv. India.
2012. *Turritella fastigiata*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p. 191. Zool. Surv. India.

**Material Examined:** i) 7 exs., Andaman, Regd. No.M18314/3.

**Measurements: (mm)**

Length	Width	Aperture Length
43.05-16.70	10.9-4.7	6.8-2.5

**Description:** Shell moderate in size, number of whorls 14 or less, very minute spiral striation present, less than 25 spiral striations, evenly spaced. Aperture quadra angular, shell turreted, last whorl compressed, brown in colour, deep chestnut brown body covered with white brown maculation. Two prominent spiral ridges present along the body, but not keeled. Aperture circular with smooth outer lip, shell more or less glossy than other *Turritellidae*, suture distinct, penultimate whorl and body whorl are convex.

**Remarks:** The oblique clouded streaks of painting are the diagnostic characteristics of this species.

**Distribution:** India: Andaman and Nicobar Islands; Elsewhere: No records.

**6. *Turritella fultoni* Melvill**

1897. *Turritella fultoni* Melvill, *Mem. Proc. Manch. Lit. Phil. Soc.* **41**(7): 14, pl.6, fig. 12. (Type locality: Omara Bay, Persian Gulf).
1901. *Eglisia fultoni*: Melvill and Standen, *Proc. Zool. Soc. London*, **2**: 387, pl.21, fig.8.
1968. *Eglisia fultoni*: Ray, *Indian Mus. Bull.*, **3** (1&2): 18, Text fig., 5.

1991. *Turritella fultoni*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1**(3):41. Zool. Surv. India.
2012. *Turritella fultoni*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p. 191. Zool. Surv. India.

**Material Examined:** i) 1 ex., Off Puri, Coll. S.W.K

**Measurement: (mm)**

Length	Width	Aperture Length
18.00	5.60	4.42

**Description:** Solid, opaque, spire angle about 16-20°; rounded whorls separated by deep sutures; each whorls encircled by strong ridges with lesser ridges between; fine straight or curved, axial striae between ridges. Thin-edged aperture broadly ovate, columella straight. White, or rarely with flame like orange-brown markings on the whorls.

**Remarks:** Some controversy exists as to the taxonomic status of *fultoni* standing on the borderland between *Turritella* and *Eglisia* (Family- Epitonidae) which really calls for some attention. Ray (1968) wrongly identified this species to the genus *Eglisia*. Rare.

**Distribution:** India: Odisha: Puri; Elsewhere: Persian Gulf. : Omara Bay (its Type locality), Henjam Island and Mussandam.

**7. *Turritella infracontracta* Smith**

1878. *Turritella infracontracta* Smith, *Proc. Zool. Soc. London*, **1878**: 817, Pl. L, fig.20.
1897. *Turritella infracontracta*: Melvill and Sykes, *Proc. Malac. Soc. London*, **2**: 170.
1986. *Turritella infracontracta*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p.167.
2000. *Turritella infracontracta*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187**: 54.
2004. *Turritella infracontracta*: Venkataraman, Jeyabaskaran, Raghuram and Alfred, *Rec. zool. Surv. India, Occ. Paper No.* **226**: 325.
2010. *Turritella infracontracta*: Rao, *Field Guide to Corals and Coral Associates of Andaman and Nicobar Islands*, p. 213. Zool. Surv. India.



2012. *Turritella infraconstricta*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p. 191. Zool. Surv. India.

**Material Examined:** 6 exs., Andaman, Regd. No. 1455.

**Measurement: (mm)**

Length	Width	Length of the aperture;
66.9-42.20	16.60-11.00	10.3-6.15

**Description:** Shell moderate in size, subulate, subturreted, whorls about 20, somewhat convex at the top and sides, and sloping narrowed at the base, thus making the width at the suture considerably less a little distance above it, transversely finely lirated, lirae varying in thickness, a few being a trifle coarser than the rest, two especially the upper, situated very near the middle of the whorl, and the lower one at the broadest part of it, being conspicuous and forming indistinct angles. Last whorl excavated beneath, finely lirated and of uniform brownish white or pale pink tint with a rather acute ridge circumscribing the base. Aperture irregularly obliquely quadrate, of the same colour as the exterior, columella slightly oblique and a little arcuate.

Colour: Brownish white ornamented with reddish brown dots.

**Remarks:** This species can be identified by the form of the whorl, the character of the markings and the spiral liration. The dottings on the ridges are very small and are arranged under one another in oblique and more or less flexuous lines which are interrupted by numerous spiral sulci. Through the prominence, although slight of the two principal lirae the whorls between them appear somewhat concave, and ridge around the base of the last whorl passes just above the labrum and winds up the spire of sutural line (Smith, 1878). Uncommon.

**Distribution:** India: Andaman and Nicobar Islands; Elsewhere: No records.

**8. *Turritella monilifera* Adams and Reeve**

1850. *Turritella monilifera* Adams and Reeve, *Zool. Samml. Moll.*, (7): 48.

1986. *Turritella monilifera*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p.167.

2000. *Turritella monilifera*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, 187: 54.

2004. *Turritella (Haustator) monilifera*: Venkataraman, Jeyabaskaran, Raghuram and Alfred, *Rec. zool. Surv. India, Occ. Paper No.* 226: 325.

2010. *Turritella monilifera*: Rao, *Field Guide to Corals and Coral Associates of Andaman and Nicobar Islands*, p. 213. Zool. Surv. India.

2012. *Turritella monilifera*: Venkataraman, Rajan, Satynanarayana, Raghunathan and Venkataraman, *Marine ecosystems and Protected areas of India*, p. 191. Zool. Surv. India.

**Material Examined:** i) 1 ex., Andaman, Regd. No. M26446/5.

**Measurement: (mm)**

Length	Width	Length of the aperture;
42.05	11.80	6.7

**Description:** Shell acuminate pyramidal, depressly concave and sharply angled at the base, whorls fifteen in number, with a broad keel beneath the sutures, concave in the middle, then two-ridged; pinkish white, keel ornamented with distant oblique red-brown dots. Aperture nearly quadrangular, strongly angulated at base, and shell moderate in size. Whorls with three prominent spiral striation, prominent from penultimate whorls to body whorls.

**Remarks:** The only painting in this species, beyond its delicate violet-pink hue, consists in the necklace-like row of red-brown dots upon the keel (Reeve, 1850)

**Distribution:** India: Andaman and Nicobar Islands; Elsewhere: No records.

**9. *Turritella maculata* Reeve**

1849. *Turritella maculata* Reeve, *Conch. Icon.*, 5: *Turritella* sp. No., 33.

2004. *Turritella maculata*: Rao, Maitra, Barua and Ramakrishna, *Fauna of Gujarat, State Fauna series*, 8(2): 289. Zool. Surv. India.

2005. *Turritella maculata*: Subba Rao and Sastry, *Conservation Area Series*, 23: 43. zool. Surv. India.

**List of the foreign species present in NZC:**

Si. No.	Name of	Collector the species	Location	Number of examples	Regd. No.
1.	<i>Torcula clathrata</i> Kiener		Ceylon	1	1469
2.	<i>Turritella declivis</i> Adam & Reeve		Mauritius	3	M18309/3
3.	<i>Turritella fuscocincta</i> Petit		Australia	30	1453
4.	<i>Turritella sinuata</i> Reeve		Australia	9	1454
5.	<i>Turritella exoleta</i> Linn.	R.W.Foster	Tabago Island, British West Indies	18	M19314/3
6.	<i>Turritella gunni</i>		Tasmania	4	1461
7.	<i>Turritella terebra</i> Linn.		Eastern Sea	6	M26447/5
8.	<i>Turritella broderipiana</i> d' orb		1	1464	
9.	<i>Turritella communis</i> Risso		Algiers	2	1462
10.	<i>Turritella vittulata</i> Adam & Reeve	China	7	1444	
11.	<i>Turritella nivea</i> Gray		East Africa, Gwadur, Baluchistan	23	M18318/3
12.	<i>Turritella nivea</i> Gray		Persian Gulf	8	M26445/5
13.	<i>Turritella capensis</i> Reeve		Cape of Good Hope	6	1459
14.	<i>Turritella capensis</i> Reeve		False Bay	12	M18306/3
15.	<i>Turritella cingulifera</i> Sowerby	Dr. J. Anderson	Margui archipelago	1	
16.	<i>Turritella sanguine natalensis</i> Smith	Donar : Natal Museum	Natal (21.6.1989)	2 exs.	M23502/4
17.	<i>Turritella variegates</i> Linn.		West Indies	5 exs	M18321/3.
18.	<i>Turritella punctata</i> Kiener		California	2 exs.	1449
19.	<i>Turritella nebulosa</i> Hinds			1	
20.	<i>Turritella bacillum</i> Hinds	Prof. J. Meggitt	Rangoon	2 exs.	M14492/2
21.	<i>Turritella bacillum</i> Hinds		Hong Kong	1	1443
22.	<i>Turritella gonostoma</i> Valenciennes-1832			1	1463
23.	<i>Turritella chrysotoxa</i> Tomlin	Natal Meseum	Aug, 1994.	3	M23529/4
24.	<i>Turritella carinifera</i> Lamarck		Cape	5	1447
25.	<i>Turritella rosea</i> Quoy & Gaimard		New Zealand	12	1452
26.	<i>Turritella hanleyana</i> Reeve		Ceylon	1	1456
27.	<i>Turritella triplicata</i> philippi		Algiers	1	M18319/3
28.	<i>Turritella fascialis</i> Menke	I.R.L.B. Tomlin Esq.	Maskat	13	M18313/3

Sl. No.	Name of	Collector the species	Location	Number of examples	Regd. No.
29.	<i>Turritella fascialis</i> Menke	Ex. Tomlin Colln.	Gulf of Oman	14	M13368/2
30.	<i>Turritella fascialis</i> Menke		Babylon Coast	2	3001/1
31.	<i>Turritella bicolor</i> Reeve		Japan	1	M18305/3
32.	<i>Turritella maculata</i> Reeve		Aden	15	
33.	<i>Mesalia waria</i> Kiener	Dr. Kobelt	Gibraltar	1	M18324/3
34.	<i>Turritella cornea</i> Lamarck		England	8	1457
35.	<i>Turritella incise</i> Reeve		Australia	1	1465
36.	<i>Turritella unguina</i> Linn.	Tiachi	Napoli	2	M18322/3
37.	<i>Turritella gracilis</i> A.Ad.		Japan	1	1458
38.	<i>Turritella multilyrata</i> Adam & Reeve		Singapore	16	1460
39.	<i>Turritella capensis</i> Reeve		False Bay	3	M18316/3
40.	<i>Mesalia lacteal</i> Miller		Green land	1	M18323/3
41.	<i>Mesalia brevia</i> Lamarck		Japan	1	146

**Material Examined:** i) 7 ex., St. Mary's Island, Udipi district, Karnataka, 01.01.2006., Coll. R. Venkitesan and party.

**Measurement: (mm)**

Length      Width      Length of the aperture;  
25.90-39.00    9.00-10.80    4.20-6.00

**Description:** Shell up to 39 mm, thin, semi translucent or opaque, acuminate turreted, whorls about 11, and spire angle about 20°. Each whorl has 2 strong, rounded spiral striation, occasional spiral ridges and many fine spiral threads. Aperture thin edged, squarish. Outer lip sinuous. Keels sometimes obsolete.

Colour-Violet white with brown mottling and stripes; fine, brown lines sometimes encircle whorls.

**Remarks:** The base of the shell is more concave, and is marked of numerous coloured linear striae, but the upper margin of the whorl is always distinguished by a row of irregular red brown spots immediate beneath the suture. A pure white form was named, unnecessarily, var.

*chionia* by Melvill, 1928:102 (Bosch, 1995),

**Distribution:** India: Gujarat, Karnataka: St. Mary's Island; Elsewhere: Gulf of Aden, Gulf of Arabia.

**10. *Turritella bicingulata* Lamarck**

1822. *Turritella bicingulata* Lamarck, *Anim. Sans. Vert.* (Deshayes edit) 9:256.

1860. *Turritella bicingulata* Lamarck, Reeve, *Conch Icon*, 5. Pl.5, sp.no. 20.

2011. *Turritella bicingulata* Venkitesan and Mukhopadhyay *Rec. zool. Surv. India*, **111**(2): 94-95.

**Material Examined:** i) 17 ex., St. Mary's Island, Udipi district, Karnataka, 01.01.2006., Coll. R. Venkitesan and party.

**Measurement: (mm):**

Length      Width      Length of the aperture;  
3.10-5.70    6.20-10.80    20.80-35.90

**Description:** Shell medium in size, up to 36.00 mm in height, acuminate turreted, whorls about 11, aperture sub quadrangular, outer lip sinuous, sculptured with two spiral ridges,

which are equally distant and prominent, intermediate grooves concave and spirally striated. Ornamented with profusely flamed, variegated with reddish brown markings. Suture rather deeply excavated, below the suture spotted with reddish brown mottling and stripes. Brown line encircles whorls. Brown line seen through the aperture. Base concave and neatly striated with violet colour. Shell white with brown markings, white base marked with violet; brown markings and the interior of the aperture purple rose.

**Remarks:** It can be distinguished from other by which a pair of conspicuous swollen keels and a bold profuse style of painting. *T. maculata* a

nearer species differs from *T. bicingulata* having in difference in early whorls the keels are very prominent developed even to the apex. The base of the shell is more concave, and is marked of numerous coloured linear striae, but the upper margin of the whorl is always distinguished by a row of irregular red brown spots immediate beneath the suture.

**Distribution:** India: Karnataka: St. Mary's Island. Elsewhere: Pakistan and Adens.

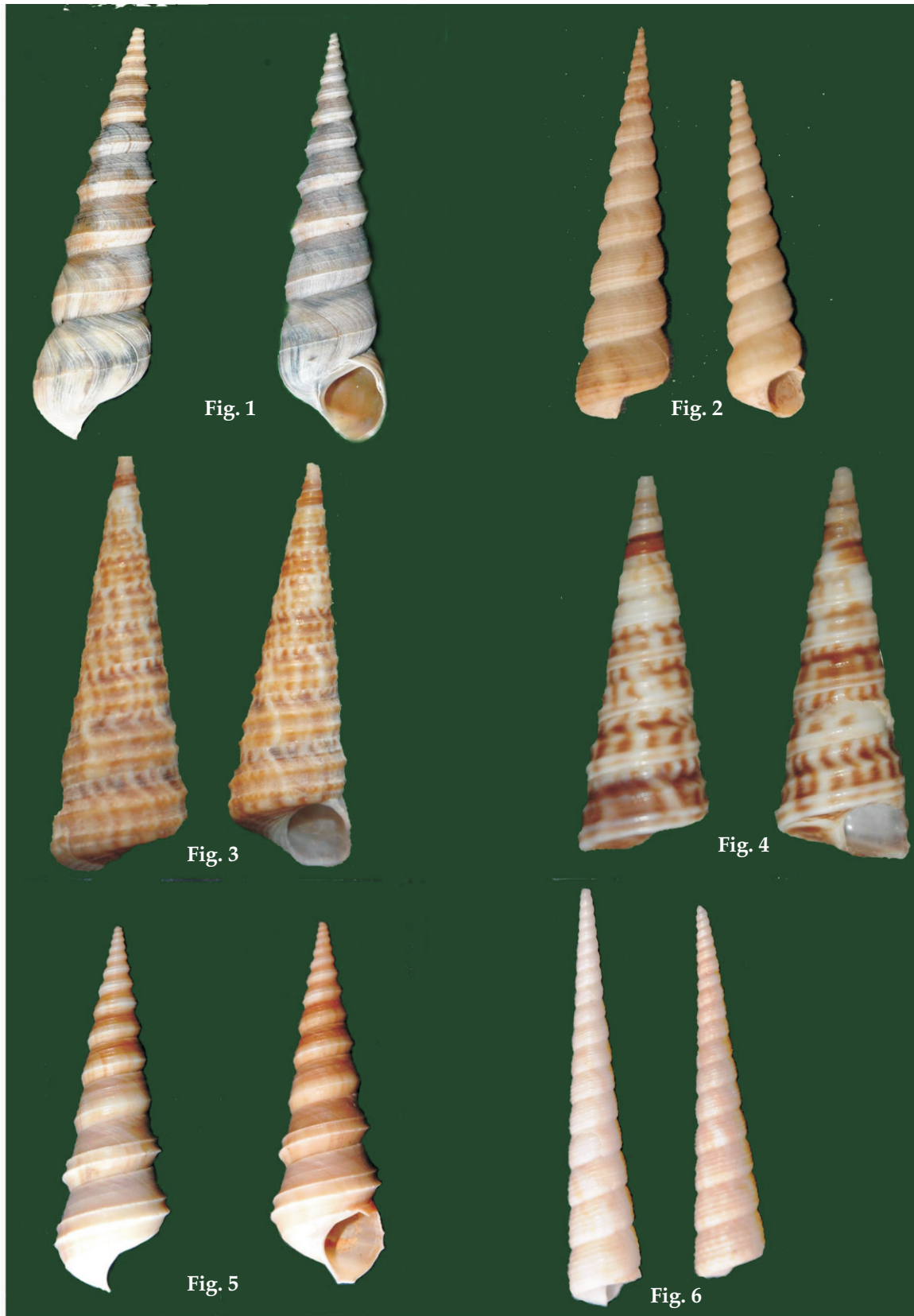
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PLATE I



**Fig. : 1.** *Turitella attenuata* Reeve; **Fig.2.** *Turitella infraconstricta* Smith; **Fig.3.** *Turritella bicingulata* Lamarck; **Fig. 4.** *Turritella maculata* Reeve; **Fig. 5.** *Turritella duplicata* (Linnaeus); **Fig. 6.** *Turritella columnaris* Kiener

## PLATE II



**Fig. : 7.** *Turritella fultoni* Melvill; **Fig. 8.** *Haustator trisulcata* (Lamarck); **Fig. 9.** *Turritella monilifera* Adam & Reeve; **Fig. 10.** *Turritella fastigiata* Adam & Reeve.