

A new species of *Petalococonchus* Lea, 1843 from the Mediterranean Sea (Mollusca, Gastropoda, Vermetidae)

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ABSTRACT

Petalococonchus (Macrophragma) laurae n. sp. is a vermetid here described as new. It is very similar in shell characters to both the species reported for the Mediterranean sea, the fossil *Petalococonchus intortus* (Lamarck, 1818) and the recent *Petalococonchus (Macrophragma) glomeratus* (Linnaeus, 1758), but the peculiar structure of the internal keels and the protoconch distinguish the new species from all the congeners; the external morphology of the soft parts add a new item in the discrimination of the recent species. The holotype of *P. glomeratus* is housed in BMNH and it is here compared with the new species.

KEY WORDS

Vermetidae, new species, *Petalococonchus* n. sp., taxonomy, Mediterranean Sea.

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INTRODUCTION

The species of the genus *Petalococonchus* Lea, 1843 are characterised by the presence in the columellar zone of a series of structures, i.e. internal keels, whose number and arrangement is a character for the first time described and utilised by Carpenter (1856) as a species-specific character. *Petalococonchus* is well represented in tropical waters by numerous species, but in the Mediterranean sea only one recent species is known, *P. (Macrophragma) glomeratus* (Linnaeus, 1758).

The validity of this peculiar character, proper to *Petalococonchus*, and the development and morphology of the earlier tele-whorls in vermetids is here reported as a good species-specific discriminating character on the basis of the study on 10 of the 25 extant species of *Petalococonchus* and is discussed in conclusions.

A second unknown Mediterranean species of *Petalococonchus* is here described as new: the morphology of shell, protoconch and external soft parts are described in detail and compared with the

holotype of *P. glomeratus* and with *P. intortus* (Lamarck, 1818), a fossil congener of the plio-pleistocene Mediterranean area.

The new species is here distinguished by any other species of *Petalococonchus* mainly on the basis of the internal keel arrangement and the shape of protoconch: additional characters useful to distinguish the new species are here reported. The close related tropical species are here compared to the new species.

MATERIALS AND METHODS

Dry and living materials of both the new species of *Petalococonchus* and *P. glomeratus* were collected by undermining the shells from hard substrates at a depth of 0 to -18 m; empty shells were found among residuals of fishing nets at a depth of 50 to 150 m.

Protoconchs of both species were collected by digging them with a needle from the base of specimens and by extracting them from the brooding females; further empty material was collected

among the shell grit collected handily with ARA. Drawings of the external soft parts were obtained observing the living animals in aquarium. Fossil materials of both *P. glomeratus* and *P. intortus* were studied and compared to the new species.

ACRONYMS. Australian Museum, Sydney, New South Wales, Australia (AMS); Danilo Scuderi collection, Catania, Italy (DSC); Angelo Lugli collection, Carpi, Modena, Italy (ALC); Moscow State University, Moscow, Russia (ZMUM); Museo Civico di Zoologia, Roma, Italy (MCZR); Museo di Zoologia dell'Università, Bologna, Italy (MZUB); Museo del Dipartimento di Biologia Animale dell'Università, Catania, Italy (MBAC); Museo Nacional de Ciencias Naturales, Madrid, Spain (MNMS); Muséum National d'Histoire Naturelle, Paris, France (MNHN); Naturhistorisches Museum Mainz, Mainz, Germany (NHMM); Stefano Palazzi collection, Modena, Italy (SPC); The Natural History Museum, London, UK (BMNH); Alberto Villari malacological collection, Messina, Italy (AVC); Zoologische Staatssammlung, Munich, Germany (ZSMC).

***Petalococonchus (Macrophragma) laurae* n. sp.**

EXAMINED MATERIAL. Holotypus, Catania, E-Sicily, Italy: S. Giovanni Li Cuti, in shallow water, on lava stones. Paratypes, same data oh holotypus, 118 empty shells and 20 little cluster (3-10 shells each); Capo Mulini village, in shallow water, on lava stones, 3 empty shell; Acitrezza village, in shallow water, on lava stones, 6 empty shells. Messina, N-E Sicily, Italy: Ganzirri village, in shallow water, on stones, 2 empty shells; Siracusa, S-Sicily, Italy: Vendicari, from beached shell-grit, 6 empty shells. Agrigento, S-Sicily, Italy: Pelagie Is., Lampedusa, from beached shell-grit, 2 empty shells. Palermo, N-W Sicily, Italy: Ustica Is., from shell-grit, 25 m depth, 1 empty shell, AVC. Kosl jun, Croatia: Pag otok, in shallow water, on stones, 5 specimens and a single little cluster with living animals, SPC; Bodrum Harbour, Turkey: in shallow water, on stones, 2 empty shells, ALC.

Holotype, 2 paratypes and a protoconch from the locus typicus in MNHN, (with no reg. number); 1 paratype in AMS, C.474169; 1 paratype in MNMS, n. 34393; 1 paratype in MZUB, MZB45413; 1 paratype in ZMUM, n. Lc 24964; 1 paratype in ZSMC,

n. 20021768; 1 paratype in MBAC, n. MBLMC-CT-78. Other paratypes in DSC.

DESCRIPTION OF HOLOTYPUS. Shell cylindrical, 16 mm in length in adult regularly coiled specimens, composed by 14 rounded, squeeze shaped whorls (Figs. 1-4). The sculpture is regular: 9 spiral lines cross numerous and equally thickened (or slightly stronger) axial ribs, which form rounded and not marked tubercles at the intersection.

True columellar keels are lacking, while a single faint central plait (Fig. 6) is present on the columella, from earlier to the 12-13th tele-whorls of an adult specimen: this columellar chord is not visible in the last whorls. The diameter of the aperture is about 2 mm. Clusters of several specimens were found, even if true vermetid trottoir, like that of some tropical species of the same genus, are not known.

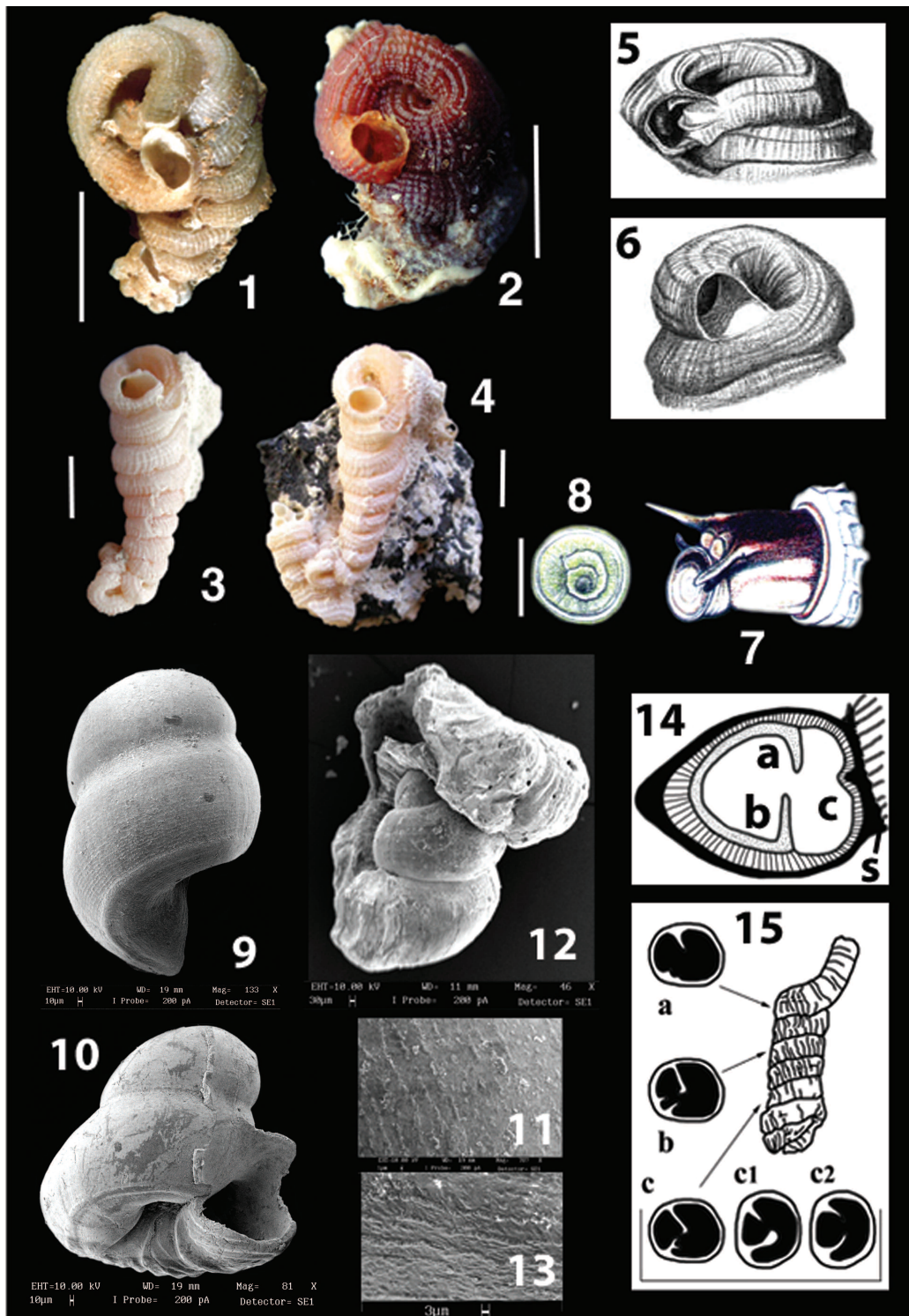
The living animal (Fig. 7) is pale cream in colour in the lower part of the metapodium, the anterior part of the mouth and the cephalic tentacles, the remaining part being dark brown; the podalic tentacles are almost black; the operculum (Fig. 8) is thin, smooth downward, with an internal spiral keel upward: it is wide 2/3 of the total opertural diameter of the tube, and allows to see a darker upper zone of the foot.

VARIABILITY. The shape of the whole shell depends on the morphology of substrate, i.e. stones and their crevices, so specimens may vary from long tricky shaped to more rounded coiled forms. Shell has the length between 12-20 mm, and shows 13-15 whorls; the shell sculpture include from 8 to 11 spiral lines cross. The color of the shell could be dark to amber brown, paler in empty shells. The columellar plait could vary in thickness depending on the shell whorls, as previously reported.

ETYMOLOGY. The specific name of the species is dedicated to my wife Laura.

BIOLOGY AND DISTRIBUTION. As other congenetics, the new species inhabits hard substrata of shallow waters. It was never recorded in intertidal zone. The new species has been recorded from Sicily to for the Ionic and Adriatic sea, but its distribution range could be wider.

COMPARATIVE NOTES. Numerous species of *Petalococonchus* are close similar in morphological characters of the shell as well as of the external soft parts. A good character to separate them is represented by the arrangement of the columellar



Figures 1-4, 6-11: *P. laurae* n. sp. Fig. 1: holotype. Fig. 2: paratype, Pag otok. Figs. 3-4: paratypes, S. Giovanni Li Cuti. Scale bar 5 mm. Fig. 6: drawing of columellar arrangement. Fig. 7: external morphology of the soft parts. Fig. 8: upward view of operculum. Scale bar 0,5 mm. Figs. 9,10: protoconchs (0,7x0,75 mm); the black arrow indicates the basal chord. Fig. 11: protoconch sculpture. Figures 5, 12, 13. *P. glomeratus*. Fig. 5: drawing of columellar arrangement. Fig. 12: protoconch (1,1x0,7 mm). Fig. 13: protoconch sculpture. Fig. 14: sketches of columellar keels in different species, from the wall of tube (a), the columella (b), and the central fold (c). Fig. 15: drawing of the columellar keels variation from earlier (c) to middle (b) and older (a) whorls in *P. intortus*.

structures, i.e. the columellar keels, originated from a layer of the upper/lower wall of the tube (Fig. 14a) or from a layer of the columella (Fig. 14b), and the central fold, which seem to originate from another distinct layer (Fig. 14c).

The columellar structures, were proposed by Carpenter (1856) as a species-specific discriminating character for *Petalococonchus*. Subsequently Mörch (1861) utilised this character to distinguish *Petalococonchus* from the morphologically close related *Thylaeodus* Mörch, 1860, currently considered a subgenus of *Vermetus* Cuvier, 1800, which bear a cancellated sculpture of the shell but lack internal structures, as confirmed by Scuderi (1999) for the Mediterranean *Vermetus (Thylaeodus) granulatus* (Gravenhorst, 1831).

The study here conducted on original descriptions of the 25 extant known species of this genus and directly on material of 10 of them confirmed as good the species-specific discriminating character of the columellar keels: no one of these known species show a single columellar plait alone.

Moreover, internal structures in a single specimen of *Petalococonchus* are here observed to vary along the whole length of the tube (Fig. 15), from earlier tele-whorls (Fig. 15c), where they become to grow, being slightly variable (Figs. 15c1, 15c2) the middle trait (fig. 15b), where they are characteristic of the species in number and arrangement, to the last whorl (Fig. 15a), becoming less numerous, more faint or totally absent.

This could cause misunderstandings on the taxonomy of species and on the real taxonomic value of this character: Monterosato (1892), for example, following Mörch (1861), placed "*Serpula*" *glomerata* L. in *Petalococonchus*, but stated: "...this subdivision was founded on species which present longitudinal internal keels, which absolutely lack in all our (Mediterranean) vermetids". The study of the material of the Monterosato collection (MCZR), which was carried out along with the present investigation, revealed on the contrary that all the specimens of *P. glomeratus* had keels in the middle trait of the shell. Pillai & Hove (1994) utilised the presence/absence, number and shape of internal keels as discriminating character for the taxonomy of *Spiraserpula*, a genus of marine sedentary Annelida, which presents analogies with *Petalococonchus* in shell morphology.

P. laurae n. sp. is described as new on the basis of a series of morphological characters, among which the presence of a single columellar plait: no species of *Petalococonchus* are known wanting the columellar keels. The record of Schiaparelli (1995) for the Ligurian sea of *P. glomeratus* with a single internal keel is probably a not complete shell of the Linnean species, not referable to the new species.

The presence of a single columellar keel and the shape and sculpture of protoconch allowed the discrimination of *P. laurae* n. sp. from the two morphologically closest species: the recent Mediterranean *P. glomeratus*, whose holotype housed in

Characters/species	<i>Petalococonchus laurae</i>	<i>Petalococonchus glomeratus</i>	<i>Petalococonchus intortus</i>
TELEOCONCH			
number of whorls	13-15	up to 30	20-22
sculpture	radial equal to the spiral	radial less marked than the spiral	radial less marked than the spiral
columellar keels	1	3	3
opening of tube	rounded	squared	squared
PROTOCONCH			
shape	rather globose	pupoid	pupoid
dimensions (mm)	0,7 x 0,75	1,1 x 0,7	0,65 x 0,4
number of whorls	1 1/2	2 1/2	2 1/2
basal chord	present	absent	present

Table I. Distinguishing characters in *Petalococonchus laurae*, *P. glomeratus* and the fossil *P. intortus*.

BMNH is here compared with the new species, and the fossil *P. intortus*: all the others characteristics are summarised in Table I.

P. glomeratus has a very characteristic protoconch (Fig. 12), never reported before in literature, constituted by 2½ whorls, the apical very inflated, measuring 1,1 x 0,7 mm, with a faint sculpture on the entire surface of few spiral and more numerous axial threads which form a reticulation detectable only after SEM magnifications (Fig. 13). The fossil *P. intortus* has a smaller protoconch, measuring 0,65 x 0,40, with 2½ whorls, the second of which higher than the previous ones: they are almost smooth and bear a single basal chord, similar to that of *P. laurae* n. sp.

P. myrakeenae (Absalão & De Carvalho Rios, 1987), from South-Eastern Brazil, is morphologically related to *P. laurae* n. sp., but shows two internal laminae, even if the original description is not complete, lacking further important characters, i.e. the protoconch and the external soft part morphology. *P. macrophragma* Carpenter, 1857 from Mexico could resemble *P. laurae* n. sp., but shows three columellar structures and a different protoconch.

The protoconch of the Indopacific *P. cereus* Carpenter, 1857 presents a basal chord similar to that of the new species, but is constituted by 2½ whorls, is bigger (0,73 x 0,54 mm) and has a pupoid shape; the adult shell is quite different, being flat, almost smooth except for some very faint spiral lines on the upper zone of the tube, crossed by thin and often dark coloured axial threads.

Two oblivious taxa could be linked to the new species: *Vermetus jonicus* Danilo et Sandri, 1856 is reported as a polychaete by Monterosato (1892), who observed the syntype in the NHMM; *Petalococonchus (Macrophragma) flavescens* (Carpenter, 1857) was reported from Sicily in the original description and Nordsieck (1968) and Parenzan (1970) listed this species among the Mediterranean Vermetidae, although firstly Mörch (1861) and later Keen (1961 e 1971), both having observed the syntype in BMNH (reg. n. 195918), reported the true Mexican distribution of this species, which is extended from Bahia San Luis Gonzaga to Mazatlán, being the Sicilian citation a mistake. Moreover, as could be argued by the original description and figures, this species, unlike *P. laurae* n. sp., have two internal laminae, lacking the central fold.

Further two new species of *Petalococonchus* were recently described from Philippines (Kelly, 2007): *P. apakadikike* Kelly, 2007 and *P. lilandikike* Kelly, 2007 compared to *P. laurae* n. sp. both have two well-developed internal keel and a different protoconch. *P. laurae* n. sp. seems to be distributed from East to West Mediterranean, including the eastern part of the Adriatic sea.

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