

Nomenclature in Mesembryanthema (Aizoaceae): the generic names by Rappa and Camarrone

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ABSTRACT

A re-examination of the seven generic names used by Rappa and Camarrone reveals that three of them were validly published (*Pentacoilanthus*, *Tetracoilanthus*, *Pteropentacoilanthus*); the first one is lectotypified here. The other four names are invalidly published. Their synonymy is given nevertheless where possible.

UITTREKSEL

'n Herondersoek van die sewe genusname wat Rappa en Camarrone gebruik het, toon dat drie van hulle geldig gepubliseer is (*Pentacoilanthus*, *Tetracoilanthus*, *Pteropentacoilanthus*); die eerste een word hier gelektotipifiseer. Die ander vier name is ongeldig gepubliseer. Hul sinonimie word nietemin aangegee waar moontlik.

INTRODUCTION

In a survey of all genera of the Aizoaceae (including the Mesembryanthema) (H.E.K.H.) it was found that the genera described by Rappa and Camarrone (1953, 1955, 1960) have never been examined critically, and their validity and synonymy have never been established. Based on recent investigations in the group involved (V.B.), it is now possible to settle the nomenclatural uncertainties. Early investigations of flowers of Mesembryanthema led Rappa (1912) to the description and distinction of two different types of nectaries: lophomorphic ones, which are crest-shaped (Figure 1A, B), and coilomorphic ones, which are conchiform or shell-shaped (Figure 2A, B). Nectaries may also be absent, and consequently Rappa (1912) names three groups: Lofomorfi, Anettari, and Coilomorfi, which were later classified as subfamilies (Rappa & Camarrone 1953, 1960). They lack Latin descriptions, however, and therefore do not conform with article 36 of the International Code of Botanical Nomenclature (Greuter *et al.* 1988, abbreviated ICBN subsequently). The names are therefore not validly published.

The fundamental distinction between lophomorphic and coilomorphic types of nectaries has been confirmed repeatedly (e.g. Ihlenfeldt 1960). Bittrich (1987) stresses the fact that the subfamily Mesembryanthemoideae (= Aptenioideae Schwant. ex Bittrich & H. Hartm.) is characterized by coilomorphic nectaries, and Bittrich & Hartmann (1988) mention them as a synapomorphic character for the subfamily. It is also worth noting that in Aptenioideae the number of carpels agrees with the number of perianth lobes as well as with the number of nectaries. N.E. Brown (1925) already used this character set in his keys to various genera. It must be remembered, though, that neither the number of carpels nor that of the nectaries is always constant within populations (e.g. *Phyllobolus* subg. *Prenia*, Bittrich 1987). Rappa & Camarrone (1953, 1955, 1960) use the number and shapes

of nectaries for further subdivision of the subfamilies, but only in the Aptenioideae (Coilomorfoideae, Rappa

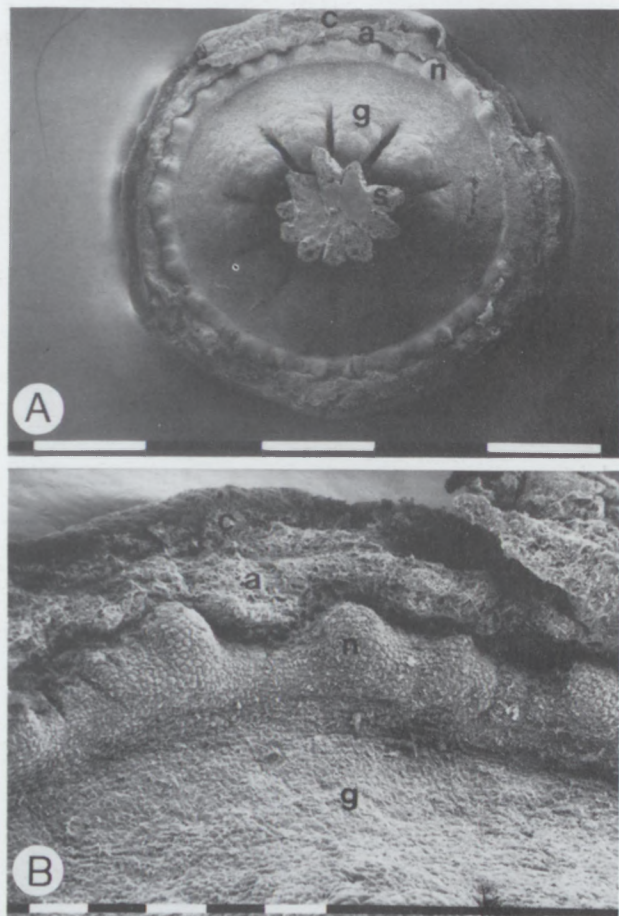


FIGURE 1.—*Leipoldtia weingangiana* (Dinter) Dinter & Schwant. ex H. Hartm. & Rust. (Ruschioideae) Hartmann 8476 (HBG). A, view of upper ovary surface, white scale bar = 1 mm; B, enlarged section of lophomorphic holonectary, the amorphous particles on the surface are remains of nectar, white scale bar = 0,1 mm. a, androecium, cut off; c, calyx, cut off; g, gynoecium raised subapically, with deep fissures between lobes; n, lophomorphic nectary which forms a complete ring (holonectary); s, styles, cut off. SEM micrograph: H. Gölling.

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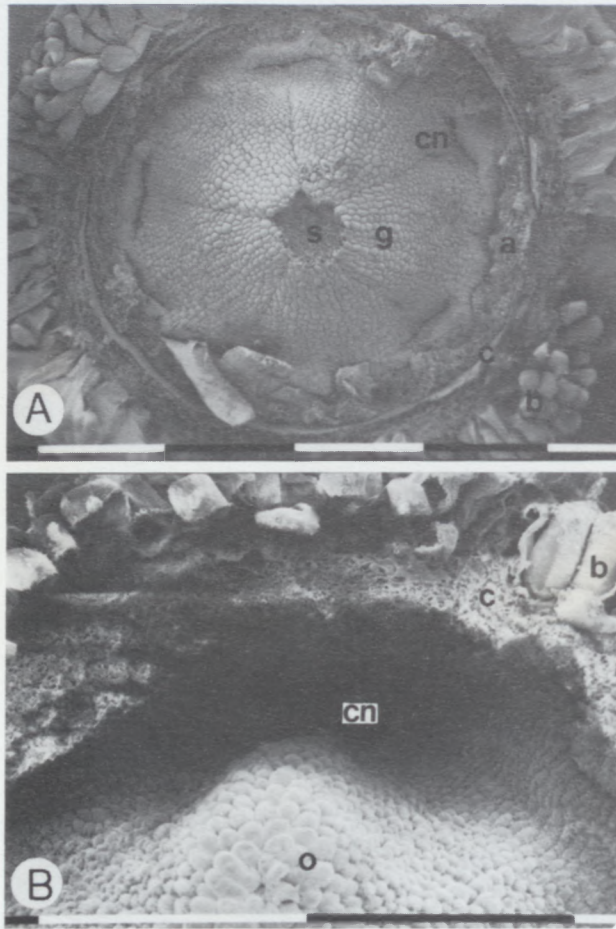


FIGURE 2. — A, *Brownanthus kuntzei* (Schinz) Ihlenfeldt & Bittrich (Aptenioideae) Ihlenfeldt & Warda 12158 (HBG), view of ovary surface with five separate coilomorphic nectaries. B, *Aridaria umbelliflora* (Jacq.) Schwant., Jürgens 22261 (HBG), closer view of a single coilomorphic nectary. a, androecium, cut off; b, prominent bladder cells; c, calyx, cut off; cn, coilomorphic nectary; g, gynoeceum; o, ovary; s, styles, cut off. SEM micrograph: H. Gölling. White scale bar = 1 mm.

& Camarrone 1960) do they draw nomenclatural consequences, i.e. name genera.

The guiding principle of Rappa & Camarrone (1953) is primarily the number of nectaries, complemented later (1955, 1960) by the absence or presence of valve wings. In the first step, two genera based on five, respectively four, nectaries are distinguished: *Pentacoilanthus* and *Tetracoilanthus* (Rappa & Camarrone 1953). Four more genera are added later after the importance of valve wings is recognized: *Perapentacoilanthus* (Rappa & Camarrone 1955), *Pteropentacoilanthus*, *Pterotetracoilanthus*, and *Peratetracoilanthus* (Rappa & Camarrone 1960). The names indicate that a certain pattern is followed predicting particular character combinations for the genera. This approach can be traced from the recognition of informal groupings (Rappa & Camarrone 1955) to the formal descriptions of taxa (Rappa & Camarrone 1960). The mechanical and even predictive procedure followed is well illustrated by the description of *Pterotetracoilanthus*, with a character combination which is theoretically possible but which the authors failed to find in any real plant (see 6. below). This unconventional approach is certainly one reason why the descriptions of Rappa & Camarrone have been neglected. Another reason is that, in most cases, the authors cite several species for their genera taken from

various other genera previously described. Also, the new genera were not typified, making identification extremely difficult. Nevertheless, none of these shortcomings alone invalidate the names as such, and a detailed re-investigation was carried out to establish a reliable taxonomy for future use. Since each genus poses its own problems, the genera are discussed separately in chronological order.

DISCUSSION

1. *Pentacoilanthus* Rappa & Camarrone (1953)

The description conforms with the relevant requirements (art. 32–36 ICBN), and the name is therefore validly published. Four species are included, *Mesembryanthemum aitonis*, *M. granulicaule*, *M. splendens* and *M. crystallinum*. Unfortunately no type species is mentioned and a lectotype must therefore be chosen.

(1) *Mesembryanthemum aitonis* Jacq. can be excluded because, in contrast to the genus description of Rappa & Camarrone (1953) the nectaries of this species are not shell-shaped but tubular; these tubes may extend as deeply into the receptacle as the locules (Figure 3). It seems unlikely that Rappa & Camarrone studied longitudinal sections and it is therefore assumed that they were unaware of the different nectary morphology of this species. Surface views do not permit the assessment of the depth of the nectary (Figure 2A, B). *M. aitonis* is therefore not available for selection as a lectotype. At present, the species is included in *Mesembryanthemum* L. subg. *Mesembryanthemum* (Bittrich 1987).

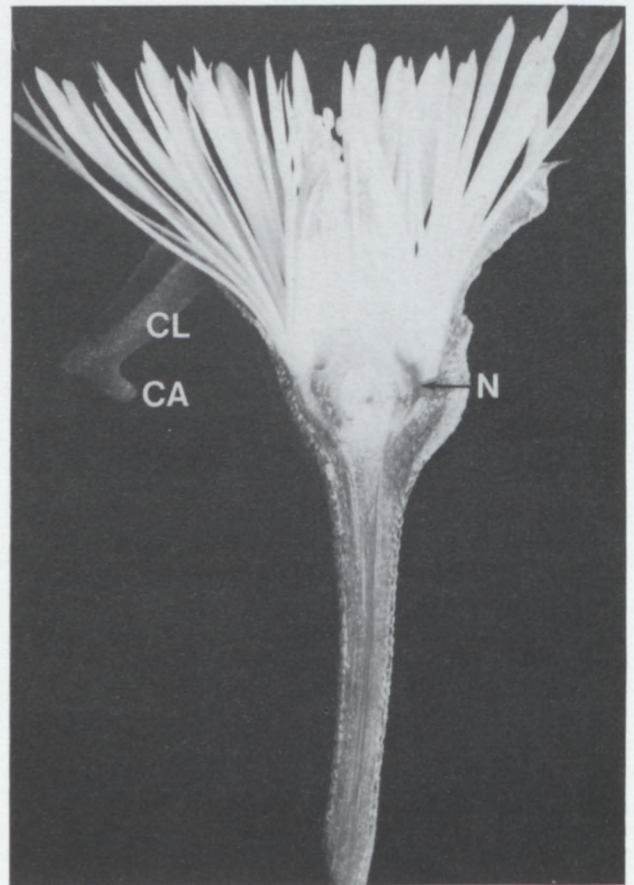


FIGURE 3. — *Mesembryanthemum aitonis* Jacq. (Aizoaceae) Ihlenfeldt & Bittrich 13857 (HBG). Longitudinal section of flower. CA, prominent dorsal appendage of CL, calyx lobe; N, one of the five very deep coilomorphic nectaries.

The remaining three species do possess shell-shaped nectaries, and the choice between them is not easy.

(2) *Mesembryanthemum granulicaule* Haw. (belonging to the genus *Psilocaulon* N.E. Br.) is a doubtful species. It is often synonymized with *Psilocaulon articulatum* (Thunb.) N.E. Br. (the type species of the genus *Psilocaulon*) because of the rough papillose surface of leaves and stem; the latter species has white to pink flowers. The drawing of *M. granulicaule*, however, which is kept at Kew and is assumed to have been seen by Haworth (it would have to be chosen as the lectotype of the species in a revision), shows yellow flowers. The very few herbarium specimens with yellow flowers were all collected in a small area in the Orange Free State. They may well represent the true *M. granulicaule* as studied by Haworth. It seems extremely unlikely, though, that Rappa & Camarrone have investigated living or pickled material of this very rare species and herbarium material is useless for the investigation of nectaries. Furthermore, in species of *Psilocaulon*, four- and five-locular ovaries can occur within one species or even on one plant. Species of *Psilocaulon* can therefore not be associated unambiguously with either *Pentacoilanthus* or *Tetracoilanthus*. Considering the care with which Rappa and Camarrone led their investigations, it seems highly unlikely that they saw species, or even specimens, with both 4- and 5-lobed ovaries.

(3) *Mesembryanthemum splendens* [now included in *Phyllobolus* subg. *Aridaria* (N.E. Br.) Bittrich, Bittrich (1987)] is a doubtful species because its identity is very difficult to determine. It belongs to a group of about twenty described species in the subgenus *Aridaria* most of which are synonymous. Due to the insufficient knowledge of the group, however, the exact number and delimitation of the species is still uncertain. It is scarcely possible to identify any species of this group with the help of literature only. The most useful characters are form and sculpture of seeds, rarely mentioned in descriptions. It is unlikely therefore, that Rappa & Camarrone investigated the true *M. splendens*, particularly since it is very rare in cultivation. Material kept under this name often belongs to the closely allied *M. umbelliflorus* Jacq. It would seem highly unwise to choose this species as the lectotype.

(4) *Mesembryanthemum crystallinum* L. is the only species figured by Rappa & Camarrone (1953). This species has not only been well known in Europe for a long time, it is also naturalized around the Mediterranean and is sometimes used as a vegetable. The figure mentioned above shows with great certainty a flower of *M. crystallinum*, because the extremely large bladder cells of the epidermis of the receptacle are highly characteristic of this species. Therefore, and in contrast to the two other species with shell-shaped nectaries discussed above, it is most probable that *M. crystallinum* is the plant studied by Rappa & Camarrone. Consequently, *M. crystallinum* is chosen as the lectotype of the genus *Pentacoilanthus*. At the same time, *M. crystallinum* is the type species of the genus *Cryophytum* (N.E. Brown 1926). By this lectotypification, the name *Pentacoilanthus* becomes superfluous and is illegitimate (art. 63.1 ICBN). It should be stressed, though, that the choice was not influenced by this consequence but is based on agreement of characters with the description and the probable identity of the original material.

It should be mentioned further that the name *Pentacoilanthus* would in any case be a synonym of another generic name, since all relevant species had been described earlier. The name *Pentacoilanthus crystallinum*, is not validly published because the basionym was not cited clearly and fully as required (art. 33.2 ICBN). At present, the species is considered to belong to *Mesembryanthemum* L. subg. *Cryophytum* (N.E. Br.) Bittrich (Bittrich 1987).

2. *Tetracoilanthus* Rappa & Camarrone (1953)

The description conforms with the relevant requirements (art. 32–36 ICBN), and the name is therefore validly published. Since only one species is included, this is accepted as the indication of the type (art. 37.2 ICBN).

Tetracoilanthus is based on the same type as the genus *Aptenia* N.E. Br. (1925), namely *A. cordifolia* (L.) Schwant. The name is therefore superfluous and consequently illegitimate (art. 63.1 ICBN).

The combination *T. cordifolius* (L. f.) Rappa & Camarrone is not validly published, because the basionym is not indicated clearly and fully (art. 33.2 ICBN). At present, the species is included in the genus *Aptenia* N.E. Br. (Bittrich 1987).

3. *Perapentacoilanthus* Rappa & Camarrone (1955)

The description of this genus is almost identical with that of *Pentacoilanthus* Rappa & Camarrone 1953 (see 1. above) except for the addition of 'valvis... quae, septis deficientibus, circa nudum axem consistunt'. This statement probably refers to the columella, the formation of which is very variable and changes from low to high with all intermediates. In Aptenioideae, the septa are always transformed into expanding keels in their upper parts, and consequently a remaining collumella will appear naked in the open capsule. These inconsistencies detract from the taxonomic value of the character. The two descriptions are consequently considered to be identical.

Although Rappa and Camarrone did not state it explicitly, there is no doubt that they coined the name *Perapentacoilanthus* to replace *Pentacoilanthus* Rappa & Camarrone (1953). They had realised in the meantime that the absence or presence of valve wings is an important character. Consequently they were now planning to group species and name genera not only according to the number of nectaries, but also according to the absence or presence of valve wings, as described in the introduction above. This is borne out by the following: a, under the heading '*Pentacoilanthus*. Genere privo di umenoprosteci' (genus deprived of valve wings), Rappa & Camarrone (1955) indicate that they intend to alter the diagnostic characters of *Pentacoilanthus*, which indeed they did later (Rappa & Camarrone 1960: 13); b, in the 1960 publication they include all the species originally mentioned under *Pentacoilanthus* Rappa & Camarrone (1953) under *Perapentacoilanthus*. This action was obviously initiated with the aim to name the genera with five, respectively four, coilomorphic nectaries in parallel fashion (*Pentacoilanthus* matching *Tetracoilanthus* without valve wings; *Pteropentacoilanthus*–*Pterotetracoilanthus* with free valve wings; *Perapentacoilanthus*–

Peratetracoilanthus with valve wings forming pockets; compare list in Rappa & Camarrone 1955: 10).

To declare *Perapentacoilanthus* a superfluous and therefore illegitimate name (art. 63.1 ICBN) requires the definite inclusion of the holotype of the earlier synonym *Pentacoilanthus*. This is not possible literally, since *Pentacoilanthus* 1953 was published without the indication of a type, but the inclusion of all four species of the original *Pentacoilanthus* 1953 under *Perapentacoilanthus* (Rappa & Camarrone 1960) makes it clear that the type would be included, whichever species had been chosen. As a consequence, *Pentacoilanthus* 1953 and *Perapentacoilanthus* 1955 must be considered synonymous, being names for the same genus.

4. *Pentacoilanthus* Rappa & Camarrone (1960)

As stated above, the characterization of the genus differs from the *Pentacoilanthus* of 1953 in an important diagnostic character, namely the absence of valve wings, and an entirely different set of species is accordingly assigned to the genus. This name therefore represents a later homonym of *Pentacoilanthus* Rappa & Camarrone 1953 (although no type is mentioned in either genus) and is consequently illegitimate (art. 64.1 ICBN). Furthermore, the lack of citation of a type at this date makes the name an invalidly published one (art. 37.1 ICBN).

All species included in *Pentacoilanthus* 1960 were taken from the genus *Sceletium* N.E. Br., and they are at present assigned to *Phyllobolus* N.E. Br. subg. *Sceletium* (N.E. Br.) Bittrich (Bittrich 1987).

5. *Pteropentacoilanthus* Rappa & Camarrone (1960)

Only one species is cited as an example with the description of the genus and this validates the name (art. 37.2 ICBN). The genus is based on the same species as *Halenbergia* Dinter, namely *H. hypertrophica* (Dinter) Dinter. The name *Pteropentacoilanthus* is therefore a superfluous name and illegitimate (art. 63.1 ICBN).

The combination *P. hypertrophicum* (Dinter) Rappa & Camarrone is neither validly published, because the basionym is not cited fully (art. 33.2 ICBN), nor legitimate, since it includes the type of an earlier named taxon (art. 63.1 ICBN).

At present, the species is considered to belong to *Mesembryanthemum* L. subg. *Opophytum* (N.E. Br.) Bittrich (Bittrich 1987).

6. *Pterotetracoilanthus* Rappa & Camarrone (1960)

No type is named with the description, and the name is therefore invalid (art. 37.1 ICBN); no species are mentioned at all.

7. *Peratetracoilanthus* Rappa & Camarrone (1960)

Eight species are cited with the description, but no type is chosen, and the name is therefore invalidly published (art. 37.1 ICBN). The new combinations are invalid as well because no basionyms are given (art. 33.2 ICBN), and

the name of the genus is invalidly published (art. 43.1 ICBN).

TAXONOMY

1. *Pentacoilanthus* Rappa & Camarrone in Lavori dell'Istituto Botanico e Giardino Coloniale Palermo 14: 32 (1953), nom. illeg. Lectotype species: *Mesembryanthemum crystallinum* L.: 480 (1753) (here designated). Type: Dillenius: 231, t. 211 (1732).

Cryophytum N.E. Br.: 412 (1925). *Mesembryanthemum* L. subg. *Cryophytum* (N.E. Br.) Bittrich: 72 (1987). Type: *C. crystallinum* (L.) Schwant., fide N.E. Brown: 245 (1926).

Perapentacoilanthus Rappa & Camarrone 1960, nom. illeg., nom. invalid (see 3 below).

2. *Tetracoilanthus* Rappa & Camarrone in Lavori dell'Istituto Botanico e Giardino Coloniale Palermo 14: 34 (1953), nom. illeg. Type: *Mesembryanthemum cordifolium* L. f.: 260 (1782). Holotype: *Thunberg s.n.* 1773 in Herb. Montin (S!) [= *Aptenia cordifolia* (L. f.) Schwant.: 69 (1928)].

Note on the holotype: there is no doubt that the sheet cited and seen is the holotype since the description on the back refers to the original publication. The specimen agrees well with the description. The holotype was already recognized by both Norlindh and Glen in 1976, but there seems to be no published reference to this. In any case, the existence of the holotype supersedes the selection of a neotype by Preston & Sell (1988).

Aptenia N.E. Br.: 412 (1925).

Litocarpus L. Bol.: t. 261 (1927), nom. illeg.

3. *Perapentacoilanthus* Rappa & Camarrone in Lavori dell'Istituto Botanico e Giardino Coloniale Palermo 15: 6 (1955), nom. illeg., nom. invalid. No type given (see 1 above).

4. *Pentacoilanthus* Rappa & Camarrone in Lavori dell'Istituto Botanico e Giardino Coloniale Palermo 18: 13 (1960), nom. illeg., nom. invalid. No type given (see 1 above).

Sceletium N.E. Br.: 412 (1925). *Phyllobolus* N.E. Br. subg. *Sceletium* (N.E. Br.) Bittrich: 75 (1987).

5. *Pteropentacoilanthus* Rappa & Camarrone in Lavori dell'Istituto Botanico e Giardino Coloniale Palermo 18: 14 (1960), nom. illeg. Type species: *Mesembryanthemum hypertrophicum* Dinter [= *Halenbergia hypertrophica* (Dinter) Dinter: 200 (1937)]. Type: *Dinter* 3875 (B!).

Halenbergia Dinter: 200 (1937).

Opophytum N.E. Br.: 412 (1925). *Mesembryanthemum* L. subg. *Opophytum* (N.E. Br.) Bittrich: 73 (1987).

6. *Pterotetracoilanthus* Rappa & Camarrone in Lavori dell'Istituto Botanico e Giardino Coloniale Palermo 18: 14 (1960), nom. invalid. No type given. No species mentioned.

7. *Peratetracoilanthus* Rappa & Camarrone in Lavori dell'Istituto Botanico e Giardino Coloniale Palermo 18: 14–15 (1960), nom. invalid. No type given.

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