A HYPOTHESIS: MARGARITA–A SMOOTH FORM OF *PUSTULARIA CICERCULA*

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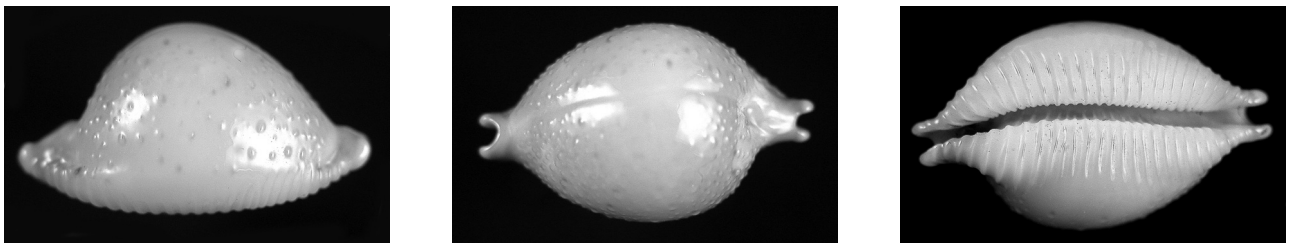
Abstract: A hypothesis is suggested that *Pustularia margarita* is not a valid species but a smooth form of *Pustularia cicercula* the shells of which are typically granulated. It is assumed that the dorsal granulations is not a good diagnostic character of a specific rank and both forms of *P. cicercula*—typically granulated and occasionally smooth—can be found in populations of the species in different proportions. This hypothesis is now under test.
Key words: Mollusca, Gastropoda, Cypraeidae, *Pustularia cicercula*, *Pustularia margarita*, intraspecific variation.

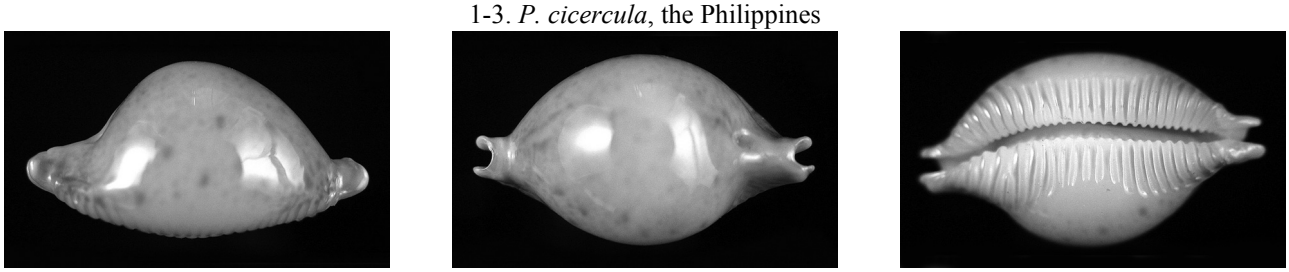
Shells of the two closely related taxa named in the literature *Pustularia cicercula* (Linnaeus, 1758) and *Pustularia margarita* (Dyllwin, 1817) were known to conchological authors of the 18th century and pictured in their works: Rumphius (1705-1711), Gualtieri (1742), and Martini (1769-1777).
C. Linnaeus often referenced to these old works in his "Systema naturae" and consequent writings hence his descriptions were sometimes too short and insufficient. For example, *Cypraea cicercula* Linnaeus, 1758: "C. testa utrinque rostrata, adspersa punctis elevatis"—shell rostrated at both ends and granulated—Figs. 1-3.

L.W. Dillwyn also referenced to the above old works when he re-described according to the new Linnaean system the smooth white shell strikingly beaked at both ends, without any markings; now we know it as *Cypraea margarita* Dillwyn, 1817 or *Pustularia margarita* (Dillwyn, 1817).

It is traditionally accepted that the main diagnostic character separating *P. cicercula* from *P. margarita* is the granulated dorsum in shells of the former, as described by C. Linnaeus. However, a conchological practice showed that this is perhaps not an obvious diagnostic shell character of a specific rank.



1-3. *P. cicercula*, the Philippines



4-6. *P. margarita*, the Philippines

P. margarita—Figs. 4-6—is mentioned in the Prodrome (Schilder & Schilder, 1938) and other works by these authors until 1966 as a subspecies of *P. cicercula* (Linnaeus, 1758). On the face of it this approach looks ridiculous: according to the original descriptions shells of *P. cicercula* are pustulated (granulated) whereas shells of *P. margarita* are completely smooth; how may two contradicting main diagnostic characters of a specific level be united in one species?

Although C. Linnaeus mentioned the pustulated dorsum as one of two diagnostic characters of *cicercula* it is not mentioned in the Prodrome! Why? Perhaps the Schilders assumed that the dorsal pustules (granules) are not an important diagnostic shell character of a specific rank and it is not the main diagnostic character of *cicercula*. Not every shell character can be accepted for diagnostic species the more so as the main diagnostic character.

Burgess (1970, 1985) mentioned *Cypraea margarita* as a synonym of *cicercula*; in the second (1985) edition of his book he explained why: "I have not recognized *margarita* as a species because, here in Hawaii, we have both smooth and pustulate forms and there is complete intergradation of *cicercula* from entirely smooth [underlined by the present author] to a very pustulate dorsum. Occasionally only one or two pustules will be visible at an extremity."
In other words, in shells of *cicercula* a number of granules vary from zero to very many; but zero granules or totally smooth dorsum is the diagnostic character of *margarita*.

It should be kept in mind that according to conchological methods two species should be separated by a conchological gap, i. e. diagnostic shell characters without intermediates. In the *cicercula-margarita* case, Burgess (1985) expressed this in the following way:
"To me, one pustule prevents a cowries from being "smooth." It is about the same as being a "little bit pregnant."

Later, in Schilder & Schilder (1971) *margarita* is already mentioned as a valid species although the Schilders did not explain the reasons of this change in a taxonomic rank of *P. margarita.*

It is known that completely smooth shells (treated as *margarita*) are found in many areas of the Indo-Pacific region from the Gulf of Aqaba and Mozambique in the West to Polynesia in the East.

In the western group of populations *margarita*-like shells are usually completely smooth and easy to separate. But there is published evidence contradicting such an opinion. Blöcher (1981) reported finding of 103 *cicercula* shells washed up ashore near Tulear, Madagascar. "Of the 103, 27 show a completely granulose dorsum; in 18 only the very top of the dorsum is free of pustules; 14 still present granulations towards the margins and the extremities; in 22 the pustules are confined to extremities; while the remaining 22 [17%] have entirely smooth surfaces…some have pronounced extremities and weakly developed central labial teeth, while others present very blunt extremities and central labial teeth extending well over their side of the base. The same variability exists with the columellar teeth, which sometimes, centrally, may even be lacking altogether." Perhaps the smooth shells mentioned were *P. margarita* and the author questioned: "Is *Cypraea margarita* Dillwyn 1817 a valid species?"

A substantial part of specimens in the eastern populations of *margarita*-like shells may be almost smooth i. e. smooth with several granules, which sometimes are hardly visible.
Such populations as a whole cannot be treated either as *cicercula* (because the dorsum of many shells may be completely smooth) or as *margarita* (because parts of shells are granulated).

Attempts to simply ignore *margarita*-like shells with totally smooth dorsum (treating *margarita* as a synonym sensy Burgess) or quite the reverse to treat them as a valid species (sensu the Schilders) both seem to be not convincing now. A decision to consider two different species if shells of both taxa are the same but differ by one granule—does not makes sense.

Consequently, a hypothesis for solving the problem is here suggested as follows:

a) It is supposed that dorsal granulations are not a diagnostic character of a specific rank for *P. cicercula* although it can be used as an auxiliary diagnostic character.
b) Several forms—very granulated, granulated, "slightly granulated" and smooth—can be found together in different proportion in different populations of *P. cicercula*.
c) Typical shells of *P. cicercula* are granulated.
d) *P. margarita* is the sporadically found extreme (smooth) form of *P. cicercula*.

In any case *P. margarita* can be formally treated as a synonym of *P. cicercula* because forms as intrasubspecific taxa are not recognized according to the ICZN. But this does not mean that f. margarita should be ignored and simply listed as a synonym; study of this form may be useful for understanding intraspecific variation in populations

of *P. cicercula* and other taxa in the genus *Pustularia*. Hence the hypothesis mentioned above is now under test in which the availability of conchological material from different localities in the Indo-Pacific region plays a critical role.

Acknowledgements
I would lile to thank Henk K. Mienis (Mollusc Collection, National Collections of Natural History, Dept. Zoology, Tel Aviv University, Tel Aviv, Israel, and National Mollusc Collection, Dept. Evolution, Systematics & Ecology, Hebrew University of Jerusalem, Jerusalem, Israel), Jean and Janine Demartini (France), Hakuei Masuko (Japan), Werner Massier (Namibia), and Fabio Moretzsohn (USA) for their help in obtaining the conchological material, malacological literature, and other information.

Literature
Beekman, E.M. 1999. Georgius Everhardus Rumphius. 1705. The Ambonese Curiosity Cabinet. Translated, edited annotated, and with an introduction by E. M. Beekman. Yale University Press. New Haven & London. 567 pp.
Blöcher, M. 1981. Is *Cypraea margarita* Dillwin 1817 a valid species? La Conchiglia 13(150-151):16.
Burgess, C. M. 1985. Burgess' Cowries of the World, 289 pp. Cape Town. Gordon Verhoef, Seacomber Publications.
Dillwyn, L.W. 1817. A descriptive catalogue of recent shells, arranged according to the Linnaean method; with particular attention to synonymy. Vol. 1:470.
Dodge, H. 1953. A historical review of the mollusks of Linnaeus. Part 2. The class Cephalopoda and the genera Conus and *Cypraea* of the class Gastropoda. Bulletin of the American Museum of Natural History 103(1). New York. 134 pp.
Martini F. H. W. 1769. Neues Syst. Conch. Cab. (Nürnberg) 1:302-485.
Schilder F.A. & Schilder, M. 1938. Prodrome of a monograph on living Cypraeidae. Proc. of Malacological Society of London, 23:119-231.
Schilder M. & Schilder F.A., 1971. A catalogue of living and fossil cowries. Institut Royal des sciences naturelles de Belgique. 246 pp.

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