

Small Shells of the Classic Turridae from Taiwan I : Introduction and reclassification

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Chen-Kwoh Chang and Wen-lung Wu (1999) Small shells of the classic Turridae from Taiwan I. Introduction and reclassification. *Bulletin of Malacology, Taiwan, ROC*, 23:61-68. Ten years ago, I (Chang) had collected shells of all families for 25 years and had a collection of over 7,000 species. During the recent 10 years, I work primarily in two fields. One field is the Family Turridae and the other field includes the small shells from Lutaotaiwan. The number of species in each group in my collection has reached 1,100 species. My present topic is the crossing of these two fields. I am preparing to write about 20 articles to show all the small turrids I got from Taiwan. First, I will express my opinion about the classification of the classic Family Turridae from the standpoint of a conchologist. I don't want to deal much with the whole classic Family Turridae but only Clavidae and Mangeliidae (which, in the past, have been subfamilies Clavinae and Mangeliinae) whose number of species occupies 97% of the total small species in the classic Family Turridae.

Key words: Turridae, Clavidae, Mangeliidae, Taiwan

Specimens

The specimens were mainly collected by Mr. T.Y. Lin on the beach of Lutaotaiwan, but some specimens (about 10%) were obtained from other locations in Taiwan. Small shells are usually considered to have an average length less than 10 mm. For this study, however, small shell are defined as those species in which the total of length plus width plus height of an average size specimen was less than one inch (= 25.4 mm). Within such size, 56% are micro-shells whose size is less than 5 mm in my collection.

The Opinion about the Classification of the Classic Family Turridae

In Chang (1995), I wrote in Chinese my opinion about the classification of the classic Family Turridae for the Chinese shelling friends. Later, some English readers asked me to translate it into English. Now here is my brief reply as part of the Introduction for this series of articles.

By studying the statistics of shell characters of 930 species of turrids in my collection, I found there is no characteristic common to all the members of the family and there is no conchological feature by which this family could be separated from its related families by a key. It causes much confusion in classification.

Some statistical data for three shell characters which were adopted in developing nomenclature in the Family Turridae by different countries were: Chinese used Tah-Lo (塔螺, meaning "tall spire") for the name of the family. Japanese used Kudamaki-gai (クダマキガイ, meaning "loosely coiling") and Taiwanese followed using Chiun-Guan Lo (捲管螺, "spiral") for the name of the family. Both English

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names *Turris* and *Pleurotoma* mean "notched side". The results I found are tabulated as follows:

Shell Characters	% of shells within the family having the shell character	Other families having the shell characters
Loosely coiling	< 7 % (fissure or deep suture included)	Siliquariidae, Vermetidae, Epitoniidae, Turritellidae, Architectonidae, Pleurotomariidae, Scissurellidae etc.
Tall spire	75 % (spire is half the shell height or taller)	Cerithidae, Potamidae, Eulimidae, Pyramidellidae, Triphoridae, Mitridae, Costellariidae, Turritellidae, Terebridae etc.
Notched side	94.5 %	Pleuromariidae, Bursidae, Scissurellidae and part of Columbelloidae, Nassariidae, Fissurellidae, Buccinidae, Muricidae and Thaididae etc. About 5,000 species of other families have the posterior sinus of Turridae.

The only way to separate this huge group of shells using present knowledge is by using radular characters as the key feature, I suppose. I suggested that this huge group be split by radular types into the following four families so that they can be distinctly separated by a key. The key is in English in this original paper. I also gave the Chinese nomenclature for these four families in that paper.

1. Shells of Family Turridae having radula of wishbone or duplex marginals with formula $1+0+1(0)+0+1$.
2. Shells of Family Mangeliidae having radula of Toxoglossate marginals with formula $1+0+0+0+1$.
3. Shells of Family Clavidae having comb-like laterals with formula $1+1+1(0)+1+1$.
4. Shells of Family Pseudomelatomidae having central radula of rectangular and lateral radulae pointed and solid with formula $0+1+1+1+0$.

I did not mention anything about Strictispirinae in that article as I had doubts about this subfamily because :

1. Conchologically, shells of this group are very close to the shells of Crassispirinae. No feature or shell characters could be found for a key to separate this group from shells of Crassispirinae.
2. The radulae of shells of this group look like immature radula of duplex types which has a collar-like flange on the inner side of the marginal teeth. The figure of immature radula of *Knefastia dalli* (Bartsch) after Shimek and Kohn (1981) is shown in Fig. 1.
3. Kilburn RN (1988, p.228) put *Paradrillia makiyana* under Strictispirinae using the radula of *Paradrillia melvilli* Powell. That radula as shown below looks like a modified wishbone type having two apparent slender blades (Fig. 2).

The Contribution of Taylor, Kantor and Sysoev

Later, Dr. DL Tippet, the curator of Family Turridae in the Smithsonian Museum told me that my results have been preempted by a work of exceptional merit by Taylor *et al.* (1993) of which I had not been aware. I obtained a copy of that article from the library of Stanford University. I am glad to know that they reached similar result in classifying the classic family Turridae by foregut anatomy. But I feel that there is still something different between our two approaches as follows:

1. They recognized the Family Strictispiridae but I mentioned nothing about that group.

2. They used Drilliidae while I used Clavidae. Shells of *Drillia* are dominant in West Africa and South Africa. Hence South African and European authors like to use Drilliidae instead of Clavidae. But the shells of *Clavus* are dominant in Indo-Pacific Ocean and hence the authors of that area such as Cernohousky and Powell *etc.* like to use Clavidae instead of Drilliidae.
3. Taylor *et al.* (1993) combined all the shells having toxoglossate radulae under Family Conidae. I follow Morrison (1966) using Family Mangeliidae separated from Family Conidae and Family Terebridae, combining Mangeliidae, Conidae and Terebridae into the Superfamily Conacea. Though shells of these families have similar radulae, they are markedly different in morphology. This is a case similar to the status of Muricidae and Thaididae. As the result of an Opinion issued by the International Commission for Zoological Nomenclature (Opinion No. 886, 1969), the name of Thaididae was recognized. Conidae and Terebridae are traditional families and they are hard to get away from shell workers' minds. Wait and see: I predict that Morrison will win the game.

Subtopics

Seven species of Family Turridae, 18 species of Family Clavidae and about 180 other species or more of Family Mangeliidae will be reported in this series. I am preparing about 10 subtopics for this magazine. One subtopic will be allocated for Turridae, two subtopics for Clavidae and the remainder for Mangeliidae.

There are four subfamilies of the Family Turridae in my collection, namely *Turrinae*, *Cochlespirinae*, *Clavatulinae* and *Crassispirinae*. Instead of a lengthy description, the following Key to subfamilies of Family Turridae is offered.

Key to Subfamilies of Family Turridae

1. Operculum, ovate with medio-lateral nucleus.....**Clavatulinae**
Operculum, leaf-shaped with apical nucleus.....2
2. Sinus with parietal callus or tubercle; radula with duplex-typed marginals;
central tooth is rarely present.....**Crassispirinae**
Sinus without parietal callus or tubercles.....3
3. Sinus, U-shaped on shoulder slope; radula, have wishbone or duplex-typed
marginals with or without central tooth.....**Cochlespirinae**
Sinus, a narrow slit or V-shaped on carinae, peripheral or immediately
above; radula marginals, wishbone type marginals with or without central tooth.....**Turrinae**

Genera and Species of Turridae

Shells of this family are mainly medium to large size. Among 113 species of Turridae (part of the Classic Turridae) from Taiwan in my collection, there are only seven species with sizes SL+SH+SW < 1.0 inch (2.54 cm). When I checked their subfamilies, I found that all of these seven species have problems in subfamily classification. These problems will be discussed in the diagnosis of each genus.

Genus *Turridrupa*

Shells are 12-33 mm in length, solid, claviform, and usually are spirally sculptured. Their sinus is U-shaped with its adapical side at the termination of 1-2 spirals on the shoulder slope. The parietal wall without a callus or tubercle. The operculum is oblong with a terminal nucleus. The radula have a large unicuspid central tooth and the marginals have an accessory limb.

Powell (1967) placed this genus under Subfamily Turrinae by shell characters while Kilburn (1988) moved it to Subfamily Crassispirinae by his so-called "crassispirine marginals".

I don't think Crassispirinae is the best placement for this genus from the conchological point of view because these shells lack a parietal callus pad or tubercle near sinus. As to the radula, Crassispirinae has the formula 1+0+0+0+1, but rarely is 1+0+1+0+1 (p 232, in Kilburn 1988). These shells have a large central tooth. Hence, I follow neither Powell (1966) nor Kilburn (1988) but would

place the shells of *Turridrupa* under Subfamily Cochlespinae where they can meet both the conchological and the radular key feature of their subfamily. The radular information in my Key to Subfamilies of Family Turridae is from Keen (1971).

1. *Turridrupa consobrina* (Powell, 1967)

Shell, 10x3.8 mm, claviform has 3 cords. On spire whorls with the middle cord, smaller; more numerous maculations, the sinus cord not confined; sinus, a deep U-shaped with its apex immediately above the peripheral cord. The parietal wall is without a callus pad. It is shown as Fig. 3. This shell is close to *Turridrupa astricta* (Reeve). In the *T. astricta*, the maculations are more widely spaced, elongated dashes, confined to the sinus cord which is heavier. Powell (1967) put this shell as subspecies of *T. astricta* Reeve. I am sorry I don't have a specimen of *T. astricta* on hand.

2. *Turridrupa cincta* (Lamarck, 1822)

Shell, 13x5.6 mm, claviform-sculptured with 3 smooth keels with the middle keel, smaller on spire whorls, occasionally with some extra spirals on some whorl.

It somewhat resembles *Turridrupa bijubata* (Reeve) in appearance. But *T. bijubata* has undulated spiral cords and dark color while this shell has smooth keels and uniformly yellowish brown color. Both shells are shown as Figs. 4-5.

3. *Turridrupa albofasciata* (E. A. Smith, 1877)

Shell, 12x5 mm looks close to the *T. bijubata* but this shell has very strong undulations of the peripheral keel, a different form of subsutural margin and the presence of a pale band between the periphery and lower keels. It is shown in Fig. 6.

Genus *Carinapex*

Shells are 3-5 mm, solid, claviform with a moderately tall spire. They have sculpture of nodulose spirals. The aperture is narrowly ovate terminating in a very short unnotched canal. Their outer lip is thickened but not variced. The sinus is deep U-shaped, with a massive parietal callus tubercle. Their opercula are leaf-shaped with an apical nucleus. Many authors treated this genus under Clavinae (now Clavidae) by their form. The radula of the type species has marginals of collar-like flanged type closed to wishbone-type shown in Fig. 9. Hence it is placed here under Crassispirinae but not Clavidae because the radulae has no comb-like teeth.

4. *Carinapex minutissima* (Garrett, 1873)

Shell, 3x1.2 mm, minute claviform, solid, spire, moderately tall, light brown has 6 mature whorls. The protoconch is very large of 3-1/2 whorls. The sculpture is two rows of large, closely-set granules. The sinus is subtubular with a massive parietal callus. The specimen from Taiwan seems broader than the Hawaiian species. These specimens are shown as Fig. 7 (Taiwan) and Fig. 8 (Hawaii). The radula of this shell has neither hollow marginals nor comb-like laterals but is between collar-like flanged type and wishbone-type and is seen in Fig. 9. Its operculum is leaf-shaped with an apical nucleus. Hence, it is placed here under Crassispirinae but not under Clavidae.

5. *Carinapex papillosa* (Garrett, 1873)

Shell, 5x2 mm, elongate-oblong with a tall spire and a short anterior canal and yellowish-white. The protoconch is not large and has about 3 whorls. The teleoconch has 8 mature whorls that are flatly constricted beneath the suture; sculptured with 2 rows of granules, 8 to the whorl. The sinus is thick, and subsutural. Its photo is shown in Fig. 10.

Genus *Paradrillia*

The shell, 8-27 mm and claviform with a tall turreted spire. The sculpture is narrow rounded spiral cords crossed by lamellate axials with nodes at the intersections. The sinus is U-shaped occupying most

of the shoulder slope. The parietal wall lacks a callus pad. The radula is elongate, of the duplex typed shown as Fig. 2 in Part one of this series of articles.

Powell (1966, p.27) described the operculum of *Paradrillia* shells as "ovate with a medio-lateral nucleus", but Kilburn (1988, p. 230) described the operculum of *P. melvilli* Powell as blanceolate, slightly curved, with terminal nucleus, translucent yellowish". Powell (1966) separated *Paradrillia* (with medio-lateral nucleus) from *Vexitomina* (with a terminal nucleus) on the basis of opercula differences. In that case, *Paradrillia* should be put under Clavatulinae and *Vexitomina* under Cochlespirinae. But Kilburn (1988) dredged two specimens of *Paradrillia melvilli* Powell having opercula with a terminal nucleus. Kilburn (1988, p.228) said, "Firstly, the operculum in the type species is unknown". Powell (1969, p.331) said, "A paratype of *P. patruelis* (Smith) in the British Museum (Natural History) has the operculum intact". He also gave a sketch of the operculum (Powell 1969, p.241).

I think, in view of this debate, that it would be best to move *melvilli* Powell from *Paradrillia* to *Vexitomina* first, and then wait on the confirmation from the British Museum (Natural History) of the operculum, description as having its nucleus being either medio-lateral or apical.

I have 8 species of these two genera but there is only one small species from Taiwan which will be shown as species 6.

6. *Paradrillia inconstans* (Smith, 1875)

Shell, 11x4 mm, claviform with a tall, acute spire. The sinus is U-shaped, on shoulder slope and the parietal callus does not form a distinct pad. The shoulder sulcus is present between the subsutural cord and the peripheral cord. Below the peripheral row of nodules, 1-3 narrow low beaded spirals are present. Its photo is shown as Fig. 11.

Genus *Inquisitor*

Shell from 11 to 65 mm, elongate fusiform with tall spire. It has sculpture of strong axials crossed by spiral cords and threads below a concave shoulder sulcus (a groove or furrow). The subsutural cord is strong, weak or obsolete. The aperture is narrowly ovate-pyriform and is contracted narrowly to a short to moderately long anterior canal. The outer lip is thin with a more or less stromboid notch in the anterior. The sinus is U-shaped on shoulder slope and has a parietal callus pad. The protoconch is conical with up to 5 smooth whorls, but usually has 2-3 whorls. The operculum is leaf-shaped with a terminal nucleus. The color is white or yellow to chocolate, but is usually yellow.

There are two different types of radula in shells of this genus. One is the duplex type, and the other is tubular and toxoglossate-like.

Thiele (1929-1935) placed these shells under Brachytonminae (now belonging to Mangeliidae), while Powell (1966) put them under subfamily Clavinae (now Family Clavidae and Turridae, Subfamily Crassipirinae). Kilburn (1988) removed those having radula of duplex-type into subfamily Crassispirinae. Kilburn (1989) also found that the tubular radula of some shells are formed from two components: a form of modified duplex-type. Hence, Taylor *et al.* (1993) placed shells of this group including both types of radulae, under Subfamily Crassispirinae in Family Turridae.

There are many names of genera proposed for this group of shells such as *Inquisitor*, *Funa*, *Pseudoinquisitor*, *Brachytoma*, *Ptychobela* etc. It is hard to make a key to conchological feature to separate them. Therefore, I simply use the genus *Inquisitor* only to group them in my collection.

I would like to express some of my own idea in classifying shells here. In my collection and in this series of articles, I never use the genera proposed to separate genera by detailed radular structure such as *Funa*, *Inquisitor* etc. My reason is that it is impossible to have the radular information for all the shells I collected. In species 7, for example, *Inquisitor* sp. is used as the specimen name (other collectors will have this same problem in separating their specimens by radular characteristics). I would not know which genus to use for this shell if the genera proposed to separate by radular characteristics is recognized. I

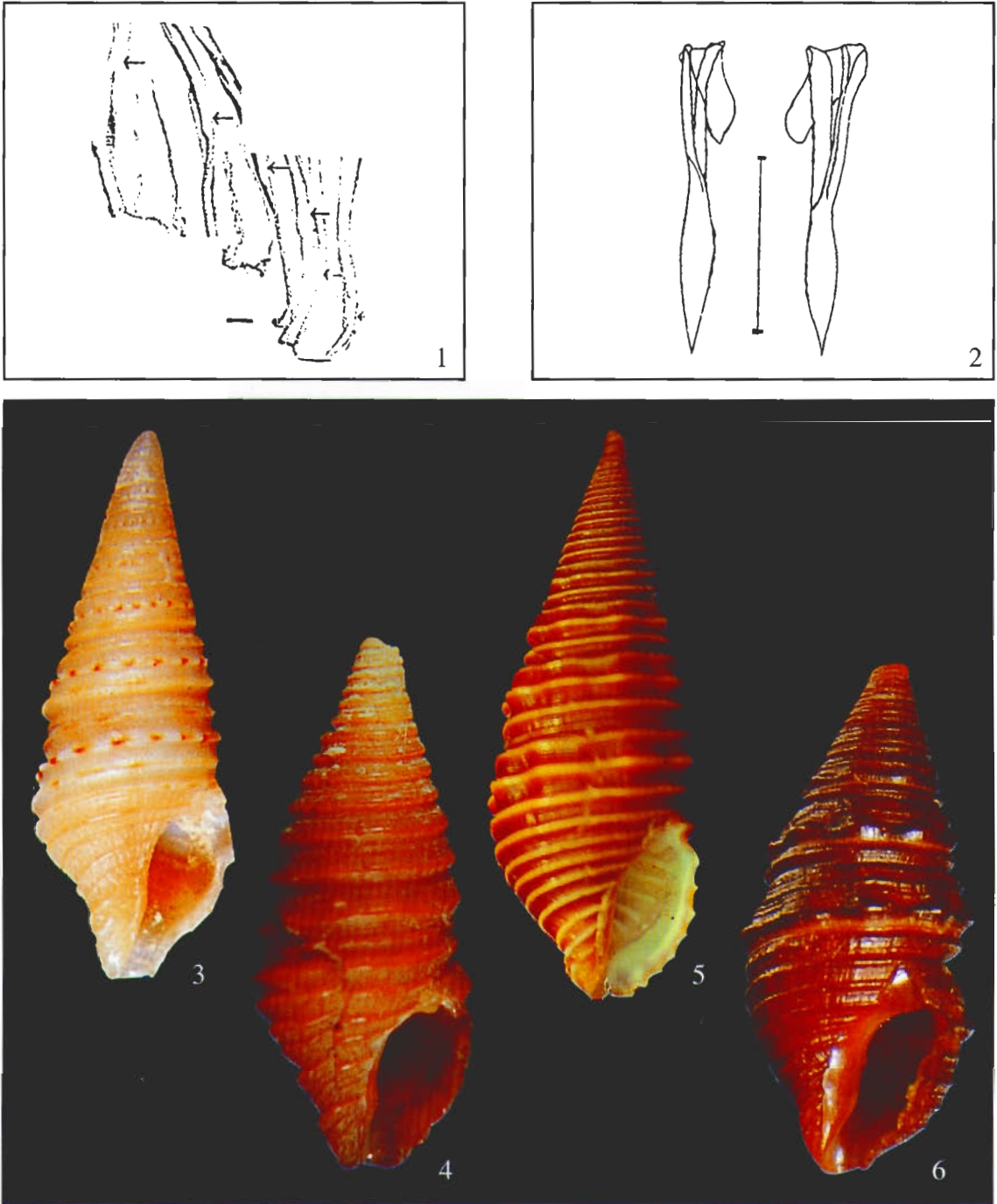
hope that malacologists will accept genera based on morphological differences (and use subgenera to separate groups by only the radula). This would allow the many conchologists to place a valid species name on their specimens and leave subgenera to the few professional malacologists.

7. *Inquisitor* sp.

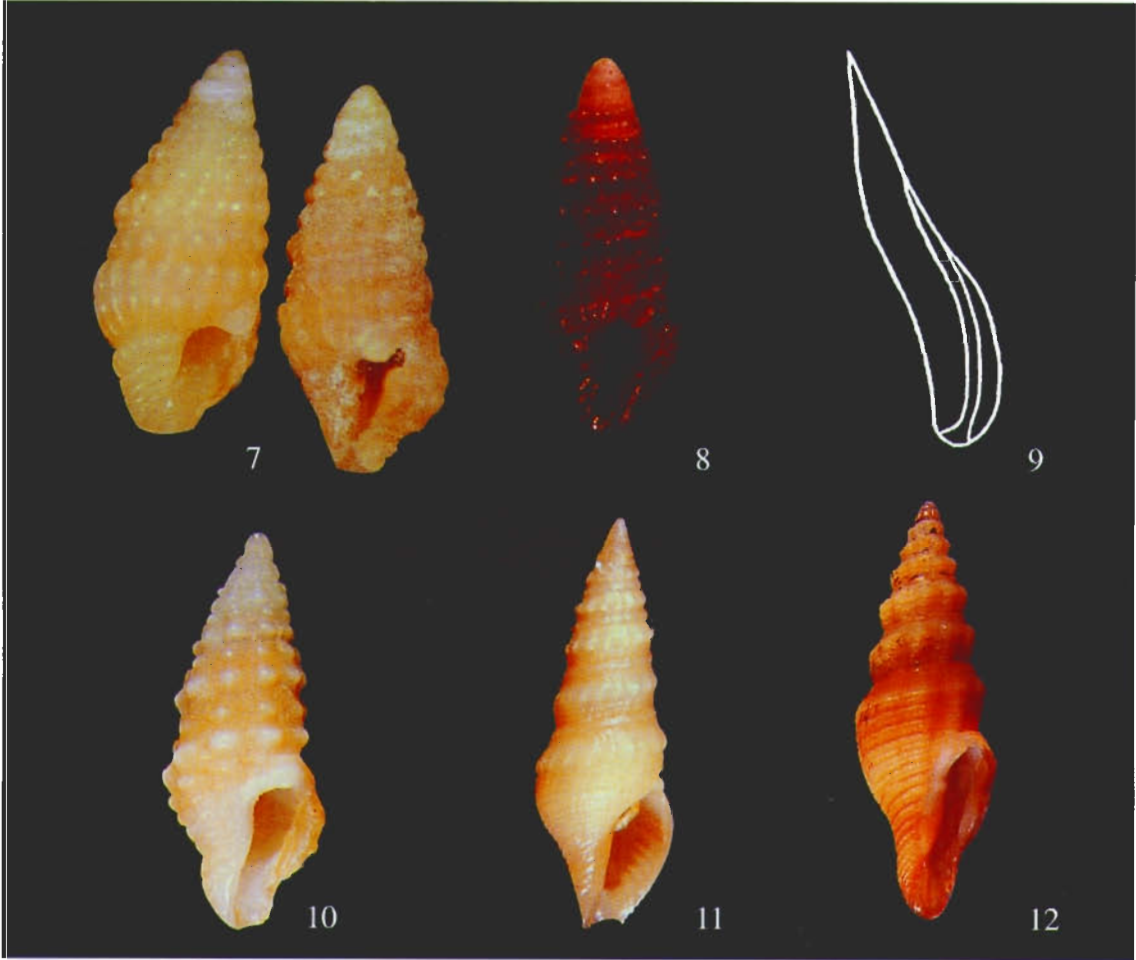
Shell, 13x4.3 mm is fusiform with a tall spire and a moderately long anterior canal. The teleoconch of a mature shell has 8, angulate whorls. The sculpture is of rounded axial ribs and narrow spiral cords with a narrow subsutural cord. It is without dorsal varix. The sinus is U-shaped with a parietal callus. The shell color is yellow. It looks like much larger *Buridrillia deroyorum* Emerson et McLean, 1992 but this shell lacks the columellar plication. Hence, it is located under *Inquisitor* here. The figures of this shell and the *B. deroyorum* after Emerson and McLean (1992) are shown in Figs. 12-13.

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1. Immature radula of *Knefastia dalli* (Bartsch), scale $25 \mu\text{m}$. 2. Radula of *Paradrillia melvilli* Powell, scale $25 \mu\text{m}$. 3. *Turridrupa consobrina* (Reeve) 4. *Turridrupa cincta* (Lamarck), 13 mm, Pescados Is., Taiwan. 5. *Turridrupa bijubata* (Reeve), 17.4mm, Pescados Is., Taiwan. 6. *Turridrupa albofasciata* (E. A. Smith), 12 mm, Pescados Is. Taiwan.



7. *Carinapex minutissima* (Garrett), 3 mm, Lutao, Taiwan. 8. *Carinapex minutissima* (Garrett), 3.2 mm, Hawaii. 9. Marginal radula tooth of *Carinapex minutissima* (Garrett), (after Powell 1966). 10. *Carinapex papillosa* (Garrett), 5 mm, Lutao, Taiwan. 11. *Paradrillia inconstans* (Smith), 11 mm, off N. Taiwan. 12. *Inquisitor* sp., 13 mm, N. Taiwan. 13 *Buridrillia deroyorum*, Emerson et McLean, 1992, 50 mm, Galapagos Islands.

台灣產小型捲管螺科 I. 總論與分類

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捲管螺科是貝類腹足綱中種類最多的科，約3000多種。由於採集困難，軟體相對的稀少，因此對本科的系統分類，就相當少有令人滿意的論著。筆者（張）檢視所收集的近千種捲管螺，依據其殼型及齒舌的特徵，建議將原來傳統的捲管螺科分為：捲管螺科（*Turridae*）、梳齒螺科（*Clavidae*）、西美螺科（*Pseudomelatomidae*）及芒果螺科（*Mangellidae*）。本系列的報導目前流通於《美國夏威夷貝類新聞網路，Internet Hawaiian Shell News》中，但有鑒於本系列的内容，完全以台灣所產的小型捲管螺為主，基於資源共享的理念，重新將該系列整理出來。第一篇係介紹傳統捲管螺科的重新分科理念，以及捲管螺科的7種小型捲管螺。