

The Gastropod Genus *Xenuroturrus* (Iredale, 1929) Evaluated and a New Turrid *Lophiotoma olangoensis*, Described from the Central Philippines

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ABSTRACT

The venomous gastropod generally known as *Xenuroturrus cingulifera* (Lamarck, 1822) belongs to the subfamily Turrinae (Family Turridae). An evaluation of all forms closely related to *Xenuroturrus cingulifera*, including newly collected materials from the central Philippines and elsewhere in the Indo-Pacific, was carried out. This analysis suggests that the genus *Xenuroturrus* is an untenable taxon, and species presently assigned to *Xenuroturrus* are provisionally included in the genus *Lophiotoma*. Thus, *Xenuroturrus cingulifera* should be referred to as *Lophiotoma cingulifera* (Lamarck, 1822). A new species in the *Lophiotoma cingulifera* complex, *Lophiotoma olangoensis*, is described. Range extensions for two other related species, *Lophiotoma albina* (Lamarck, 1822) and *Lophiotoma kingae* (Powell, 1964) are documented. The most unexpected result from our survey is that two species previously assigned to different genera (*Xenuroturrus* and *Lophiotoma*), i.e., *Lophiotoma cingulifera* and *Lophiotoma albina*, have proven to be very closely related forms, except for the length of the siphonal canal. Thus, a short siphonal canal, the diagnostic characteristic of species previously included in *Xenuroturrus*, does not appear to be a morphological character that justifies separation into different genera or subgenera within the Turrinae.

Key words: venomous snail, toxoglossate gastropod, Conacea, molluscan taxonomy, Turridae

INTRODUCTION

Our laboratories have been engaged for some years in characterizing venom components from the predatory gastropods belonging to the genus *Conus* (Olivera & Cruz, 2001). Recently, we initiated an investigation of other gastropod venoms, including those belonging to the subfamily Turrinae. One of the species analyzed is conventionally identified as *Xenuroturrus cingulifera* (Lamarck, 1822) in most standard taxonomic treatments (Powell, 1964; 1966; Springsteen & Leobrera, 1986; Abbott & Dance, 1986; Okutani, 2000). Requests for specimens of this species from dealers in the central

Philippines usually resulted in a number of diverse forms being delivered, including specimens collected by shell-fishermen from Olango Is., Cebu, Philippines that were superficially similar to, but had some consistent differences from *Xenuroturrus cingulifera*. In an effort to clarify the taxonomy of these diverse forms, a systematic examination of all forms related to *Xenuroturrus cingulifera* has been carried out. As a result of this study, a new species has been defined and major reservations regarding the suitability of using *Xenuroturrus* as a genus or subgenus have been raised.

This is the second paper in a series with the long-term goal of evaluating the larger Indo-Pacific Turrrinae. The first paper of the series treated the entire genus *Turrus*, but focused only on forms found within the Philippines (Olivera, 1999). In contrast, in this paper, all forms of a relatively small clade within the Turrrinae are examined from all over the Indo-Pacific; the wider biogeographic study proved to be necessary to more properly define relationships between the various forms. In addition to the material from the Philippines that was accessible to the author, materials from two major museum collections in the U.S., the American Museum of Natural History in New York City and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. were also examined.

This article discusses in detail most of the species traditionally assigned to the genus *Xenuroturrus* (Iredale, 1929). The genus *Xenuroturrus* was originally described by Iredale with *X. legitima* (Iredale, 1929) as the type. However, *X. legitima* is generally regarded as a synonym of *X. cingulifera* (Lamarck, 1822; Powell, 1964; Kilburn, 1983; Higo et al., 1999). We have evaluated species related to *X. cingulifera*, and one conclusion from this work is that the putative clade of species related to "*Xenuroturrus cingulifera*," the type species of the genus, does not, in fact, correspond to the conventional concept of the genus *Xenuroturrus*. *Xenuroturrus* is therefore a problematic taxon, and as a provisional solution we propose the inclusion of *Xenuroturrus* spp. in the genus *Lophiotoma* (broadly defined to also include certain other genera/subgenera, such as *Lophioturrus* and *Unedogemmula*). We note that in the last comprehensive treatment of the Indo-Pacific Turrrinae by Powell (Powell, 1966), he described *Xenuroturrus* as including shells that were "moderately large, 25-72 mm, with a tall spire but truncated anterior end." He closes with the remark, "Except for the truncated anterior end, the genus resembles *Lophiotoma*."

For the remainder of this paper, all species discussed will be referred to the genus *Lophiotoma*, and not *Xenuroturrus*. From this point on, we will not use *Xenuroturrus cingulifera*, but *Lophiotoma cingulifera*, and the group of related species will be referred to as the "*Lophiotoma cingulifera* clade." The greatly expanded range of specimens available from

a number of localities, particularly the central Philippines and Hawaii has allowed a more comprehensive evaluation of the different forms in this clade. As a result, in addition to a new species being proposed, range extensions for several species are documented. In discussing the species in this clade, it is convenient to divide them into three groups: (1) the species and forms most closely related to *Lophiotoma cingulifera* itself, which have the most prominent maculations at the sinus rib, as does *Lophiotoma cingulifera*; (2) the *Lophiotoma kingae* group, which have more prominent maculations in the subsutural region, rather than on the sinus rib; (3) the *Lophiotoma millepunctata* group, which lack prominent maculations in both the subsutural region and sinus rib.

MATERIALS

Molluscan specimens were purchased from commercial dealers, in particular, from Pta. Engaño, Mactan, and Cao-Oy, Olango, Cebu Province, Philippines. Specimens were also systematically examined from the American Museum of Natural History, New York City, and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. The private collection of Turrrinae of the author was used as an additional resource. The holotype of *Lophiotoma olangoensis* will be deposited in the collection of the Philippine National Museum.

RESULTS

Description and evaluation of distinctive forms

The Lophiotoma cingulifera Group

Overview

Included in this group are two species, *Lophiotoma cingulifera* and *Lophiotoma albina*. We make the case that these species are more closely related to each other than to any other. This conclusion will be surprising to most molluscan taxonomists, since *L. albina* was conventionally separated generically from "*Xenuroturrus cingulifera*." Powell's treatment of *L. cingulifera* adequately described the variation in this

species. However, the wider range of *L. albina* specimens available for this study has allowed us to establish the close affinity of *L. albina* to *L. cingulifera*, as well as to document a range extension for the species.

Fig. 1 shows a comparison of *L. albina* and *L. cingulifera*. Both species are widely distributed over the Indo-Pacific region. Since *L. albina* is generally found in deeper water, it has not been as well represented in collections. At the present time, the distribution of *L. albina* is discontinuous; it has been reported from the western Pacific, as far east as Guam and Fiji, and from southeastern Africa, in the Mozambique/Madagascar region. One reason for grouping *L. cingulifera* together with *L. albina* is the similarity in the structure of the sinus rib; Fig. 1A-C shows a close-up of the sinus ribs of *L. albina* and *L. cingulifera* demonstrating their strikingly similar construction. The apparent maculated pattern in the sinus rib of both species consists of dark brown regions with 2-4 parallel dark brown dashes on the ribs of the sinus rib, alternating with pure white regions. These distinctive peripheral ribs are easily differentiated from the sinus ribs of all other species. Furthermore, the subsutural region and sculpture of the spiral whorls are also very similar.

An examination of the southeast African form of *L. albina* provides compelling evidence that *L. albina* is closely related to *L. cingulifera*. *L. cingulifera* has a much truncated anterior, with a short slightly curved siphonal canal. In western Pacific specimens of *L. albina*, the shell is whiter, the canal is longer and in most specimens quite straight (Fig. 1D). The southeast African form of *L. albina* is more similar in color to *L. cingulifera*, and not only has a proportionally shorter canal, but also has a quite pronounced curvature of the canal, as is characteristic of the truncated canal of *L. cingulifera*. Thus, in several respects, southeast African specimens of *L. albina* (Fig. 1E) have characteristics that appear intermediate between western Pacific *L. albina* and *L. cingulifera*.

Lophiotoma cingulifera (Lamarck, 1822)

Powell recognized two subspecies of *Lophiotoma cingulifera*. Because this is a variable species, we will defer a final assignment of subspecies since within a

single geographic area considerable variation can be found. Thus, previously described distinctive populations, such as *erythraea* from the Red Sea need to be re-evaluated after better sampling of the populations from these areas is obtained. It is unclear whether any of these *L. cingulifera* populations are truly isolated; although in Powell's map of the geographic distribution of the species, the Red Sea population looks well separated from the other documented localities, the species has been collected from closely adjacent areas such as Somalia (an example is in the American Museum of Natural History, New York: AMNH 142648 – a dead-collected specimen that seems to be a typical *L. cingulifera*).

Description (adapted from Powell, 1964)

Adult shell 20-70 mm in height, tall-spined with a short anterior canal. A narrow, conic protoconch with 4 to 4-1/2 whorls, densely sculptured with slightly curved strong rounded axials crossed at right angles by weak spiral lirae. Teleoconch whorls 8-12. The sinus is deep and narrow, with the sinus rib consisting of 2-3 cords that appear maculated with alternating white and dark areas. The dark areas are made by strong dark brown dashes on the individual sinus cords, the color often diffused between the ribs, giving the appearance of a square maculation. Between the strong dark dashes on the component ribs is a white area usually elevated, compared to the dark maculated region (Fig. 1C). The characteristically maculated sinus rib, combined with the short anterior canal are diagnostic characteristics of this species. The spire is tall, generally twice the height of aperture plus canal with rather straight outlines. The adult sculpture consists of a dense coating of spiral cords and threads; the subsutural area is rather broad with 4-5 crisp cords, followed by the prominent sinus rib. The body whorl is subangulated at about half apertural height and strongly excavated between this and a distinct fasciole, often showing a false umbilical chink. The color is creamy white, minutely peppered with reddish-brown dots and dashes on all of the spiral cords with numerous primary and weaker spirals over the entire body whorl. The density of the reddish-brown markings varies, leading to a variation in the perceived color of various specimens, from a light pinkish to a dark brick red. Below the sinus rib, there are typically

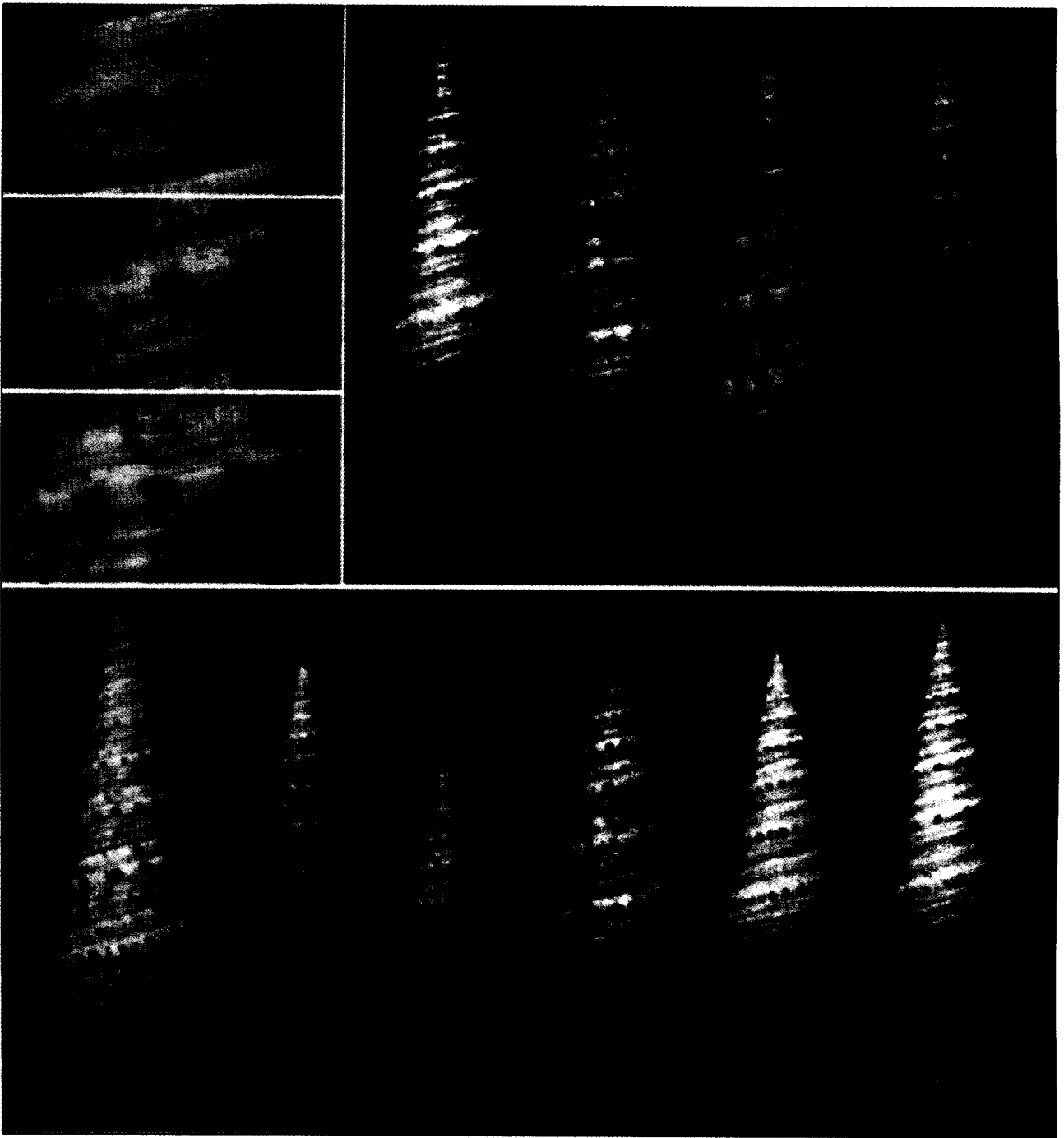


Fig. 1. A comparison of *Lophiotoma albina* and *Lophiotoma cingulifera*. Panels A to C and D to G are not printed to scale; a comparison of the relative natural sizes of the different specimens is shown in H. Specimens of *L. albina* from Guam (A, D, and H6) and from the Mozambique channel (B and E), as well as from the Philippines (H5) are compared to specimens of *L. cingulifera* from the Philippines, shallow water (C and H1), the Philippines, deep water (G and H2), and from Guam (F and H3). The similarity in the sinus rib structure of *L. albina* (A, B) vs. *L. cingulifera* (C) is diagnostic of the close relationship between the two species. Although the color of different specimens varies considerably, the basic pattern of reddish-brown dots on the spiral ribs is very similar, with the variation in the size and frequency of the dots, accounting for the color differences. H1, H2, and H3 are *L. cingulifera*, while H4, H5, and H6 are *L. albina*. H1 is *L. cingulifera*, form *legitima*, Philippines; H2 is *L. cingulifera*, deep-water, reddish-brown form, Philippines; H3 is *L. cingulifera*, oceanic form, Guam; H4 is *L. albina*, S.E. African form; H5 is *L. albina*, Philippines; and H6 is *L. albina*, Guam. Photography by Kerry Matz.

about three broad-curved ribs and two strong primary cords over the base.

Variation

Specimens from oceanic localities such as Guam tend to be smaller, and with finer sculpture (Fig. 1F). In the western Pacific, the form *legitima* is often collected in shallow water, but there are a number of distinctive deep-water forms. The specimen with dark brick red coloration is from the central Philippines (Fig. 1G).

Lophiotoma albina (Lamarck, 1822)

Like *L. cingulifera*, this species has the sinus rib strongly maculated. The obvious difference is that the siphonal canal is significantly longer in *Lophiotoma albina*. The typical form from the western Pacific is characteristically lighter in color than *L. cingulifera*, with a longer and relatively narrower canal, while the southeast African population has a shorter, broader, distinctly curved siphonal canal and is more pinkish in color (see Fig. 1H-4, 1H-5, and 1H-6, for a comparison of W. Pacific and S.E. African forms).

Description (adapted from Powell, 1964)

The chief distinguishing characteristics are the sinus rib with three or four cords, on which are parallel regularly-spaced dark brown dashed markings on each of the component cords of the sinus rib (Fig. 1A,B). This alternates with an intervening white area, which is raised compared to the dark brown dashes, giving the general appearance of a revolving row of peripheral maculations. The general appearance of the shell is white, but actually consists of a sprinkling of minute brown dots very similar to *L. cingulifera*, but more sparsely distributed. The protoconch is eroded in most specimens, but appears similar to that of *L. cingulifera*. The subsutural area is generally rounded with a relatively weak spiral sculpture. The sinus rib is above mid-whorl on the spire. Typically, the body whorl has 3 strong primary ribs below the sinus rib, with 2 more in the base region and a series of weaker cords on the siphonal canal.

Remarks

There is considerable variation in the relative proportion of the canal to the spire. This occurs even among specimens collected in the same general locality. Fig. 1H shows one specimen from the western Pacific with a much broader spire angle and shorter canal, and another that is slender with a longer canal. Despite the variation in the outline of the shell, the shell pattern itself is remarkably constant. Western Pacific specimens have a generally creamy white color and the revolving row of peripheral maculations. Many specimens have been collected in the last decade in the central Philippines by hookah at depths between 15-40 fathoms. The species also has been collected at various localities by scuba divers, at depths >80 feet. The specimen from Guam is an eastward range extension for this species. A specimen in the American Museum of Natural History (AMNH 122270) was reportedly collected from "Viti Levu, Fiji" in 1962, another eastward range extension (the same lot number also contains a typical *L. cingulifera* and a dead-collected *L. millepunctata*).

The Lophiotoma kingae Group

Overview

This group of species shares one diagnostic characteristic – the sinus rib is much less prominently marked than the strongly maculated subsutural area, a reversal of the *L. cingulifera* pattern. We recognize two species in this group, *Lophiotoma kingae* (Powell, 1964), which is found in the eastern central Pacific, from Hawaii to the Marquesas Islands, and *Lophiotoma olangoensis*, new species, from the western Pacific. The latter has been confused with either *L. cingulifera* or *L. millepunctata*, but appears to have a closer affinity to *L. kingae*.

Lophiotoma kingae (Powell, 1964)

This species originally described by Powell from a Hawaiian specimen was believed to be endemic to Hawaii. We provide a range extension to the Marquesas Islands. In addition, it appears that the species is highly variable in Hawaii. This may be a case of incipient speciation to occupy ecological niches that are empty

Table 1. *Lophiotoma olangoensis*, new species

Specimen (all typical forms)	Measurements (mm)			Locality
	Length	Aperture	Width	
Holotype	37.0	12.8	12.2	Olango Island, Cebu, Philippines
Paratype 1	41.3	14.4	12.9	Olango Island, Cebu, Philippines
Paratype 2	28.3	10.2	8.9	Olango Island, Cebu, Philippines
Paratype 3	33.2	13.3	11.4	Olango Island, Cebu, Philippines
Paratype 4	43.0	15.6	13.6	Olango Island, Cebu, Philippines
Paratype 5	36.0	12.5	10.8	Olango Island, Cebu, Philippines
Paratype 6	30.8	11.9	10.2	Olango Island, Cebu, Philippines
Paratype 7	32.4	13.1	11.6	Olango Island, Cebu, Philippines
Paratype 8	36.8	12.9	11.3	Olango Island, Cebu, Philippines
Paratype 9	29.4	11.1	9.8	Guadalcanal*

*Label from an old collection; needs to be verified.

in Hawaii but filled by other species in the clade in the western Indo-Pacific. Since both *L. cingulifera* and *L. millepunctata* are absent from the Hawaiian Islands, the various varieties of *L. kingae* may be expanding into the niches normally dominated by those species. This would be a situation similar to that described by Alan Kohn for *Conus miliaris* in Easter Island (Kohn, 1978), where the normally narrow distribution of prey of the species throughout the Indo-Pacific was found to be considerably expanded at this remote locality, presumably due to the absence of congeneric competition.

Description of typical form (Powell, 1964)

Typical Hawaiian specimens are 15-18 mm, with a tall, narrowly conic dark brown protoconch of 4-1/2 whorls, sculptured with closely spaced axials, followed by 6-1/2 to 7 teleoconch whorls. The sculpture of the spiral whorls consists of a heavy subsutural fold bearing two smooth spiral cords followed by the heavy projecting sinus rib, margined top and bottom by smooth rounded cords. Below this is a weaker spiral cord with a second emergent over the last whorl. There are six smooth cords below the level of the top of the aperture and a further 4 closely spaced cords on the weak interior fasciole. Interstices of all spiral cords smooth, except for an occasional thread. Sinus a deep narrow square-cut slit. Color creamy white with a spiral series of large dark red-brown rectangular maculations on the subsutural fold and a tessellation of spots on all the other

spiral cords, those on the base and fasciole dark reddish-brown, the rest light brown. The typical form has the subsutural cords, and the base and neck cords much more darkly colored than the spiral cords in between, producing a diagnostic color contrast in the body whorl.

Collection data

The type locality is 20-40 fathoms on fine sand off Keehi, Oahu, Hawaii; the holotype is in the B. T. Bishop Museum in Honolulu. Dredgings of various localities in Oahu Island at depths from 10-40 fathoms have yielded most of the specimens in collections. Recently, three specimens were collected by H. Morrison in Nuku Hiva, in the Marquesas Islands. These provide a significant range extension and suggest that this species may be found elsewhere in the South Pacific.

Variation

In addition to the typical form, a variant in Hawaii (Fig. 2B-3 and Fig. 2E-8) has a base and fasciole background color that is brown; in the typical form of the species, this base color is creamy white (not brown) with the dark brown dashes restricted to the spiral cords. A similar variant specimen is found in the American Museum of Natural History collection (AMNH 259001, collected in 65 feet, in a shallow sand bed, Makaha, Oahu, Hawaii).

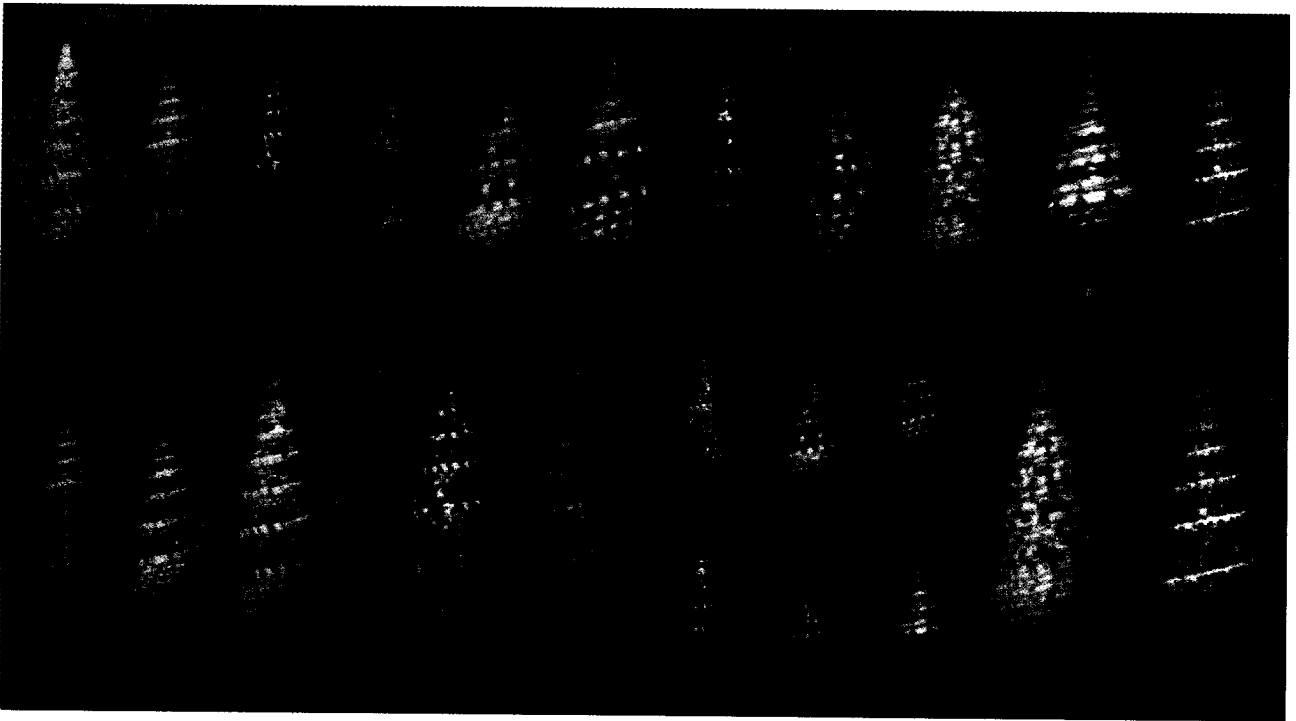


Fig. 2. Forms in Groups II and III of the *Lophiotoma cingulifera* clade. Panels A to D show all specimens at approximately the same size, while panel E illustrates the actual relative size of the different specimens. Group II species shown are: *Lophiotoma olangoensis*, new species (A and E1-5) and *Lophiotoma kingae* (B and E6-11). Group III species are *Lophiotoma cerithiformis* (C and E12) and *Lophiotoma millepunctata* (D and E13).

Lophiotoma olangoensis, new species. The specimens illustrated are: the holotype (A1), paratype 1 (A2 and E1), paratype 2 (E2), and paratype 6 (E3); all collected near Olango Island, Cebu, Philippines, the type locality. Two specimens of the dark-reddish form provisionally assigned to this species are illustrated: from Japan (A3 and E4) and from the Philippines (E5). Similar specimens are commercially sold by Japanese dealers under the name *Lophiotoma millepunctata zonifera*.

Lophiotoma kingae. Typical specimens from Hawaii (B1, B2, E6, and E7). These show the range of variation in the typical form. Atypical forms: form with brownish anterior (B3 and E8); Marquesas Islands specimens (B4, B5, E10, and E11); large broad form from Hawaii (B6 and E9). Note the much larger size of the last form (E9) compared to all other specimens of *L. kingae* (E6-8, 10-11).

Lophiotoma cerithiformis (C and E12) from Oahu, Hawaii. *Lophiotoma millepunctata* (D and E13), specimen from Nada, Wakayama, Japan, 30-50 fathoms.

The specimens collected in the Marquesas Islands (Fig. 2E-10, 2E-11) have coarser sculpture. In one of three specimens examined, the contrasting color pattern between the central body whorl and the base is similar to Hawaiian specimens (although with relatively less contrast), but in two specimens (one shown in Fig. 2E-10) all spiral cords have the dark reddish-brown color instead of the spiral cords in the central region of the body whorl with lighter yellow-brown markings. Thus,

L. kingae is a much more polymorphic and geographically widely-distributed species than originally realized.

A much more distinctive variety is a large broad form from Hawaii, showing the same general color pattern with the extent of tessellation in the base and fasciole much less prominent than in the typical form; the shells examined are much larger (to 40 mm at least) than the

Table 2. The *Lophiotoma cingulifera* clade.

Species	Distinctive forms	Typical locality
<i>Lophiotoma cingulifera</i> (Lamarck, 1822)	Oceanic form Form "legitima" Form "erythraea"	Guam Philippines Red Sea
<i>Lophiotoma albina</i> (Lamarck, 1822)	Western Pacific form Southeast African form	Philippines, Guam Mozambique
<i>Lophiotoma kingae</i> (Powell, 1964)	Typical form Brown anterior form Marquesas form Large broad form	Hawaii Hawaii Nuku Hiva Hawaii
<i>Lophiotoma olangoensis</i> (new species)	Typical form Coarse, brick red form	Philippines Japan
<i>Lophiotoma millepunctata</i> (Sowerby, 1908)	New Caledonian form Japanese form	
<i>Lophiotoma cerithiformis</i> (Powell, 1964)		Hawaii

typical form. An example of this distinctive variant (Fig. 2B-6 and 2E-9) is shown with the typical form. This may be an example of incipient speciation, as discussed above.

***Lophiotoma olangoensis* (new species)**

The intensive collection efforts using hookah methods by fishermen centered around Olango Island, Cebu in the central Philippines have resulted in the collection of a form that is commercially identified either as a small *L. cingulifera* or as a variation of *L. millepunctata*. However, these specimens appear to belong to a distinct species that is allied to *L. kingae*. A dark form with coarser sculpture is provisionally assigned to this species, but may ultimately deserve subspecific/ separate species status.

Description

Protoconch generally similar to *L. cingulifera*, but rather eroded in all specimens examined. There are 10-11 teleoconch whorls in adult specimens. The general outline of shells from the type locality is similar to that of *L. cingulifera*, as is the general sculpture. However, *L. olangoensis* is easily differentiated from *L.*

cingulifera through the boldly maculated subsutural region, which comprises three spiral cords (with the middle one usually being stronger on the larger whorls). The area between the subsutural spiral cords is also heavily striated with dark brown. The dark brown zone alternates with a whitish region. This maculated subsutural area is bordered by a raised sinus rib, composed of 2-3 spiral cords. These have parallel dashed markings which are much less prominent than the larger, darker-blotched pattern of the subsutural region. In the larger spire whorls, there are usually at least 2 spiral cords emergent, which are also marked with light reddish-brown markings. The body whorl below the sinus rib has numerous parallel spiral cords, all marked with small reddish-brown maculations, much finer than the markings in the subsutural region. There are a total of about 5 primary cords with weaker ones between. The siphonal canal is relatively short and curved; in many specimens, the spiral cords at the neck and the fasciole are darker than the corresponding cords in the rest of the body whorl (a feature indicating an affinity with *L. kingae*). From the type locality, the variation in the intensity of color is due to the frequency of fine reddish-brown dashes in the spiral cords.

Specimens of *L. olangoensis* (28-43 mm in length) are generally larger than typical *L. kingae* but do not reach the size of the *legitima* form of *L. cingulifera*.

Comparisons

The species looks similar to (and has been confused with) *L. cingulifera*, with the diagnostic difference in the subsutural region noted above. Typical *L. kingae* are smaller and have a strong contrast in color markings between the canal and fasciole region, versus the middle body whorl; the typical *L. olangoensis* is generally narrower, longer, and has a finer sculpture than “broad form” *L. kingae* (although the length of the shell is similar).

Dark brick-red form

This form is tentatively assigned to the species; it has been found from Japan to the Philippines. Japanese specimens of this distinctive form (Fig. 2A-3 and 2E-4) are sold by Japanese dealers as *Lophiotoma millepunctata zonifera*, a name which appears to be a synonym of *L. millepunctata* (although originally described as a subspecies of “*Pleurotoma cingulifera*”). This distinctive form, distinguished by its generally larger size, coarser structure with thicker spiral cords, and darker brick-red color, may comprise a different species or subspecies, but until the relationship between *L. olangoensis* and these specimens is better understood, we provisionally regard it as a form of *L. olangoensis*. It should be noted that there are also differences in the general shape of the shell: typical *L. olangoensis* have a short, broad siphonal canal; the brick-red form generally has a proportionally longer, narrower and more pointed canal. This form has also been collected in the Philippines (Fig. 2E-5), but is much less well represented than typical *L. olangoensis*.

The Lophiotoma millepunctata Group

Overview

This group is disjointed in its biogeographic distribution. Two species are included, *Lophiotoma millepunctata* (Sowerby, 1908), that is discontinuously known from Japanese waters and the South Pacific islands close to

New Caledonia, and *Lophiotoma cerithiformis* (Tinker, 1952), which has been collected only from the Hawaiian Islands. These species can be distinguished from those above by the absence of strong dark brown maculations on either the sinus rib (characteristic of *L. cingulifera* and *L. albina*) or the subsutural region (characteristic of *L. kingae* and *L. olangoensis*). In the Japanese form of *L. millepunctata*, it is characteristically the lower part of the whorl below the sinus rib that has the darkest markings, instead of the subsutural region or the sinus rib itself.

It should be noted that the Japanese specimens of *L. millepunctata* appear to be distinct in a number of characters from those found in New Caledonia, with the New Caledonian specimens appearing more similar to *L. cerithiformis*. Although we have followed Powell's scheme for *L. millepunctata* and *L. cerithiformis*, it may turn out that the Japanese form of *L. millepunctata* deserves separate subspecific or even separate species status. At present, there is insufficient material to evaluate this possibility.

***Lophiotoma millepunctata* (Sowerby, 1908)**

Description (adapted from Powell, 1964)

Adult shell 20-50 mm. Protoconch of 4 to 4-1/2 axially costate whorls, very similar to *L. cingulifera*. Teleoconch whorls, 9 or 10. The color pattern consists of sparse brown speckles, minus maculations on the sinus or subsutural region. The sinus ribs are more prominent than in *L. cingulifera*, and there is a distinct undulation of the base. Japanese specimens (one is illustrated in Fig. 2D) tend to be larger (50 mm) than the specimens from New Caledonia (25-35 mm), and the dashed markings on the spiral cords are generally longer, particularly in the spiral cords anterior to the sinus rib.

***Lophiotoma cerithiformis* (Powell, 1964)**

Description

The adult shell is 33-53 mm, with a multispiral narrowly conic protoconch of 4 to 4-1/2 whorls; brown and densely sculptured with slightly curved strong rounded axials crossed at right angles by weak spiral lirae. These are followed by 10-11 teleoconch whorls. The subsutural

fold is bulging; the spiral whorls consist of the subsutural fold (typically with 3-5 weak spiral threads) that is separated from the sinus rib by a narrow, deeply-channeled concavity. The sinus rib is composed of two strong rounded spiral cords with a concavity between them. Below the sinus rib are 2-4 crisp cords of varying strength. There are about 10 primary cords and occasional interstitial threads on the base below the sinus area plus four cords in the weak fasciole. The sinus is deep and narrow. The shell ground color is white, rather evenly speckled with reddish-brown dots and dashes. Powell describes the species as being found at depths of 6-8 fathoms. So far, no specimens have been found outside Hawaiian waters. A specimen is illustrated in Fig. 2C.

A comment on other species which may be related to the *L. cingulifera* clade

In his review of *Xenuroturris*, in addition to four of the species examined above (*L. cingulifera*, *kingae*, *millepunctata*, and *cerithiformis*), Powell included two other species, *Xenuroturris castanella* and *Xenuroturris incredula*. In a later addendum (Powell, 1967), a third species was included in *Xenuroturris*, *X. gemmuloides*. *X. castanella* may well be related to the *L. cingulifera* clade; Powell implied that this was a species that evolved from a *L. cingulifera*-like ancestral form. He also indicated that in his opinion, *X. incredula* from Australia was a form related to *L. millepunctata*. However, both of these species appear to be somewhat more distant phylogenetically from the group described above. Compared to *L. castanella* and *L. incredula*, other forms within *Lophiotoma* may be more closely related to the *L. cingulifera/kingae/millepunctata* complex (such as *Lophiotoma notata* from Japan, or *Lophiotoma ruthveniana*). The peripheral gemmulate sinus cord of *X. gemmuloides* suggests that the affinity of this form for the *L. cingulifera* group may be even more distant. There are additional reddish-brown forms of *Lophiotoma*, whose phylogenetic status is presently uncertain, that may belong in this clade as well. However, we believe that the suite of species that are treated above do in fact form the most closely-related core species in the clade, and that these other forms are probably more remotely-related.

DISCUSSION

The Status of *Xenuroturris* (Iredale, 1929)

The analysis above shows that as a genus or subgenus, *Xenuroturris* is a problematic taxon. At a minimum, *L. albina* would need to be included in the redefined taxon. However, previous diagnoses of this genus (or subgenus, depending on the author) generally refer to a truncated siphonal canal as a major characteristic of species to be included in the group. The evidence presented above is consistent with the siphonal canal length, being unsuitable as a morphological character for differentiating taxa at the generic or subgeneric level. The separation of *Xenuroturris* from *Lophiotoma* in previous taxonomic schemes for the Turridae implied that it is a reliable diagnostic trait. Thus, it seems that the morphological criteria that would differentiate *Xenuroturris* spp. from other species in *Lophiotoma* are weak at best, and we feel it advisable to discontinue the use of *Xenuroturris* at the present time as a generic or subgeneric taxon. Kilburn expressed similar sentiments in his monograph on the South African Turrinae (Kilburn, 1983). The recent taxonomic treatments of the Turrinae have tended to recognize *Xenuroturris* only as a subgenus of *Lophiotoma* instead of as a full genus (Taylor et al., 1993; Higo et al., 1999), but the analysis of related forms presented above suggests that even this may be inappropriate.

However, the suite of species described above probably comprises a distinctive and coherent clade; it is possible that when a broader understanding of the relationships between the species in *Lophiotoma* (s.l.) has been achieved, additional forms will be assigned to the clade. It is also quite likely, given that some members of the *L. cingulifera* clade are relatively small forms that live in deep water, that additional species and subspecies will be discovered as more systematic collecting at the 30-100 m level is done over a wider range of the Indo-Pacific. All of the presently known forms within the *L. cingulifera* clade are summarized in Table II.

CONCLUSION

Evidence that the molluscan genus *Xenuroturris* (Iredale, 1929) is an unacceptable taxon has been

presented, and all species previously assigned to *Xenuroturrus* are provisionally placed in *Lophiotoma*. The well known venomous species formerly called *Xenuroturrus cingulifera* should thus be referred to as *Lophiotoma cingulifera* (Lamarck, 1822). A new species, *Lophiotoma olangoensis*, is described from the central Philippines; this form is related to, but distinct from *Lophiotoma cingulifera*.

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