

***Denticulabrum*, a new genus of buccinid gastropods (Gastropoda: Buccinidae) from the Neogene of Indonesia**

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*Denticulabrum gen. nov. is proposed for Fusus (Clavella) sangiranensis Martin, 1906 (type species) and F. javanus Martin, 1879, from the Miocene of Indonesia. This buccinid gastropod genus is characterized by the presence of a blunt labral tooth at the end of a spiral groove, and by a terminal, adapically extended varix. Denticulabrum may be closely related to Cominella Gray, 1850, and Tomlinia Peile, 1937, but differs from both in many details of shell morphology. Several fossil and living Indo-West Pacific buccinids in addition to Denticulabrum have evolved a labral tooth, whereas in tropical America only two species are known to have this feature.*

*Key words: Gastropoda, Prosobranchia, Buccinidae, Denticulabrum gen. nov., Cominella, Tomlinia, Miocene, taxonomy, Indo-West Pacific, Indonesia.*

## INTRODUCTION

Gastropods whose shells have a tooth or spine on the abapical sector of the outer lip have evolved repeatedly beginning in the Late Cretaceous period. In an effort to discover when, where, how often, and under which circumstances such a labral tooth has arisen, I have conducted a large-scale survey of collections of fossil and Recent gastropods. Such a survey of specimens is essential in view of the fact that the presence and character of the labral tooth are rarely mentioned in species descriptions. In the collection of Cenozoic Indonesian fossils at the Nationaal Natuurhistorisch Museum in Leiden, I discovered two labral-tooth-bearing taxa whose morphology and relationships have until now remained poorly known. Here I provide the new genus *Denticulabrum* for two Late Miocene buccinid gastropod species, and discuss the relationships of this group to several other taxa including the Pleistocene to Recent genus *Tomlinia* Peile, 1937. I also comment on the distribution of labral-tooth-bearing buccinids in the Indo-West Pacific region and in tropical America.

Abbreviations. ANSP, Academy of Natural Sciences of Philadelphia, PA, USA; RGM, Nationaal Natuurhistorisch Museum, Department of Paleontology, Leiden, The Netherlands; USNM, United States National Museum, Smithsonian Institution, Washington, DC, USA.

## SYSTEMATICS

Family Buccinidae Rafinesque, 1815

Subfamily Phosinae Gray, 1857

Photinae auct.

**Denticulabrum** gen. nov.Type species: *Fusus (Clavella) sangiranensis* Martin, 1906 (figs. 1-2).

Description. – Shell medium-sized (maximum height 36.0 mm), ovate-conic, low-spined (aperture height:shell height, 0.63-0.87); last whorl abapically sloping or with convex sides, not constricted at base; protoconch probably paucispiral; teleoconch of about five whorls, the early ones with axial ribs and weak spiral cords, later whorls smooth except for five or six basal cords; upper part of whorl initially rounded, but angulate in adult; aperture elongate-ovate, its height more than three times its breadth; outer lip of adult a terminal varix, adapically extended, its edge reflected, especially on abapical sector; adaxial (inner) side of outer lip smooth or with six weak denticles; blunt labral tooth present at lip edge at apertural end of uppermost spiral groove on base; adapical end of aperture narrow, bordered by elongate ridge on outer lip and by strong parietal ridge on inner lip; columella concave, with one strong basal fold and a much weaker one immediately above it; siphonal fasciole present, rounded; umbilical chink absent.

Material examined. – *D. javanus*: RGM 9252, 47084 (Ci Burial, Java). *F. sangiranense*: RGM 9255 (Kali Cemoro, Jogjakarta), RGM 47130 (Ci Gombel, Semarang).

Other species included. – *Fusus javanus* Martin, 1879.

Stratigraphic and geographical distribution. – Early to late Miocene, Java.

Remarks. – Much uncertainty has surrounded the taxonomic placement of the two species I here assign to the new genus *Denticulabrum*. After first describing and illustrating *Fusus javanus* in 1879 (Martin, 1879: 58, pl. 10 fig. 13), Martin (1895: 88) listed the species as a member of *Latirus* Montfort, 1810, subgenus *Leucozonina* Gray, 1847, but did not offer a rationale for this assignment. Upon the advice of M. Cossmann, Martin (1919: 118) reassigned *F. javanus* to *Mazzalina* Conrad, 1860. Finally, Martin (1928: 123) placed the species in *Cominella*. Martin (1906: 307, pl. 44 fig. 728) described and illustrated *Fusus (Clavella) sangiranensis*. In 1928 (p. 123), he reassigned this species along with *F. javanus* to *Cominella*. Van Regteren Altena (1950: 233) placed *F. sangiranensis* in *Tomlinia*, but made no mention of *F. javanus*. Neither Martin nor van Regteren Altena noted the presence of a labral tooth in these two species, and only van Regteren Altena provided arguments in support of his taxonomic assignment.

The two species of *Denticulabrum* differ from the fascioliariid genus *Leucozonina*, by having a determinate outer-lip varix instead of a simple, indeterminate lip; and by having the labral tooth formed at the end of a groove instead of at the end of a cord. Moreover, the adaxial side of the outer lip of *Denticulabrum* is smooth or weakly toothed, whereas that of *Leucozonina* is adorned with beaded lirae.

*Denticulabrum* lacks the basal columellar folds characteristic of *Leucozonina* and other peristerniine and fascioliariine fascioliariids. The terminal varix of *Denticulabrum* also sets this genus apart from fascioliariids generally, which rarely if ever develop a unique adult outer lip.

The resemblance of *Denticulabrum* to *Mazzalina*, a Paleocene to late Eocene genus belonging either to the Melongenidae or Fascioliariidae from the southeastern United



Figs. 1-4. 1-2, *Denticulabrum sangiranense* (Martin, 1906), Kali Cemoro; RGM 9255 (shell height 30.1 mm)  
3-4, *Tomlinia rapulum* (Reeve, 1846), Malacca; ANSP 33-654 (shell height 29.4 mm).

States and Brazil, is very superficial. *Denticulabrum* differs from *Mazzalina* by having a determinate instead of simple, sharp outer lip; by the presence of a labral tooth instead of a convexity on the abapical sector of the outer lip; by the presence of a parietal thickening in the adult stage; and by the adaxially sloping, conical instead of constricted base.

Species of the group of genera around *Cominella* (for taxonomy and review see Finlay, 1926; Powell, 1979; Beu & Maxwell, 1990) resemble *Denticulabrum* in lacking a basal constriction of the last whorl and in sometimes having a labral tooth. In *Cominella* (*C. acutinodosa* (Reeve, 1846) from southwestern Australia (USNM 691693, 691707, Bandidoot Bay, Barrow Island), I have found a labral tooth that is formed as a ventrally directed, enlarged crenulation, the seventh along the outer lip counting from the suture, located at the end of an enlarged spiral cord. In *Iosepha tasmanica* Tenison-Woods, 1879, from southern Australia and *I. glandiformis* (Reeve, 1847) from New Zealand (*I. tasmanica*: USNM 638596, Dunsborough, Western Australia; *I. glandiformis*: Vermeij collection), the labral tooth forms medially as a point between the adapical and abapical sectors of the outer lip, and does not correspond to an external cord or groove. In *Denticulabrum*, by contrast, the labral tooth forms at the end of a groove. Moreover, *Denticulabrum* differs from the *Cominella* group in developing a terminal adult varix, and in showing no trace of an abapical sinus on the outer lip, which in *Cominella* s. s. exists as a very shallow, short incurving just behind the siphonal notch. It is possible that *Denticulabrum* belongs to the *Cominella* group in the buccinid subfamily Photinae. Although *Cominella* and related genera are restricted to the temperate to subtropical coasts of New Zealand and Australia in the Recent fauna, the group was represented in the Antarctic Peninsula during the late Eocene (Stilwell & Zinsmeister, 1992) and by at least one species in the early Pliocene of Okinawa in southwestern Japan (MacNeil, 1961; Noda, 1980, 1988).

The monotypic tropical eastern Pacific genus *Triumphis* Gray, 1857, superficially resembles *Denticulabrum* in the reduction of axial sculpture on younger whorls and by the development of an increasingly prominent shoulder angulation during growth. It differs, however, by having an indeterminate outer lip whose adaxial side is prominently lirate and whose edge bears distinct crenulations on the abapical sector. Although *Triumphis* has generally been regarded as a buccinid, I have assigned it to the Pseudolividae because of its close resemblance to the pseudolivid genus *Macron* H. & A. Adams, 1853 (see Vermeij, 1997, 1998a). *Triumphis* is unusual among members of this family in lacking a labral tooth at the end of a groove on the shell's base. In this respect, *Denticulabrum* would fit well into the Pseudolividae, but it differs from all members of that family by having a reflected, adapically extended, terminal varix.

*Denticulabrum* also bears a close resemblance to *Nicema* Woodring, 1964, a Miocene to Recent genus from tropical America. In fact, the Recent eastern Pacific *N. subrostrata* (Wood, 1828) is often treated as a member of the genus *Triumphis* (see Keen, 1971). Species of *Nicema* differ from *Denticulabrum* by having a simple, indeterminate outer lip with abapical crenulations along the edge, an adapical notch, and brief lirae on the adaxial (inner) side; by being constricted at the base; and by the absence of a labral tooth. I tentatively assigned *Nicema* to the buccinid subfamily Photinae (Vermeij, 1997, 1998a).

Peile (1937: 365-367) proposed the genus *Tomlinia* for the Recent Indo-Malaysian species *Buccinum rapulum* Reeve, 1846 (figs. 3-4) on the basis of the very peculiar radula, in which tiny needle-shaped denticles alternate with the comb-like cusps of the rachidian tooth. Noting a slight resemblance of the lateral teeth of the radula with those of *Cominella*, Peile assigned *Tomlinia* to the Buccinidae. In discussing his new taxon *Tomlinia*

*rapulum gracilis* (Kendang beds, Plio-Pleistocene of east Java), van Regteren Altena (1950: 232, figs. 21-22) noted a similarity in the axially ribbed and spirally threaded early whorls and smooth later whorls of his subspecies with the older *Fusus sangiranensis*, and assigned the latter species to *Tomlinia*. After examining Recent *T. rapulum* (ANSP 33606, 33654, 33668, 21876, all from the region around Malacca and Singapore), I conclude that the species I have assigned to *Denticulabrum* are distinct in at least six characters from *Tomlinia*. (1) *Tomlinia* has a simple, unreflected, indeterminate outer lip that is not adapically extended. (2) The adapical sector of the outer lip of *Tomlinia* forms a broad, shallow sinus, whereas that of *Denticulabrum* does not. (3) The adaxial side of the outer lip is smooth in *Tomlinia*, whereas there may be denticles (especially on the abapical sector) in *Denticulabrum*. (4) *Tomlinia* lacks a labral tooth, which is present in *Denticulabrum*. (5) The base of the last whorl of *Tomlinia* is constricted (that is, its lateral profile is concave outward), whereas that of *Denticulabrum* is evenly conical to slightly convex. (6) The siphonal fasciole of *Tomlinia* is adapically bounded by a keel, whereas it is rounded in *Denticulabrum*. In addition, the parietal thickening of *Tomlinia* is a pad that does not extend spirally into the aperture, whereas in *Denticulabrum* it is a spirally continuous feature in the adult shell, although it appears to be absent in immature specimens. *Tomlinia* has a higher spire (aperture height:shell height, 0.59-0.67) and a markedly more polished surface than *Denticulabrum* (aperture height:shell height, 0.63-0.87). The protoconch of *Tomlinia rapulum* (ANSP 33654), about which nothing had been published previously, consists of two smooth whorls, beginning with a domed nucleus. The demarcation between the protoconch and teleoconch is distinct. Peile (1937) reported that the operculum has a terminal nucleus.

## DISCUSSION

The two species of *Denticulabrum* are not the only Indo-West Pacific buccinoideans to have developed a labral tooth. In *Preangeria* Martin, 1921 (early Miocene to Recent), a long labral spine forms at the end of a basal groove at the abapical extremity of the outer lip. I tentatively assigned this genus to the buccinid subfamily Pisaninae (see Vermeij, 1998b). Also in this subfamily are the Indo-West Pacific genera *Cantharus* Röding, 1798, *Pollia* Gray in Sowerby, 1834, and *Cancellopollia* Vermeij & Bouchet, 1988. Members of this group have a labral tooth formed at the end of a groove located either near the middle or toward the abapical end of the outer lip (Vermeij & Bouchet, 1998). Still another Indo-West Pacific buccinid with a labral tooth is *Phoracanthus ickei* (Martin, 1914), the middle Eocene type and only species of *Phoracanthus* Cossmann & Martin in Martin, 1914, from the Nanggulan beds of Java. As in the *Cantharus* group, the labral tooth forms at the end of a groove near but not at the abapical extremity of the outer lip.

I know of only two labral-tooth-bearing buccinid species in the fossil and Recent faunas of tropical America. These are the Recent *Buccinum cimis* Reeve, 1846, from the Galápagos and Cocos Islands, a taxon whose classification remains controversial and unresolved and an undescribed Pliocene species of *Gemophos* Olsson & Harbison, 1953, from Florida.

The related family Nassariidae represents another group in which a labral tooth has evolved chiefly or exclusively in the Indo-West Pacific region. In a broad worldwide but incomplete survey of Recent Nassariidae, I have uncovered several species with a very small, blunt labral tooth located at the abapical end of the outer lip, immediately adjacent to the siphonal notch. This minute tooth or spine is situated on the abapical

end of the very short, shallow sinus that characterizes most nassariids. In his monograph, Cernohorsky (1984) did not comment on this feature, nor has any previous author as far as I have been able to determine. So far, I have found the labral tooth in the following taxa (nomenclature following Cernohorsky, 1984): *Nassarius* (*Niotha*) *bella* (Marrat, 1877), *N. (N.) crenolirata* (A. Adams, 1852), *N. (N.) echinata* (A. Adams, 1852), *N. (Zeuxis) olivaceus* (Bruguière, 1789), and all living species of *Hebra* H. & A. Adams, 1853. These are all Indo-West Pacific species. I strongly suspect that the species of the subgenus *Niotha* H. & A. Adams, 1853, listed above will turn out to belong to *Hebra*, because the restricted callus and tuberculate to spinose sculpture of these species are very similar to those features in *Hebra*. Although many nassariids in tropical America have a tiny rounded lobe in the position of the labral tooth, no species outside the Indo-West Pacific has developed such a tooth.

In summary, a labral tooth appears to have evolved in at least four Indo-West Pacific buccinid clades, two tropical American buccinid clades (but only in one species each), and at least twice among Indo-West Pacific nassariids. At present, nothing is known about the possible functions of the labral tooth in these groups. I hope that further taxonomic and experimental work on these species, many of which are common and easily accessible, will shed further light on this problem.

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