



Report on the turrid genera *Gemmula*, *Lophiotoma* and *Ptychosyrinx* (Gastropoda: Turridae: Turrinae) from the China seas

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Abstract

Based on the material deposited in the Marine Biological Museum of the Chinese Academy of Sciences, Qingdao, the present paper reports 26 turrid species, which belong respectively to three genera of the subfamily Turrinae, including four new species, *Gemmula grandigyrate* **sp. nov.**, *Gemmula flata* **sp. nov.**, *Lophiotoma pseudocosmoi* **sp. nov.**, and *L. verticala* **sp. nov.**, and four species newly recorded from the China seas. *Gemmula grandigyrate* **sp. nov.** is peculiar in the genus in having a large conical protoconch of six whorls; *Gemmula flata* **sp. nov.** is similar to the “martini series Powell, 1964” in the shell profile, but can be easily separated from the species of this series by the shell sculpture; *Lophiotoma pseudocosmoi* **sp. nov.** differs from the close species of the genus *Lophiotoma* and a similar species of the genus *Gemmula*, *G. cosmoi* (Sykes, 1930), by the peripheral carina and the shell height; *Lophiotoma verticala* **sp. nov.** looks like a species of genus *Fusiturris*, *F. undatiruga* (Bivona, 1832), but differs from the latter by the stronger axial fold, less conspicuous spiral folds, stronger peripheral carina and deeper sinus.

Key words: Turridae; Turrinae; *Gemmula grandigyrate* **sp. nov.**; *Gemmula flata* **sp. nov.**; *Lophiotoma pseudocosmoi* **sp. nov.**; *Lophiotoma verticala* **sp. nov.**; new species; new recorded species; China seas

Introduction

The mollusk Family Turridae H. & A. Adams, 1853, is the largest family in the Class Gastropoda with remarkable diversity of the shell forms. Because of the tremendous variation of shell shape, size and sculptural characteristics as well as the shell color, the turrid species are very difficult to distinguish.

Up to now, the classification of the Turridae is still confused. Mainly based on shell characters, Powell (1966) recognized nine subfamilies of the family. McLean (1971) recognized 15 subfamilies. Taylor *et al.* (1993) studied the relationships among the sub-groups of the superfamily Conoidea with cladistic analysis, and proposed to divide the traditional Turridae (s. l.) into five families: Drilliidae Morrison, 1966, Pseudomelatomidae Morrison, 1966, Strictispirinae McLean, 1971, Turridae H. and A. Adams, 1853 (s. s., sensu Taylor *et al.*, 1993) and Conidae Fleming, 1822. Those genera with slender, hypodermic marginal teeth in the traditional Turridae (s. l.) were included in the family Conidae in their system. In the present paper, we follow the system of Taylor *et al.* (1993).

Olivera (1999, 2002, 2004a, 2004b) published a series of reports about the subfamily Turrinae from the Philippines. In the series, he “provisionally uses only three major genera in the Turrinae for forms that are broadly distributed over the Indo-Pacific: *Turris* (Röding, 1798), *Lophiotoma* (Casey, 1904), and *Gemmula* Weinkauff, 1875”. Of the three genera, the genus *Lophiotoma* (s. l.) encompasses not only all species that Powell (1964, 1966) assigned to *Lophiotoma* (s. s.), but also all of the species previously assigned to the genera *Lophioturris* Powell, 1964, *Xenuroturris* Iredale, 1929 and *Unedogemmula* MacNeil, 1960. Kilburn

(1983) suggested that the species of “*Unedogemmula*” should be included in *Lophiotoma* (s. l.) rather than *Gemmula*. This opinion has been followed by Taylor *et al.* (1993) and Olivera (2004a). Olivera (2002, p. 49) evaluated the genus *Xenuroturrus* Iredale, 1929 as “an unacceptable taxon, and all species previously assigned to *Xenuroturrus* are provisionally placed in *Lophiotoma*. Thus, *Xenuroturrus cingulifera* should be referred to as *Lophiotoma cingulifera*”. In the present paper, we adopt Olivera’s (2002) opinion.

When we sorted the mollusk collection of the Marine Biological Museum of the Chinese Academy of Sciences (MBMCAS), in the Institute of Oceanology, Chinese Academy of Sciences (IOCAS), a lot of turrid specimens collected from the China seas were separated out. Five species of genus *Turrus* of the subfamily Turrinae (Turridae) from the China seas were reported recently (Li & Li 2007); this paper reports 26 species of the other three genera, *Gemmula*, *Lophiotoma* and *Ptychosyrinx*, of the subfamily, including four new species and four species newly recorded from the China seas.

Material and methods

The material was collected by investigations carried out since the 1950s, including the “National Comprehensive Oceanography Survey” (NCOS, 1958-1960), “China-Vietnam Marine Resource Investigation Cooperative of the Beibu Gulf (=Gulf of Tonkin)” (1959-1962), and the “China-Germany Marine Biota Cooperative Investigations of Hainan Island, China” (1990-1992), from the Chinese waters of the East and South China Seas, including the waters off Fujian, Guangdong Provinces, Beibu Gulf (= Gulf of Tonkin), Hainan Island, Xisha Islands (= Paracel Islands) and Nansha Islands (=Spratly Islands).

All the materials are deposited in the MBMCAS. Genera and species are arranged alphabetically. The following abbreviations are used in the text: IOCAS = Institute of Oceanology, Chinese Academy of Sciences; MBMCAS = Marine Biological Museum of the Chinese Academy of Sciences in the IOCAS; RN = museum registration number; CN = preliminary registration number when the sample(s) was collected; spm (s) = specimen(s); AT = Agassiz trawl; BT = Beam trawl; coll. = collector(s); ECS = the East China Sea; SCS = the South China Sea.

Species list

(Three genera, 26 species. The species with an asterisk “*” are the species newly recorded from the China seas)

Gemmula (Gemmula) congener (E. A. Smith, 1894)

Gemmula (Gemmula) cosmoi (Sykes, 1930)

**Gemmula dampierana* Powell, 1964

**Gemmula (Gemmula) cf. diomedea* Powell, 1964

Gemmula flata **sp. nov.**

Gemmula cf. *gemmulina* (Martens, 1902)

**Gemmula gilchristi* (Sowerby, 1902)

Gemmula grandigrata **sp. nov.**

Gemmula (Gemmula) kieneri (Doumet, 1840)

Gemmula pseudogranosa (Nomura, 1940)

Gemmula rarimaculata Kuroda & Oyama, 1971

Gemmula sp.

Gemmula speciosa (Reeve, 1843)

Gemmula (Pinguigemmula) thielei (Finlay, 1930)
Lophiotoma cingulifera cingulifera (Lamarck, 1822)
Lophiotoma deshayesii (Doumet, 1839)
Lophiotoma hastula (Reeve, 1843)
Lophiotoma ina MacNeil, 1960
Lophiotoma indica indica (Röding, 1798)
Lophiotoma koolhoveni (Oostingh, 1938)
Lophiotoma leucotropis (Adams & Reeve, 1850)
Lophiotoma notata (Sowerby, 1889)
Lophiotoma pseudocosmoi **sp. nov.**
Lophiotoma unedo (Kiener, 1839-40)
Lophiotoma verticala **sp. nov.**
 **Ptychosyrinx timorensis* (Powell, 1964)

Taxonomy

Family Turridae H. & A. Adams, 1853

Subfamily Turrinae Swainson, 1840

Genus *Gemmula* Weinkauff, 1875

Gemmula (Gemmula) congener (E. A. Smith, 1894)

(Pl. 1, fig. 1)

Pleurotoma congener E. A. Smith, 1894: 160, pl. 3, figs. 4, 5.

Pleurotoma (Gemmula) congener.— Schepman 1913: 403.

Turris (Gemmula) congener.—Melvill 1917: 144.

Gemmula congener congener. — Powell 1964: 251, pl. 191, figs. 1–4.

Gemmula (Gemmula) congener. — Cernohorsky 1987: 123, figs. 1–4 (not fig.5).

Material examined. **ECS.** 1 spm, RN MBM028715, CN F13B-16, 30°00'N, 124°00'E, 63 m, AT, 24. X. 1959. **Beibu Gulf.** 1 spm, CN R124B-70, 20°45'N, 108°00'E, silt, 39 m, AT, coll. B. Zhang & W. Yuan, 14. XII. 1959; 1 spm, CN Q136-23, 20°15'N, 107°00'E, muddy sand, 31 m, AT, coll. F. Sun, 1. II. 1960; 1 spm, CN X72B-43, 19°00'N, 106°00'E, muddy sand, 28 m, coll. Fan, 11. II. 1960; 1 spm, CN Z14B-28, 19°00'N, 108°00'E, fine sandy mud, 73.5 m, 16. V. 1960; 2 spms, CN X23B-52, 19°00'N, 106°30'E, sandy mud, 41 m, AT, 8. XII. 1959; 1 spm, CN Q247B-4, 20°45'N, 107°30'E, silt, 31 m, AT, 16. VII. 1960; 1 spm, CN R107-57, 20°00'N, 107°00'E, muddy fine sand, 36 m, AT, 5. XII, 1959; 1 spm, CN X63B27, 19°30'N, 108°30'E, fine sandy silt, 55.5 m, AT, 9. II. 1960. **SCS.** 2 spms, CN K118B-34, 20°30'N, 112°00'E, sandy mud, 72 m, 6. II. 1960; 1 spm, CN S187B-11, 21°30'N, 115°00'E, sandy mud, 86.6, AT, 9. I. 1960; 1 spm, CN N143B-16, 17°30'N, 110°00'E, sandy mud, 140 m, AT, 10. III. 1960. **Nansha Islands.** 8 spms, CN SSIVB49-8, 5°15'N, 108°45'E, muddy sand, 111 m, AT, 16. V. 1987; 1 spm, CN SSIV45-21, 4°00'N, 110°00'E, muddy sand, 99 m, AT, 15. V. 1987; 1 spm, CN SSVIII10-15, 8°52'N, 108°40'E, sand, 94 m, 10. VI. 1990; 1 spm, CN SSVIII8-16, 7°24'N, 104°52'E, muddy sand, 44 m, AT, 9. VI. 1990; 1 spm, CN SSB-2, 5°30'N, 112°00'E, 142 m, 23. IX. 1994; 1 spm, CN SSB9-2, 4°30'N, 109°30'E, 108 m, 23. IX. 1994.



PLATE 1. Species of Subfamily Turritinae, fig. 1. *Gemmula (Gemmula) congener* (CN X72B-43) ; 2-3. *G. (Gemmula) cosmoi* (CN K164B-28-1); 4. *G. (Gemmula) kieneri* (CN SSBII15-9-1); 5-6. *G. flata* **sp. nov.** (holotype, CN 7-20); 7. *Lophiotoma hastula* (CN S148-B18-1); 8. *Lophiotoma ina* (CN 59-1-26); 9. *Lophiotoma koolhoveni* (CN X84B-31).

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
SSIVB49-8-1	36.0	12.2	19.6	0.34	0.54
SSIVB49-8-2	38.1	10.7	20.2	0.28	0.53
SSIVB49-8-3	35.9	11.1	17.3	0.31	0.48
X72B-43	42.1	12.3	20.9	0.29	0.50
X23B-52-1	16.5	6.2	8.5	0.37	0.52

Distribution. East China Sea, Beibu Gulf, northern South China Sea and Nansha Islands; Japan.

Remarks. The present specimens agree well with the figure reported by Cernohorsky (1987: 123, fig. 4). Cernohorsky (1987) suggested that the development of the bicarinate subsutural cord is variable in *Gemmula congener* (E. A. Smith, 1894), and that *G. rarimaculata* Kuroda & Oyama 1971 is a synonym. We do not agree with Cernohorsky (1987) because *G. congener* has distinctly broader shell than *G. rarimaculata*, and the details of shell sculpture of the two species is different.

Powell (1964) reported three recent subspecies of *Gemmula congener*: *G. c. cosmoi* (Sykes, 1930), *G. c. diomedea* Powell, 1964, and type subspecies *G. c. congener* (E. A. Smith, 1894). They were evaluated as separated species more recently by Cernohorsky (1987) and Kilburn (1983).

***Gemmula (Gemmula) cosmoi* (Sykes, 1930)**

(Pl. 1, figs. 2-3)

Turris cosmoi Sykes, 1930: 82, text-fig.

Gemmula congener cosmoi.—Powell 1964: 252, pl. 192.

Gemmula (Gemmula) cosmoi.—Kilburn 1983: 567, figs. 8, 14, 33–36; Cernohorsky 1987: 123–134.

Material examined. **ECS.** 3 spms, CN F14B-31, 29°30'N, 124°00'E, fine sand, 70 m, AT, 24. X. 1959; 1 spm, 30°00'N, 123°30'E, muddy sand, 60 m, 8. XII. 1959. **Beibu Gulf.** 1 spm, CN R10H-15, 20°00'N, 108°30'E, 60.5 m, clay, AT, 4. XI. 1959; 1 spm, CN Y51B-24, 19°45'N, 108°00'E, 57 m, muddy sand, AT, 4. II. 1960; 1 spm, CN K255B-2A, 19°30'N, 108°00'E, 70 m, muddy sand, 14 X. 1960; 1 spm, CN Y97B-71, 19°45'N, 108°30'E, 62 m, muddy sand, AT, 18. IV. 1960; 1 spm, 19°00'N, 108°00'E, 58.9 m, 6. VII. 1960. **SCS.** 14 spms, CN K33B-16, 19°30'N, 113°00'E, 180 m, muddy fine sand, AT, 21. IV. 1959; 1 spm, CN K164B-28, 20°00'N, 113°30'E, 129 m, muddy sand, AT, 9. IV. 1960. **Nansha Islands.** 2 spms, CN SSBV19-9, 5°35'N, 114°51'E, 206 m, AT, 29. VII. 1988; 4 spms, CN Ns2B-2, 5°00'N, 110°00'E, 136 m, 6. XII. 1993; 19 spms, CN Ns5B-6, 146 m, sandy mud; 5 spms, CN SSB2-6, 8°30'N, 109°00'E, 143 m, 17. IX. 1994; 1 spm, CN Ns5B-6, 5°30'N, 112°00'E, muddy sand, 146 m, 10. XII. 1993; 1 spm, CN SSBIV-, 5°00'N, 110°00'E, 167 m, AT, 5. V. 1987; 1 spm, CN SSAIV-3, 5°16'N, 114°10'E, sandy mud, 173 m, 9. V. 1987; 2 spms, CN SSBV-9, 4°55'N, 113°20'E, muddy sand & shell debris, AT, 1. VIII. 1988; 1 spm, CN SSBIV-27, 5°30'N, 110°18'E, 167 m, AT, 15. V. 1987; 7 spms, CN SSB8-10, 5°30'N, 110°30'E, 224 m, 22. IX. 1994; 2 spm, CN SSBII25-17, 5°40'N, 112°06'E, muddy sand, 170 m, AT, 31. VII. 1988; 14 spms, CN K33B-16, 19°30'N, 113°00'E, muddy fine sand, 180 m, AT, 21. IV. 1959; 1 spm, CN K143B-41, 18°30'N, 111°30'E, sandy mud, 182 m, AT, 11. IV. 1959.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
SSBV19-9-1	32.7	11.0	17.2	0.34	0.53
SSBV19-9-2	29.8	10.9	14.5	0.37	0.49
K164B-28-1	43.2	13.5	24.8	0.31	0.57
SSB2-6-1	18.2	6.9	10.0	0.38	0.55
K164B-28-2	42.2	14.0	23.5	0.33	0.56

Distribution. East China Sea, Beibu Gulf, South China Sea and Nansha Islands; Philippines.

Remarks. Powell (1964) considered this species to be endemic to Japan, and Kilburn (1983) reported this species also from Natal and Southern Mozambique. Cernohorsky (1987) extended the geographic range into Malagasy.

**Gemmula dampierana* Powell, 1964

(Pl. 4, figs. 3-4)

Gemmula dampierana Powell, 1964: 248, pl. 186, fig. 5; Kosuge, 1988: 118, pl. 47, figs. 1–2, 4–5; text-f. 1.

Material examined. SCS. 1 spm, CN SIII11B-89, 21°45'N, 114°30'E, silty mud, 62.4 m, AT, 11. VII. 1959; 1 spm, CN SIII14B-74, 22°15'N, 115°00'E, sandy mud, 42 m, AT, 13. VII. 1959; 1spm, CN SIII5B-34, 21°30'N, 114°00'E, silty mud, 75.5 m, AT, 10. VII. 1959; 1 spm, CN Q44B-47, 17°30'N, 109°00'E, silty mud, 92 m, AT, 11. IV. 1959; 1 spm, CN N172-39, 19°00'N, 111°30'E, sandy mud, 162 m, AT, 7. IV. 1960; 1 spm, CN S210B-50, 21°30'N, 114°30'E, silty mud, AT, 8. IV. 1960; 1 spm, N181B-59, 20°00'N, 111°15'E, silty mud, 50 m, BT, 9. IV. 1960; 1spm, CN S191B-16, 21°30'N, 114°30'E, silty mud, 75 m, AT, 9. I. 1960; 1 spm, CN N147B-14, 18°12'N, 109°45'E, sandy mud, 64 m, BT, 10. III. 1960; 1 spm, CN 10-32, 17°30'N, 110°00'E, silty mud, 168 m, At, 28. I. 1959; 1 spm, CN N98B-98, 20°00'N, 111°15'E, sandy mud, 44 m, AT, 29. X. 1959; 1 spm, CN Q118B-67, 22°45'N, 116°00'E, fine sandy mud, 23 m, AT, 10. I. 1960; 1 spm, CN R36B-6, 18°00'N, 109°30'E, muddy sand, 70 m, AT, 14. VII. 1959; 1 spm, CN N138B-67, 18°30'N, 110°15'E, silty mud, 51.5 m, BT, 9. III. 1960; 3 spms, CN N48B-72, 21°00'N, 108°30'E, silty mud, 35 m, AT, 20. IV. 1959.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
N181B-59	18.8	6.1	9.5	0.32	0.51
SIII14B-74	14.8	5.8	7.5	0.39	0.51
SIII11B-89	16.8	5.5	8.3	0.33	0.49
210B-50	16.5	5.5	8.2	0.33	0.50
N172-39	14.2	5.3	7.3	0.37	0.51

Distribution. South China Sea; Australia. Not previously recorded from China seas.

Remarks. The specimens are smaller in size than the holotype, and the numbers of whorls is 11.5, which is more than the 8 in the holotype. The other features exactly agree with Powell's (1964) descriptions. Kosuge (1988) also reported this species from western coast of Australia.

**Gemmula (Gemmula) cf. diomedea* Powell, 1964

(Pl. 4, figs. 1-2)

Gemmula congener diomedea Powell, 1964: 253, pl. 191, figs. 5, 6; Kosuge, 1988: 119, pl. 47, figs. 6–8; text-figs. 2, 5–12.

Gemmula diomedea.—Abbott & Dance 1982: 238.

Material examined. SCS. 1 spm, CN N48B-49, 21°00'N, 108°30'E, mud, 35 m, AT, 20. IV. 1959; 1 spm, CN K113B-80, 21°00'N, 112°30'E, muddy sand, 55 m, AT, 16. XI. 1959; 1 spm, CN N169B-19, 20°15'N, 111°30'E, sandy mud, 57 m, BT, 6. IV. 1960.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
N169B-19	30.5	8.9	13.2	0.29	0.43
N48B-49	15.2	5.1	7.9	0.34	0.52
K113B-80	27.0	8.9	12.5	0.33	0.46

Distribution. South China Sea; Philippines. Not previously recorded from China seas. The 35m depth of the present record represents the shallowest bathymetric record for the species.

Remarks. The three specimens agree with the previous descriptions and illustrations of most of the shell features of *G. diomedea*, although the anal sinus is different from that of the holotype of the species. Powell (1964) considered this species is an intermediate form between *Gemmula (Gemmula) cosmoi* (Sykes, 1930) and *G. congener* (E. A. Smith, 1894), but these two forms were found in depths between 182–640m, much deeper than the present species.

****Gemmula flata* sp. nov.**

(Pl. 1, figs. 5-6)

Type material. SCS. 1 spm, holotype, CN 7–20, 112°30'E, 19°00'N, 472 m, A. T., Feb. 17 1959.

Measurements (mm).

Length (mm)	Width	Aperture	W/L	A/L
31.5	11.0	17.3	0.35	0.55

Etymology. From *flatus*, Latin, means flat. The specific name is in reference to the rather flat-side profile to each whorl in the spire of the shell.

Diagnosis. Shell 31.5 mm in height, broadly fusiform, with tall, turreted spire and long straight canal; suture distinct, followed by a strong crested subsutural fold. With 11 whorls, including protoconch of 3 whorls, upper 1 or 2 nuclear whorls smooth, eroded to certain extent, remainder axially costate. Peripheral carina is low on the spire whorls.

Description. Shell 31.5 mm in height, solid, broadly fusiform; spire tall, slightly shorter than height of aperture plus canal; with 11 whorls, including protoconch of three whorls, upper one or two nuclear whorls smooth, eroded to certain extent, remainder with axial costae. Spire whorls sculptured with wavy spiral fold, followed by strong crested subsutural fold composed of three closely spaced cords, with central cord strongest. With about four to five crisp strong spirals on concave shoulder area, then a prominent gemmate bicarinate peripheral keel composed of two to three closely spaced cords. Gemmules vertically fused, about 38–50 gemmules per whorl. Peripheral carina set low on spire whorls, almost at lower suture, forming rather flat-sided profile to each spire whorl with base contracted, forming relatively long anterior canal. Upper base with two strong spaced spiral cords, two to three fine intermediate cords between them, neck and anterior end with about 20 spaced cords, with fine intermediate threads. Outer lip thin, covered by extensions of spiral cords externally, sinus deep, U-shaped, situated on peripheral carina; inner lip smooth. Anterior canal moderately long, almost straight. Color uniformly buff.

Distribution. Only known from South China Sea so far.

Remarks. Powell (1964) noted a species complex namely “*Gemmula martini* series”, including four species: *G. martini* (Tesch, 1915), *G. aethiopica* (Thiele, 1925), *G. sibogae* (Schepman, 1913) and *G. sibukoensis* Powell, 1964. Powell pointed out that the four species share the following character: “the peripheral carina is low on the spire whorls, almost on the lower suture, which results in a rather flat-sided profile to each whorl in spire”. *Gemmula flata* sp. nov. also has this character, and is similar in shell profile to the four species, should be a member of this complex. The new species can be easily distinguished from the other four species of the complex by the details of the shell sculpture, including the crisp spiral cords, strong crested subsutural fold, and the more concave spire whorls.

***Gemmula cf. gemmulina* (von Martens, 1902)**

(Pl. 4, figs. 6-7)

Gemmula (*Gemmula*) *gemmulina* von Martens, 1902: 238; Powell 1964: 260, pl. 200, fig. 2, pl. 201, figs 1, 2.

Material examined. Bohai Gulf. 1 spm, CN H238B-7, coarse sand, 20 m, 9. VII. 1959. Beibu Gulf. 1 spm, CN N158B-83, 18°15'N, 108°45'E, muddy coarse sand, 38 m, AT, 13. III. 1960. SCS. 1 spm, CN Q101B, 23°15'N, 117°00'E, sandy mud, 23 m, AT, 20. XI. 1959; 1 spm, CN 2-42, 18°45'N, 110°45'E, shell debris & mud, 118.5 m, AT, 25. I. 1959; 1 spm, CN R25B-15, 19°00'N, 110°45'E, sandy mud, 80 m, AT, 10. VII. 1959.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
Q101B	24.8	8.5	10.8	0.34	0.44
H238B-7	17.6	5.5	8.4	0.31	0.48
R25B-15	14.3	5.2	7.2	0.36	0.50
N158B-83	11.1	4.4	5.1	0.40	0.46
2-42	15.8	5.5	7.5	0.35	0.47

Distribution. Bohai Gulf, South China Sea; Sumatra, Philippines.

Remarks. The present specimens are very similar to *Gemmula gemmulina* Powell 1964 in shell form. The only difference in the number of the gemmulate nodes: the present specimens have nearly 30 gemmulate nodes, 20 more than in the types. The species was also found from the South China Sea (off Dongsha Islands (Pratas Is.))(Powell (1966)). So we refer it to *Gemmula gemmulina* von Martens, 1902 rather than a new species. The holotype was collected from west coast of Sumatra at 677 m depth, much deeper than the present specimens in the depth 20–118.5 m.

****Gemmula gilchristi* (Sowerby, 1902)**

(Pl. 4, fig. 5)

Pleurotoma gilchristi Sowerby, 1902: 99, pl. 2, fig. 9.*Gemmula gilchristi*.—Powell 1964: 249, pl. 189, figs. 1, 2.

Material examined. ECS. 1 spms, CN F14B, 29°30'N, 124°00'E, fine sand, 70 m, AT, 29. VII. 1988. SCS. 1 spm, CN Q101B-48, 23°15'N, 117°00'E, Shantou, Guangdong Province, muddy sand, 23 m, AT, 20. XI. 1959; 1 spm, 19°30'N, 111°15'E, sandy mud, 90 m, 28. I. 1959.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
F14B	24.5	7.4	11.0	0.30	0.45
Q101B-48	19.2	6.6	8.8	0.34	0.46
	10.5	3.8	5.1	0.36	0.49

Distribution. East and South China Seas; South Africa, Zanzibar, Andaman Islands, Japan.

Remarks. The present specimens agree with Powell's (1964) descriptions and figures (pl. 189, figs. 1, 2) of *G. gilchristi* from South Africa, although their shells are white, the subsutural fold is uniform light yellow. Based on the holotype and four other specimens collected from Japan, Durban and Andaman, Powell (1964)

noted that the color of this species is uniform golden to light reddish brown for shallow water shells; the topotypes are white with pale brown between the peripheral gemmules.

***Gemmula grandigyrate* sp. nov.**

(Pl. 5, figs. 1–3)

Type material. SCS. 1 spm, CN Q32A-3, 18°00'N, 110°30'E, silt, 142 m, IV. 1978.

Measurements (mm).

Length (mm)	Width	Aperture	W/L	A/L
8.2	3.5	4.4	0.43	0.54

Etymology. From *grandis*, Latin, means big, large; *gyratus*, Latin, means circle, made in a circular form, rounded. The specific name is in reference to the large conical protoconch consisting of six whorls.

Diagnosis. Shell small, broadly fusiform, with tall turreted spire and long straight canal; spire little shorter than height of aperture plus canal; with eight whorls, including a large conical protoconch of six whorls, the first whorl smooth, remainder axially costate. Color uniformly buff.

Description. Shell small, 8.2 mm in height, broadly fusiform; spire tall, turreted, slightly shorter than height of aperture plus canal; with eight whorls, including large conical protoconch of six whorls, first whorl smooth, other whorls axially costate. Spire whorls sculptured firstly with strongly crested subsutural fold, composed of two closely spaced cords, first one lower than second, about three crisp spirals on concave shoulder area, then prominent, gemmate, bicarinate peripheral keel, also composed of two closely spaced cords, about 20 vertically fused gemmules on penultimate whorl. Upper base with three strong spaced primary cords, neck and anterior end with about 11 spaced threads. Outer lip broken, inner lip smooth, columella with distinct trace of elongated spiral folds, anterior canal moderately long, notched. Color uniformly buff.

Remarks. *Gemmula grandigyrate* sp. nov. can be easily distinguished from all other known species of the genus *Gemmula* by the large conical protoconch with 6 whorls, a peculiar structure in the genus *Gemmula*.

***Gemmula (Gemmula) kieneri* (Doumet, 1840)**

(Pl. 1, fig. 4)

Pleurotoma kieneri Doumet, 1840: 2, pl. 10.

Pleurotoma carinata Reeve 1843, pl. 7, fig. 56.

Gemmula kieneri. — Powell 1964: 246, pl. 186, figs. 2, 3.

Material examined. ECS. 1 spm, CN V485B-42, 29°30'N, 127°00'E, medium sand, 107 m, AT, 27. VI. 1976. SCS. 1 spm, CN 54-418, Shanwei Guangdong Province, intertidal zone, 11. IV. 1954; 1 spm, 58-M0327, Xincun, Hainan Island, intertidal zone, 16. IV. 1958; 2 spms, CN 58M-327, Xincun, Hainan Island, intertidal zone; 1 spm, CN 54-429, intertidal zone, Shanwei, Guangdong Province, 13. IV. 1954; 1 spm, CN 54-331, Jieshi, Guangdong Province, intertidal zone, 27. III. 1954; 1 spm, 19°30'N, 112°00'E, 124 m, fine sand & shell debris, 30. VII. 1959; 1 spm, 20°30'N, 112°30'E, 80 m, sandy mud, 16. II. 1959; 1 spm, CN Q86B-26, 17°00'N, 109°30'E, 171.5 m, muddy sand, AT, 22. XI. 1959; 1 spm, 20°15'N, 111°30'E, silty mud & fine sand, 71 m, 26. I. 1959; 3 spms, 20°00'N, 112°30'E, muddy sand, 108 m, 5. VII. 1959; 1 spm, CN N96B-59, 19°30'N, 111°15'E, medium sand, 89 m, AT, 29. X. 1959. **Nansha Islands.** 1 spm, CN SSI VB50-9, 5°38'N, 109°05'E, 147 m, AT, 16. V. 1987; 1 spm, CN SSBIV-7, 5°00'N, 112°15'E, 105 m, clay, 11. V. 1987; 12 spms, CN SSBII15-9, 6°24'N, 115°35'E, 145-148 m, muddy sand, AT, 27. VII. 1988; 8 spms, CN SSB2-5,

8°30'N, 109°00'E, 143 m, 17. IX. 1994; 1 spm, CN SSB5-4, 11°00'N, 110°00'E, 93 m, 17. IX. 1994; 6 spms, CN SSBIII-42, 107 m, 15. V. 1987; 2 spms, CN NS5B-6, 5°30'N, 112°00'E, sandy mud, 143 m, 10. XII. 1993; 2 spms, CN SSB5-4, 5°30'N, 108°30'E, 93m, 17. IX. 1994; 1 spm, CN SSB-9, 4°30'N, 110°30'E, 108 m, 23. IX. 1994.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
--	32.4	10.2	17.2	0.31	0.53
58-M0327	55.2	17.0	27.5	0.31	0.50
58M-327-1	61.5	18.8	31.2	0.31	0.51
SSBII15-9-1	55.4	17.8	29.5	0.32	0.53
SSBII15-9-2	26.2	9.2	14.6	0.35	0.56

Distribution. East and South China Seas, Nansha Islands; Japan, Philippines. Common in South China Sea.

***Gemmula pseudogranosa* (Nomura, 1940)**

(Pl. 2, fig. 4)

Turris (*Gemmula*) *pseudogranosa* Nomura, 1940: 112, pl. I, figs. 2a, 2b.

Gemmula pseudogranosa. —Tucker, 2004: 1264.

Material examined. ECS. 1 spm, CN V469B-41, 27°20'N, 126°00'E, fine sand, 162 m, AT, 10. X. 1975.

Measurements (mm).

CN	Length	Width (mm)	Aperture (mm)	W/L	A/L
V469B-41	20.9	6.2	7.5	0.30	0.36

Diagnosis. Shell medium in size, 20.9 mm in height; with very elongated turreted spire and short anterior canal. Spire about 2.5 times of height of aperture plus anterior canal. Spire whorls sculptured firstly with strong flat subsutural fold, composed of two closely spaced cords, with a less prominently projecting gemmate bicarinate peripheral keel. Color uniformly buff.

Distribution. East China Sea, Taiwan.

***Gemmula* sp.**

(Pl. 2, figs. 5-6)

Material examined. Yellow Sea. 2 spms, CN Y351B-7, 34°00'N, 123°30'E, silty mud, 66 m, AT, 16. X. 1959.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
Y351B-7-1	19.2	6.3	9.4	0.33	0.49
Y351B-7-2	19.5	6.3	9.5	0.32	0.49

Distribution. Yellow Sea; Japan. Not previously recorded from Yellow Sea.

Remarks. The two specimens collected from the Yellow Sea in 1959 were light reddish brown in colour. Because they have gemmules on the peripheral carina, especially on the early whorls, we assigned them to genus *Gemmula*. Unfortunately, our specimens shell surfaces are worn to a certain extent, and they lack distinct characters to be identified to any species of the genus.



PLATE 2. Species of Subfamily Turrinae, figs. 1-2. *Gemmula rarimaculata* (CN X228B-25); 3. *Gemmula* (*Pinguigemmula*) *thielei* (CN SSBV22-7); 4. *Gemmula pseudogranosa* (CN V469B-41); 5-6. *Gemmula* sp. (CN Y351B-7); 7. *Ptychosyrinx timorensis* (CN KY9B-1); 8. *Lophiotoma cingulifera cingulifera* (CN Xincun-1)

****Gemmula rarimaculata* Kuroda and Oyama, 1971**

(pl. 2, figs. 1–2)

Gemmula (Gemmula) rarimaculata Kuroda and Oyama, 1971: 222, pl. 57, fig. 9, pl. 111, fig. 6; Kosuge, 1988: 120, pl. 47, fig. 3.

Material examined. Beibu Gulf. 1 spm, CN X228B-25, 17°30'N, 107°00'E, medium sand, 52 m, AT, 17. VIII. 1962. **SCS.** 1 spm, CN K33B-17, 19°30'N, 113°00'E, muddy fine sand, 180 m, AT, 21. IV. 1959; 1 spm, CN LX56B-20, 21°15'N, 100°00'E, silty mud, 18 m, AT, 1. VII. 1959; 2 spms, CN S219B-50, 21°30'N, 115°30'E, muddy sand, 115 m, AT, 13. IV. 1960; 1 spm, CN K164B-31, 20°00'N, 113°30'E, muddy sand, 129 m, AT, 9. IV. 1960.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
S219B-5-1	21.5	7.4	10.8	0.34	0.50
S219B-5-2	22.2	7.3	12.3	0.33	0.55
K164B-31	21.5	7.2	11.3	0.33	0.53
K33B-17	22.5	7.1	10.8	0.32	0.48
X228B-25	27.6	9.3	14.0	0.34	0.51
LX56B-20	17.0	5.5	8.4	0.32	0.49

Distribution. Beibu Gulf, South China Sea; Fiji, Queensland, Philippines. Not reported previously from China seas.

Remarks. The six specimens are covered by the descriptions of the holotype reported by Kuroda and Oyama (1971), although they variable in shell form and sculpture. In the six specimens, three have a slightly longer siphonal canal, and a more convex shell outline than the holotype.

***Gemmula speciosa* (Reeve, 1843)**

(Pl. 3, fig. 1)

Pleurotoma speciosa Reeve, 1843, pl. 2, fig. 9.

Pleurotoma (Gemmula) speciosa.—Tryon 1884: 173, pl. 4, fig. 48.

Turris (Gemmula) guadurensis.—Melvill 1917: 145.

Gemmula speciosa.—Powell 1964: 245, pl. 186, fig. 1; Olivera 2004b: 3, fig. 1.

Material examined. Beibu Gulf. 1 spm, X43B-63, 17°30'N, 107°00'E, 50 m, muddy sand, AT, 11. XI. 1959; 1 spm, R190B-92, 20°15'N, 108°30'E, 61.5 m, sandy mud, 15. IV. 1960; 6 spms, X228B-, 52 m, medium sand, AT, 17. VIII. 1962; 1 spm, X188B-95, 18°00'N, 106°40'E, 33 m, clay, AT, 10. IV. 1962; 1 spm, X195B-102, 19°00'N, 106°30'E, 43 m, fine sandy clay, AT, 11. IV. 1962; 1 spm, CN X175B-30, 20°40'N, 108°30'E, fine sandy silt, 49 m, AT, 22. I. 1962; 1 spm, CN X200B-15, 19°30'N, 108°30'E, silt, 51 m, AT, 13. IV. 1962. **SCS.** 2 spms, Sanya, Hannan Island, intertidal zone, 1958; 1 spm, CN 58M-284, Sanya, Hannan Island, intertidal zone, 2. IV. 1958; 2 spms, K164B-28, 20°00'N, 113°30'E, 129 m, muddy sand, AT, 9. IV. 1960; 1 spm, CN N214B-33, 17°00'N, 109°00'E, sandy mud, 108 m, AT, 15. V. 1960; 3 spms, CN N215B-36, 17°00'N, 108°30'E, fine sandy mud, 93 m, AT, 15. V. 1960; 1 spm, CN Q83B-52, 18°00'N, 109°30'E, muddy sand, 68 m, AT, 21. XI. 1959. **Nansha Islands.** 1 spm, SSMIV-8, 4°30'N, 112°15'E, 78 m, clay, middle-level trawl, 11. V. 1987; 1 spm, Ns4B-13, 6°00'N, 111°20'E, 105 m, fine sandy clay, 7. XI. 1993; 1 spm, SSB11-10, 4°30'N, 111°30'E, 80 m, 23. IX. 1994.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
--	79.8	26.6	41.5	0.33	0.52
--	69.5	21.9	22.4	0.32	0.32
X228B-1	43.1	13.5	24.3	0.31	0.56
X228B-2	31.4	11.5	16.8	0.37	0.54
X228B-3	27.4	11.2	14.8	0.41	0.54

Distribution. Beibu Gulf, South China Sea, Nansha Islands; Arabian Sea, Japan, Philippines. The species is common in the South China Sea. The north limited distributed range of this species is northern South China Sea.

***Gemmula (Pinguiggemula) thielei* Finlay, 1930**

(Pl. 2, fig. 3)

Gemmula thielei Finlay, 1930: 47.*Pinguiggemula thielei*. — Powell 1964: 279, pl. 215, fig. 7; Kosuge 1986, pl. 30, figs. 7–9

Material examined. Nansha Islands. 1 spm, CN SSBV22-7, 4°53'N, 113°46'E, 709 m, clay, AT, 29 VII. 1988

Measurements (mm).

Length	Width	Aperture	W/L	A/L
42.2	16.9	26.5	0.40	0.63

Distribution. South China Sea; off west coast of Sumatra, Indonesia.

Remarks. This species is very similar to *Gemmula philippinensis* Powell, 1964. Powell (1964) indicated that “this species differs from *G. philippinensis* in having two instead of three spiral keels in addition to the peripheral flange-like keel, and in *G. thielei* (Finlay, 1930) only the peripheral keel is gemmate, whereas in *G. philippinensis* all four keels are gemmate”. The only one specimen collected from the South China Sea has two spiral keels.

Genus *Lophiotoma* Casey, 1904***Lophiotoma cingulifera* (Lamarck, 1822)**

(Pl. 2, fig. 8)

Pleurotoma cingulifera Lamarck, 1822: 94; Kiener 1839–40: 17, pl. 17, fig. 1; Reeve 1843: pl. 1, sp. 1; Tryon 1884: 166, pl. 3, fig. 23.*Xenuroturrus cingulifera cingulifera*. — Powell 1964: 322, color pl. 175, figs. 12, 19, 20; Springsteen & Leobrera 1986: 269, pl. 76, fig. 22.*Lophiotoma cingulifera*.—Olivera 2002: 42, figs. 1C, H1-3.

Material examined. SCS. 1 spm, Xincun, Hainan Island, intertidal zone; 2 spms, Hele, Hainan Island, intertidal zone.

Measurements (mm).

Collected site	Length	Width	Aperture	W/L	A/L
Xincun-1	36.9	11.7	14.5	0.32	0.39
Hele	35.0	11.8	14.5	0.34	0.41

Distribution. Hainan Island; Japan to New Caledonia and eastward to the Marshall Islands and Fiji.

Remarks. The two specimens agree with the descriptions of Powell, 1964 (as *Xenuroturrus cingulifera cingulifera*) and Olivera, 2002.

***Lophiotoma deshayesii* (Doumet, 1839)**

(Pl. 3, figs. 2-3)

Pleurotoma deshayesii Reeve 1843, pl. 3, fig. 19.

Pleurotoma indica.—Tryon 1884: 168, pl. 6, fig. 80.

Turrus polytropa.—Kira 1971: 92, pl. 35, fig. 16.

Gemmula (Unedogemmula) deshayesii.—Powell 1964: 270, pl. 175, figs. 7, 8, pl. 210, figs. 1, 2.

Material examined. Bohai Gulf. 1 spm, CN 0003, Beidaihe, Hebei Province, intertidal zone, IV. 1950; 1 spm, CN H225B-2, 40°05'N, 121°38'E, 23 m, muddy sand, AT, 18. VII. 1952; 1 spm, CN H395-12, 40°05'N, 121°38'E, 17 m, muddy sand, AT, 27. X. 1959; 2 spms, CN H333B-8, 40°32'N, 120°59'E, 18.4 m, muddy sand, AT, 31. X. 1959. **Yellow Sea.** 6 spms, CN 104B-14, 32°30'N, 124°00'E, 43 m, AT, 9. XI. 1959; 1 spm, CN Y407B-3, 34°00'N, 121°15'E, 17 m, muddy sand, AT, 28. X. 1959; 1 spm, CN Y271B-31, fine sand, 9.5 m, AT, 12. VII. 1959; 1 spm, CN 56-105, Jiaozhou Bay, Qingdao, Shandong Peninsula, 9. VIII. 1956. **ECS.** 1 spm, CN 57-892, Dongshan, Fujian Province, intertidal zone, 18. IV. 1957; 3 spms, CN 57-711, Pingtan, Fujian Province, intertidal zone, 21. III. 1957; 1 spm, CN 53-657, Pingyang, Zhejiang Province, intertidal zone, 31. V. 1953; 2 spms, CN 57-610, Sansha, Fujian Province, intertidal zone, 26. II. 1957. **Beibu Gulf.** 5 spms, CN Q184B-42, 109°30'E, 20°30'N, 16 m, muddy sand, AT, 17. IV. 1960; 1 spm, CN K264B-20, 18°30'N, 108°30'E, 25 m, coarse sand, AT, 23. X. 1960. **SCS.** 11 spms, CN N55B-1, 21°15'N, 110°45'E, 12 m, muddy sand, AT, 11. VII. 1959; 2 spms, CN N190B-16, 21°15'N, 110°45'E, 12 m, coarse sand, AT, 10. IV. 1960; 1 spm, CN N134B-31, 19°15'N, 110°45'E, fine sand, 35 m, AT; 2 spms, CN 55-848, Yinggehai, Hainan Island, intertidal zone, 8. IV. 1955; 3 spms, CN 57-966, Nan'ao, Guangdong Province, intertidal zone, 1. V. 1957.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
104B-14-1	59.7	17.9	30	0.30	0.50
N134B-31	59.5	18.9	30.0	0.32	0.50
56-105	62.5	19.8	29.5	0.32	0.47
55-848-1	34.5	11.9	18.3	0.34	0.53
57-966-1	50.9	15.0	27.5	0.29	0.54

Distribution. Bohai Gulf, Yellow Sea, East and South China Seas; Japan, Philippines.

Remarks. This species has a wide range in China seas, from Bohai Gulf southward to South China Sea. The specimens agree with the descriptions of Powell, 1964.



PLATE 3. Species of Subfamily Turrinae, fig. 1. *Gemmula speciosa* (CN X228B-1); 2-3. *Lophiotoma deshayesii* (CN N134B-31); 4-5. *L. unedo* (CN K218B-15); 6. *L. notata* (CN N67B-41-2); 7. *L. indica indica* (CN SSVIII8-16); 8. *L. leucotropis* (CN 57-966-1).

***Lophiotoma hastula* (Reeve, 1843)**

(Pl. 1, fig. 7)

Pleurotoma hastula Reeve, 1843: pl. 17, fig. 139.

Turris (Tomopleura) trypanodes. —Melvill 1917: 148.

Gemmula (Unedogemmula) hastula.—Powell 1964: 272, pl. 211.

Material examined. **Beibu Gulf.** 2 spms, CN R124B-19, 20°45'N, 108°00'E, 32 m, fine sand & clay, AT, 14. XI. 1959; 1 spm, CN K2BB-57, 19°30'N, 107°00'E, 49.6 m, muddy sand, AT, 7. VII. 1960; 1 spm, CN X1B1B-25, 20°40'N, 109°30'E, 22 m, fine sand & clay, AT, 23. I. 1962; 1 spm, CN X277B-4, 18°00'N, 106°30'E, 43 m, coarse & fine sand, AT, 11. X. 1962; 2 spms, CN X243B-10, 19°40'N, 107°30'E, 48 m, coarse sand & shell debris, AT, 21. VIII. 1962. **SCS.** 2 spms, CN S128-B18, 22°15'N, 115°00'E, 42.3 m, sandy mud, AT, 11. XI. 1959; 2 spms, CN S148-B18, 22°15'N, 115°00'E, 42.3 m, sandy mud, 11. XI. 1959; 4

spms, CN Q188B-38, 20°30'N, 107°30'E, 34 m, muddy sand, AT, 18. IV. 1960. **Nansha Islands**. 4 spms, CN SSVIIIB8-16, 7°24'N, 104°52'E, muddy sand, AT, 9. VII. 1990; 1 spm, CN SSBVIII5-56, 6°29'N, 106°24'E, 46 m, muddy sand, 8. VI. 1990.

Measurements (mm).

Specimen	Length	Width	Aperture	W/L	A/L
S148-B18-1	36.8	10.2	20.5	0.28	0.56
S148-B18-2	36.9	10.8	20.1	0.29	0.54
SSVIIIB8-16-1	26.0	7.7	13.8	0.30	0.53
SSVIIIB8-16-2	28.5	8.3	15.5	0.29	0.54
SSVIIIB8-16-3	24.5	7.2	13.2	0.29	0.54

Distribution. Beibu Gulf, South China Sea, Nansha Islands; Persian Gulf, Arabian Sea. This is a common species in the South China Sea.

Remarks. Reeve (1843) provided a brief description and a hand-painting figure of the holotype. More recently, Powell (1964) provided more detailed and distinct descriptions and a figure of the holotype. Their figures are different to a certain extent on the shell profile. The present specimens agree well with the descriptions and figure of the holotype provided by Powell (1964), and do not vary in shell features.

****Lophiotoma ina* (MacNeil, 1960) n. comb.**

(Pl. 1, fig. 8)

Unedogemmula ina MacNeil, 1960: 102, pl. 5, fig. 7.

Gemmula (Unedogemmula) ina. — Powell 1964: 273, pl. 210, fig. 3.

Material examined. SCS. CN 59-1-26, 1 spm (protoconch and outer lip broken), 20°15'N, 111°30'E, silty mud & fine sand, 71 m, 26. I. 1959.

Measurements (mm).

Length	Width	Aperture	W/L	A/L
35.0	10.8	19.3	0.31	0.55

Diagnosis. Shell medium size, 35.0 mm in height; spire high, pagodiform, with prominent peripheral angle, shoulder straight. Color grayish white.

Distribution. South China Sea; Okinawa (type locality, Japan). This species was previously collected only from the type locality Okinawa, Japan, in Miocene, as a fossil species.

Remarks. Taylor *et al.* (1993) treated with the genus *Unedogemmula* as a synonym of *Lophiotoma*. We followed their opinion and transfer this species to the genus *Lophiotoma* from *Gemmula* as a new combination. The present specimen agrees with the previous descriptions and illustrations.

***Lophiotoma indica indica* (Röding, 1798)**

(Pl. 3, fig. 7)

Turris indica Röding, 1798: 124, pl. 145, figs. 1345, 1346; Hedley 1922: 215.

Pleurotoma marmorata.—Lamarck 1822: 95 (non 1816); Kiener 1839–40: 9, pl. 6, fig. 1, pl. 7, fig. 2; Reeve 1843, pl. 3, figs. 21a, b.

Lophiotoma (Lophioturris) indica. —Powell 1964: 311, color pl. 175, figs. 2, 39, 16 & pl. 242; Springsteen & Leobrera 1986: 266, pl. 76, fig. 10.

Lophiotoma indica indica.— Olivera, 2004a: 4, fig. 1A.

Material examined. Beibu Gulf. 1 spm, CN X34B-55, 22°15'N, 115°00'E, mud, 69 m, AT, 10. XI. 1959.

Nansha Islands. 1 spm, CN SSVIII B8-16, 7°24'N, 104°52'E, muddy sand, 44 m, AT, 9. V. 1990; 4 spms, CN SBVII5-53, 6°29'N, 106°24'E, muddy sand, 46 m, 8. VI. 1990.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
SSVIII B8-16	59.5	14.5	35.5	0.24	0.60
SBVII5-53-1	29.4	8.4	15.5	0.29	0.53
SBVII5-53-2	31.0	8.2	17.1	0.26	0.55
SBVII5-53-3	15.5	4.8	8.3	0.31	0.54
X34B-55	22.5	7.5	12.5	0.33	0.56

Distribution. Beibu Gulf, Nansha Islands; Ceylon, Japan, Philippines, Austria, and Fiji.

Remarks. Olivera (2004a) recognized two subspecies of *Lophiotoma indica*: the typical subspecies *L. i. indica* (Röding, 1798) is distributed in New Guinea to the Philippines and Japan, *L. i. queenslandica* Olivera, 2004a is distributed in the southeastern edge of the range from Queensland, Australia to Fiji. Our specimens agree well with the typical subspecies.

***Lophiotoma koolhoveni* (Oostingh, 1938), n. comb.**

(Pl. 1, fig. 9)

Turris (Gemmula) koolhoveni Oostingh, 1938: 28, pl. 1, fig. 22.

Gemmula (Unedogemmula) koolhoveni.— Powell, 1964: 274, pl. 210, fig. 4.

Material examined. Bohai Gulf. 1 spm, CN H226B-5, 40°05'N, 121°38'E, sandy mud, 23.5 m, 18. VII. 1959. **Beibu Gulf.** 1 spm, CN X38B-85, 18°30'N, 108°30'E, 28.5 m, 11. XI. 1959; 1 spm, CN Q239-6, 20°15'N, 109°30'E, 24.5 m, AT, 14. VII. 1960; 1 spm, CN Q293B-50, 20°45'N, 107°30'E, muddy sand, 31 m, 11. XI. 1960; 1 spm, CN Q123-17, 20°04'N, 109°30'E, 62 m, 7. II. 1960; 1 spm, CN X84B-31, 18°45'N, 108°30'E, coarse sand, 24 m, AT, 13. II. 1960; 1 spm, Q123-17, 20°04'N, 109°30'E, 62 m, 7. II. 1960. **SCS.** 1 spm, CN S161-13-17, 20°00'N, 116°00'E, fine sand, 85 m, 23. XI. 1959; 1 spm, CN S161-B17, 22°00'N, 116°00'E, fine sand, 85 m, AT, 23. IX. 1959; 1 spm, CN K167B-122, 21°15'N, 114°00'E, coarse sand, 51 m, AT, 9. IV. 1960. (Shells of specimens from Beibu Gulf and SCS all broken).

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
Q239-6	23.0	7.5	11.5	0.33	0.50
K167B-122	24.5	7.9	11.3	0.32	0.46
S161-B17	17.8	6.1	8.5	0.34	0.48
Q123-17	21.5	6.9	11.6	0.32	0.54
X84B-31	42.5	12.9	21.6	0.30	0.51



PLATE 4. Species of Subfamily Turrinae, figs. 1-2. *Gemmula (Gemmula) cf. diomedea* (CN N169B-19); 3-4. *Gemmula dampierana* (CN N181B-59); 5. *Gemmula gilchristi* (CN F14B); 6-7. *Gemmula cf. gemmulina* (CN Q101B).

Diagnosis. Shell of medium size, 17.8–42.5 mm in height; with gemmules only on upper spire whorls and regular, spaced spiral cords. Color grayish white.

Distribution. Bohai Gulf, Beibu Gulf, South China Sea; Java: South Bantam (Pliocene).

Remarks. The specimens agree well with the previous descriptions and illustrations. This species is easily recognized by the gemmules only on the upper whorls and the regular sharp, dense spiral cords. Taylor *et al.* (1993) took the genus *Unedogemmula* as a synonym of *Lophiotoma*. We followed their suggestion here and transfer this species from the genus *Gemmula* into the genus *Lophiotoma* as a new combination.

***Lophiotoma leucotropis* (Adams & Reeve, 1850)**

(Pl. 3, fig. 8)

Pleurotoma leucotropis Adams & Reeve, 1850: 40, pl. 10, fig. 7.

Lophiotoma leucotropis. — Powell 1964: 312, color pl. 175, figs. 4, 5, pl. 242.

Material examined. Yellow Sea. 33 spms, CN B-20, 32°00'N, 124°30'E, muddy sand, 47 m, AT, 31. V. 1992. **ECS.** 2 spms, CN 53-743, Kanmen, Zhejiang Province, intertidal zone, 14. VI. 1953; 1 spm, CN 57-892, Dongshan, Fujian Province, intertidal zone, 18. IV. 1957; 1 spm, CN 57-810, Xiamen, Fujian Province, intertidal zone, 5. IV. 1957; 8 spms, CN 57-711, Pingtan, Fujian Province, intertidal zone, 21. III. 1957; 1 spm, CN G-6, Changjiang River Estuary, mud, 58 m, 16. IX. 1985. **SCS.** 1 spm, Shangchuan, Guangdong Province, intertidal zone, 16. I. 1956; 11 spms, CN 54-668, Yangjiang, Guangdong Province, intertidal zone, 10. XI. 1954; 5 spms, CN 57-966, Nan'ao, Guangdong Province, intertidal zone, 1. I. 1957; 1 spm, CN 55-902, Xinchun, Hainan Island, intertidal zone, 24. XII. 1955; 3 spms, CN K246B-11, 18°00'N, 106°50'E, 19 m, muddy fine sand, AT, 14 VII. 1960; 4 spms, CN S181B-9, 23°15'N, 117°00'E, 24.7 m, fine sand, AT, 5. I. 1960. **Beibu Gulf.** 1 spm, 221B-3, 19°00'N, 105°45'E, 14.2 m, muddy sand, 19. V. 1960; 1 spm, X74B-61, 19°00'N, 105°45'E, 12.8 m, muddy sand, 11. II. 1960; 5 spms, CN y38B13-33, 21°15'N, 108°06'E, 28.5 m, muddy sand, AT, 11. XII. 1959.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
55-902	33.5	10.9	18.3	0.33	0.55
--	48.5	15.3	24.5	0.32	0.51
--	23.5	8.5	12.5	0.36	0.53
57-892	36.5	11.8	19.7	0.32	0.54
57-966-1	47.7	16.1	26.5	0.34	0.56

Distribution. Yellow Sea, East and South China Seas; Japan, Philippines.

***Lophiotoma notata* (Sowerby, 1889)**

(Pl. 3, fig. 6)

Pleurotoma notata Sowerby, 1889: 566, pl. 28, fig. 17.

Turris notata. — Habe 1962: 77, pl. 38, fig. 16.

Lophiotoma acuta. — Powell, 1964: 305, pl. 234; 1966: 50. (not Perry, 1811)

Lophiotoma notata. — Tucker, 2004: 687.

Material examined. SCS. 2 spms, CN N67B-41, 19°30'N, 111°00'E, shell debris & coarse sand, 38 m, AT, 13. VII. 1959; 1 spm, CN L 69B-52, 20°00'N, 111°15'E, silty mud, 52 m, BT, 25. IV. 1959; 2 spms, CN R28B-9, 18°30'N, 110°30'E, coarse sand, 103 m, AT, 10. VII. 1959; 1 spm, CN Q93B-64, 18°45'N, 110°30'E, coarse sand, 31 m, AT, 24. XI. 1959; 1 spm, CN 16-44, 21°30'N, 113°45'E, 38 m, BT, 17. III.

1959; 1 spm, CN R29B-231, 18°15'N, 110°30'E, coarse sand, 120 m, AT, 10. VII. 1959; 4 spms, CN N177B-56, 19°15'N, 111°00'E, coarse sand & shell debris, 67 m, AT, 8. IV. 1960. **Nansha Islands.** 3 spms, CN SSBIV-41, 4°30'N, 110°00'E, 107 m, 15. III. 1987; 1 spm, CN Ns4B-4, 5°00'N, 112°00'E, silty mud, 105 m, 7. X. 1993; 1 spm, CN SSB10-6, 4°30'N, 110°30'E, 100 m, 23. IX. 1994.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
N67B-41-1	51.8	15.9	25.2	0.31	0.49
N67B-41-2	55.5	17.4	26.3	0.31	0.47
N67B-41-3	44.8	14.8	21.5	0.33	0.48
--	53.9	15.8	25.2	0.29	0.47
SSB10-6	43.0	11.9	19.2	0.28	0.45

Distribution. Commonly distributed in Indo-West Pacific. Beibu Gulf, South China Sea, Nansha Islands; Red Sea and East Africa to Japan and Malanesia.

Remarks. Powell (1964) treated the *Pleurotoma notata* Sowerby, 1889 as a junior synonym of *Pleurotoma acuta* Perry, 1811, and provided a figure of Sowerby's (1889) holotype from Hong Kong. Tucker (2004) still treated *Lophiotoma notata* (Sowerby, 1889) (= *Pleurotoma notata* Sowerby, 1889) as a separated species from *Lophiotoma acuta* (Perry, 1811) (= *Pleurotoma acuta* Perry, 1811). The present specimens agree exactly with Sowerby's (1889) holotype. We follow Tucker (2004) and identified them as *Lophiotoma notata* (Sowerby, 1889).

***Lophiotoma pseudocosmoi* sp. nov.**

(Pl. 5, figs. 4–6)

Type material. Holotype: SCS. CN R33B-14, 19°30'N, 113°00'E, muddy fine sand, 180 m, AT, 21. IV. 1959.

Measurements (mm).

Length	Width	Aperture	W/L	A/L
17.0	6.9	9.2	0.41	0.54

Etymology. From *pseudēs*, Greece, means false, deceptive; *cosmoi*, a specific name in same family. The specific name is in reference to the species resembles another species of the family, *Gemmula* (*Gemmula*) *cosmoi* (Sykes, 1930).

Diagnosis. Shell small, peripheral carina with two closely spaced cords, with distinct gemmules only on early whorls, while on the later whorls plain. Subsutural cords prominent. Color light yellow, with irregular longitudinal brown streaks and dots.

Description. Shell small, 17 mm in height, broadly fusiform; spire tall, turreted, slightly shorter than height of aperture plus canal; suture distinct; with 11 whorls, including large conical protoconch of four whorls, first two whorls smooth, others with axial costae. Spire whorls sculptured firstly with strongly crested subsutural fold, composed of two closely spaced cords, first one finer than second; about four to five crisp spirals on concave shoulder area, then prominent, gemmate, bicarinate peripheral keel, distinct gemmulations only on first four whorls. Upper base with two strong spaced primary cords, neck and anterior end with about 16 spaced threads, with fine secondary spiral lines among them. Aperture ovate, outer lip thin, inner lip smooth, columella with distinct trace of elongated spiral folds, anterior canal moderately long, almost straight. Color light yellow, with irregular longitudinal brown streaks and dots.

Distribution. Only known from the type locality.

Remarks. *Lophiotoma pseudocosmoi* **sp. nov.** is similar to the typical form of *L. unedo* (Kiener, 1839–1940) in shell form in accordance with Olivera (2004a: 17, fig.5, top row 2). It can be distinguished from the latter by the different shell sculpture in detail and the smaller shell height. The shell profile of *L. pseudocosmoi* **sp. nov.** looks like that of *Gemmula (Gemmula) cosmoi* (Sykes 1930). It can be readily distinguished from the latter by the different peripheral carina.

***Lophiotoma unedo* (Kiener, 1839–1940)**

(Pl. 3, figs. 4–5)

Pleurotoma unedo Kiener, 1839–1940: 19, pl. 14, fig. 1; Reeve 1843, pl. 2, fig. 12; Tryon 1884: 165, pl. 3, fig. 20.

Gemmula unedo.—Kira 1971, pl. 35, fig. 17.

Gemmula (Unedogemmula) unedo.—Powell 1964: 269, pl. 175, figs. 1, 6, pl. 208, figs. 1, 2; Kuroda, Habe & Oyama, 1971: 223, pl. 57, fig. 6.

Lophiotoma (Unedogemmula) unedo.— Olivera, 2004a: 15, fig. 5.

Material examined. Beibu Gulf. 1 spm, CN K218B-15, 19°00'N, 108°30'E, silty mud, 18 m, AT, 8. VII. 1960; 1 spm, CN Q195-34, 20°45'N, 109°30'E, sandy mud, 19 m, AT, 20. IV. 1960.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
K218B-15	42.9	12.8	22.9	0.30	0.53
Q195-34	40.4	12.3	22.5	0.30	0.56

Distribution. Beibu Gulf; Persian Gulf, East Indies and Japan.

Remarks. Olivera (2004a) discussed the taxonomic position of *Lophiotoma unedo* (Kiener, 1839–1940) and indicated that the *Lophiotoma unedo* complex “is one of the most confusing groups of the large Turridae”. The complex can be divided into two distinct forms based on the whole, the typical form and the typical Japanese form. Olivera (2004a) doubted the taxonomic positions of the two forms: “feel that it would be premature to separate them at the subspecific or specific level, or to conclude that they are conspecific”. Our specimens agree well with the typical Japanese form which are quite different from Kiener’s (1839–1940) type form. We discussed with Dr. Kilburn about the position of our specimens, he suggested that they are *Lophiotoma unedo* (personal communication). We accepted his suggestion and assign our specimens as *L. unedo* here.

***Lophiotoma verticala* sp. nov.**

(Pl.5, figs. 7–9)

Type material Holotype: Beibu Gulf. CN X152B-50, 18°00'N, 105°40'E, coarse and fine sand, 13 m, AT, 12. I. 1962.

Measurements (mm).

Length	Width	Aperture	W/L	A/L
15.7	5.9	8.1	0.38	0.52



PLATE 5. Species of Subfamily Turrinae, figs. 1-3. *Gemmula grandigyrate* **sp. nov.** (holotype, CN Q32A-3); 4-6. *Lophiotoma pseudocosmoi* **sp. nov.** (holotype, CN R33B-14); 7-9. *Lophiotoma verticala* **sp. nov.** (holotype, CN X152B-50).

Etymology. From *verticalis*, Latin, means vertical. The specific name is in reference to the nearly perpendicular profile of the shell is just below the peripheral carina.

Diagnosis. Shell small, sculpture with strong, rounded, subsutural fold and strongly projected, rounded, overhanging peripheral carina on upper part of each post-nuclear whorl. Color uniformly yellowish brown.

Description. Shell small, 15.7 mm in height, elongate fusiform; with tall spire and relatively long, straight anterior canal, spire turreted, about equal to height of aperture plus canal; suture distinct, with ten whorls, including conical protoconch of two whorls, apex eroded, remainder with fine axial costae. Spire whorls sculptured firstly with conspicuous, rounded subsutural fold, more rounded on early whorls and flat on adult whorls, followed by prominent, rounded peripheral carina, protruding above shell surface, like brim of hat or edge of roof. Profile of later adult whorls under peripheral carina nearly perpendicular. Entire whorl encircled by rounded spiral cords, rendered noticeably gemmulate at points of intersection with rounded and slightly oblique axials. Aperture elongate ovate, outer lip thin, sinus narrow and deep, U-shaped, situated on peripheral carina; inner lip smooth. Anterior canal moderately long, almost straight. Color uniformly yellowish brown.

Distribution. Only known from the type locality.

Remarks. The peculiar shell profile of *Lophiotoma verticala* **sp. nov.** can distinguish it from all other species of the genus. The shell profile of *L. verticala* looks like that of *Fusiturris undatiruga* (Bivona, 1832) (from Spain) according to Powell's (1964) figure. It differs from the latter by the following shell features: the axial folds are less strong and the spiral folds are more prominent, the peripheral carina protrudes over the surface, the sinus is deep and narrow (*vs* the axial folds are more prominent and the spiral folds are not conspicuous, the peripheral carina is less strong and does not protrude over the surface, the sinus is narrow and broad in *F. undatiruga*).

This species seems to fit the characters of the genus *Fusiturris* rather than *Lophiotoma* based on the descriptions reported by Powell (1966), but Powell maintained (1966) that the recent species of *Fusiturris* occur only in the Mediterranean and southward along the equatorial coast of West Africa, its Indo-Pacific counterpart species should be put in *Lophiotoma*. We tentatively assign this species to the genus *Lophiotoma* here until further evidence is found.

Genus *Ptychosyrinx* Thiele, 1925

**Ptychosyrinx timorensis* (Tesch, 1915)

(Pl. 2, fig. 7)

Pleurotoma (s. str.) *timorensis* Tesch, 1915: 27, pl. 77 (5), figs. 52, 53.

Ptychosyrinx timorensis teschi Powell, 1964: 291, pl. 223, figs. 5, 6.

Gemmula (*Ptychosyrinx*) *teschi*.—Sysoev 1996: 17, figs. 68–70.

Material examined. ECS. 2 spms, CN KY9B-, 29°10'N, 127°30'E, silty mud, 1070 m, AT, 4. VIII. 1981; 1 spm, CN Ky8B-68, 27°30'N, 128°10'E, silty mud, 900 m, AT, 3. VIII. 1981.

Measurements (mm).

CN	Length	Width	Aperture	W/L	A/L
KY9B-1	33.5	12.2	15.0	0.36	0.45
KY9B-2	21.3	8.5	10.4	0.40	0.49
Ky8B-68	16.9	6.8	8.0	0.40	0.47

Distribution. East China Sea; Indonesia, Celebes, Moluccas and Borneo.

Remarks. Powell (1964) reported this form as a subspecies of *Ptychosyrinx timorensis* (Tesch, 1915). The present specimens agree well with Powell's (1964) descriptions. Sysoev (1996) raised it as a separated species distinct from *P. timorensis* because it has a much broader fusiform shell than that of *P. timorensis* and treated the *Ptychosyrinx* as a subgenus of *Gemmula*. He also mentioned that *G. teschi* varies in the prominence of the spiral ribs on the shell base and the number of peripheral tubercles. Robba *et al.* (1989) synonymized *Ptychosyrinx timorensis teschi* Powell, 1964 as a junior synonym of *Ptychosyrinx timorensis* (Tesch, 1915). We followed the opinion of Robba *et al.* (1989) here.

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References

- Abbott, R.T. & Dance S.P. (1982) *Compendium of Seashells*. E. P. Dutton Inc., New York, 411 pp., col. Illustr.
- Adams, A. & Reeve, L. (1848-1850) *Mollusca*. Zool. Voy. Samarang, pp. 1-87, v-xv, iii-x, pls., I-XXIV.
- Casey, T.L. (1904) Notes on the Pleurotomidae with descriptions of some new genera and species. *Transactions of the Academy of Science of St. Louis*, 14, 123-170.
- Cernohorsky, W.O. (1987) Taxonomic notes on some deep-water Turridae (Mollusca: Gastropoda) from the Malagasy Republic. *Records of the Auckland Museum*, 24, 123-134.
- Doumet, E. (1840) *Pleurotoma in Mollusques*. Magasin de Zoologie. Series II year II: pl. 10+2 pp; pl. 11+ 2 pp.
- Finlay, H.J. (1930) New shells from New Zealand Tertiary Beds, pt. 3. *Transactions of the New Zealand Institute*, 61, 81-84.
- Habe, T. (1962) *Coloured Illustrations of the Shells of Japan* (II). Hoikusha, Osaka, Japan, ix + 148 pp.
- Hedley, C. (1922) A Revision of the Australian Turridae. *Records of the Australian Museum*, 13 (6), 213-259.
- Iredale, T. (1929) Queensland molluscan notes, No.1. *Memoirs of the Queensland Museum*, 9 (3), 261-297.
- Kiener, L.C. (1839-40) Pleurotome. *Iconica coquilles vivante*, 5, 1-84.
- Kilburn, R.N. (1971) Notes on some deep-water Volutidae, Turbinellidae and Turridae chiefly from off southern Mozambique and Natal, with descriptions of two new species (Mollusca: Gastropoda). *Annals Natal Museum*, 21 (1), 123-133, text figs.
- Kilburn, R.N. (1983) Turridae (Mollusca: Gastropoda) of southern Africa and Mozambique. Part 1. Subfamily Turrinae. *Annals Natal Museum*, 25 (2), 549-585, illustr.
- Kira, T. (1971) *Coloured illustrations of the shells of Japan*. Hoikusha Publishing Co., Ltd., Osaka.
- Kosuge, S. (1986) Report on the family Turridae collected along the North-western Coast of Australia (Gastropoda) (1) (Plate 30-34). *Bulletin of the Institute of Malacology Tokyo*, 2 (5), 80-90.
- Kosuge, S. (1988) Report on the family Turridae collected along the North-western Coast of Australia (Gastropoda) (3) (Plate 47; text-figs. 1-15). *Bulletin of the Institute of Malacology Tokyo*, 2 (7), 118-123.
- Kuroda, T., Habe T. & Oyama, K. (1971) *The sea shells of Sagami Bay*. Maruzen Co., Ltd., Tokyo.
- Lamarck, J.B.P.A.de M. (1822) *Pleurotome (Pleurotoma)*. In: Histoire naturelle des animaux sans vertebres. Paris: Lamarck. 7, 90-102.
- Li, B. & Li, X. (2007) An account of the Genus *Turris* species (Mollusca: Gastropoda: Turridae) from the East and South China Seas. *Zootaxa*, 1397, 63-68, pl. 1.
- MacNeil, F.S. (1960) Tertiary and Quaternary Gastropoda of Okinawa. *U. S. geol. Surv. Prof. Pap.* 339, pp. III-IV, 1-148, pls. 1-19.
- McLean, J.H. (1971) A revised classification of the family Turridae, with the proposal of new subfamilies, genera and subgenera from the Eastern Pacific. *Veliger*, 14 (1), 114-130.
- Melville, J.C. (1917) A Revision of the Turridae (Pleurotomidae) Occurring in the Persian Gulf, Gulf of Oman and the North Arabian Sea as Evidenced Mostly Through the Results of Dredgings Carried out by Mr. F. W. Townsend.

- 1893–1914. *Proceedings of the Malacological Society of London* 12, 140–201.
- Nomura, S. (1940) Mollusca dredged by the Husa-maru from the Pacific Coast of Tiba Prefecture, Japan. *Record of Oceanographic Works in Japan*, 12 (1), 81–116, pl. II.
- Olivera, B.M. (1999) The subfamily Turrinae in the Philippines: The Genus *Turris* (Röding, 1798). *Philippine Journal of Science*, 128 (4), 295–318.
- Olivera, B.M. (2002) The gastropoda genus *Xenuroturris* (Iredale, 1929) evaluated and a new turrid, *Lophiotoma olangoensis*, described from the Central Philippines. *Science Diliman*, 14 (2), 40–50.
- Olivera, B.M. (2004a) Large forms in *Lophiotoma*: four new species described in the Philippines and three from elsewhere in the Indo-Pacific. *Science Diliman*, 16 (1), 1–28.
- Olivera, B.M. (2004b) Evaluation of Philippine *Gemmula* I. Forms related to *G. speciosa* and *G. kieneri*. *Science Diliman*, 16 (2), 1–14.
- Oostingh, C.H. (1938–1940) Die Mollusken des Pliocäns von Süd-Bantam in Java. *Ingenieur Nederl. Indië*, 5–7, pls. 8–19.
- Powell, A.W.B. (1964) The family Turridae in the Indo-Pacific. Part 1. The subfamily Turrinae. *Indo-Pacific Mollusca*, 1, 227–346.
- Powell, A.W.B. (1966) The molluscan families Speightiidae and Turridae. *Bulletin of the Auckland Institute and Museum*, 5, 1–184, 23 plates.
- Reeve, L.A. (1843–46) Monograph of the Genus *Pleurotoma*. *Conchologia Iconica*, vol. 1, Pls. I–XL.
- Robba, E., Sartono, S., Violanti, D. & Erba, E. (1989) Early Pleistocene gastropods from Timor. *Memorie di Scienze Geologiche*, 41, 61–113.
- Röding, P.F. (1798) *Museum Boltenianumsive Catalogus Cimeliorum e Tribus Regnis Naturae quae olim Collegerat Joa. Fried. Bolten, M.D.p. d., per XL. Annus Proto Physicus Hamburgensis. Pars Secunda Continens Conchylia sive Testacea Univalvia, Bivalvia & Multivalvia*. Johan. Christi. Trapii, Hamburg, viii + 199 pp.
- Schepman, M.M. (1913) The Prosobranchia of the Siboga Expedition. Part 5. Toxoglossa. *Siboga Expedition Monograph*, 49, 367–452, pl. 24–30.
- Smith, E.A. (1894) Natural history notes from H. M. Indian Marine Survey Steamer *Investigator*, Commander C. F. Oldham, R. N.-Series II., no. 10. Report upon some Mollusca dredged in the Bay of Bengal and the Arabian Sea. *Annals and Magazine of Natural History, series 6*, 14, 157–174, pls. 3–5.
- Sowerby, G.B. (1889) Descriptions of fourteen new species of shells from China, Japan, and the Andaman Islands, chiefly collected by Deputy Surgeon-Gen. R. Hungerford. *Proceedings of the Zoological Society of London*, 1888, 565–570, pl. 28.
- Sowerby, G.B. (1902) Mollusca of South Africa. *Marine Investigations of South Africa*, 2, 93–100, pl. 2.
- Springsteen, F.J. & Leobrera, F.M. (1986) *Shells of the Philippines*. Carfel Seashell Museum, Manila, Philippines.
- Sykes, E.R. (1930) On a new species of *Turris* from Japan. *Proceedings of the Malacological Society of London*, 19, 82, text-fig.
- Sysoev, A.V. (1996) Deep-sea conoidean gastropods collected by the John Murray Expedition, 1933–34. *Bulletin of the Natural History Museum Zoology Series*, 62, 1–30, illustr.
- Taylor, J.D., Kantor, Yu. I. & Sysoev, A.V. (1993) Foregut anatomy, feeding mechanisms, relationships and classification of the Conoidea (=Toxoglossa) (Gastropoda). *Bulletin of the Natural History Museum of London, Zoology*, 59 (2), 125–170, figs. 1–27.
- Tesch, P. (1915) Jungtertiäre und Quartäre Mollusken von Timor. *Paläontologie von Timor*, 5, 1–134, pls. 73–95.
- Thiele, J. (1925) Gastropoden der deutschen Tiefsee- Expedition. II. Teil. *Wissenschaftliche Ergebnisse deutschen Tiefsee- Expedition auf dem Dampfer Valdivia 1898–1899*, 17 (2), 1–382.
- Tryon, G.W. (1844) Conidae and Pleurotomidae. *Manual of Conchology*, 6, 151–413.
- Tucker, J.K. (2004) Catalog of Recent and fossil turrids (Mollusca: Gastropoda). *Zootaxa*, 682, 1–1295.
- von Martens, E. (1902) Einige neue Arten von Meer-Conchylien aus den Sammlungen der deutschen Tiefsee-Expedition. *Sitzungs-Berichte der Gesellschaft Naturforschender Freunde zu Berlin*, 1902, 237–244.
- Weinkauff, H.C. (1875) Systematisches Conchylien-Cabinet von Martini und Chemnitz. Die Familie *Pleurotomidae*, 1–248.