

CYCLOPHORIDAE AND POMATISIDAE (MOLLUSCA: PROSOBRANCHIA) OF THE SEYCHELLES ISLANDS

JUSTIN GERLACH

University Museum of Zoology Cambridge, Downing Street, Cambridge CB2 3EJ, U.K.

Abstract The taxonomy of the Cyclophoridae and Pomatidae of the Seychelles islands is reviewed. Two species of Cyclophoridae are recorded: *Cyathopoma blandfordi* Adams, 1868 and *C. picardense* sp. nov.. Three species of Pomatidae are recorded: *Tropidophora pulchra* (Gray, 1834), *T. gardineri* sp. nov. and *T. ligata* (Müller, 1774). The last species is recorded from one small population on Cosmoledo atoll, now possibly extinct, and an isolated shell washed ashore on Silhouette Island.

Key words Aldabra, Cosmoledo, *Cyathopoma*, *Silhouette*, *Tropidophora*,

INTRODUCTION

The Seychelles islands support some 87 species of terrestrial snail (Gerlach in prep.), of these 5 belong to the prosobranch families Cyclophoridae and Pomatidae with representatives on islands covering the range of geological history in the region, from the Gondwana fragments of the granitic islands to the 10,000 year old southern coral atolls. In Seychelles the families include only two genera; *Cyathopoma* and *Tropidophora* respectively. The largely Asian genus *Cyathopoma* comprises 60 species in Madagascar (Emberton & Rakotomalala 1996; Emberton 2003) and two species in Seychelles, whilst *Tropidophora* is restricted to Africa and the western Indian Ocean with 14 species in the Mascarenes (Griffiths 2000) and 95 described taxa from Madagascar (although only 60 of these may be valid; Emberton & Rakotomalala 1996). One species is present in the granitic islands of Seychelles and two in the coral islands, with several additional taxa recorded as subfossil material from Aldabra. Two of the Seychelles species have been regarded as distinct species but have been referred to only by manuscript names, all the Seychelles taxa are reviewed here and the manuscript names validated.

METHODS AND MATERIAL

For *Tropidophora* species, sculpture and colour patterns have been described using the method of Emberton (1995) of counting all chords on the body whorl, identifying 6 basic carinae and 10

basic colour bands. Descriptions of *Cyathopoma* are based on the arrangement used by Emberton (2003) to facilitate comparison of Seychelles and Madagascar taxa.

All available material of Seychelles Cyclophoridae and Pomatidae was studied. Institutional abbreviations are:
BMNH – British Museum (Natural History)
NPTS – Nature Protection Trust of Seychelles
NMW – National Museum of Wales

FAMILY CYCLOPHORIDAE

Cyathopoma blandfordi Adams, 1868

Fig. 1a,b

Cyathopoma blandfordi Adams 1868: 291; Nevill 1870: 65

Cyathopoma blandfordi Nevill 1878; Pfeiffer 1841: 25; Martens & Wiegmann 1898: 5; Sykes 1909: 58; Germain 1934: 125; Barnacle 1962: 56; Lionnet 1984: 242; Gerlach 1987: 32

Shell Globular, 1.9-4.5mm high, 2.9-5.0mm wide (Table 1); 4-4½ convex whorls, protoconch of 1½ unsculptured whorls. Body whorl periphery round, lacking carinae. Spire low-conic, slightly domed; apex acute. Suture channelled, not covered by sculpture; whorl shoulder absent. Aperture round; aperture height/shell height 0.52, aperture width/shell diameter 0.47, aperture height/width 1.00. Umbilicus broad (34.4-(36.95±1.20)-48.5% of shell diameter; n=9). Embryonic sculpture smooth, slightly granular. Body-whorl sculpture of 16 spiral cords (0.4mm apart), of which 4 always strongly developed; most pronounced on the last 2 whorls; fine, regular axial striae (110mm⁻¹). Intersections of spiral carinae and axial striae bear fine, minute

TABLE 1 DIMENSIONS (MM) OF SEYCHELLES *CYATHOPOMA* SPECIES

		Height	Diameter	H/D	Whorls	n
<i>C. blanfordi</i>	Mahé	2.0-(2.50±0.82)-4.0	2.9-(3.25±0.39)-4.2	1.0-(1.20±0.12)-1.45	4-4½	38
	Silhouette	2.5-(3.51±0.89)-4.5	3.0-(3.98±0.40)-5.0	0.83-(0.88±0.01)-0.90	4-4½	40
	Praslin	1.9-(2.25±0.79)-4.1	2.8-(3.12±0.35)-4.0	0.90-(0.91±0.02)-1.21	4-4½	8
	La Digue	2.1-(2.22±0.91)-3.6	2.7-(3.00±0.43)-3.9	1.1-(1.32±0.22)-1.35	4-4½	6
<i>C. picardense</i>	Aldabra	1.0-(1.18±0.13)-1.6	1.1-(1.37±0.28)-1.8	0.69-(0.81±0.12)-1.00	3¼	7
	holotype	1.6	1.8	0.89	3¼	

(0.25-0.7mm), regularly spaced (0.1mm apart) hairs. Hairs in umbilicus reduced: very short and indistinct. Operculum circular; nucleus central, loosely coiled; post nucleus tightly, evenly coiled; outer surface steeply concave, the embryonic whorls forming a central, flat circle. Shell dark brown, umbilicus paler. Immature specimens are grey. Operculum white to light brown.

Body Eyes sessile, tentacles short. Body dark brown

Distribution Endemic; found throughout the granitic islands in all forest habitats from 150-700m (Mahé, Silhouette, Praslin, La Digue).

Material studied Holotype BMNH un-numbered; Mahé, coll. G. Nevill 1868. Other material: NPTS M1997.61 (*Pisonia* forest, Silhouette, J. Gerlach 1.viii.1990), NPTS M1997.73 (La Reserve, Mahé, J. Gerlach 1989-94), M2003.84 (Mon Plaisir, Silhouette, J. Gerlach vii.2000), M2003.89 (Gratte Fesse, Silhouette, J. Gerlach 3.viii.1998).

Cyathopoma picardense sp. nov.

Fig. 1c

Cyathopoma picardense Barnacle 1962: 56; Lionnet 1984: 242; Gerlach 1987: 32

Cyathopoma sp. Gerlach & Griffiths 2002: 671

Shell Globular, 1.0-1.6mm high, 1.1-1.8mm wide (Table 1); 3¼ convex whorls, protoconch of 1 unsculptured whorl; apex pointed. Body whorl periphery round, lacking carinae. Spire low-conic, slightly domed; apex acute. Suture narrowly channelled, not covered by sculpture. Whorl shoulder slightly present, fairly flat, narrow, rather step sloped. Aperture round; aperture height/shell height 0.48, aperture width/

shell diameter 0.49, aperture height/width 1.05. Umbilicus broad (25-(30.68±4.39)-36% of shell diameter; n=5). Diameter of first 1.5 whorls 0.42mm. Embryonic sculpture smooth, slightly granular. Body-whorl sculpture of 7-14 spiral cords (number increasing with size of shell), 4 present on underside, entering umbilicus; fine, regular axial striae (100mm⁻¹). Fine, minute (0.1mm), regularly spaced (0.1mm apart) hairs present on the striae, these are usually worn off. Operculum circular; nucleus central, loosely coiled; post nucleus tightly, evenly coiled; outer surface steeply concave, the embryonic whorls forming a central, flat circle. Shell and operculum grey.

Body not known.

Distribution Endemic; found only on Aldabra (Picard, Malabar and Grande Terre).

Material studied Holotype NPTS M2001.61 and 10 paratypes NMW.Z.2002.027.00009 & NPTS M2002.61 (all Takamaka, Grande Terre, Aldabra, R. Chapman, 3.xi.1997).

Notes This species was referred to as *C. picardense* by Barnacle (1962), Lionnet (1984) and Gerlach (1987), all using the name written on specimen labels by Sykes, however, the name was never validated by a description as required by the International Code of Zoological Nomenclature Article 13.1.1 (ITZN 2000). It is validated here, and is derived from the type locality, Picard.

Comparisons This species is distinct from other western Indian Ocean *Cyathopoma* species in the lack of well-developed carinae. It superficially resembles *C. blanfordi* but is usually higher than wide, in contrast to the relatively broad shells

Fig. 1. a) *Cyathopoma blandfordi* with spines intact; b). *C. blandfordi* with spines removed ; c) *Cyathopoma picardense*; d) *Tropidophora pulchra*; e) *Tropidophora gardineri*; f) *Tropidophora ligata*. Scale bar 3mm (a-c), 10mm (d-f).

of the granitic islands species. As with other Aldabran molluscs it is probably closely related to a Madagascan species, most closely resembling *C. iva* Emberton, 2003 in having a low spire (height/diameter=0.8-1.1) and similar sculpture. *C. picardense* differs from *C. iva* in lacking the spikelets on the border of the operculum

Family Pomatiasidae

Tropidophora pulchra (Gray, 1834)

Fig. 1d

Cyclostoma pulchrum Gray 1834: 28; Nevill 1878
Cyclostoma ortyx Eydoux 1838: pl.117; Dufo 1840:
 191; Pfeiffer 1841: 13

TABLE 2 DIMENSIONS (MM) OF SEYCHELLES *TROPIDOPHORA* SPECIES

		Height	Diameter	H/D	Whorls	N
T. pulchra	Mahé	10.7-(12.97±1.07)-14.8	12.3-(13.99±0.85)-15.6	0.83-(0.94±0.09)-1.04	4	27
	Silhouette	10.8-(14.22±1.47)-15.0	12.7-(14.09±0.75)-17.7	0.88-(0.95±0.11)-1.24	4	53
	Praslin	11.8-(11.95±0.04)-14.1	12.7-(13.63±0.10)-15.3	0.86-(0.88±0.01)-0.96	4	7
	Curieuse	?	10.3	?	?	2
	La Digue	8.9-10.5	10.2-12.4	0.85-0.87	4	2
	Felicite	10.6	12.2	0.87	4	1
	Fregate	10.0	11.8	0.85	4	1
T. gardineri	all Aldabra	8.8-(11.21±0.97)-12.7	9.6-(11.82±0.81)-13.0	0.90-(0.95±0.04)-1.03	3¼-4¼	11
	Grande Terre	8.8-(10.43±1.52)-12.3	9.6-(11.05±1.212)-12.1	0.90-(0.94±0.06)-1.03	3¼-4¼	4
	Esprit	10.5-(10.98±0.45)- 11.5	11-(11.50±0.44)-12	0.91-(0.95±0.03)-0.95	3¼-4¼	6
	holotype	12.3	12.1	1.03	4¼	
T. ligata	Cosmoledo	10.0-21.2	11.1-17.9	0.91-1.18	4-4½	2
	Silhouette	10.9	10.5	1.04	4¼	1

Cyclostomus (Tropidophora) pulcher Nevill 1870: 65
Cyclostoma sechellarum (Leptopoma?) Pfeiffer 1874: 302;

Cyclostoma (Tropidophora) pulchrum Martens & Wiegmann 1898: 4

Tropidophora pulchrum Sykes 1909: 58; Barnacle 1962: 56; Lionnet 1984: 242; Gerlach 1987: 35

Tropidophora pulchra Germain 1921: 435

Tropidophora sechellarum Germain 1921: 435

Tropidophora (Eutropidophora) pulchra Germain 1934: 125

Leptopoma Sechellarum Edlinger 1988: 391

Shell Conical, 8.9-15.0mm high, 10.2-17.7mm wide (Table 2); 4 convex whorls; protoconch of one smooth whorl; apex pointed. Fine irregular radial ribs; 6 well developed but not expanded carinae on the last 3 whorls. Mouth slightly reflected; umbilicus open (10.7-(16.2±0.23)-24.6% of shell width; n=24). Shell thick; dull red brown with darker irregular radial bands crossing the mainly white carinae, dark spiral band below the center of the body whorl. Darker colour variations have brown and dark brown markings. Operculum spiral with a depressed centre; off-white with darker center.

Body Eyes on low prominences. Very dark brown, dorsally darker.

Distribution Endemic; found throughout

granitic islands in all forest habitats on Mahé, Silhouette, Praslin, Curieuse (extinct), La Digue (extinct), Felicite and Fregate. Occurs in forest habitats from sea level to 700m; an arboreal species.

Material studied NPTS M1997.118, 187 & 211 (subfossils, La Digue, J. Gerlach 1.iii.1992 & 25.vii.1996), M1997.119 (subfossils, Beau Vallon, Mahé, J. Gerlach 10.vi.1986), M1997.119, 199, 2002.30 & 2003.52 (subfossils, Anse Kerlan, Praslin, J. Gerlach 14.vi.1996, 20.vii.1996 & iv.2002), M1997.122, 2003.111 & 129 (Fregate, J. Gerlach 26.vii.1987, 30.ix.2002), M1997.125 (ex. G. Lionnet colln., Felicite), M1997.137 (La Reserve, Mahé, J. Gerlach 1990-4), M1997.159 (17.vii.1994, subfossil, Mahé, J. Gerlach), M2003.83 (vii.2000, Mon Plaisir, Silhouette, J. Gerlach), M2003.170 (30.ix.2003, Chemin Montagne Possee, Silhouette, J. Gerlach).

Notes *T. pulchra* most closely resembles the Madagascan *T. aspera* (Poitiez & Michaud, 1838) but has a highly distinct colour pattern and is considerably smaller (less than half the size).

***Tropidophora gardineri* sp. nov.**

Fig. 1e

Tropidophora gardineri Barnacle 1962: 56; Lionnet 1984: 242; Gerlach 1987: 35

Tropidophora sp. '*gardineri*' Gerlach & Griffiths

2002: 671

Shell Conical, 8.8-12.7mm high, 9.6-13.0mm wide (Table 2); 3¼-4¼ convex whorls. Mouth slightly reflected; umbilicus open (7.69-(12.45±2.11)-17.27% of shell width; n=11; Grande Terre = 10.8-(12.27±1.967)-14.58%; Esprit = 11.67-(14.23±1.96)-17.27%); apex pointed. Protoconch smooth, fine radial striate, giving a velvety appearance; 8-12 spiral cords (8-10 on second whorl only on Grande Terre, 10-12 on body whorl on Esprit), spiral cords present in umbilicus. Sculpture on body whorl may include 1-2 prominent cords (35% of Esprit shells with one prominent, 14% with two). Shell thick; light grey with darker irregular radial bands and 7 indistinct spiral bands, protoconch purplish brown. Operculum spiral with a depressed centre; off-white with darker center.

Body not known.

Distribution Endemic; found only in coastal habitat on Aldabra (Picard, Grande Terre - Dune d'Messe, Bassin Fregate, Esprit).

Material studied Holotype NPTS M2001.2 (Esprit, Aldabra, J. Gerlach 16.xii.2000). 10 paratypes: NMW.Z.2002.027.00023 (Esprit, Aldabra, J. Gerlach 16.xii.2000), M2002.48 (Dune d'Messe, Grande Terre, Aldabra, R. Chapman 23.vi.1997), M2004.31 (Picard, Aldabra, J. Gerlach 12.xii.2000).

Notes This species was referred to as *T. gardineri* by Barnacle (1962), Lionnet (1984) and Gerlach (1987), all using the name written on specimen labels by Sykes, however, the name was never validated by a description as required by the International Code of Zoological Nomenclature Article 13.1.1 (ITZN 2000). It is validated here, and is named after J.S. Gardiner who led the Percy Sladen Trust Expeditions to Seychelles in 1905 and 1908-9, which collected the first material of this species. *T. gardineri* is a smooth form, resembling *T. ligata* (Müller, 1774) in the lack of carinae and may be descended from an unbanded founder of that taxon.

Different species of subfossil *Tropidophora* have been recorded from a number of fossil deposits on Aldabra.

Tropidophora (Ligatella) ligata (Müller, 1774)
var. *affine* (Sowerby, 1847)

Fig. 1f

Tropidophora (Ligatella) ligata var *affinis* Connolly 1925: 265

Tropidophora ligata Barnacle 1962: 56; Lionnet 1984: 242; Gerlach 1987: 35

Tropidophora rogatum Barnacle 1962: 56; Lionnet 1984: 242; Gerlach 1987: 35

Tropidophora (Ligatella) ligata var *affine* Gerlach & Griffiths 2002: 671

Shell Conical, 10.0-21.2mm high, 11.1-17.9mm wide (Table 2); 4-5 convex whorls. Mouth slightly reflected; umbilicus open (9.5-(10.2±0.22)-14.2% of shell width; n=6); apex pointed. Fine irregular radial ribs and 12 spiral cords, this is greatly reduced around the umbilicus. Shell thick; pale grey with 1-6 brown spiral lines, occasionally all bands may be absent. Operculum spiral with a depressed centre; off-white with darker centre.

Body not known.

Distribution In Seychelles recorded only from Cosmoledo (Menai), with a single shell washed up on a beach on Silhouette. The species has been recorded from Mauritius, Madagascar (Diego Suarez) and South Africa. Var. *affine* has been reported from Mauritius and South Africa. The Seychelles population has not been recorded since 1905 despite searches in suitable habitat (P. Matyot, R. & G. Gerlach pers. comm.) and may be extinct.

Material studied BMNH un-numbered (Menai, Cosmoledo, 1907), NPTS M2003.170 (La Passe beach, Silhouette, G. Gerlach 2003).

Comparison *T. ligata* differs from many other members of the subgenus *Ligatella* (such as *T. insularis* (Pfeiffer, 1851) and *T. fimbriata* (Lamarck, 1822)) in the presence of a distinct banding pattern in most individuals. Banded individuals of *T. lienardi* Morelet, 1876 are similar but the most prominent band is the 6th in that species rather than the 7th and it also has a carina developed and a denser arrangement of cords.

ACKNOWLEDGEMENTS

I am grateful to an anonymous reviewer for constructive comments.

REFERENCES

- ADAMS H 1868 Descriptions of new species of shells collected by Geoffrey Nevill Esq., at Mauritius, the Isle of Bourbon, and the Seychelles. *Proceedings of the Zoological Society of London* (1868): 288-292
- BARNACLE GAS 1962 The land and freshwater shells of the Seychelles group of islands (including the Amirantes, Coetivy, Farquhar, Cosmoledo and Aldabra). *Journal of the Seychelles Society* 2: 53-57
- CONNOLLY M 1925 Notes on a collection of non-marine Mollusca from the islands of the Indian Ocean. *Journal of Conchology, London* 17: 257-266
- DUFO H 1840 Observations sur les mollusques marins, terrestres et fluviatiles des îles Séchelles et des Amirantes. *Annales des Science Naturelles, (2 Zoologie)* 14: 45-80, 166-221
- EDLINGER K 1988 Beiträge zur Gastropodenfauna der Seychellen, Komoren und Maskarenen. *Annalen des Naturhistorisches Museum Wien* 90B: 387-400
- EMBERTON KC 1995 Cryptic, genetically extremely divergent, polytypic, convergent, and polymorphic taxa in Madagascan *Tropidophora* (Gastropoda: Pomatisidae). *Biological Journal of the Linnean Society* 55: 183-208
- EMBERTON KC 2003 Madagascan *Cyathopoma* sensu lato, *Archiv fuer Molluskenkunde* 132(1/2): 9-91
- EMBERTON KC & RAKOTOMALALA MF 1996 Madagascar's biogeographically most informative land-snail taxa. In: Lourenço, W.R. (Ed.). *Biogéographie de Madagascar*. ORSTOM, Paris.
- EYDOUX JFT 1838 Mollusques du voyage de la Favorite. *Magazine de Zoologie Paris* 1838: 1-12, pl. 114-119
- GERLACH J 1987 *The land snails of Seychelles. A field guide*. Privately published.
- GERLACH J & GRIFFITHS O 2002 The land snails of the Aldabra islands, western Indian Ocean. *Journal of Conchology* 37: 667-679
- GERMAIN L 1921 *Faune malacologique terrestre et fluviatile des Iles Mascareignes*. Angers, Paris. 495pp
- GERMAIN L 1934 L'origine et la composition de la faune malacologique terrestre et fluviatile des Iles Séchelles. *67e Congres de la Societe des Savants* 113-133
- GRAY JE 1834 Characters of new species of land and freshwater shells. *Proceedings of the Zoological Society London* 1834: 28
- GRIFFITHS OL 2000 Nine new species of Mascarene land snails (Mollusca: Gastropoda). *Molluscan Research* 20: 37-50
- ITZN 2000 *International Code of Zoological Nomenclature, 4th edition*. International Trust for Zoological Nomenclature/Natural History Museum, London.
- LIONNET JFG 1984 Terrestrial testaceous molluscs. In: Stoddart, D.R. (Ed.) *The biogeography and Ecology of the Seychelles Islands*. W. Junk, The Hague.
- MARTENS E VON & WIEGMANN F 1898 Land- und Süßwasser-Mollusken der Seychellen nach den Sammlungen von Dr. Aug. Brauer. *Mitteilung der Zoologische Sammlungen der Museum fur Naturkunde, Berlin* 1: 1-94
- NEVILL G 1870 Additional notes on the land shells of the Seychelles Islands. *Proceedings of the Zoological Society of London* (1869): 61-69
- NEVILL G 1878 *Handlist of Mollusca in the Indian Museum 1. Gastropoda*. Indian Museum, Calcutta.
- PFEIFFER L 1874 *Novitates Conchologicae*. Cassel, Berlin.
- PFEIFFER LGC 1841 *Symbolae ad Historiam Heliceorum*. Vol. 1. Cassel, Berlin.
- SYKES ER 1909 The land and freshwater Mollusca of the Seychelles archipelago. *Transactions of the Linnean Society of London (Zoology)* 13: 57-64