

Conturbatia, a new genus of Streptaxidae (Mollusca, Gastropoda, Pulmonata)

J. Gerlach¹

With 3 figures and 1 table

Abstract

A new genus and species of the terrestrial carnivorous snail family Streptaxidae is described from Frégate island, Seychelles. The species *Conturbatia crenata* is known from a single specimen from *Pterocarpus indicus* Willd. woodland. It appears to be related to the Seychelles endemic genera *Imperturbatia*, *Careoradula*, *Silhouettia* and *Acanthennea*. Although the creation of monotypic genera is not ideal, the conchological and radular differences are here considered sufficiently distinct to justify the creation of a new monotypic genus. The status of all streptaxid genera and subgenera will need re-evaluation when anatomical data on types of many African genera become available. The radula of this species is greatly reduced, which is suggested to be an adaptation for carrion feeding. The restricted range of this species and its anatomical specializations make this taxon of great conservation significance.

Key words: Mollusca, Gastropoda, Pulmonata, Streptaxidae, Seychelles Islands, taxonomy, biogeography.

Introduction

The Streptaxidae of Seychelles were recently reviewed based on extensive shell and spirit material (Gerlach 1995, Gerlach & van Bruggen 1999). This included specimens of 19 species from the islands of Mahe, Anonyme, South-east, Cerf, St. Anne, Silhouette, Praslin, Curieuse, La Digue and Felicite. A record from Frégate island was discussed but considered to be erroneous due to the absence of streptaxids from recent collections of Frégate snails. The Seychelles streptaxid fauna was found to include a high proportion of endemic forms, including seven endemic genera. The majority of these occur in high altitude and mist-forest habitats which are restricted to the high islands of Mahé and Silhouette. A less diverse fauna, comprising more wide-spread endemic taxa was found on the lower islands of Praslin, Curieuse, La Digue and Felicite. Records from the small islands comprise deliberate introductions (South-east, Cerf and St. Anne) or possibly accidental introduction (Anonyme).

The endemic genera have been suggested to have Asiatic affinities (Gerlach & van Bruggen 1999) although the basis for such a suggestion has not been discussed; their long isolation and

the highly distinctive morphologies of genera such as *Priodiscus*, *Imperturbatia*, *Silhouettia*, *Careoradula*, *Augustula* and *Acanthennea* make identification of affinities difficult. In some cases specializations have been extreme, such as the loss of the radula in *Careoradula* (Gerlach & van Bruggen 1998). These features of obscure origins and unique specializations make the Seychelles streptaxid fauna of exceptional interest. Additionally, the fauna has been thoroughly researched and extensively collected. With the completion of the recent revision (Gerlach & van Bruggen 1999) it was believed that all Seychelles streptaxid taxa had been described.

During a visit to Frégate by the author in September 1999 eight terrestrial mollusc species were collected, including a specimen of a streptaxid. This specimen was immediately identifiable as a new taxon, bearing a slight superficial resemblance to the Seychelles endemics *Acanthennea erinacea* and '*Gulella*' *silhoettensis*. This specimen is described below as a new genus and species. No evidence of the occurrence of '*Gonaxis*' *souleyetianus* could be found and the record (Germain 1934) remains doubtful, as noted previously (Gerlach & van Bruggen 1999: 40).

¹ 133 Cherry Hinton Road, Cambridge CB1 7BX, U.K. e-mail: jstgerlach@aol.com
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Abbreviations

Institutional abbreviation: ZMB – Museum für Naturkunde, Humboldt University Berlin (formerly Zoologisches Museum Berlin).

Measurement abbreviations: H – shell height; D – shell diameter; the ratio H/D indicates the shape of the shell.

Genus *Conturbatia* gen. nov.

Diagnosis. A conical streptaxid with prominent sculpture of regular ribs with a faint spiral component; sculpture continues on the underside to the open umbilicus. Aperture edentulous; labrum slightly incrassate, broadly reflected, constricted on the outer margin and receding. Umbilicus distinctively slot-shaped. Anatomically diagnosed by the short diverticulum at the top of the penis sheath and slight apical constriction of the penis. Odontophore cartilage greatly reduced; radula absent.

Distribution. Restricted to Frégate island, Seychelles.

Type species. *Conturbatia crenata* spec. nov.

Etymology. *Conturbatia*, Latin for disturbed, referring to the disturbed nature of the type locality and the irregular form of the body whorl in comparison to anatomically similar genus *Imperturbatia* Martens, 1898.

Conturbatia crenata spec. nov.

Material studied. One adult; Frégate (ZMB Moll. 102537).

Material dissected. One adult (ZMB Moll. 102537).

Type material. Holotype ZMB Moll. 102537 (coll. J. Gerlach, 12. IX. 1999, *Pterocarpus indicus* woodland).

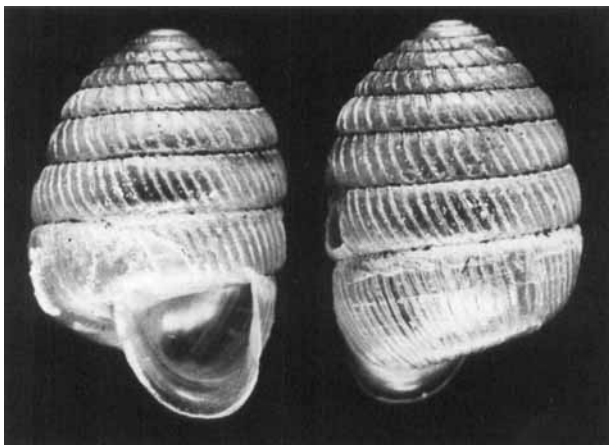


Fig. 1. *Conturbatia crenata*. Photograph of holotype ZMB Moll. 102.537 (scale bar in mm). **A.** front view. **B.** back view.

Type locality. *Pterocarpus indicus* woodland, Frégate.

Shell (Figs 1, 2a–c). Shell ovoid-conical; 9 whorls with 1 smooth nuclear whorls. Whorls ornamented with fine, regular radial ribs (10 mm^{-1}), ribs extending onto undersurface and into umbilicus, becoming sinuous around periphery. Irregular spiral striae (80 mm^{-1}) are detectable on the raised portions of the ribs. Irregular growth lines present on the body whorl. Surface glossy, translucent. Periphery without keel; whorls only slightly convex; suture moderately shallow. Apex slightly pointed. Aperture oblong; lip flared and slightly thickened; edentulous and receding; palatal margin constricted. Columella thickened. Umbilicus open, relatively broad (12% of the underside), deep (extending to apical whorls) and slot-shaped. Periostracum absent.

Dimensions. Holotype $6.4 \times 4.9\text{ mm}$, H/D 1.31, 9 whorls; aperture $1.7 \times 1.6\text{ mm}$.

Body. Foot fawn, tentacles dark vermilion. Mantle beige with vermilion spots. Violet spots along mantle border.

Anatomy.

Salivary gland. Elongate (2 mm), simple.

Radula. All radula and odontophore structures reduced. Odontophore small (1 mm), no radula detected. It is possible that a greatly reduced radula was present but not located.

Reproductive anatomy (Fig. 2d–e). The genital atrium is moderately long, the spermatheca short and simple. Penis elongate (11 mm) and extremely thin (0.02 mm); penial retractor muscle terminal. Penis sheath present on lower half; vas deferens passes through sheath. Penis constricted internally at end of sheath (not detectable externally); a short penial diverticulum is present at the end of the sheath. Penis slightly expanded terminally with a subterminal constriction. Basal and apical portions of penis regularly ornamented with chitinous, black spinules which are visible through the penis wall. The spinules are sparse and simple in shape at the base of the penis and absent from the middle third. The apical portion of the penis contains regularly arranged distinctively recurved bifid spinules (0.015 mm). There is a short (0.3 mm), indistinct epiphallus.

Distribution. Frégate, the single specimen was found in a rotten *Cocos nucifera* L. log in *Pterocarpus indicus* woodland. The precise distribution is not known; the island is 200 ha in area and *P. indicus* woodland covers approximately 24 ha.

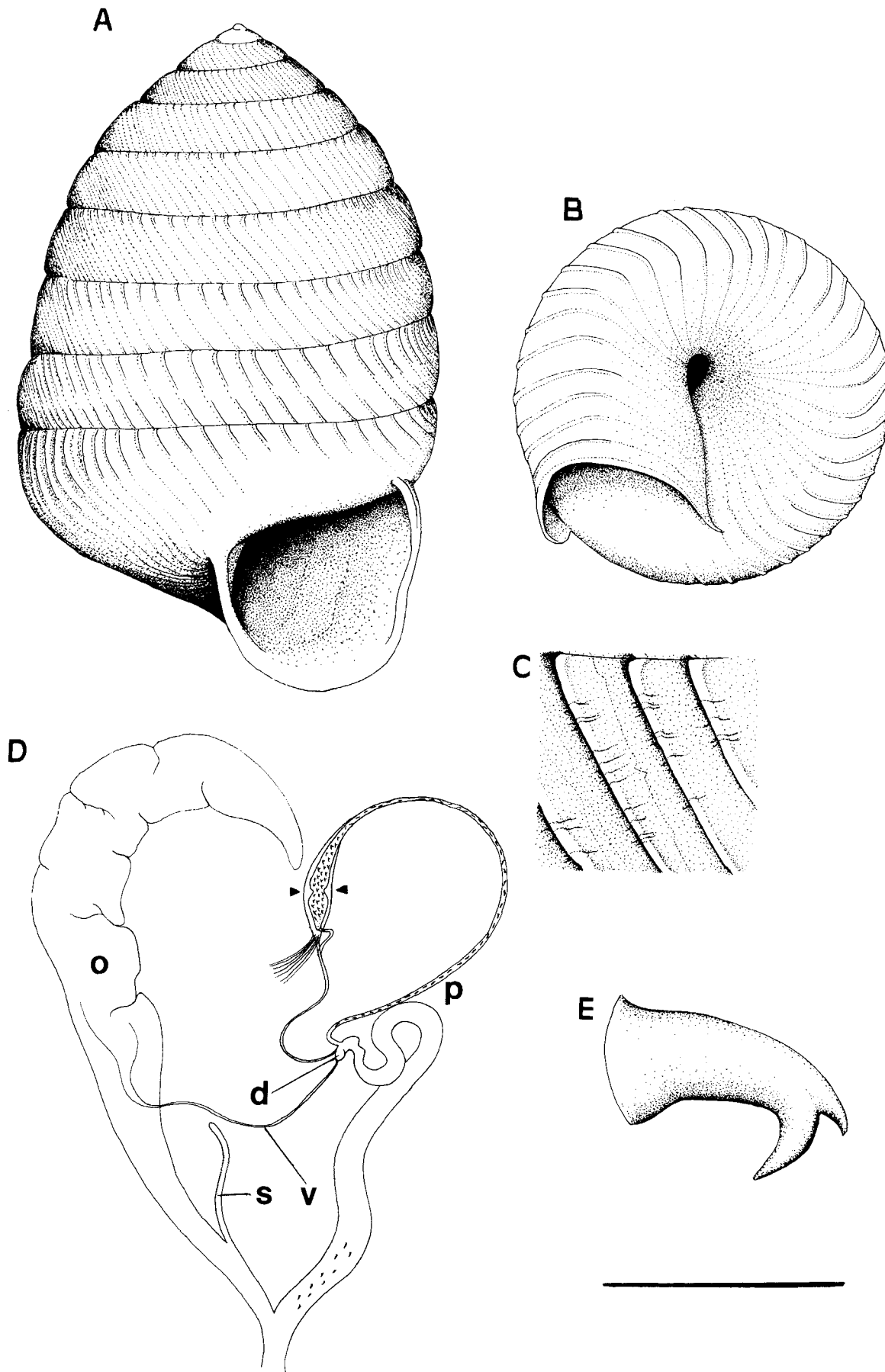


Fig. 2. *Conturbatia crenata*. **A** & **B**, shell (scale bar 2mm); **C**, shell sculpture (scale bar 0.5 mm); **D**, reproductive anatomy (scale bar 3 mm), arrows mark point of penial constriction; **E**, recurved bifid spinule (scale bar 0.015 mm).
 Key: d – penial diverticulum; m – penial retractor muscle; o – spermooviduct; p – penis; s – spermatheca; v – vas deferens

Etymology. *crenata*, Latin for a notch, referring to the slot-shaped umbilicus.

Comparisons. The resemblance of *Conturbatia crenata* to '*Gulella*' *silhouettensis* is only superficial; '*G.*' *silhouettensis* differs in its reduced sculpture, lower number of whorls (7), closed umbilicus, angle columella, regular aperture and fully developed odontophore and radula. The resemblance to *Acanthennea erinacea* is more profound and *C. crenata* appears to form a monophyletic group with *Imperturbatia*, *Silhouettia*, *Careoradula* and *Acanthennea*. This group is defined by the distinctive shape of the labrum: the slight inward constriction of the peristome at the middle of the outer margin, the sharply receding labrum and its strongly angled join to the body whorl. The constriction of the peristome is seen in some '*Gulella*' species, however, in these it represents an inward bulge, supporting a palatal lamella or large denticle. The close affinity of the genera *Imperturbatia*, *Silhouettia* and *Careoradula* was noted by Martens (1898) who included them all in his description of *Imperturbatia*. Martens also included *Augustula braueri*, however this differs in apertural, sculptural and anatomical characters.

Conturbatia has a muscular penis sheath as in *Silhouettia* which appears to be absent from *Imperturbatia*, *Careoradula* and *Acanthennea*. The recurved bifid spinules of *Conturbatia* are identical to those found in *Silhouettia* (Fig. 19g in Gerlach & van Bruggen 1999: 43, but erroneously described as 'simple' in text)¹; this form has not been detected in any other streptaxid, although bifid spinules are present in *Acanthennea*. From these comparisons *Conturbatia* appears to be most closely related to *Silhouettia* although the conical shell is more reminiscent of *Acanthennea*. In order to investigate the relationships of these genera further cladistic analysis of their morphology was carried out using the following characters and codings:

1. Shell shape (0 = conical or bulimod, 1 = helicoid)
2. Density of ribs (mm⁻¹) (coded as: 0 < 5, 1 = 5–9, 2 > 9)
3. Umbilicus (open = 0, closed = 1)
4. Penis sheath (absent = 0, present = 1)
5. Penis terminal shape (not expanded = 0, expanded = 1)
6. Penial spinules (absent = 0, simple = 1, bifid and recurved = 2)
7. Epiphallus (free = 0, contained in penis sheath = 1)
8. Spermatheca (long = 0, short = 1)
9. Spermatheca and duct (not distinct = 0, distinct = 1)
10. Radula central tooth (0 = fully developed, 1 = absent)
11. Number of laterals (0 < 30, 1 > 30)

Table 1

Character states used in cladistic analysis (characters listed in text)

Taxon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
<i>Edentulina dussumieri</i>	0	0	1	1	0	1	1	0	1	0	0
<i>Imperturbatia constans</i>	1	1	0	0	0	0	0	1	0	0	1
<i>Imperturbatia violascens</i>	1	1	0	0	0	1	0	1	0	?	?
<i>Silhouettia silhouettae</i>	1	2	0	1	1	2	1	1	0	1	0
<i>Careoradula perelegans</i>	1	0	0	0	1	0	0	1	0	1	0
<i>Acanthennea erinacea</i>	0	0	1	1	0	1	0	0	1	0	1
<i>Conturbatia crenata</i>	0	2	0	1	1	2	1	1	0	1	0

The character states are shown in Table 1. The choice of outgroup is problematic but as all members of the group share the elongate penial anatomy found in *Edentulina dussumieri*, this taxon was used. *E. dussumieri* may not be closely related to continental African '*Edentulina*' (Gerlach & van Bruggen 2000) and it may belong to a monophyletic Seychelles streptaxid radiation, its affinities cannot be ascertained without knowledge of the anatomy of *E. ovoidea*, the type species of *Edentulina*. Whether or not *E. dussumieri* belongs to the Seychelles radiation or is a colonist should not affect its use as an outgroup of the species grouping examined here. Analysis was performed using Hennig 86 (Farris 1988) a branch and bound algorithm and unweighted, non-additive characters. This analysis

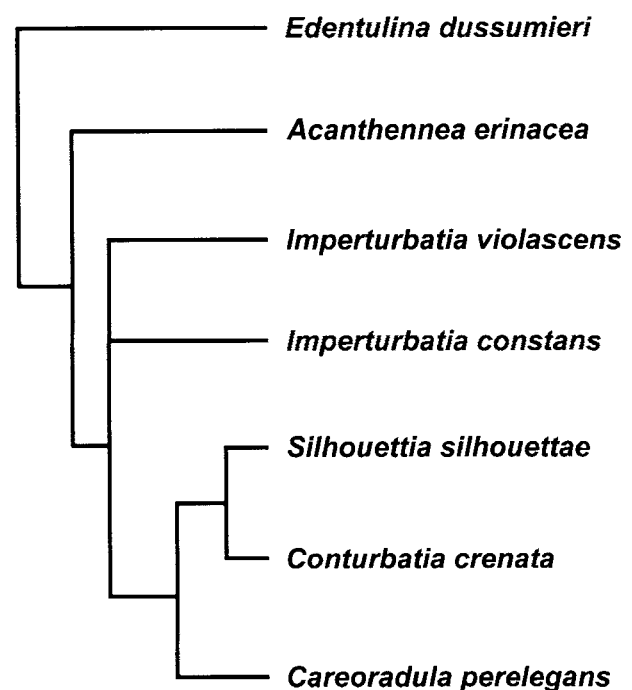


Fig. 3. Cladistic relationships of *Imperturbatia*, *Silhouettia*, *Conturbatia*, *Acanthennea* and *Conturbatia*. Tree length 18 steps, consistency index 0.72, retention index 0.72.

¹ This publication is also erroneous in the type designation for *S. silhouettae*, which should be ZMB Moll. 57283 (4 syntypes).

produced two equally parsimonious trees of 18 steps (strict consensus tree shown in Fig. 3) with consistency and retention indices of 0.72, this supports the suggestion that *Conturbatia* is closely related to *Silhouettia*. From a strictly cladistic view-point it could be argued that *Conturbatia* should be included in *Silhouettia* and the monotypic nature of both genera may be seen as a point questioning the validity of their generic status. However, the two taxa are conchologically highly distinct, with clear differences in sculpture and overall form. The reproductive anatomy of the two taxa could be considered to be different at species level but the absence of the radula in *Conturbatia* indicates a significant evolutionary difference between the taxa. In the light of the significant conchological and radular difference between *Conturbatia* and *Silhouettia* I believe it to be advisable to maintain the two as separate monotypic genera. Until the taxonomy of the African Streptaxidae has been resolved by anatomical examination of the types of the major genera (particularly *Edentulina*, *Gulella* and *Gonaxis*) it is impossible to determine whether conchological and radular distinctiveness should separate taxa at generic or sub-generic levels. When the necessary type species have been examined the generic placement of all African streptaxidae will need re-examination.

All of the Seychelles genera referred to above are restricted to high-altitude forest on Mahé and Silhouette islands with the exception of *Conturbatia*, the distribution and habitat of which remain anomalous. The biogeographical relationship of Frégate to the other islands of the Seychelles group is contradictory (Gardner 1984, Gerlach 1999); the evidence of the Streptaxidae suggests a connection between Frégate and Mahé and Silhouette which is not easily explicable on vicariance grounds.

Note. The reduction of the odontophore and radula is reminiscent of the total loss of these structures in *Careoradula* (Gerlach & van Bruggen 1998 & 1999). In *Careoradula* the loss of these structures is associated with carrion feeding (Gerlach & van Bruggen 1998). The reduction of the radula (or its complete loss) in *Conturbatia* may also be indicative of a carrion diet. Radula reduction in two of the six Seychelles endemic streptaxid genera may suggest that adaptation to carrion feeding may be more widespread in the Streptaxidae as a whole than has previously been suspected. Observations of carrion feeding have been made in some 'Gu-

lella' species, in the form of captive animals eating mammalian liver (Aitken 1981). The vast majority of streptaxids have not been studied anatomically; in those that have, radulas with 1–3 teeth per row have been reported for some 'Gulella' species (Aitken 1981, Verdcourt 1961, 1990).

The presence of an endemic streptaxid in dry, lowland woodland is unexpected, especially as the *Pterocarpus indicus* woodland concerned is of completely anthropogenic origin. This tree was introduced to Seychelles and was planted on Frégate in the early part of the 20th century. It now forms the main woodland area on the island and is inhabited by several localised or endemic invertebrates (e.g. the enid snail *Pachnodus fregatensis* Van Mol & Coppo, 1980, tenebrionid beetle *Polposipes herculeanus* Solier, 1848 and scorpion *Chiromachus ochropus* Koch, 1848). The original habitat of Frégate is not known but may be assumed to have included significant areas of mixed, lowland forest. Any work to restore woodland cover on Frégate should ensure that new woodland areas are similar in structure to the *Pterocarpus indicus* woodland that is currently of such great conservation significance. Furthermore, conservation work on Frégate should ensure that the island's endemic species are given highest priority; of these *Conturbatia crenata* is the most important as the island's only fully endemic genus. In the conservation ranking for streptaxid sites given by Gerlach & van Bruggen (1999: 12) Frégate was not ranked due to the dubious nature of the recorded streptaxid. The discovery of *C. crenata* would give Frégate a ranking of 10, a rank shared only with Mt. Dauban on Silhouette, further highlighting the importance of this island to Seychelles biodiversity conservation.

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