

Charopid land snails (Gastropoda Pulmonata Charopidae) from Mayotte, Comores: alive and well

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The land snail fauna of Mayotte, the oldest of the Comores Islands, has been resurveyed for the first time since the pioneering work of Morelet in the 19th century. All historically recorded species in the family Charopidae are now documented based on live-taken specimens or fresh shells. In contrast with many other radiations of tropical island land snails, the Mayotte faunule appears to be exempt from extinctions. The family Charopidae is represented in Mayotte by 10 species of *Psichion* Gude 1911, five of them new, and one new species of *Phaulocystis* H. Watson 1934. All species are endemic to the Comores, and all except two may be restricted to Mayotte. *Helix mica* Morelet 1879 is treated as a senior synonym of *Helix miliaris* Morelet 1887, the type species of *Psichion*. *Helix mutica* and *H. radiolata*, both Morelet 1882 (earlier classified in the family Hygromiidae), *H. homalospira* Morelet 1883 (earlier classified in the Punctidae) and *Helix arachne* Morelet 1877 are transferred to *Psichion*.

KEY WORDS: land snails, *Psichion*, *Phaulocystis*, new species, Comores, Mayotte, extinction.

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INTRODUCTION

Located in the northern part of the Mozambique Channel, Mayotte (“Maore”) is the easternmost island of the Comores. It has an overall area of 375 km² (~ 40 × 15 km), and culminates at Mt Bénara, with an altitude of 660 m. Mayotte is entirely volcanic and the older formations are 7-8 million years old (STIELTJES 1988). Because of its geological age, Mayotte is more dissected than the younger islands to the west: Anjouan, only 80 km away, reaches 1594 m; Moheli, 790 m; Grande Comore, 2361 m.

Although the first species of land snail unequivocally originating from the Comores was named by Bruguière as early as 1789 (*Bulimus ovoideus*), the land snail fauna of the archipelago was not significantly surveyed until the latter half of the 19th century, when Morelet published a string of publications based on collections by C.W. Bewsher and E. Marie (MORELET 1877, 1879, 1882, 1883). Except for scattered additions based on material collected on Anjouan and Moheli during the 1930-1950s (FISCHER-PIETTE & VUKADINOVIC 1974), our knowledge of the land snail fauna of the Comores is basically what it was 120 years ago. At present, 136 native species of land snails and slugs are known from the Comores, of which 90 on Mayotte, 58 on Anjouan, 37 on Grande Comore, and 18 on Moheli. Of the 90 native species recorded from Mayotte, 55 (61%) are endemic to that single island.

Morelet based his descriptions of the fauna of Mayotte on material collected by E. Marie, a French administration officer who was resident in Mayotte from 1881 until 1883. Marie appears to have been a very skilled collector and his material, nowadays disseminated among the collections of several European and North American institutions, remains the single most important source of specimens and knowledge of the land snail fauna of that island. Since Marie’s time, human population pressure has increased considerably: the population density is now estimated to be around 700 per km². Primary forests occupy roughly 5% of the land (PASCAL 2002), and are fragmented into four major blocks corresponding to areas of higher elevation: Mt Hachiroungui (altitude 496 m) in the north-west; Mts M’tsapéré, Combani, Sohoa and Maévadoani (altitude 572 m) in the center-north; Mts Tchaourembo-Bénara (altitude 660 m) in the center-south; and Mt Choungui (altitude 594 m) in the south. These forest patches occupy the steeper slopes and are separated by low rolling hills with secondary agro-forests, cultivated lands, fallows and bad-lands.

Concomitant with habitat loss, numerous species extinctions have taken, and are taking, place in the land snail faunas of many tropical oceanic islands (e.g., BOUCHET & ABDOU 2003, LYDEARD et al. 2004, IUCN 2004). For example, 1/3 of the native species of Rodrigues are already extinct (GRIFFITHS 1994). Considering the grossly outdated information, it was not known whether the diversity documented by Morelet still existed on Mayotte, whether extinctions had already taken place, or even whether the existing system of protected areas was representative of the

endemic land snail habitat. This prompted a survey of the land snails of Mayotte, which took place in 2001-2003 within a project led by Dr Jean-Noël Labat within the Tropical Ecosystems Programme of the French Ministry of Environment. The purpose of the present paper is to document the results of the 2001-2002 survey, focussing on representatives of the pulmonate superfamily Punctoidea, with future papers to report on the rest of the gastropod fauna.

The superfamily Punctoidea is distributed mainly in the southern hemisphere, in the Pacific islands and throughout the Australian, Oriental, Ethiopian and Neotropical provinces, with a smaller number of taxa in the Palearctic and Nearctic regions (SCHILEYKO 2001). The taxa present in the Comores belong to Trachycystinae Schileyko 1986, a clade characterized by the well developed epiphallus with longitudinal pilasters (not present in Endodontinae) and by the unique elongated cases located in the penis and filled with something resembling seminal fluid. Based on these characters we treat Trachycystinae as members of the family Charopidae Hutton 1884. Trachycystinae are considered a valid subfamily of Endodontidae by SCHILEYKO (2001) and a synonym of the subfamily Charopinae of the family Charopidae by HAUSDORF & BOUCHET (in BOUCHET & ROCROI 2005).

ABBREVIATIONS AND TEXT CONVENTIONS

All descriptions are standardised, starting with the description of the shell, followed by the table of dimensions and proportions, and continuing, when applicable, with the descriptions of the external characters of cephalopodium, jaw and genital apparatus.

The number of protoconch whorls in our measurements does not include the nucleus. (When the number of protoconch whorls is measured along the suture, it gives values 0.5 higher than when the nucleus is excluded).

The number of smaller radial *riblets* between larger radial *ribs* has been counted for all species. The width of the smaller microscopic riblets and the distance between them are approximately the same in all species relative to shell size. Thus, the relative distance between larger radial ribs is clearly defined by the number of microscopic riblets between them.

D refers to larger diameter, *SD* to smaller diameter (90° to *D*), *H* to shell height, *U* to diameter of umbilicus, *AH* to height of aperture, *AW* to width of aperture. Also, *H/D* and *D/U* values were calculated, as well as *U/FAW* where *FAW* refers to the outer width of the former aperture, measured from the umbilical view, half-a-whorl (180°) from the current aperture. It is used here only in order to evaluate the relative diameter of the umbilicus in addition to *D/U*. We used *FAW* in comparison with the umbilicus because the *U/FAW* value does not change much with age and therefore would be applicable to juveniles as well as to adults, unlike *D/U* which could be affected by adult modifications of the last whorl. In addition, *FAW* and *U* have similar values, positioned on the same line next to each other, and therefore in most cases would only require simple comparison and not necessarily precise measurements (Fig. 13C). All precise measurements and ratios in decimals are given in the tables. Rounded numbers and ratios are given in the descriptions to facilitate comparisons.

In the lists of the examined material, *lv* refers to live-taken specimens; *dd* to empty shells; *spms* to material in historical collections, the initial condition of which at the time of collection is not known.

MATERIAL

In total, 3 weeks were spent in the field, in March 2001 (wet season, collectors A. Abdou, P. Bouchet and O. Griffiths) and August 2002 (dry season, collectors A. Abdou, P. Bouchet and C. Handl), and 27 stations were surveyed, of which 18 yielded material of Cha-

ropidae (Appendix 1). Living specimens and empty shells were hand picked under green foliage, on trunks and rock surfaces, and on the ground, in leaf litter, fallen palm sheaths, and under the bark of fallen trees. Leaf litter and top soil were searched for larger shells, then sieved, and the smaller fractions were sorted with the aid of a dissecting microscope. In addition, historical material has been examined in the collections of The Natural History Museum, London (BMNH) and Muséum National d'Histoire Naturelle, Paris (MNHN).

SPECIES DESCRIPTIONS

Phylum Mollusca
 Class Gastropoda
 Informal group Pulmonata
 Clade Stylommatophora
 Informal group Sigmurethra
 Superfamily Punctoidea Morse 1864
 Family Charopidae Hutton 1884

Genus *Phaulocystis* H. Watson 1934

Type species: *Helix aulacophora* Ancey 1890, by original designation.
 See SCHILEYKO 2001: 911-912 for diagnosis and distribution.

Phaulocystis iris n. sp. (Figs 1A, 2, 3A-C, 6A)

Type material. Holotype and 12 paratypes from the type locality and 4 paratypes from Mlima Choungui. All in MNHN.

Type locality. Mayotte, Mlima Tchaourembo, summital forest, 12°52.1'S, 45°08.7'E, 450-535 m.

Other material examined. Mlima Choungui, 320-500 m, 4 lv, 3 dd. Tchaourembo Range, Mt Ngouni, 450 m, 12 dd. Mlima Bepilipili, 400-640 m, 3 lv, 27 dd. Mlima Bénara, 500-650 m, 67 dd. Mlima Tchaourembo, 450-535 m, 106 dd.

Diagnosis. Teleoconch with narrow (~ 1/4 of FAW) umbilicus; microscopic spiral sculpture becoming much stronger and distant on umbilical wall; radial sculpture (0-4 microscopic riblets in-between slightly larger radial ribs) produces the iridescent effect. Epiphallus 1.5 times longer than penis and enters penis apically, i.e. there is no caecum. Penial retractor connects mostly to distal part of epiphallus and with lesser portion to proximal part of penis.

Description. Shell pale corneous-brown, globose (height/larger diameter ~ 4/5), with narrow umbilicus (~ 1/4 of FAW). Exposed parts of early whorls rather convex, separated by impressed suture. Protoconch (~ 1 whorl) with microscopic spiral riblets (about 30 on exposed part) and irregular malleation. Spiral sculpture continues on teleoconch, becoming much stronger and distant on umbilical wall. Teleoconch,

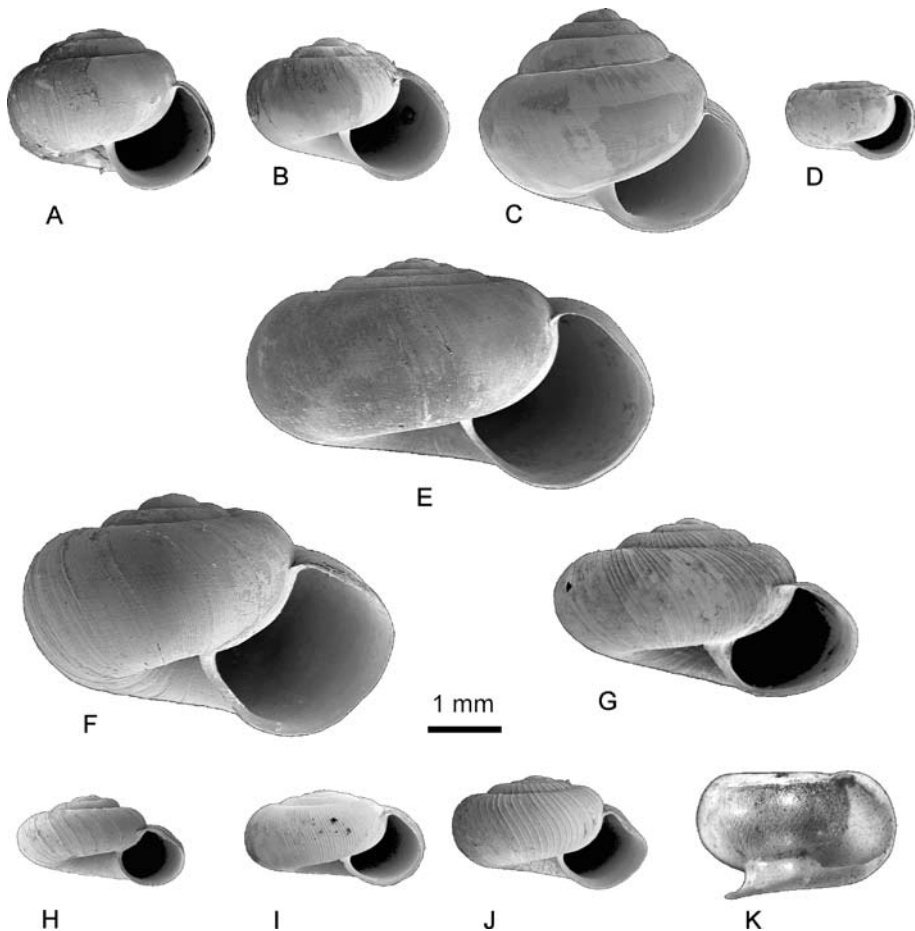


Fig. 1. — A, *Phaulocystis iris* n. sp., holotype [Mayotte, Mlima Tchaourembo, 450-535 m]. B, *Psichion labati* n. sp., holotype [Same]. C, *P. mica* (Morelet 1879) [Grande Comore]. D, *P. kowatiiti* n. sp., holotype [Mayotte, Mlima Bénara, 500-650 m]. E, *P. muticum* (Morelet 1882) [Mayotte, Mlima Tchaourembo, 450-535 m]. F, *P. arachne* (Morelet 1877) [Same]. G, *P. retrocostatum* n. sp., holotype [Mlima Choungui, southern slope, 320-500 m]. H, *P. radiolatum* (Morelet 1882) [Mayotte, Sohoa/Choungui, 80-150 m]. I, *P. nematomphalos* n. sp., holotype [Mayotte, between Moutsamoudou and Cape Saziley, 3-20 m]. J, *P. concavum* n. sp., holotype [Mayotte, Mlima Tchaourembo, 450-535 m]. K, *P. homalospira* (Morelet 1883) [Mayotte, Mlima Bénara, 500-650 m].

in addition to described spiral sculpture, with 0-4 microscopic riblets in-between slightly larger radial ribs. This radial sculpture is extremely dense and produces the iridescent effect. Aperture widely lunate (cut by penultimate whorl for about 1/4) with straight and sharp columellar, basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by thin transparent callus.

Dimensions and proportions of 13 adult specimens (types): see Table 1.

Posterior part of cephalopodium rounded above, not keeled, with straight posterior branches of peripodal groove connected at caudal end without any fossula.

Lateral parts of sole (under peripedal groove) almost smooth, foot (above peripedal groove) weakly papillose. Jaw thin and narrow. Genital opening between bases of upper and lower right tentacles.

Anatomical description based on 1 individual from Mayotte, Mlima Choungui, 320-500 m.

Vagina, about the same length as narrow free oviduct. Length of the distal portion of spermathecal duct about the same as combined length of vagina and free oviduct. Distal portion of spermathecal duct swollen (about 2.5 times wider than free oviduct), suddenly at first but then gradually narrowing towards spermatheca, becoming as narrow as vas deferens and bending over proximal portion of spermoviduct just before connection to spermatheca itself. Spermatheca, positioned next to loop of gut, both next to albumen gland. Right ommatophoral retractor passes through peni-oviducal angle. Vas deferens enters epiphallus just slightly laterally, but not forming any flagellum. Proximal part of epiphallus slightly wider than vas deferens, with longitudinal folds visible as less transparent whitish thickenings through epiphallic duct wall; distal part slightly narrower with smaller longitudinal folds. Epiphallus 1.5 times longer than penis and enters penis apically, i.e. there is no caecum. Relatively large oval-shaped rigid semi-transparent case, filled with substance resembling seminal fluid coagulated in alcohol, is attached to the penial wall in the middle of the penis. Penial retractor connects to distal part of epiphallus and to proximal part of penis.

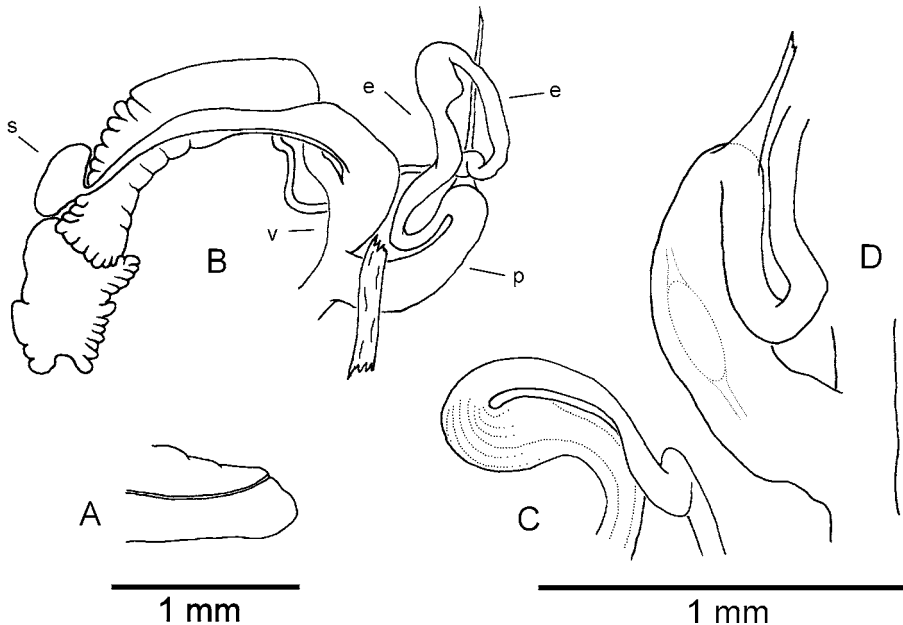


Fig. 2. — Anatomy of *Phaulocystis iris* n. sp., paratype [Mayotte, Mlima Choungui, 320-500 m]. A, Foot. B, General view of genital apparatus (e: epiphallus, p: penis, s: spermatheca, v: vagina). C, Internal structure of the epiphallus. D, Internal structure of the penis.

Etymology. *Iris* was the Greek goddess of the rainbow; with reference to the iridescent appearance of the shell surface due to the dense radial sculpture. Used as a noun in apposition.

Remarks. Conchologically, *Phaulocystis iris* can be easily distinguished from any other Mayotte Charopidae by its much denser radial sculpture. It is assigned here to *Phaulocystis* based on its distinct apical epiphallic-penial connection. It differs from the type species of the genus mainly by less elongated vagina, swollen distal portion of spermathecal duct, and relatively wider penis. However, these differences likely result from a difference in contraction, the specimen of *P. aulacophora* illustrated by WATSON (1934: pl. 20, fig. 23) having probably been preserved in a more relaxed condition. Conchologically, *P. iris* differs from *P. aulacophora* by its comparatively higher shell, with slightly larger umbilicus and denser radial sculpture. The oval object in the penis of *P. iris* (Fig. 2D) is probably homologous with so-called “spermatophores” described in the penis of *Trachycystis* and probably functions as a carbonate buffer during copulation (MURATOV 1999), or perhaps is the allosperm packet received during external sperm exchange (EMBERTON & PEARCE 2000).

Genus *Psichion* Gude 1911

Type species: *Helix miliaris* Morelet 1887, junior synonym of *Helix mica* Morelet 1879 (see herein), by original designation.
See SCHILEYKO 2001: 909-910 for diagnosis, synonymy and distribution.

Psichion labati n. sp. (Figs 1B, 3D-F, 6B)

Type material. Holotype and 3 paratypes (all dd) from the type locality; and 1 dd paratype from Mlima Bénara. All in MNHN.

Type locality. Mayotte, Mlima Tchaourembo, summital forest, 12°52.1'S, 45°08.7'E, 450-535 m.

Other material examined. Ridge above Mtsangamboua, 150-200 m, 1 dd.

Diagnosis. Teleoconch with narrow (~ 1/4 of FAW) umbilicus and with 4-7 microscopic riblets in-between larger radial ribs. Periostracum, on fresh shells, is expanded into membranous ridges along a whole length of each larger radial rib.

Description. Shell pale corneous-brown, globose (height/larger diameter ~ 3/4), with narrow umbilicus (~ 1/4 of FAW). Exposed parts of early whorls rather convex, separated by impressed suture. Protoconch (~ 1 whorl) with weak spiral riblets in places, with some weak radial riblets and irregular microscopic malleation. Spiral riblets a little more pronounced on teleoconch but not strong. Teleoconch, in addition to described spiral sculpture, with 4-7 microscopic riblets in-between larger radial ribs. Periostracum is expanded into membranous ridges along a whole length of each larger rib. Periostracal ridges better developed on apical side and on fresh

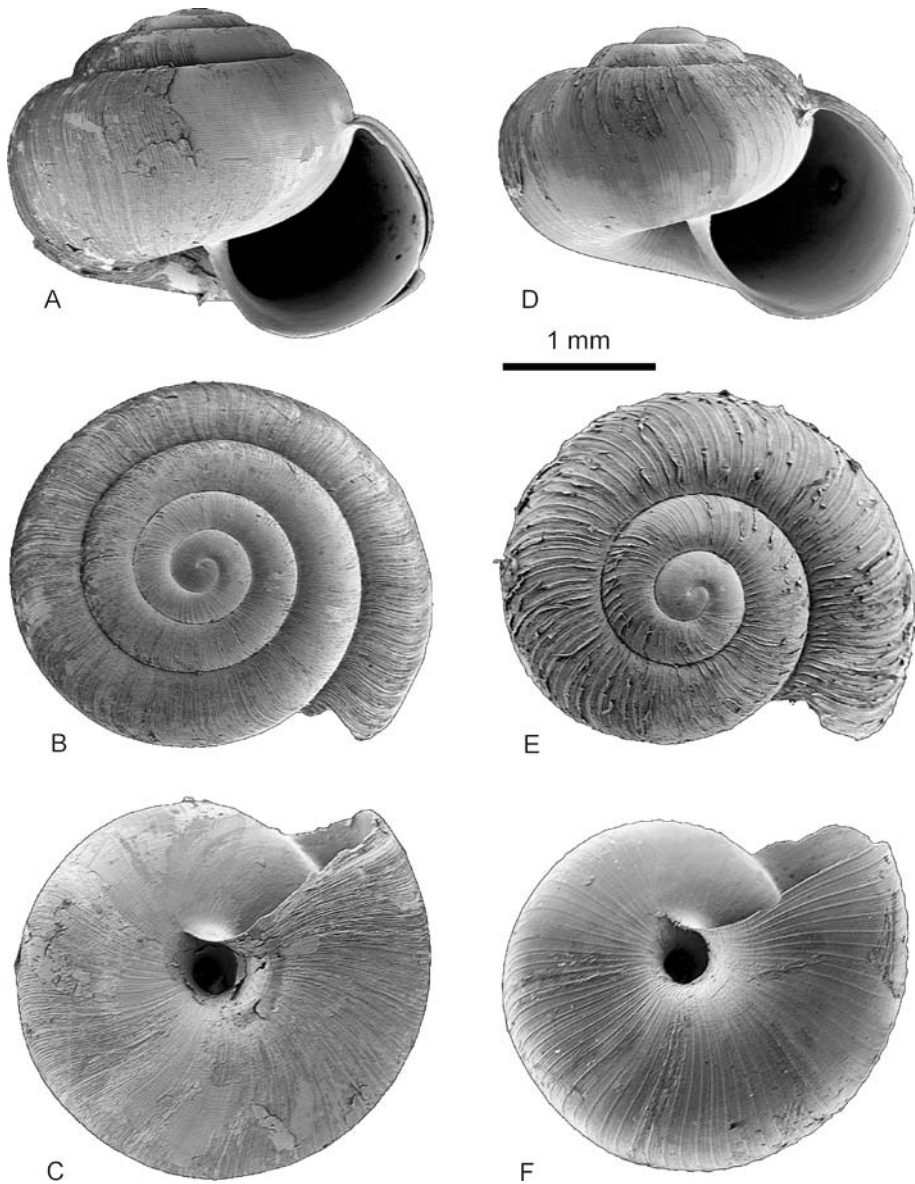


Fig. 3. — A-C, *Phaulocystis iris* n. sp., (A holotype, B-C paratypes). D-F, *Psichion labati* n. sp. (D holotype, E-F paratypes). [All from Mayotte, Mlima Tchaourembo, 450-535 m].

shells. Aperture widely lunate (cut by penultimate whorl for about 1/4) with straight and sharp columellar, basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Dimensions and proportions of 4 adult specimens (types): see Table 2.

Etymology. Named after Dr Jean-Noël Labat, botanist at MNHN and principal investigator of the research programme that funded our field work in Mayotte.

Remarks. *Psichion arachne* (Morelet 1877) and *P. radiolatum* (Morelet 1882) share with *P. labati* similar periostracal expansions on larger radial ribs, but these are more widely spaced in *arachne* (14-16 smaller riblets between larger ribs) and *radiolatum* (8-14) than in *P. labati* (4-7). *P. labati* also differs from *P. arachne* by its smaller adult size and narrower umbilicus, and from *P. radiolatum* by its relatively higher shell and much narrower umbilicus. *Psichion mica* (Morelet 1879) is about 1.5 times larger than *P. labati*, and *P. mica* subadults of comparable size have a similar overall shape; *P. labati* differs from such specimens by a wider umbilicus, less pronounced spiral sculpture and fewer (4-7 versus 8-22 in *P. mica*) smaller radial riblets between larger radial ribs. *P. labati* subadults also have a rounded periphery in contrast to the angulated periphery of *P. mica* subadults. *Psichion labati* is most similar in size and shell shape to *Phaulocystis iris*, and differs from it by its more broadly spaced radial sculpture. We place *P. labati* in *Psichion* based on shell shape and sculpture.

Psichion mica (Morelet 1879) n. comb. (Figs 1C, 4, 5A-C, 6C)

Helix mica MORELET 1879: 308, pl. 12, fig. 1.

Helix miliaris MORELET 1887: 282, pl. 9, fig. 1. (syn. nov.)

Nanina (Macrochlamys) mica; TRYON 1886: 107, pl. 36, fig. 66.

Psichion miliaris; GUDE 1911: 272; SCHILEYKO 2001: 910.

Trachycystis (Psichion) miliaris; ZILCH 1959: 217; FISCHER-PIETTE & VUKADINOVIC 1974: 32, fig. 11.

Kaliella miliaris; FISCHER-PIETTE, BEDOUCHA & SALVAT 1966: 5.

Trachycystis (Psichion) mica; FISCHER-PIETTE & VUKADINOVIC 1974: 31, fig. 10.

Type material. *Helix mica*: 3 syntypes, BMNH 1893.2.4.1054-1056; *Helix miliaris*: 5 syntypes, BMNH 1893.2.4.1045-1049.

Type locality. *Helix mica* and *Helix miliaris*: both from Anjouan.

Material examined. Historical material (all MNHN): Grande Comore, Humblot coll., 12 spms; Mayotte, Coll. Denis, 2 spms; Mayotte, Coll. Staadt ex Fulton, 1928, 2 spms; Anjouan, Forêt de M'rémami, Millot coll. 1953, 9 spms in 2 lots; Anjouan, 11 spms in 2 lots; Mohéli, Forêt de Fomboni, 600 m, Millot coll., 4 spms; "Comores", 14 spms in 2 lots; "Comores", Coll. Jousseau, 2 spms. 2001-2002 Survey: Mlima Mtsapere, 400-450 m, 1 lv, 3 dd; Barakani waterfall, 50 m, 6 dd; Between Moutsamoudou and Cape Saziley, 3-20 m, 4 dd; Vahibéni, valley of the Gouloué river, 100 m, 8 dd.

Diagnosis. Teleoconch with very narrow umbilicus partially covered by columellar edge and with 8-22 microscopic riblets in-between irregular very distant faint larger radial ribs. Epiphallus, about same length as penis, enters penis laterally, forming short obtuse penial caecum. Large epiphallic pilaster shortly bifurcating near entrance to penis and coming in contact (but not connecting) with two large penial pilasters, positioned close to each other.

Description. Shell pale corneous-brown, globose (height/larger diameter ~ 4/5), with very narrow umbilicus, partially covered by columellar edge. Exposed parts of

Table 1.
Dimensions (in mm) and proportions of 13 adult specimens (types) of *Phaulocystis iris* n. sp.

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Holotype	2.40	3.00	2.76	0.48	0.80	6.25	1.44	1.4	4.25
Mean (n = 13)	2.22	2.91	2.60	0.42	0.76	6.91	1.38	1.35	4.18
Range	2.08-2.40	2.75-3.12	2.44-2.76	0.35-0.52	0.69-0.81	5.69-7.89	1.32-1.46	1.28-1.42	4.00-4.25
Standard deviation	0.09	0.11	0.10	0.05	0.03	0.66	0.05	0.05	0.13

Table 2.
Dimensions (in mm) and proportions of 4 adult specimens (types) of *Psichion labati* n. sp.

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Holotype	2.20	2.92	2.60	0.40	0.75	7.30	1.40	1.40	3.50
Mean (n = 4)	2.12	2.82	2.49	0.36	0.75	7.99	1.41	1.35	3.36
Range	2.00-2.28	2.68-3.00	2.36-2.60	0.32-0.40	0.75-0.76	7.30-8.38	1.36-1.52	1.28-1.40	3.13-3.50
Standard deviation	0.14	0.16	0.13	0.04	0.01	0.51	0.08	0.05	0.18

Table 3.
Dimensions (in mm) and proportions of 9 adult specimens of *Psichion mica* (Morelet 1879) (6 from Anjouan without precise locality data and 3 from Vahibéni, valley of the Gouloué river, 100 m).

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Mean (n = 9)	3.20	3.90	3.61	0.20	0.82	20.35	1.78	1.91	4.15
Range	3.04-3.44	3.64-4.32	3.32-3.92	0.16-0.28	0.78-0.84	14.3-27.0	1.2-1.84	1.64-2.08	4.00-4.44
Standard deviation	0.14	0.22	0.20	0.04	0.02	4.64	0.04	0.16	0.15

teleoconch whorls rather convex, separated by impressed suture. Exposed part of protoconch (~ 1 whorl) not convex, with shallow suture, with barely visible microscopic spiral riblets (about 35 on exposed part) and irregular microscopic malleation. Spiral sculpture continued and becoming clearly visible and strong on teleoconch. Teleoconch, in addition to described spiral sculpture, with 8-22 microscopic riblets in-between irregular very distant faint larger radial ribs. Aperture widely lunate (cut by penultimate whorl for about 1/4) with straight and sharp columellar; basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Dimensions and proportions of 9 adult specimens (6 from Anjouan without precise locality data and 3 from Mayotte, Vahibéni): see Table 3.

Posterior part of cephalopodium rounded above, not keeled, with straight posterior branches of peripedal groove connected at caudal end without any fossula. Lateral parts of sole (under peripedal groove) almost smooth, foot (above peripedal groove) weakly papillose. Jaw thin and narrow. Genital opening between bases of upper and lower right tentacles.

Anatomical description based on 1 individual from Mayotte, Mlima Mtsapere, 400-450 m.

Vagina about 1/2 length of penis. Both free oviduct and wider distal portion of spermathecal duct about 1.5 times longer than vagina. Distal portion of spermathecal duct swollen, gradually narrowing towards spermatheca, becoming as nar-

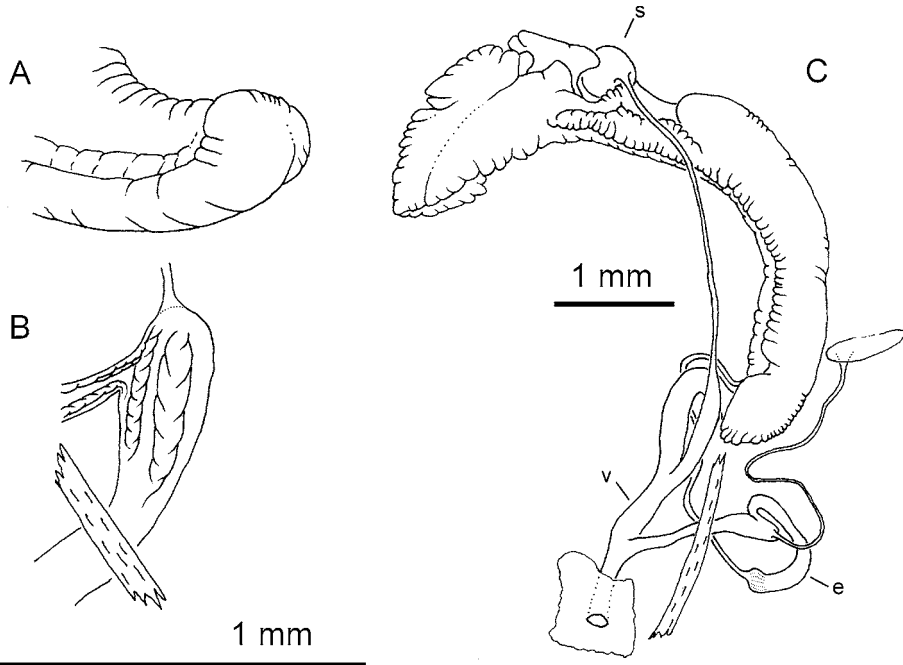


Fig. 4. — Anatomy of *Psychion mica* (Morelet 1879) [Mayotte, Mlima Mtsapere, 400-450 m]. A, Foot. B, Internal structure of the penis. C, General view of genital apparatus (e: epiphallus, s: spermatheca, v: vagina).

row as vas deferens and bending over proximal portion of spermoviduct just before connection to spermatheca itself. Spermatheca, positioned next to loop of gut, both next to albumen gland. Right ommatophoral retractor passes through penioviducal angle. Vas deferens enters epiphallus essentially apically, not forming a flagellum. Epiphallus, about same length as penis, consists of two about-equal-length parts. Proximal part of epiphallus much wider than vas deferens, with 6-8 slightly spirally curving longitudinal folds visible as less transparent whitish thickenings through epiphallic duct wall and with single large longitudinal pilaster, continuing till the penis. Middle part slightly narrower with larger longitudinal folds gradually becoming smaller in distal part. Distal part of epiphallus positioned parallel and very close to proximal part of penis, creating appearance of long caecum. However, epiphallus enters penis almost apically, forming only very short obtuse penial caecum and opens into penis in front of two large, penial pilasters positioned close to each other. Large epiphallic pilaster shortly bifurcating near entrance to penis and coming in contact (but not connecting) with large penial pilasters. Penial retractor connects to proximal part of penis.

Remarks. Although FISCHER-PIETTE & VUKADINOVIC (1974: 32) kept *Trachycystis mica* and *T. miliaris* as two species, they noted that they had problems allocating their material to one or the other species and did not exclude that they should be synonymized. The type material of both nominal species from Anjouan falls within the range of variation observed in our material from Mayotte, and we here formally synonymize them. The name *Helix mica* has priority.

The genital anatomy of *P. mica* is very similar to *P. ectima* (Melvill & Ponsonby 1899) from South Africa, which was illustrated by WATSON (1934: pl. 21, fig. 26) as having a long penial caecum. However, the length of the caecum may have been misinterpreted by Watson because, in all the species of *Psichion* we examined from Mayotte, a substantial portion of the distal part of the epiphallus is positioned parallel and very close to the proximal part of the penis, regardless of the actual length of the caecum.

***Psichion kowatiiti* n. sp.** (Figs 1D, 5D-F, 6D)

Type material. Holotype and 9 paratypes in MNHN.

Type locality. Mayotte, Mlima Bénara, 12°52.6'S, 45°09.6'E, 500-650 m.

Other material examined. Mlima Bénara, with the type lot, 28 dd; Mlima Bepilipili, 400-640 m, 3 dd.

Diagnosis. Shell with almost planulate spire, very narrow [$\sim 1/6$ (16%) of FAW] umbilicus and with 4-7 microscopic riblets in-between slightly larger radial ribs on teleoconch. Protoconch with clearly visible spiral riblets but without any radial riblets. Aperture narrowly lunate-cut by penultimate whorl for about one-half.

Description. Shell pale corneous-brown, depressed (height/larger diameter $\sim 3/5$), with high whorls but very low, almost planulate spire; with very narrow ($\sim 1/6$ [16%] of FAW) umbilicus. Exposed parts of early whorls rather convex, sepa-

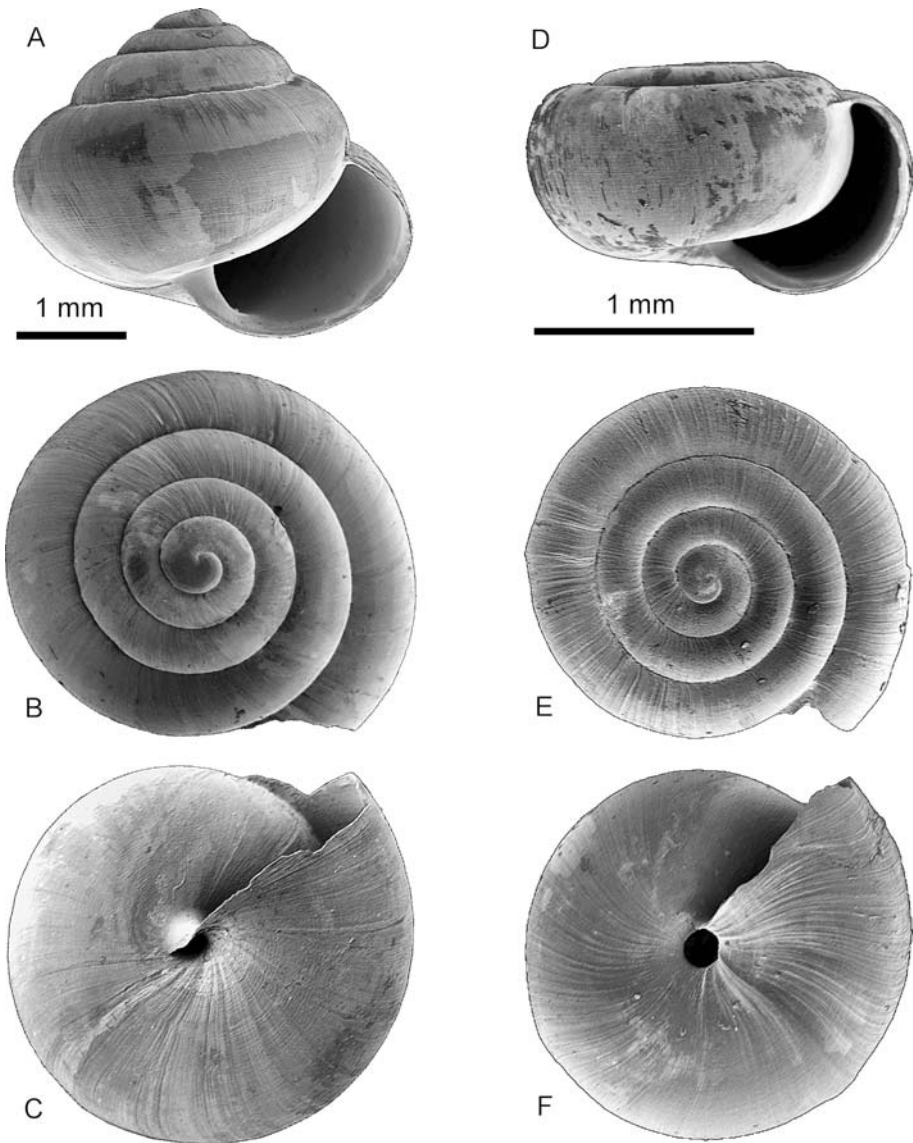


Fig. 5. — A-C, *Psychion mica* (Morelet 1879) [A: Grande Comore, B: Anjouan, C: Mayotte, Vahibéni, valley of the Gouloué river, 100 m]. D-F, *Psychion kowatiti* n. sp., (D holotype, E-F paratypes) [Mayotte, Mlima Bénara, 500-650 m].

rated by impressed suture. Protoconch (~ 1.25 whorls) with clearly visible spiral riblets (about 20 on exposed part) and irregular microscopic malleation in places. Teleoconch, with strong spiral riblets and with 4-7 microscopic riblets in-between slightly larger radial ribs. Aperture narrowly lunate (cut by penultimate whorl for about 1/2) with straight and sharp columellar, basal and palatal edges, i.e. without

any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Dimensions and proportions of 10 adult specimens (types): see Table 4.

Etymology. From “kowa”, land snail, and “tiiti”, very small, in the Chimaore language; used as a noun in apposition.

Remarks. The relatively strong protoconch spiral sculpture of *Psichion kowatiiti* is unlike that in any other Charopidae from Mayotte. In general outline, it resembles species of *Cyclocystis* H. Watson 1934, and *Trachycystis bathycoele* (Melvill & Ponsonby 1892) [two syntypes BMNH 1912.8.16.356-357 examined; and see HERBERT & KILBURN (2004: 238, fig.)] from South Africa. However, these also have radial riblets on the protoconch in addition to the well developed spiral sculpture, and their teleoconchs have a much wider umbilicus. Pending examination of the anatomy, which may indicate that a new genus is required, and despite strong protoconch spiral sculpture and low teleoconch spire, *P. kowatiiti* is provisionally assigned to *Psichion*, based on similar teleoconch sculpture and narrow umbilicus.

Psichion muticum (Morelet 1882) n. comb. (Figs 1E, 7, 8A-C, 11A)

Helix mutica MORELET 1882: 186, pl. 10, fig. 1.

Helicella (Trichia) mutica; TRYON 1887: 184, pl. 40, figs 29-31.

Trichia(?) mutica; FISCHER-PIETTE & VUKADINOVIC 1974: 62, fig. 21.

Type material. 3 syntypes BMNH 1893.2.4.1033-1035.

Type locality. Mayotte.

Material examined. Historical material: Mayotte, Coll. H. Fischer ex Crosse ex Marie, 1 spm. (MNHN). 2001-2002 Survey: Mlima Mtsapere, 400-450 m, 9 lv, 4 dd; Boueni peninsula, Bounvoudranavi, 180 m, 22 dd; Mlima Combani, 380-420 m, 1 lv, 8 dd; Mlima Choungui, 320-500 m, 9 dd; Tchaourembo Range, Mt Ngouni, 450 m, 13 dd; Mlima Bepilipili, 400-640 m, 3 dd; Mlima Maévadoani, above Tsararano, 200-300 m, 8 dd; Mlima Mapouéra, Dzoumonyé forest reserve, 250 m, 2 dd; Mlima Bénara, 500-650 m, 25 dd; Mlima Tchaourembo, 450-535 m, 24 dd; Mlima Mtsapéré, 500-560 m, 3 dd.

Diagnosis. Teleoconch with moderately wide (~ 1/2 of FAW) umbilicus, with microscopic spiral sculpture becoming much stronger and distant on the umbilical wall and with 1-6 microscopic riblets in-between larger radial ribs. Epiphallus enters penis laterally, forming short penial caecum. Large epiphallic pilaster shortly bifurcating near entrance to penis and coming in contact (but not connecting) with two large, penial pilasters positioned close to each other. These penial pilasters beginning at the base of single small, almost spherical stimulator, positioned apically inside short penial caecum. Middle portion of vas deferens making loop around penial retractor that connects apically to proximal part of penis.

Description. Shell pale corneous-brown with alternating lighter-darker colouration, rather depressed (height/larger diameter ~ 2/3), with moderately wide (~ 1/2 of FAW) umbilicus. Exposed parts of early whorls rather convex, separated

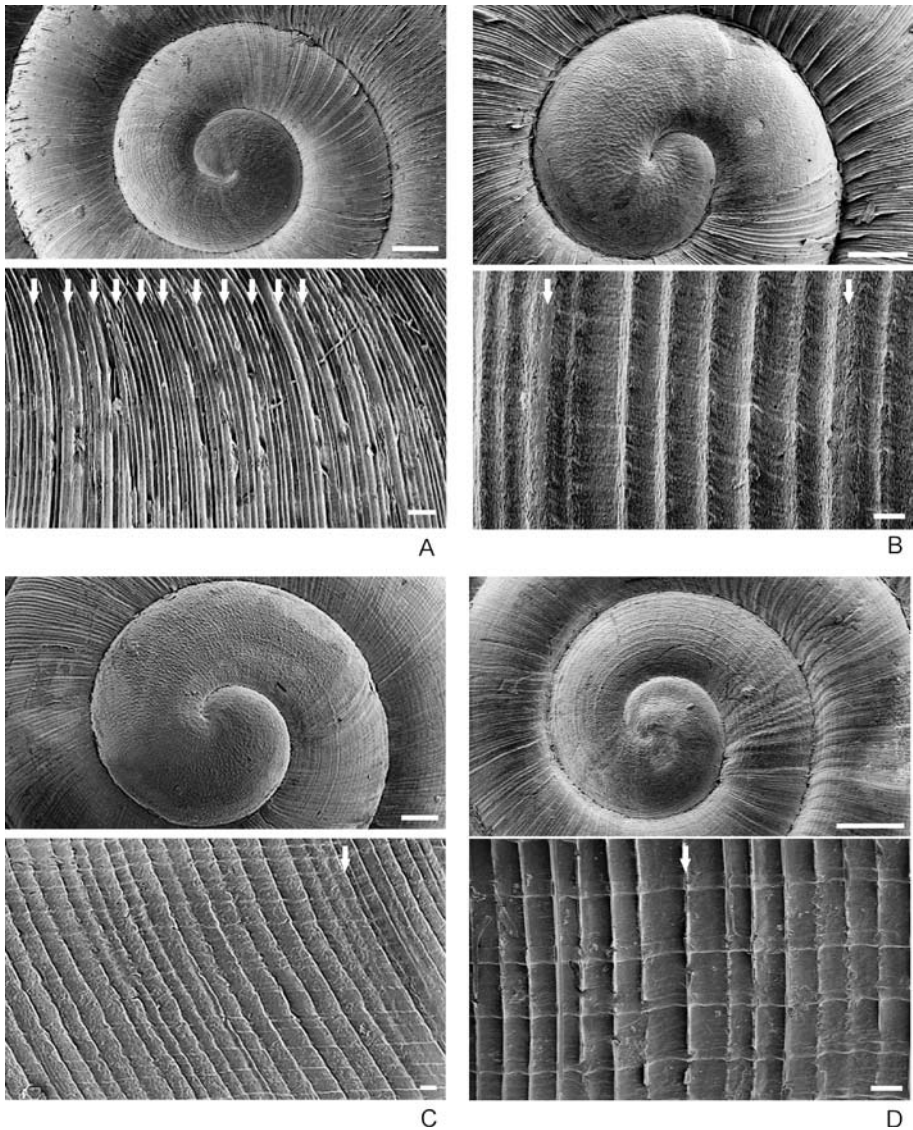


Fig. 6. — A. *Phaulocystis iris* n. sp., paratype. B. *Psichion labati* n. sp., paratype and holotype [Mayotte, Mlima Tchaourembo, 450-535 m]. C. *Psichion mica* (Morelet 1879) [Anjouan]. D. *Psichion kowatiiti* n. sp., paratype and holotype [Mayotte, Mlima Bénara, 500-650 m]. Arrows indicate larger ribs. Scales: 100 μm , 10 μm .

by impressed suture. Protoconch (~ 1 whorl) with irregular microscopic malleation and indistinct radial riblets in last quarter. Teleoconch with microscopic spiral sculpture becoming much stronger and distant on the umbilical wall and with 1-6 microscopic riblets in-between larger radial ribs. Aperture widely lunate (cut by penultimate whorl for about 1/5) with straight and sharp columellar, basal and pal-

atal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus. Upper palatal edge slightly produced forward.

Dimensions and proportions of 8 adult specimens (7 from Mlima Tchaourembo and 1 from Mayotte, Coll. H. Fischer ex Crosse ex Marie): see Table 5.

Posterior part of cephalopodium just slightly angular above, but not keeled, with straight posterior branches of peripodal groove connected at caudal end without any fossula. Lateral parts of sole (under peripodal groove) almost smooth, foot (above peripodal groove) weakly papillose. Jaw thin and narrow with fine close vertical riblets. Genital opening between bases of upper and lower right tentacles.

Anatomical description based on 2 individuals from Mayotte, Mlima Mtsapere, 400-450 m.

Vagina about 1/2 length of penis. Free oviduct about same length as vagina. Wider distal portion of spermathecal duct about the same length as penis as well as combined length of vagina and free oviduct. Distal portion of spermathecal duct swollen, gradually narrowing towards spermatheca, becoming as narrow as vas deferens and bending over proximal portion of spermoviduct just before connection to spermatheca itself. Spermatheca, positioned next to loop of gut, both next to albumen gland. Right ommatophoral retractor passes through peni-oviducal angle. Vas deferens enters epiphallus essentially apically, not forming a flagellum. Epiphallus, about 2 times longer than penis, consists of two parts, each about same length as penis. Proximal part of epiphallus much wider than vas deferens, with about 20

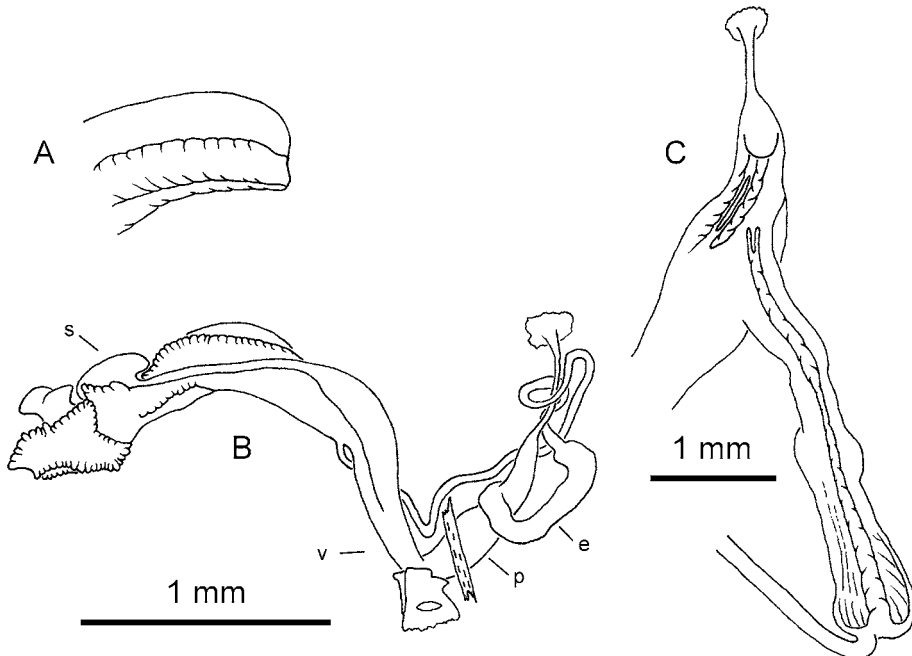


Fig. 7. — Anatomy of *Psichion muticum* (Morelet 1882) [Mayotte, Mlima Mtsapere, 400-450 m]. A, Foot. B, General view of genital apparatus (e: epiphallus, p: penis, s: spermatheca, v: vagina). C, Internal structure of the penis and the epiphallus.

slightly spirally curving small longitudinal folds visible as less transparent whitish thickenings through epiphallic duct wall and with single large longitudinal pilaster, continuing till the penis. Distal part of epiphallus slightly narrower with the same large longitudinal pilaster as in proximal part and with about 6 smaller longitudinal folds. Longitudinal folds in proximal part connecting to each other on the border of proximal and distal part of epiphallus forming narrow ring and not continuing to distal part of epiphallus, replaced there by larger 6 folds. Epiphallus enters penis laterally, forming short penial caecum. Large epiphallic pilaster shortly bifurcating near entrance to penis and coming in contact (but not connecting) with two large, penial pilasters positioned close to each other. These penial pilasters beginning at the base of single small, almost spherical stimulator, positioned apically inside short penial caecum. Small elongated case filled with substance resembling seminal fluid coagulated in alcohol is positioned in-between two large penial pilasters at the base of one of them, just in front of epiphallus entrance. Middle portion of vas deferens makes loop around penial retractor that connects apically to proximal part of penis.

Remarks. Despite its shell more depressed and more broadly umbilicated than that of *Psichion mica*, we place *Helix mutica* in *Psichion* because of its genital apparatus, very similar to that of *P. mica*. Small oval object in-between penial pilasters of *P. muticum* is probably homologous with relatively larger oval case described earlier in this paper inside the penis of *Phaulocystis iris*.

Psichion arachne (Morelet 1877) n. comb. (Figs 1F, 8D-G, 9, 11B)

Helix arachne MORELET 1877: 329, pl. 12, fig. 7.

Phasis (Trachycystis) arachne; PILSBRY 1894: 38.

Trachycystis arachne; FISCHER-PIETTE & VUKADINOVIC 1974: 31.

Type material. 2 syntypes from Anjouan, BMNH 1893.2.4.1031-1032.

Type locality. Anjouan.

Material examined. Historical material (all MNHN): Mayotte, Coll. H. Fischer ex Crosse ex Marie, 2 spms; Mayotte, Coll. Jousseume, 1 spm.; Anjouan, 2 spms. 2001-2002 Survey: Mlima Mtsapere, 400-450 m, 4 lv, 11 dd; Boueni peninsula, Boungoudranavi, 180 m, 8 dd; Ridge above Mtsangamboua, 150-200 m, 2 dd; Mlima Combani, 380-420 m, 15 dd; Mlima Choungui, 320-500 m, 4 dd; Mlima Bepilipili, 400-640 m, 1 lv; Mlima Maévadoani, above Tsararano, 200-300 m, 1 dd; Mlima Bénara, 500-650 m, 21 spms; Dapani Forest below Vatouankaridi, 200 m, 2 dd; Mlima Tchaourembo, 450-535 m, 40 spms; Mlima Mtsapéré, 500-560 m, 1 dd.

Diagnosis. Teleoconch with narrow (~ 1/3 of FAW) umbilicus and weak spiral riblets and with 6-30 (mostly 14-16) microscopic riblets in-between very distant high periostracal radial ribs. Distance between large high periostracal radial ribs approaching distance between the suture (width of exposed shell tube) on the preceding whorls. Epiphallus, approximately twice as long as penis, enters penis almost apically, i.e. essentially there is no caecum. Penis with semicircular pilaster that forms in effect small papilla, which separates smaller proximal part of the penis with epiphallic entry from much larger distal part of the penis.

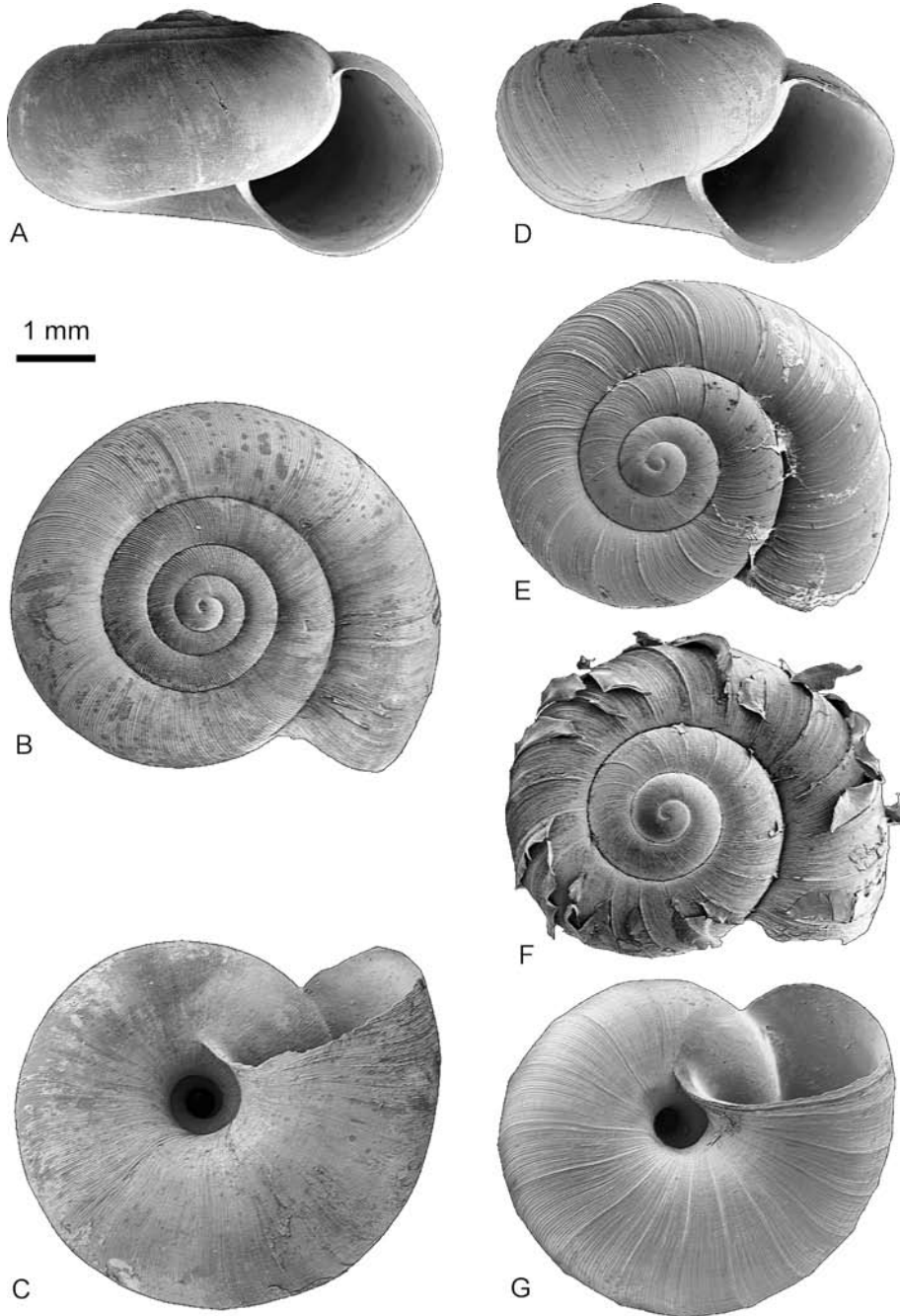


Fig. 8. — A-C, *Psychion muticum* (Morelet 1882). D-G, *Psychion arachne* (Morelet 1877). [All from Mayotte, Mlima Tchaourembo, 450-535 m].

Description. Shell pale corneous-brown, slightly depressed (height/larger diameter $\sim 5/7$), with narrow ($\sim 1/3$ of FAW) umbilicus. Exposed parts of early whorls rather convex, separated by impressed suture. Protoconch (~ 1 whorl) with irregular microscopic malleation. Teleoconch with weak spiral riblets and with 6-30 (mostly 14-16) microscopic riblets in-between very distant high periostracal radial ribs. Distance between large high periostracal radial ribs approaching distance between the suture (width of exposed shell tube) on the preceding whorls. Aperture widely lunate (cut by penultimate whorl for about $1/4$) with straight and sharp columellar, basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Dimensions and proportions of 9 adult specimens (from Mlima Tchaourembo): see Table 6.

Posterior part of cephalopodium rounded above, not keeled, with straight posterior branches of peripodal groove connected at caudal end without any fossula. Lateral parts of sole (under peripodal groove) almost smooth, foot (above peripodal groove) weakly papillose. Jaw thin and narrow. Genital opening between bases of upper and lower right tentacles.

Anatomical description based on 1 individual from Mayotte, Mlima Mtsapere, 400-450 m.

Vagina very short, as well as free oviduct. Combined length of vagina and free oviduct about the same as length of penis, as well as combined length of vagina and swollen distal portion of spermathecal duct. Distal portion of spermathecal duct very swollen, suddenly narrowing towards spermatheca, later becoming as narrow as vas deferens and bending over proximal portion of spermoviduct just before

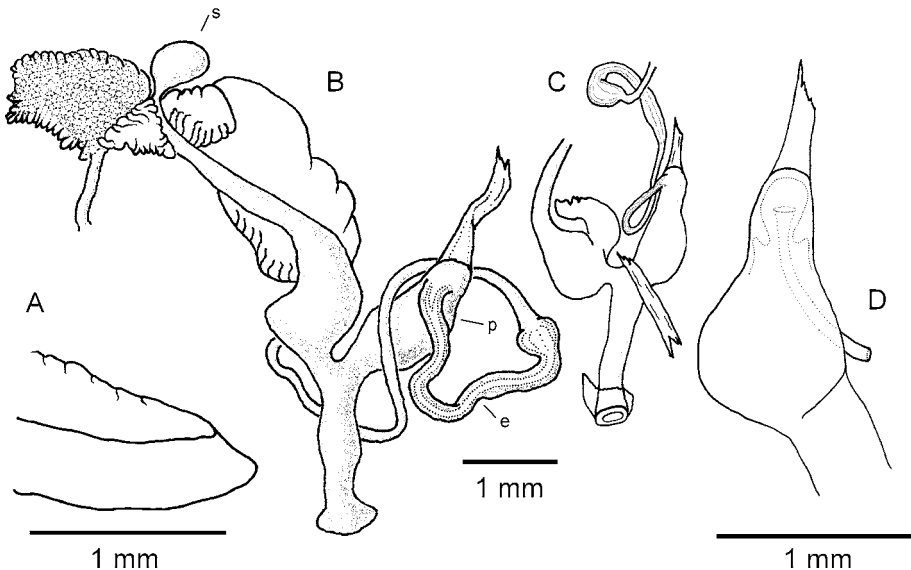


Fig. 9. — Anatomy of *Psychion arachne* (Morelet 1877) [Mayotte, Mlima Mtsapere, 400-450 m]. A, Foot. B, General view of genital apparatus (e: epiphallus, p: penis, s: spermatheca). C, Distal parts of genital apparatus. D, Internal structure of the penis.

Table 4.
Dimensions (in mm) and proportions of 10 adult specimens (types) of *Psichion kowaititi* n. sp.

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Holotype	1.16	1.96	1.76	0.16	0.59	12.25	0.92	0.84	4.25
Mean (n = 10)	1.11	1.80	1.73	0.16	0.59	12.14	0.90	0.88	4.30
Range	1.00-1.20	1.68-1.96	1.56-1.88	0.12-0.20	0.58-0.63	9.20-16.0	0.84-0.92	0.84-0.92	3.75-4.55
Standard deviation	0.06	0.09	0.08	0.03	0.01	2.31	0.03	0.04	0.23

Table 5.

Dimensions (in mm) and proportions of 8 adult specimens of *Psichion muticum* (Morelet 1882) (7 from Mlima Tchaourembo, 450-535 m and 1 from Mavotte, Coll. H. Fischer ex Crosse ex Marie).

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Mean (n = 8)	3.53	5.73	5.04	1.34	0.62	4.30	2.55	2.46	4.53
Range	3.00-4.19	4.94-6.63	4.31-6.06	1.06-1.63	0.58-0.66	4.07-4.66	2.25-3.00	2.13-2.81	4.13-5.00
Standard deviation	0.45	0.57	0.60	0.18	0.03	0.23	0.24	0.25	0.28

Table 6.

Dimensions (in mm) and proportions of 9 adult specimens of *Psichion arachne* (Morelet 1877) (from Mlima Tchaourembo, 450-535 m).

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Mean (n = 9)	3.65	5.20	4.57	0.80	0.70	6.49	2.54	2.47	3.90
Range	3.00-3.88	4.94-5.44	4.38-4.75	0.75-0.88	0.67-0.75	6.03-7.00	2.44-2.75	2.70-2.69	3.75-4.00
Standard deviation	0.13	0.17	0.14	0.05	0.03	0.31	0.12	0.10	0.10

connection to spermatheca itself. Spermatheca, positioned next to loop of gut, both next to albumen gland. Right ommatophoral retractor passes through peni-oviducal angle. Vas deferens enters epiphallus essentially apically, not forming a flagellum. Epiphallus, about 2 times longer than penis, consists of two parts, each about same length as penis. Proximal part of epiphallus much wider than vas deferens, with about 16 slightly spirally curving small longitudinal folds visible as less transparent whitish thickenings through epiphallic duct wall and with single large longitudinal pilaster, continuing till the penis. Distal part of epiphallus slightly narrower with the same large longitudinal pilaster as in proximal part and with about 4 smaller longitudinal folds. Longitudinal folds in proximal part connecting to each other on the border of proximal and distal part of epiphallus forming narrow ring and not continuing to distal part of epiphallus, replaced there by larger 4 folds. Distal part of epiphallus positioned parallel and very close to proximal part of penis, creating appearance of long caecum. However, epiphallus enters penis almost apically, i.e. essentially there is no caecum. Penis consists of two parts. Proximal part has epiphallic entry and semicircular pilaster in front of it that forms in effect small papilla, which separates proximal part from much larger distal part. Distal part with weak, wide longitudinal folds, some of which "V" shaped towards atrium. Penial retractor connects to proximal part of penis.

Remarks. *Psichion arachne* differs from *P. mica* by its more depressed shell with wider umbilicus, but it is less depressed than similar *P. muticum*. It differs from both these species by the presence of large radial ribs with periostracal lamellar expansions and, anatomically, by the presence of semicircular pilaster at the border between proximal and distal parts of the penis as well as by its relatively shorter, swollen penis. However, the swollen appearance of the distal parts of the genital apparatus of *P. arachne* also could be explained by their very contracted condition.

Psichion retrocostatum n. sp. (Figs 1G, 10A-C, 11C)

Type material. Holotype and 1 paratype (both dd) in MNHN.

Type locality. Mayotte, Mlima Choungui, southern slope, 12°57.5'S, 45°08.0'E, 320-500 m.

Material examined. Mlima Mtsapere, 400-450 m, 1 dd; Mlima Choungui, 320-500 m, 2 dd; Mlima Maévadoani, 200-300 m, 9 dd; Mlima Bénara, 500-650 m, 1 dd; Dapani Forest, 200 m, 3 dd; Mlima Tchaourembo, 450-535 m, 7 dd.

Diagnosis. Teleoconch with wide [$\sim 2/3$ (62-64%) of FAW] umbilicus, very dense spiral riblets and with 7-10 microscopic riblets in-between larger radial riblets. Protoconch with weak spiral riblets (about 40 on exposed part) better visible on last half whorl and with irregular microscopic malleation. Radial sculpture on last whorl greatly inclining towards earlier whorls ($\sim 45^\circ$ to the suture from apical view).

Description. Shell pale corneous-brown, depressed (height/larger diameter $\sim 3/5$), with wide [$\sim 2/3$ (62-64%) of FAW] umbilicus. Exposed parts of early whorls

rather convex, separated by impressed suture. Protoconch (~ 1 whorl) with weak spiral riblets (about 40 on exposed part) better visible on last half whorl and irregular microscopic malleation. Teleoconch with very dense spiral riblets and with 7-10 microscopic radial riblets in-between larger radial ribs. Radial sculpture on last whorl greatly inclining towards earlier whorls (~ 45° to the suture from apical view). Aperture widely lunate (cut by penultimate whorl for about 1/4) with straight and sharp columellar, basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Dimensions and proportions of 10 adult specimens (2 types, 4 from Mlima Tchaourembo, 2 from Dapani Forest, 1 from Mlima Maévadoani, and 1 from Mlima Mtsapere, 400-450 m): see Table 7.

Etymology. From the Latin *retro*, backwards, to the rear, and adjective *costatus* (-a, -um), ribbed; with reference to the very oblique radial ribs.

Remarks. *Psichion retrocostatum* is easily separated from all the other Charopidae from Mayotte by its very dense spiral sculpture and by the very oblique radial sculpture on the last whorl. It is somewhat similar in shell shape to *Psichion muticum*, and differs from it by its smaller adult size, proportionally wider umbilicus and the peculiarity of its radial ribs. *Psichion retrocostatum* is similar in size to *Psichion arachne*, and differs from it by a more depressed shell with much wider umbilicus. Proportionally it somewhat resembles the much smaller *P. radiolatum*. However, it never develops high, spaced, periostracal lamellae as in *P. arachne* and *P. radiolatum*. In the absence of anatomical data, we tentatively classify *P. retrocostatum* in *Psichion*, based on its stronger resemblance to *P. muticum* than to any other Mayotte species.

***Psichion radiolatum* (Morelet 1882) n. comb. (Figs 1H, 10D-F, 11D, 13D-F)**

Helix radiolata MORELET 1882: 187, pl. 10, fig. 2 (not fig. 3, see below).

Trichia (?) *radiolata*; FISCHER-PIETTE & VUKADINOVIC 1974: 62, fig. 22.

Type material. Morelet described or redescribed three species, two of which now belonging to Charopidae, in the same issue of "Journal de Conchyliologie": *Helix mutica*, *H. micra* (now in Euconulidae) and *H. radiolata*, all illustrated in plate 10. However, the numbering of the illustrations of *H. micra* and *H. radiolata* has been reversed: *Helix micra* is illustrated in fig. 3 (not fig. 2, which represents *H. radiolata*), and *Helix radiolata* is illustrated on fig. 2 (not fig. 3, which represents *H. micra*). Fig. 3 was subsequently copied by TRYON (1887: pl. 40, figs 33-34) and his description of "*Helicella* (*Trichia*) *radiolata* Morelet" (TRYON 1887: 184) corresponds to *H. micra* as well. In addition to (or perhaps because of) this original confusion, the type material of *H. radiolata* was mislabelled after the illustrations had been prepared: a specimen (BMNH 1893.2.4.978, measuring 2.25/1.6 mm) labelled as "Type" of *H. radiolata* is in fact *H. micra*; the word "*radiolata*" was crossed out on the label, but later was written again with a different handwriting, indicating persisting confusion. (Four specimens of *micra* in a separate lot [BMNH 1893.2.4.1050-1053] were correctly labelled as types of that species).

To stabilize our application of the name *Helix radiolata*, we here fix as neotype a specimen from: Mayotte, Sohoa/Choungui, dry forest among boulders, 12°48.3'S, 45°06.1'E, 80-150 m, collected by A. Abdou & P. Bouchet, 24 March 2001, to be deposited in BMNH reg. no. 20040613 (Fig. 13D-F).

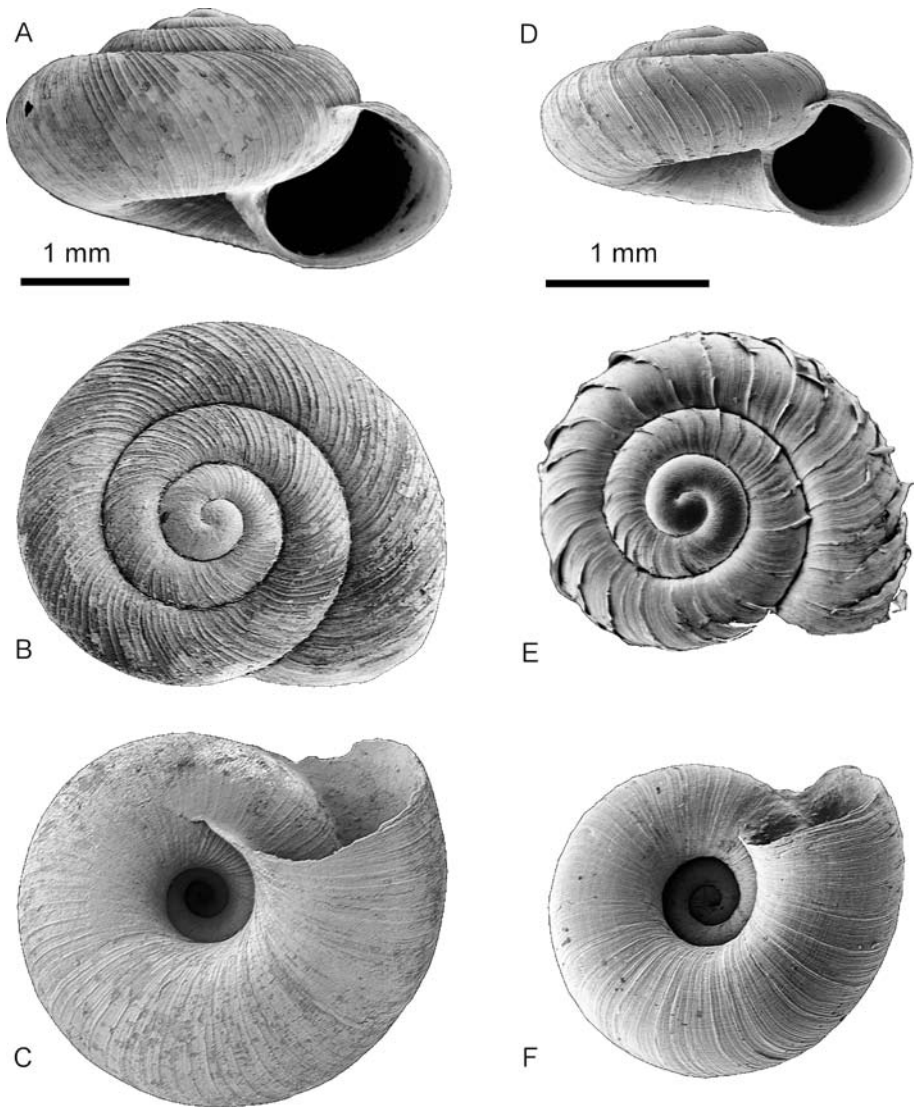


Fig. 10. — A-C. *Psychion retrocostatum* n. sp. [A, Holotype - Mlima Choungui, southern slope, 320-500 m; B-C, Mayotte, Mlima Tchaourembo, 450-535 m]. D-F, *Psychion radiolatum* (Morelet 1882) [Mayotte, Sohoa/Choungui, 80-150 m].

Type locality. Mayotte, Sohoa/Choungui. Dry forest among boulders. 12°48.3'S, 45°06.1'E, 80-150 m.

Material examined. 2001-2002 Survey: Right bank of the Mroni Rouaka river, 40-60 m, 12 dd; Ridge above Mtsangamboua, 150-200 m, 2 dd; Mt Ngouni, 450 m, 16 dd; Sohoa/Choungui, 80-150 m, 15 dd; Mlima Bénara, 500-650 m, 32 dd; Dapani Forest below Vatoukaridi, 200 m, 1 dd; Vahibéni, valley of the Gouloué river, 100 m, 16 dd; Mlima Tchaourembo, 450-535 m, 7 dd.

Diagnosis. Shell depressed (height/larger diameter $\sim 5/9$), with very wide [almost as wide (80-90%) as FAW] umbilicus. Teleoconch with 8-14 microscopic riblets in-between very distant high periostracal radial ribs. Distance between large high periostracal radial ribs approaching distance between the suture (width of exposed shell tube) on the preceding whorls. Aperture subcircular, cut by penultimate whorl for about 1/9.

Description. Shell pale corneous-brown, depressed (height/larger diameter $\sim 5/9$), with very wide (almost as wide [80-90%] as FAW) umbilicus. Exposed parts of early whorls rather convex, separated by impressed suture. Protoconch (~ 1 whorl) with irregular microscopic malleation. Teleoconch with spiral riblets and with 8-14 microscopic riblets in-between very distant high periostracal radial ribs. Distance between large high periostracal radial ribs approaching distance between the suture (width of exposed shell tube) on the preceding whorls. Aperture sub-circular (cut by penultimate whorl for about 1/9) with straight and sharp columellar; basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Dimensions and proportions of 10 adult specimens (7 from type locality and 3 from Vahibéni): see Table 8.

Remarks. *P. radiolatum* stands apart from other species of *Psichion* because of its depressed shell and very wide umbilicus; the sculpture, however, is similar to that of *P. arachne* and *P. retrocostatum*. In the absence of anatomical data, we tentatively classify it in *Psichion*, but living animals may indicate that a new genus is required. *P. radiolatum* is similar to *Trachycystis liricostata* (Melvill & Ponsonby 1891) from South Africa [Holotype BMNH 1911.8.8.17 examined], differing from it by much finer, denser spiral sculpture and much more depressed shell.

***Psichion nematomphalos* n. sp.** (Figs 1I, 12A-C, 14A)

Type material. Holotype and 7 paratypes from type locality in MNHN.

Type locality. Mayotte, between Moutsamoudou and Cape Saziley, dry coastal forest with baobabs, 12°59.1'S, 45°11.0-11.8'E, 3-20 m.

Other material examined. Between Moutsamoudou and Cape Saziley, with the type lot, 23 dd; Tchaourembo Range, Mt Ngouni, 450 m, 1 dd; Mlima Bénara, 500-650 m, 11 dd.

Diagnosis. Shell depressed, with moderately wide ($\sim 1/2$ of FAW) umbilicus, with microscopic spiral sculpture becoming much stronger and distant on the umbilical wall and with 3-6 microscopic riblets in-between larger radial ribs on teleoconch.

Description. Shell pale corneous-brown, depressed (height/larger diameter $\sim 3/5$), with moderately wide ($\sim 1/2$ of FAW) umbilicus. Exposed parts of early whorls rather convex, separated by impressed suture. Protoconch (~ 1 whorl) with irregular microscopic malleation and indistinct radial riblets in last quarter. Teleoconch with microscopic spiral sculpture becoming much stronger and distant on the umbilical wall and with 3-6 microscopic riblets in-between larger radial ribs.

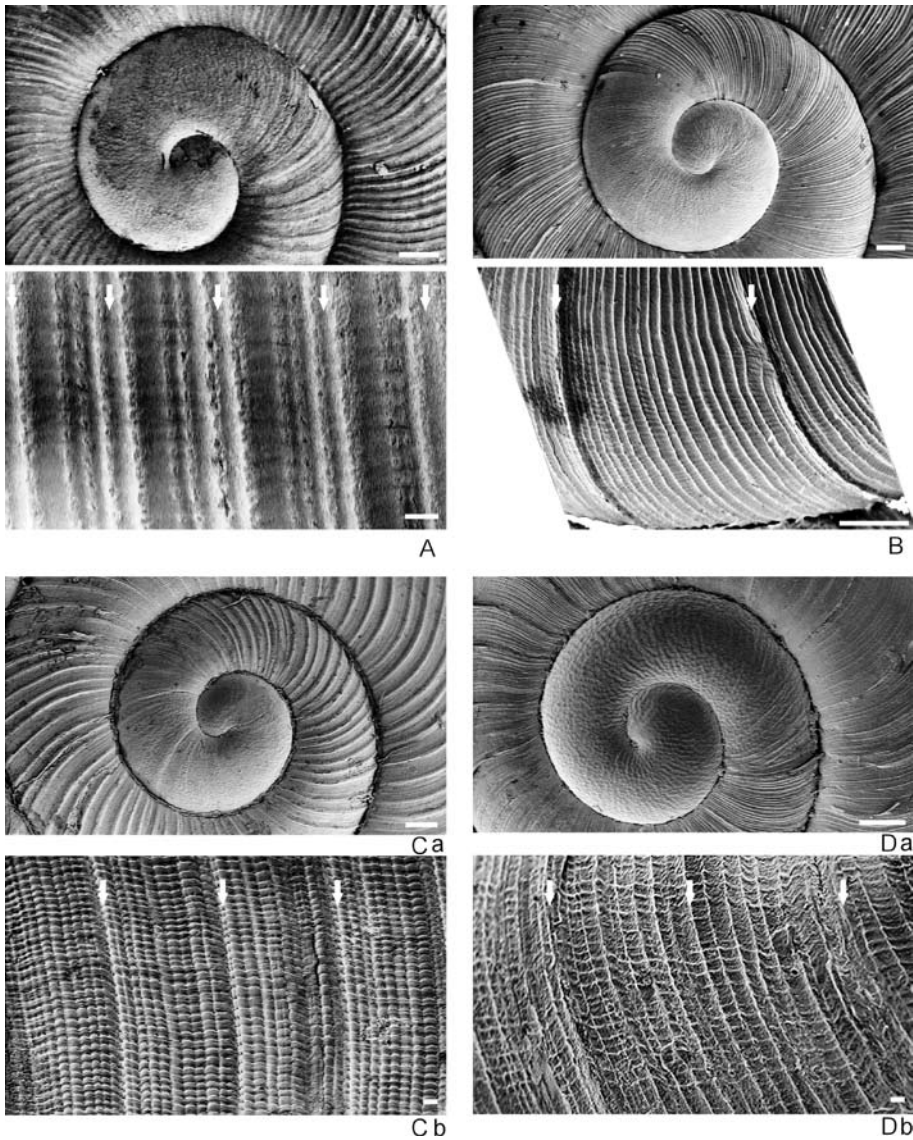


Fig. 11. — A, *Psychion muticum* (Morelet 1882). B, *Psychion arachne* (Morelet 1877) [Mayotte, Mlima Tchaourembo, 450-535 m]. C, *Psychion retrocostatum* n. sp. destroyed after pictures were taken [a: Mayotte, Mlima Tchaourembo, 450-535 m; b: Mayotte, Mlima Maévadoani, above Tsararano, 200-300 m]. D, *Psychion radiolatum* (Morelet 1882) [a: Mayotte, Sohoa/Choungui, 80-150 m; b: Mayotte, Vahibéni, valley of the Gouloué river, 100 m]. Arrows indicate larger ribs. Scales: 100 μ m, 10 μ m (A, C-D) and 100 μ m, 100 μ m (B).

Aperture widely lunate (cut by penultimate whorl for about 1/5) with straight and sharp columellar, basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Dimensions and proportions of 8 adult specimens (types): see Table 9.

Table 7.

Dimensions (in mm) and proportions of 10 adult specimens of *Psichion retrocostatum* n. sp. (2 types, 4 from Mlima Tchaourembo, 450-535 m, 2 from Dapani Forest, 200 m, 1 from Mlima Maévadoani, 200-300 m, and 1 from Mlima Mitsapere, 400-450 m).

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Holotype	2.84	4.56	4	1.19	0.62	3.83	1.81	1.87	4.00
Mean (n = 10)	2.52	4.1	3.64	1.03	0.62	4.00	1.59	1.69	3.91
Range	2.20-2.84	3.44-4.56	3.12-4.04	0.84-1.24	0.53-0.67	3.57-4.36	1.52-1.81	1.40-1.92	3.50-4.30
Standard deviation	0.21	0.37	0.33	0.14	0.04	0.31	0.09	0.18	0.26

Table 8.

Dimensions (in mm) and proportions of 10 adult specimens of *Psichion radiolatum* (Morelet 1882) (7 from type locality and 3 from Vahibéni, valley of the Gouloué river, 100 m).

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Neotype	1.36	2.40	2.16	0.80	0.57	3.00	0.84	0.80	3.20
Mean (n = 10)	1.33	2.32	2.10	0.78	0.57	2.97	0.78	0.76	3.07
Range	1.16-1.60	2.18-2.44	1.96-2.32	0.64-0.84	0.53-0.68	2.75-3.41	0.72-0.88	0.72-0.88	2.75-3.30
Standard deviation	0.13	0.13	0.14	0.08	0.04	0.19	0.05	0.05	0.17

Etymology. From the Greek *nema* (genitive *nematos*), thread, and *omphalos*, umbilicus; with reference to the microscopic spiral sculpture becoming much stronger on the umbilical wall; treated as a noun in apposition.

Remarks. *Psichion nematomphalos* closely resembles *P. muticum* and is tentatively placed in the same genus, based on overall shell shape and sculpture similarities. The two species differ by the incremental parameters of their shells: in *P. nematomphalos*, the shell has a maximum diameter of ~ 2.5 mm at 4 whorls and ~ 1.6 mm for 3 whorls, whereas *P. muticum* has a maximum diameter of ~ 6.5 mm for 5 whorls, ~ 4.3 mm for 4 whorls, and ~ 2.4 mm for 3 whorls. Thus, subadults of *P. muticum* with 3 whorls have about the same size as adults of *P. nematomphalos* with 4 whorls. *P. nematomphalos* also superficially resembles *Trachycystis ordinaria* Melvill & Ponsonby 1908, from South Africa [Holotype BMNH 1908.12.14.44 examined; treated as a probable synonym of *T. rivularis* (Krauss, 1848) by HERBERT & KILBURN (2004: 236)], and differs from it by narrower whorls, more depressed shell and stronger spiral sculpture. *Psichion nematomphalos* is quite similar to *P. concavum* n. sp. (see below).

***Psichion concavum* n. sp. (Figs 1J, 12D-F, 14B)**

Type material. Holotype and 11 paratypes (all dd) from type locality in MNHN.

Type locality. Mayotte, Mlima Tchaourembo, summital forest, 12°52.1'S, 45°08.7'E, 450-535 m.

Other material examined. Mlima Tchaourembo, with type lot, 46 dd; Tchaourembo Range, Mt Ngouni, 450 m, 4 dd; Mlima Bepilipili, 400-640 m, 5 dd; Mlima Bénara, 500-650 m, 23 dd.

Diagnosis. Shell with low apex and moderately wide (~ 1/2 of FAW) umbilicus, with 7-10 microscopic riblets in-between larger radial ribs on teleoconch. Upper palatal edge of aperture and last whorl just before the aperture above periphery are flattened to slightly concave and slightly produced forward.

Description. Shell pale corneous-brown, depressed (height/larger diameter ~ 3/5), with low apex and moderately wide (~ 1/2 of FAW) umbilicus. Exposed parts of early whorls rather convex, separated by impressed suture. Protoconch (~ 1 whorl) with irregular microscopic malleation and indistinct radial riblets in last half. Teleoconch with microscopic spiral sculpture and with 7-10 microscopic riblets in-between moderately distant larger radial ribs. Aperture widely lunate (cut by penultimate whorl for about 1/5) with straight and sharp columellar, basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus. Upper palatal edge of aperture and last whorl just before the aperture above the periphery are flattened to slightly concave and slightly produced forward.

Dimensions and proportions of 12 adult specimens (types): see Table 10.

Etymology. Latin adjective *concavus* (-a, -um), concave, curving inwards; by reference to the concave upper palatal edge of the aperture.

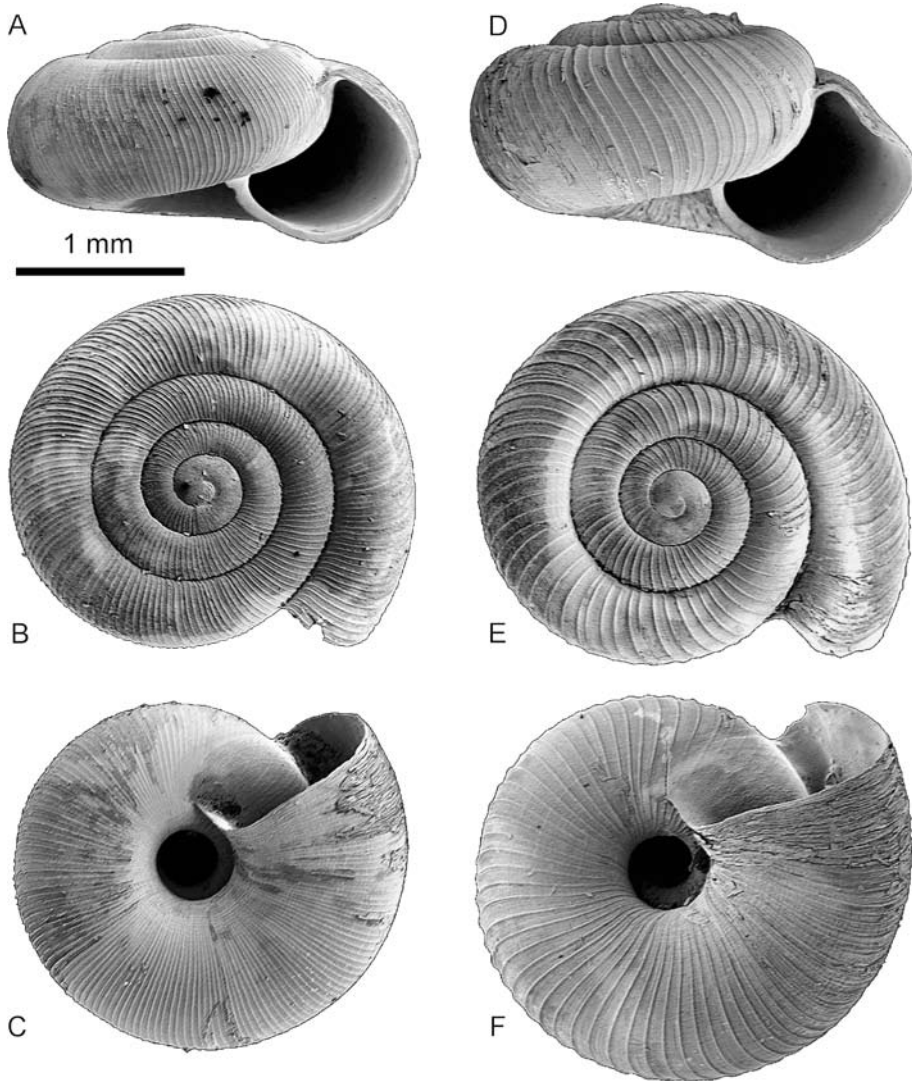


Fig. 12. — A-C, *Psichion nematomphalos* n. sp. (A holotype, B-C paratypes) [Mayotte, between Mout-samoudou and Cape Saziley, 3-20 m]. D-F, *Psichion concavum* n. sp. (D holotype, E-F paratypes) [Mayotte, Mlima Tchaourembo, 450-535 m].

Remarks. *Psichion concavum* is quite similar to *P. nematomphalos*, and differs from it by evenly developed spiral sculpture of minute threads that do not become stronger on the umbilical wall, and by a slightly more spaced radial sculpture. In *P. concavum*, the final portion of the last whorl is flattened and produced forward adapically of periphery, instead of regularly convex in *P. nematomphalos*. We tentatively place *Psichion concavum* in the same genus with *P. nematomphalos* and *P. muticum*, based on overall shell shape and sculpture similarities.

Table 9.
Dimensions and proportions of 8 adult specimens (types) of *Psichion nematophalos* n. sp.

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Holotype	1.52	2.56	2.36	0.60	0.59	4.27	1.08	0.96	4.00
Mean (n = 8)	1.47	2.50	2.22	0.53	0.59	4.75	1.08	1.00	3.93
Range	1.40-1.52	2.40-2.56	2.08-2.36	0.48-0.64	0.58-0.62	4.00-5.33	1.04-1.12	0.92-1.08	3.75-4.20
Standard deviation	0.05	0.08	0.08	0.06	0.02	0.43	0.03	0.05	0.13

Table 10.
Dimensions and proportions of 12 adult specimens (types) of *Psichion concavum* n. sp.

	H	D	SD	U	H/D	D/U	AH	AW	Number of whorls
Holotype	1.72	2.84	2.50	0.60	0.61	4.73	1.04	1.12	4.00
Mean (n = 12)	1.59	2.70	2.32	0.56	0.59	4.81	1.01	1.13	3.83
Range	1.40-1.80	2.52-2.84	2.08-2.50	0.48-0.62	0.54-0.65	4.40-5.75	0.90-1.08	0.96-1.24	3.50-4.00
Standard deviation	0.12	0.11	0.12	0.04	0.04	0.35	0.05	0.09	0.13

Psichion homalospira (Morelet 1883) n. comb. (Figs 1K, 13A-C, 14C)

Helix homalospira MORELET 1883: 191, pl. 8, fig. 14.

Punctum(?) homalospira; FISCHER-PIETTE & VUKADINOVIC 1974: 31.

Type material. Holotype (by monotypy) not located in BMNH.

Type locality. Mayotte.

Material examined. Mlima Bénara, 500-650 m, 1 dd.

Diagnosis. Shell flattened above and below, with wide [almost as wide (80-95%) as FAW] umbilicus and with 2-4 microscopic riblets in-between slightly larger radial ribs on teleoconch. Protoconch irregularly microscopically malleated.

Description. Shell pale corneous-brown, flattened above and below; with wide [almost as wide (80-95%) as FAW] umbilicus. Exposed parts of early whorls rather convex, separated by impressed suture. Protoconch (~ 1 whorl) irregularly microscopically malleated, with inconclusive spiral striations on first quarter. Teleoconch, with microscopic spiral riblets and with 2-4 microscopic riblets in-between slightly larger radial ribs. Aperture widely lunate (cut by penultimate whorl for about 1/3) with straight and sharp columellar, basal and palatal edges, i.e. without any adult apertural characters. Columellar and upper palatal edges connected by very thin transparent callus.

Remarks. Our single broken shell has only 3.5 whorls ($H = 1.60$; $D \sim 2.80$; $SD \sim 2.48$; $U = 1.20$; $H/D = 0.57$; $D/U = 2.33$), but there is clear indication that another half whorl has been chipped off. Considering its almost planispiral coiling, intact specimens would be of about the same height but would have a significantly larger diameter, reaching size and proportions as in the original description. Yet, without any further specimens, we still consider our identification as doubtful.

At generic level, *Psichion homalospira* is similar to species of *Cyclocystis* with regard to size, planulate apex, wide umbilicus and teleoconch sculpture. However, the sculpture of protoconch lacks the distinct spiral and radial sculpture characteristic of *Cyclocystis*. Based on similarity in protoconch and teleoconch sculpture with *Psichion muticum*, we tentatively treat them as congeneric.

DISCUSSION

Composition of the fauna

Most African punctoids belong to the Charopidae, and traditionally were classified in subgenera of *Trachycystis* Pilsbry 1893. However, *Trachycystis* s.s. is characterized by an autapomorphy in the male genital apparatus: it has a short, almost spherical, epiphallus, and pronounced specialized penial pads equipped with so-called "spermatophores" (elongated cases filled with something resembling seminal liquid). Other taxa of Trachycystinae have a much longer epiphallus and simpler internal structure of the penis (see SCHILEYKO 2001: 903-920). We follow SCHILEYKO (2001) in recognising subgenera of *Trachycystis* as separate genera.

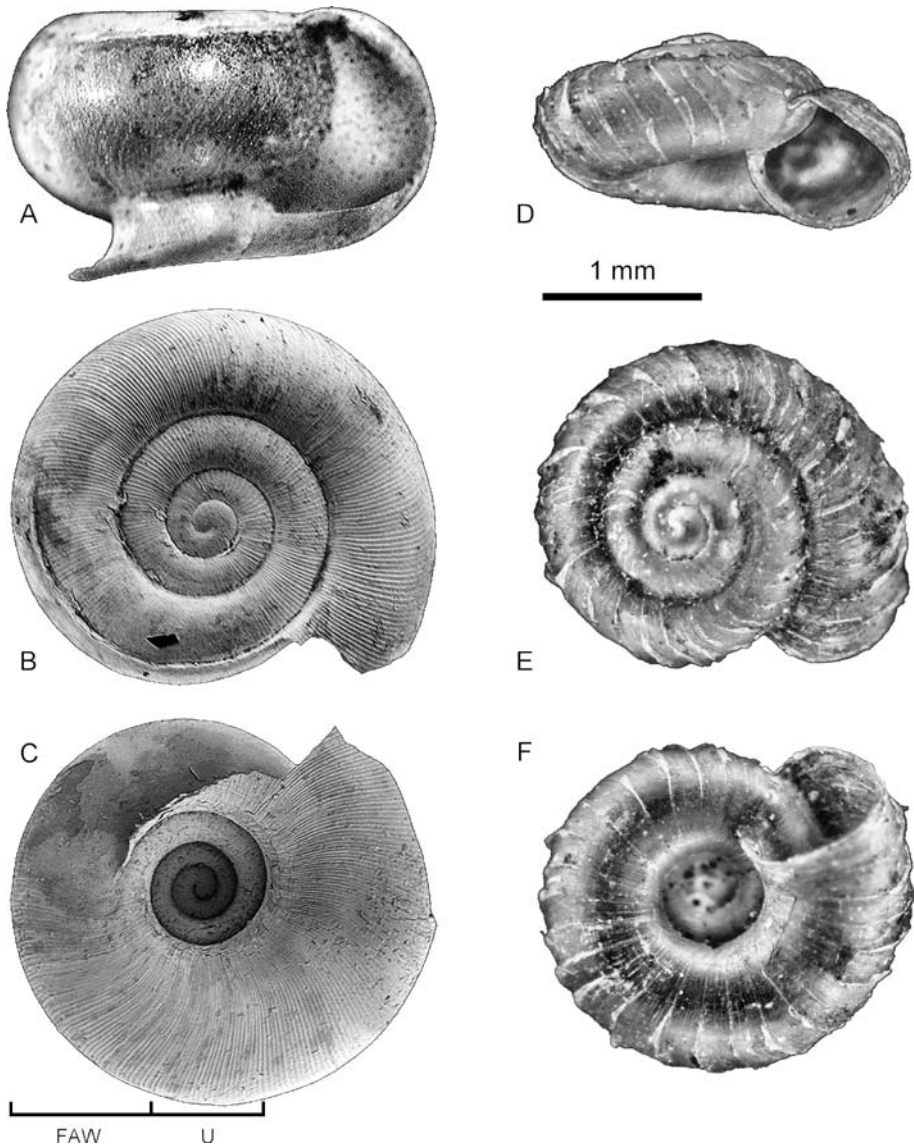


Fig. 13. — A-C, *Psychion homalospira* (Morelet 1883) [Mayotte, Mlima Bénara, 500-650 m]. D-F, *Psychion radiolatum* (Morelet 1882), neotype [Mayotte, Sohoa/Choungui, 80-150 m].

The genital anatomy of four Mayotte species has been investigated, resulting in the recognition of at least two genera, *Psychion* and *Phaulocystis*. However, as the species investigated anatomically represent only 36% of the total, this faunule may be more diverse at the generic level. Thus we have noted under several species, such as *Psychion kowatiiti*, that our generic allocations based on shell characters are only tentative.

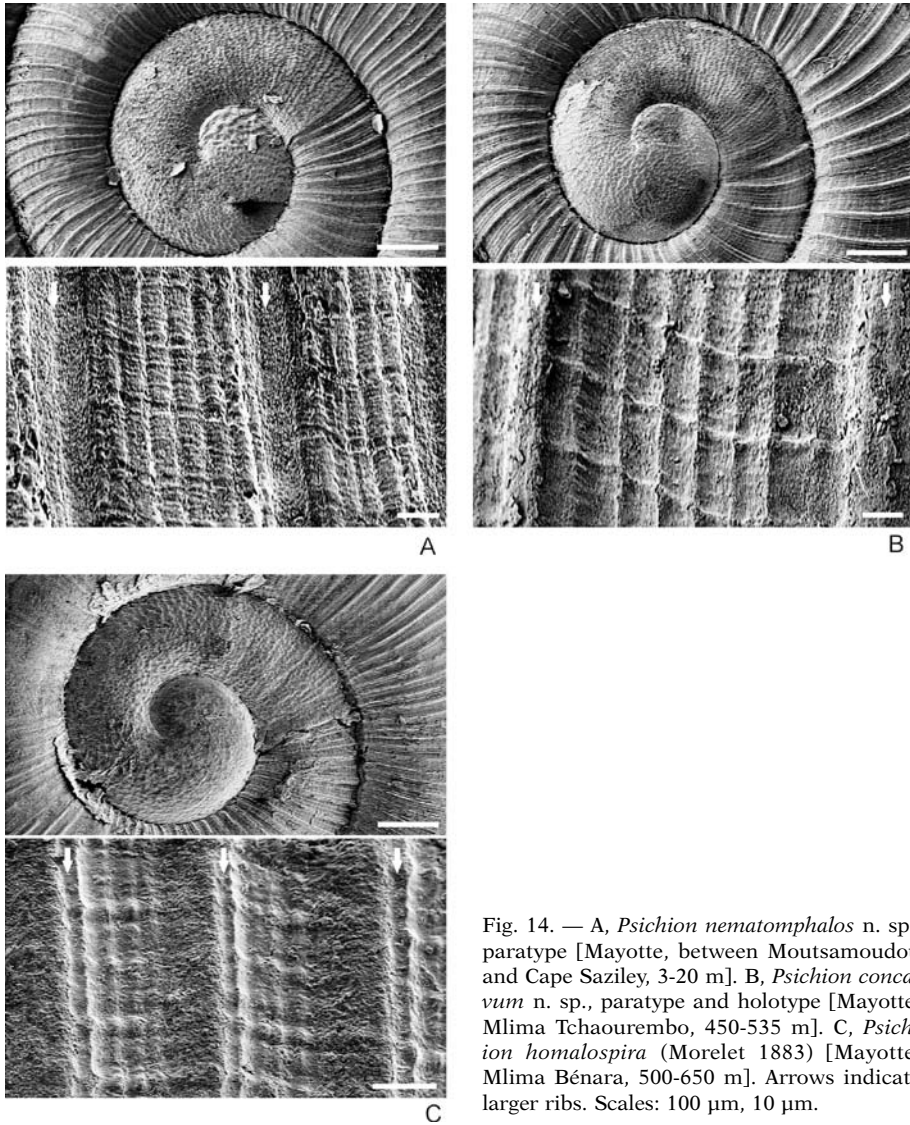


Fig. 14. — A, *Psichion nematomphalos* n. sp., paratype [Mayotte, between Moutsamoudou and Cape Saziley, 3-20 m]. B, *Psichion concavum* n. sp., paratype and holotype [Mayotte, Mlima Tchaourembo, 450-535 m]. C, *Psichion homalospira* (Morelet 1883) [Mayotte, Mlima Bénara, 500-650 m]. Arrows indicate larger ribs. Scales: 100 μ m, 10 μ m.

Summary of the composition of the charopid fauna of Mayotte (* indicates that the species has been studied anatomically):

Genus *Phaulocystis* H. Watson 1934:

* *Ph. iris* n. sp.

Genus *Psichion* Gude 1911:

Ps. labati n. sp.,

* *Ps. mica* (Morelet 1879),

Ps. kowatiiti n. sp.,

- * *Ps. muticum* (Morelet 1882),
- * *Ps. arachne* (Morelet 1877),
- Ps. retrocostatum* n. sp.,
- Ps. radiolatum* (Morelet 1882),
- Ps. nematomphalos* n. sp.,
- Ps. concavum* n. sp.,
- Ps. homalospira* (Morelet 1883).

Zoogeography and relationships

Our perception of the regional diversification of Punctoidea changed rather considerably in the 1990s. Until then, some 125 species of Punctoidea had been reported from continental Africa, with more than 50 species in South Africa alone (SCHILEYKO 2001, HERBERT & KILBURN 2004). Conversely, only four species were known from Madagascar. Then, EMBERTON (1994) described three new Malagasy species which he placed in *Pilula*, based on shell characters, FISCHER-PIETTE et al. (1994), equally based on shell characters alone, described 10 new *Trachycystis* and two new *Psichion* (treated by them as a subgenus of *Trachycystis*). Later, EMBERTON & PEARCE (2000) described 9 species of Malagasy charopids in a new genus *Reticulapex*. Further east, the diversity of punctoids drops sharply in the Mascarenes, with 2 species of *Pilula* on Réunion, one species of *Propilula* on Mauritius (GERMAIN 1918), and none at all on Rodrigues (GRIFFITHS 1994).

Species assigned to *Psichion* (about 25 species) are known from continental (South and East) Africa (WATSON 1934, SCHILEYKO 2001), Madagascar (FISCHER-PIETTE et al. 1994), and the Comores. *Phaulocystis* is represented by more than 30 species in South and East Africa. The discovery of *P. iris* in Mayotte opens the possibility of finding representatives of this genus on Madagascar as well. The type species of *Pilula* Martens 1898, *Helix praetumida* Morelet 1860, from Réunion, is still unknown anatomically, and its relationship to the Mayotte taxa is unclear. Conchologically, *Pilula praetumida* differs from all Mayotte charopids by its weak radial sculpture and distinctly shouldered whorls. The type species of the monotypical genus *Propilula* is known only from empty shells.

Inventory and endemism

Historically, six nominal species now referable to the Charopidae had been described from the Comores. One of these has here been placed in synonymy. The other five are regarded as valid and six species are described as new, with a resulting total of 11 charopid species now recorded from Mayotte. The new species are, on average, significantly smaller than the species known since the 19th century: the size of the new species ranges from 2 to 4 mm (mean 2.8 mm), whereas the size of the already known species ranges from 3 to 6 mm (mean 4.4 mm). The new species also appear to be significantly more restricted in the number of sites of their occurrence: the new species have been found in 2 to 6 sites (mean 3.67), whereas the already known species were found in 1 to 11 sites (mean 7.00). However, it is difficult to say whether this reflects a real difference in their geographical and/or ecological rarity, or whether it merely reflects the fact that smaller species are more difficult to find. Considering that one of the new species is known from only two

sites, it is likely that the current inventory is still incomplete and more species are probably awaiting discovery. It is of interest to note that, among the flora of Mayotte, several spectacular new species have also been discovered in the last decade, e.g. *Labramia mayottensis* Labat, Pignal & Pascal 1997, or *ErythrospERMUM sifarii* Hul, Labat & Pascal 1999, two species of Sapotaceae and Flacourtiaceae, respectively, that reach a height of 20-25 m.

Nine of the eleven charopid species now known from Mayotte are endemic to that island, one (*Psichion arachne*) is known also from Anjouan, and one (*Psichion mica*) is known from all four islands of the Comores. However, a discussion of levels of single-island endemism is not significant in view of the very uneven quality of sampling among islands. Before the 2001-2002 survey, Mayotte was already the best surveyed island in the archipelago, and our survey has reinforced this imbalance.

Conservation

Given the very limited range of the Charopidae on Mayotte and forest loss in the last decades, all the species studied here qualify as VU (Vulnerable) under the IUCN Red List criteria. We found only empty shells for 7 of the 11 species, but we have no reason to suspect that they are not still extant, and we attribute this fact to the difficulty of sampling live specimens of minute species in the field. At least some of the empty shells are very fresh, with colour and periostracum, and suggest a very recent death. Actually, some of these snails may have been collected alive in the leaf litter and top soil, and were dried when the collection was processed for sieving and sorting. The local conservation status of the Mayotte charopid fauna is in sharp contrast with the current situation on several oceanic islands with historically diverse endodontid faunas. For instance, Mangareva, in eastern Polynesia, had 30 endemic species for a land area of 27 km² but all are now extinct (ABDOU & BOUCHET 2000), and more extinctions are listed for the Cook Islands and the Tuamotus (IUCN 2004). St Helena's 11 species of *Helenoconcha* and *Pseudocampylaea* are all extinct (ASHMOLE & ASHMOLE 2000). On Mauritius, *Propilula cyclaria* (Morelet 1875) is extinct and deposits where it occurs have been dated from 5,000-15,000 years BP (GRIFFITHS 1991, 2000). The results of the 2001-2002 Mayotte land snail survey were thus highly unexpected.

The Bénara-Tchaourembo range stands out as the region of Mayotte with the highest number of Charopidae. Four sites were sampled (Mlima Bepilipili, Mlima Bénara, Mlima Tchaourembo, Mt Ngouni) between 400 and 650 m, and yielded no less than 10 species (*Psichion arachne*, *P. kowatiiti*, *P. radiolatum*, *P. labati*, *P. muticum*, *P. nematomphalos*, *P. concavum*, *P. retrocostatum*, *P. homalospira* and *Phaulocystis iris*). The only species missing from that list is *Psichion mica*, which we collected elsewhere at four sites; its absence from the Bénara-Tchaourembo range may not be a sampling artefact. The second richest area is the the Choungui-Dapani, which we sampled on two occasions between 200 and 500 m, and which yielded 5 species (*Psichion radiolatum*, *P. arachne*, *P. muticum*, *P. retrocostatum* and *Phaulocystis iris*). The third richest area is the Mtsapéré range which was sampled three times between 400 and 560 m, yielding 4 species (*Psichion mica*, *P. arachne*, *P. muticum* and *P. retrocostatum*). Nine sites yielded only one or two species, together adding up to 5 species (*Psichion mica*, *P. arachne*, *P. radiolatum*, *P. muticum* and *P. nematomphalos*). Nine sites (not listed in this paper), or 33% of the sites sampled, had no charopid at all. It is probably not a coincidence that the three richest areas

are also those with the largest tracts of rainforest on Mayotte, and these are now enclosed within “Réserve Forestière” (forest reserve). It is more surprising to see that Mt Combani, also a reserve with a significant extension of rainforest, has a poor representation of Charopidae, with only two species.

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APPENDIX 1

The stations that yielded material of Charopidae.

Right bank of the Mroni Rouaka river, between the waterfall and the main road. Secondary forest on escarpment, 12°50.5'S, 45°7.4-7.7'E, alt. 40-60 m. A. Abdou & P. Bouchet, 11 March 2001. *Psichion radiolatum* (12 dd).

Mlima (= Mount) Mtsapere, east slope. Rainforest on slope, 12°45.9'S, 45°11.4'E, alt. 400-450 m. A. Abdou & P. Bouchet, 12 and 21 March 2001. *Psichion arachne* (4 lv, 11 dd), *P. mica* (1 lv, 3 dd), *P. muticum* (9 lv, 4 dd), *P. retrocostatum* (1 dd).

Boueni peninsula: Bounvoudranavi. Forest at base of cliff, 12°54.8'S, 45°05.6'E, alt. 180 m. A. Abdou & P. Bouchet, 13 March 2001. *Psichion arachne* (8 dd), *P. muticum* (22 dd).

Ridge above Mtsangamboua. Rainforest, 12°41.4'S, 45°06.0'E, alt. 150-200 m. A. Abdou, P. Bouchet & O. Griffiths, 16 March 2001. *Psichion arachne* (2 dd), *P. labati* (1 dd), *P. radiolatum* (2 dd).

Mlima Combani. Rainforest, 12°48.3'S, 45°09.1'E, alt. 380-420 m. A. Abdou, P. Bouchet & O. Griffiths, 17 March 2001. *Psichion arachne* (15 dd), *P. muticum* (1 lv, 8 dd).

Barakani waterfall. Secondary forest, 12°50.1'S, 45°07.8'E, alt. 50 m. A. Abdou, P. Bouchet & O. Griffiths, 17 March 2001. *Psichion mica* (6 dd).

Mlima Choungui, southern slope. Rainforest giving way to low scrub on steep summital slope, 12°57.5'S, 45°08.0'E, alt. 320-500 m. A. Abdou, P. Bouchet & O. Griffiths, 18 March 2001. *Psichion arachne* (4 dd), *P. muticum* (9 dd), *P. retrocostatum* (2 dd), *Phaulocystis iris* (4 lv, 3 dd).

Between Moutsamoudou and Cape Saziley. Dry coastal forest with baobabs, 12°59.1'S, 45°11.0-11.8'E, alt. 3-20 m. A. Abdou, P. Bouchet & O. Griffiths, 20 March 2001. *Psichion mica* (4 dd), *P. nematomphalos* (31 dd).

Tchaourembo Range, Mt Ngouni. Rainforest with Pandanus, 12°52.1'S, 45°07.7'E, alt. 450 m. A. Abdou & P. Bouchet, 22 March 2001. *Psichion concavum* (5 dd), *P. muticum* (13 dd), *P. nematomphalos* (1 dd), *P. radiolatum* (16 dd), *Phaulocystis iris* (12 dd).

Mlima Bepilipili, south slope. Rainforest, 12°52.8-53'S, 45°10.1-10.3'E, alt. 400-640 m. A. Abdou & P. Bouchet, 23 March 2001. *Psichion arachne* (1 lv), *P. concavum* (5 dd), *P. kowatiiti* (3 dd), *P. muticum* (3 dd), *Phaulocystis iris* (3 lv, 27 dd).

Sohoa/Choungui. Dry forest among boulders, 12°48.3'S, 45°06.1'E, alt. 80-150 m. A. Abdou & P. Bouchet, 24 March 2001. *Psichion radiolatum* (15 dd).

Mlima Maévadoani, above Tsararano. Forest on slope above plantations, 12°49.2-12°49.3'S, 45°10.0'E, alt. 200-300 m. A. Abdou, P. Bouchet & C. Handl, 9 August 2002. *Psichion arachne* (1 dd), *P. muticum* (8 dd), *P. retrocostatum* (9 dd).

Mlima Mapouéra, Dzoumonyé forest reserve. Slope forest with small boulders, 12°42.8'S, 45°03.6'E, alt. ca 250 m. A. Abdou, P. Bouchet & C. Handl, 10 August 2002. *Psichion muticum* (2 dd).

Mlima Bénara. Rainforest, 12°52.6'S, 45°09.6'E, alt. 500-650 m. A. Abdou, P. Bouchet & C. Handl, 12 August 2002. *Psichion arachne* (21 dd), *P. concavum* (23 dd), *P. homalospira* (1 dd), *P. kowatiiti* (38 dd), *P. labati* (1 dd), *P. muticum* (25 dd), *P. nematomphalos* (11 dd), *P. radiolatum* (32 dd), *P. retrocostatum* (1 dd), *Phaulocystis iris* (67 dd).

Dapani forest below Vatounkaridi summit. Rainforest with large boulders, 12°57.6'S, 45°08.4'E, alt. 200 m. A. Abdou, P. Bouchet & C. Handl, 14 August 2002. *Psichion arachne* (2 dd), *P. radiolatum* (1 dd), *P. retrocostatum* (3 dd).

Vahibéni: valley of the Gouloué river. Gallery-forest at cliff base, 12°47.3'S, 45°11.3'E, alt. 100 m. A. Abdou, P. Bouchet & C. Handl, 15-16 August 2002. *Psichion mica* (8 dd), *P. radiolatum* (16 dd).

Mlima Tchaourembo. Summital forest, 12°52.1'S, 45°08.7'E, alt. 450-535 m. A. Abdou, P. Bouchet & C. Handl, 17 August 2002. *Psichion arachne* (40 dd), *P. concavum* (58 dd), *P. labati* (4 dd), *P. muticum* (24 dd), *P. radiolatum* (7 dd), *P. retrocostatum* (7 dd), *Phaulocystis iris* (119 dd).

Mlima Mtsapéré. Low forest on ridge crest, 12°45.8'S, 45°10.7'E, alt. 500-560 m. A. Abdou, P. Bouchet & C. Handl, 19 August 2002. *Psichion arachne* (1 dd), *P. muticum* (3 dd).