

## A REVIEW OF THE GENUS *ADROMISCHUS* LEMAIRE.\*

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[Indexed at end of the Article.]

The genus *Adromischus* was first described by Lemaire (Jard. Fleur. II. Misc. 59) in 1852, two species—*A. robustus* and *A. mucronatus*—being described by him for the first time, and nine species, originally described by their authors under *Cotyledon* Linn., were transferred [according to Berger (1)] by Lemaire to his new genus. These species all had in common a dwarf habit and a spicate or racemose arrangement of the usually erect flowers round the upper part of the elongated and scape-like inflorescence-rhachis in 1—2—3-flowered cymules, characters which these species do not share with typical species of *Cotyledon* Linn. (emend.) and which were utilised by Harvey (2) about 10 years later, when he monographed the known South African species of the genus for the first time, for his Sect. *Spicatae*. Under this section Harvey (2) described *Cotyledon Zeyheri* Harv., and redescribed *C. hemisphaerica* Linn., *C. cristata* Haw. and *C. mammillaris* Linn. f., the incorrectness of his treatment of these species being noted further on under their respective heads. Five species, which really also belong to this section, were further enumerated by Harvey (2) under the “Imperfectly known and doubtful species,” and he seems to have been quite ignorant of Lemaire’s paper, for he does not refer to the two species described by Lemaire under *Adromischus*, nor to this generic name. Harvey certainly appears to have regarded the characteristic inflorescence features as having no more than sectional value.

The same state of affairs seems to have obtained among all later authorities, for example Dr. S. Schonland in his several papers on the South African species of *Cotyledon*. No reference to Lemaire’s article is found until the late Professor Alwin Berger monographed the *Crassulaceae* (1), vol. 18. Here Berger resuscitated Lemaire’s generic name and gave the transferences of eight additional species, seven of which had been described under the generic name *Cotyledon* in recent times, so that the genus *Adromischus* Lem., as circumscribed by Berger (1), then stood accredited with 15 species, Lemaire’s two species being held by Berger to be conspecific with two previously described plants. In the present paper, the writer has added a further 15 to Berger’s total, either as hitherto undescribed species, or as new transferences, or new names, together with critical notes on some of the older species, as well as including three from other German authors and not previously referred to.†

\* This paper was completed in the year 1938, and references to some of the later authors, e.g. von Poellnitz, have been inserted by the Editor. (See also Appendix.)

† The latest area to yield an interesting series of species new to botanical science, is South-West Africa, where Dr. Kurt Dinter has been responsible for the discovery of these novelties. Thus the present article has included four from that Territory, but it would appear from current publications that correct identification of the species (judging from the descriptions published) is as rare as imaginative nomenclature for the species.

As re-circumscribed for purposes of this paper, the genus presents the following outstanding characteristics :

1. The stems are succulent in all species, though variously developed, being frequently very dwarf [*A. nanus* (N. E. Br.), *A. cristatus* (Haw.), *A. rupicolus* \*], usually about 10 cm. high, seldom up to 90 cm. (*A. kleinioides*) and rarely obsolescent [*A. humilis* (Marl.), *A. Schaeferianus* (Dtr.)] though one is described as a semi-shrub (*A. montium-Klinghardtii*).

As a rule they are unbranched, though a number have a few very short and stubby or podgy branches [*A. hemisphaericus* (Linn.), *A. umbraticolus*, *A. rotundifolius* (Haw.)], while at least one [*A. caryophyllaceus* (Burm. f.)], is very distinctly branched, and are erect and suffrutescent, being very rarely prostrate and rooting at the nodes [*A. mammillaris* (Linn. f.)].

In almost all species the stems are devoid of a hairy indumentum, but *A. cristatus* (Haw.) and *A. clavifolius* (Haw.) are unique in the possession of numerous short and closely interwoven reddish- to rusty-brown rather coarse and curly "aerial roots" which have water absorptive properties, according to Marloth. Such species as *A. hemisphaericus* (Linn.), *A. festivus*, etc., are frequently found with tufts of adventitious roots arising from the cauline nodes, but these should not be confused, at least as to function, with the aerial roots of the two former species. A true hairy indumentum occurs only in such species as *A. Schaeferianus* (Dinter), *A. leucothrix*, *A. Zeyheri* (Harv.), in which the leaves and inflorescence are pubescent or hispid, while in *A. cristatus* (Haw.) and *A. clavifolius* (Haw.) only the leaves are softly pubescent. In nearly all species of the genus, also, the younger parts at least are densely covered with a whitish bloom caused by a waxy secretion, this no doubt playing an important part in reducing transpiration losses.

The leaves, which are invariably thick and fleshy, are either alternate and closely crowded (or scattered), or opposite—see examples in sectional groups below—or rosulate [*A. humilis* (Marl.)], and, in several of the species, are beautifully spotted or blotched with purple to chocolate-brown flecks and dots—*A. festivus*, *A. Cooperi* (Baker), *A. Marianae* (Marl.), *A. tricolor*, *A. fusiformis* (Rolfe), *A. maculatus* (Salm Dyck), the spots or blotches usually flowing into an irregular and larger blotch under the apical margin. (Here may incidentally be noted that this blotching of the leaves is by no means so variable as some authorities have assumed.) In shape the leaves vary from flat and obovate-cuneate, e.g. *A. rhombifolius* (Haw.), *A. rotundifolius* (Haw.), *A. sphenophyllus*, to orbicular or sub-orbicular or reniform, e.g. *A. rupicolus*, *A. nanus* (N. E. Br.), to fusiform or spindle-shaped, e.g. *A. kleinioides*, *A. fusiformis* (Rolfe), *A. tricolor*, ovoid- to subglobose and terete in cross-section, e.g. *A. mammillaris* (Linn. f.), semiglobose [*A. hemisphaericus* (Linn.)], oblong or oblong-elliptic and semiterete in cross-section [*A. Marianae* (Marl.)], sometimes with a deep sulcus on the upper face (*A. leucothrix*). In all these the leaves are always distinctly sessile, but, on the other hand, *A. festivus*, *A. pachylophus*, *A. Zeyheri* (Harv.), *A. cristatus* (Haw.) and *A. clavifolius* (Haw.), share the unique property of having their much thickened terete to semiterete leaves narrowed from about the middle or lower third of their length into a distinct much thinner terete "petiolar" portion, the apices being flattened and crisped or undulate. In *A. Cooperi* (Baker), and *A. pachylophus* again, the apical part of the subcylindric leaves is flattened and expanded into an ovate or ovate-rotundate broader part, which is also a unique character in the genus, and to which the specific epithet of the latter refers.

The inflorescence invariably partakes of the nature of a typical spike or true raceme, though a hard and fast line cannot be drawn between groups of species on this score alone, since the flowers may be sessile even when mature, but become distinctly pedicelled in the fruiting stages. In their arrangement the flowers appear more usually to be singly disposed

\* Specific names cited without an author's name are new, and are accompanied by descriptions or validating references further on.

along the rhachis, which is most generally unbranched, but 3-flowered sessile or subsessile cymules occur in the lower half of the inflorescences of such species as *A. kleinioides*, *A. triflorus* (Linn. f.)—the specific epithet here being self-explanatory—*A. Alstoni* (Schonl. and Bak. f.), and *A. sphenophyllus*, typically so in the first two, and from 1-3 in the last two, whereas in *A. maculatus* (Salm Dyck) the number varies from 1-2 (so far as seen), though here the 1-flowered condition would appear to be the more usual.

Two well marked conditions of flower colour occur in the genus, the Little Namaqualand and Little Karoo species having striated green corolla-tubes with salver-shaped limbs which are either bright scarlet above and below or white above and scarlet to wine red on the lower face, while the more northerly species (i.e. those found north and, in the N.E., just south of the Orange River), have purple corolla-tubes and dull purple limbs which become completely reflexed over the apical part of the former, the throat being very generally of a richer and deeper purple.

The leaves of several (if not all) species are capable of rooting from the base [*A. umbraticolus*, C. A. Sm., *A. rupicolus*, *A. Mariana* (Marl.)], and in course of time will give rise to a new plant thus affording a ready method of propagation.

It would seem that at least some of the species of the genus are toxic to stock, an undetermined species from Namaqualand [probably *A. Alstoni* (Schonl. & Bak. f.)], being reported from that area as causing the so-called "krimpsiekte" in goats, while experimental feeding tests carried out with *A. umbraticolus* C. A. Sm. at Onderstepoort Veterinary Research Laboratories (near Pretoria), have shown this species to be fairly toxic with the development of cotyledonotoxin poisoning symptoms (*Cotyledonosis*), closely resembling those seen in animals poisoned by species of "true" *Cotyledon*.

Many of the species have already been accurately figured in colour (sub. gen. *Cotyledon*), though several of the plants represented by these rather excellent plates have been erroneously identified, as a glance through the synonymy given under each species below (e.g. *A. sphenophyllus*, *A. kleinioides*) will show, and it is not surprising to note that several of the older "Flora Capensis" species, in the light of critical examination, are at present known only from the type gathering [*A. Zeyheri* (Harv.), *A. filicaulis* (E. & Z.), *A. trigynus* (Burch.), *A. triflorus* (Linn. f.)]; some only from description [*A. rhombifolius* (Haw.)], the type being apparently non-existent; some only from a figure [*A. hemisphaericus* (Linn.), *A. Cooperi* (Baker), *A. kleinioides*, *A. fusiformis* (Rolfe)], of which the original specimens were apparently never kept, while yet other species have only been re-discovered once or thrice [*A. maculatus* (Salm Dyck), *A. caryophyllaceus* (Burm. f.), *A. mammillaris* (Linn. f.), *A. hemisphaericus* (Linn.), the first in 1908, 1926 and 1930, the second in 1878, the third in 1926 and 1930, and the last in c. 1824].

Many of the older species were prime favourites in European hot houses and all these were described in the first instance from cultivated plants, the earliest known species (as to actual date of publication) being *A. hemisphaericus* (Linn.), which was in cultivation in Sherard's famous garden at Eltham, near London, prior to 1737, when it was accurately figured and described by Dillenius, Linnaeus subsequently (1762) naming the species from this plate, while *A. caryophyllaceus* (Burm. f.) was figured by the elder Burmann in 1738, and named from this plate by the younger Burmann in 1768. There is however, a great deal of indirect evidence for believing that the elder Burmann figured the plant before Dillenius figured his, Burmann's figure being practically no more than a copy of a plate executed in colour at the Cape during the time of the elder v. d. Stel's governorship, i.e. prior to 1699, and contained in the famous Codex Witsenius, which was never published, but came to Burmann's hands via the Commelins. Thus he quotes that the plant "*A. Casp. Commel. in Catal. MSto ad Cod. Wits. vocatur Sedum Africanum montanum, foliis orbiculatis, floribus parvis, variegatis; & in Cod. Wits. Sedum Africanum montanum, minus, folio rotundo, flore ex rubro & albo variegato, ubi & dicitur quod in montibus*

crescat inter rupium fissuras, florens Novembri." He also gives synonyms from Boerhaave and Tournefort, as well as "Cotyledon Africanum, foliis oblongis, floribus umbellatis, fibrosa radice, *Oldenl.* (sphalm. *Olendent.*) *Catal. Plant. Afric.* p. 27," while Plukenet's (*Mant.* p. 169) "Sedum Africanum, angustis longioribus foliis, Jasmini floribus umbellatum," also cited, obviously foreshadows a later epithet of the specific name *Cotyledon jasminiflora* by which the species was described by Salm Dyck (see p. 628).

It is not, of course, possible always to judge of the correctness of synonymy involving the pre-Linnaean phrase names, but there is ample reason to believe that the Dutch authors cited above, at least, were all dealing with the same species, living material of which had been collected at the Cape, most probably by Oldenland during one of his excursions to the eastern part of the Colony after plants, and sent by Governor Simon v. d. Stel to the Dutch gardens at Amsterdam and Leiden. From these historical gardens plants were also sent to many other gardens by way of exchange, both Plukenet and Tournefort, for example, receiving South African plants on a number of occasions of which there are actual records. It thus seems reasonably safe to assume that, in the particular case under review, all the authors cited had the same plant in mind. This being the case, then it follows that historically, *A. caryophyllaceus* (Burm. f.) is by far the oldest recorded species of the genus.

The Haworthian species of the genus (described by Haworth as species of *Cotyledon*, of course), were all described from specimens sent by James Bowie from the Cape to and cultivated at Kew between the years 1815-25, while Salm Dyck, who will be remembered for his monumental volumes on the "Aloes" and "Mesems," also had specimens from the Cape about the same time, principally from Ecklon, in addition to receiving some material from his correspondent Haworth, and cultivated these in his famous succulent garden on the Continent. Then there was a lapse in the introduction of new species of the genus until Thomas Cooper visited South Africa to collect plant material for William Saunders of Reigate in the early 60's. Three species of the genus were later figured for Saunders' "Refugium Botanicum"—*A. Cooperi* (Baker), *A. sphenophyllus*, *A. maculatus* (Salm Dyck)—from specimens sent to Reigate by Cooper, but it is only of comparatively recent date that such species as *A. cristatus* (Haw.) and *A. clavifolius* (Haw.), etc., are again coming into favour in Europe, a fine collection of species of the genus being in cultivation in the Royal Botanic Gardens, Kew (1930).

In general, unless exceptionally well dried, or accompanied by detailed notes on all parts of the fresh plant, accurate identification of the species from herbarium or other dried material is extremely difficult and in some cases well-nigh impossible. To obviate this difficulty in the future preservation of dried specimens should be duplicated by spirit material, as well as by accurate, wholly or partly coloured figures of the complete plant, together with notes made from the fresh plant of those features which are liable to disappear in the preservative fluid. The writer has found a system of "nature prints" made from the fresh leaves very useful in reconstructing their shape from the dried material. For this purpose cross-sections are cut at short intervals from one or more leaves with an old razor blade or sharp penknife, the exposed surface being inked over at every successive cut and carefully pressed on to a slip of paper in the exact order of the sections, this being supplemented by a "print" from a median longitudinal section of one or more leaves, care being naturally exercised not to exert undue pressure on the section in making each "print." The outlines are then very carefully inked over in india ink.

It is quite obvious, of course, that the system of "nature prints" could be used very effectively in succulent genera such as *Aloe*, *Haworthia*, *Crassula*, *Cotyledon*, *Euphorbia*, *Trichocaulon*, etc., and that where polymorphism in the leaves occurs, a representative series of "prints" could be made and attached to the sheet on which the dried specimen is afterwards mounted.

In maintaining *Adromischus* Lem. (emend.) as a genus distinct from *Cotyledon* Linn. (emend.), chief reliance is placed upon the characters presented by the inflorescence, in which the spicate to racemose arrangement of the 1-3-flowered cymules (as opposed to the paniced inflorescence of typical species of *Cotyledon*), is correlated with the shape of the corolla-tube, which is either somewhat ventricose above the base or narrowly cylindrical, and the fusion of the segments so as to form a salver-shaped spreading or at length reflexing 5-toothed limb (rarely 5-lobed). Schonland (<sup>3</sup>), in his last paper on the genus *Cotyledon*, maintains Harvey's two original sections—PANICULATAE (= *Cotyledon* Linn., emend.) and SPICATAE (= *Adromischus* Lem., emend.)—but comes to the erroneous conclusion that the branching of the inflorescence of *Cotyledon caryophyllacea* Burm. f. (*loc. cit.* 151) bridges over the gap between the two sections. The arrangement of the flowers along the inflorescence-rhachis and its few racemose branches is, however, that of a typical raceme, and the structure of the corolla-tube and limb is that of other species of *Adromischus* Lem. (emend.), i.e. *Cotyledon* § *Spicatae* Harv. Branching of the inflorescence-rhachis also occurs, for example, in such species as *A. trigynus* (Burch.), *A. umbraticolus* C. A. Sm., *A. sphenophyllus*, *A. caryophyllaceus* (Burm. f.), etc., but in each case the flowers, apart from their structure, are always spicately or racemosely arranged and not paniced at the apex of the branches.

The known species of *Adromischus* Lem. appear to be readily capable of being grouped in two subdivisions, for which purpose (a), the inflorescence parts, and (b), the disposition of the leaves may be utilised :

(a) Owing to the inconstancy of the character presented by the type of inflorescence and the disposition of the flowers along the rhachis (1-2-3 at a node, though in some the 3-flowered condition remains constant), neither of the two characters could be employed satisfactorily for subdividing the genus. The nature of the limb of the corolla, however, is far more useful. Comparison, for example, of the corollas of such species as *A. kleinioides*, *A. rotundifolius* (Haw.), *A. maculatus* (Salm Dyck), *A. caryophyllaceus* (Burm. f.), and *A. mammillaris* (Linn. f.), with those of *A. rupicolus*, *A. nanus* (N. E. Br.), *A. umbraticolus* C. A. Sm., *A. procurvus* (N. E. Br.), show in the former group relatively long apical processes or teeth on the corolla-lobes, but these are absent or at most very much reduced in the latter group. This difference is also correlated with colour differences. Thus in the first group the corolla-tube is green and slightly ventricose above the base, and the limb white with (or without) rosy to pale scarlet flushes along the middle of each lobe, and usually scarlet to rosy-red below, or the limb entirely reddish to wine red or rusty red-brown. In the second group the corolla-tube is purple or purplish-mauve and cylindrical, with a deep purple or purply-mauve throat, the limb being similarly coloured on both faces, though paler along the margins.

(b) A more obvious and conveniently described character for subdivision of the genus into two well marked groups is found in the disposition of the leaves on the stem, a consideration of which leads to the following :

**I. Alternifolii** \*, Sect. nov.—Leaves alternate, usual closely crowded, though occasionally loosely scattered along the stem or its branches, rarely subrosulate.

e.g. *A. fusiformis* (Rolfe), *A. hemisphaericus* (Linn.), *A. mammillaris* (Linn. f.), *A. rotundifolius* (Haw.), *A. kleinioides*, *A. caryophyllaceus* (Burm. f.), etc.

**II. Oppositifolii**, Sect. nov.—Leaves opposite and decussate.

e.g. *A. maculatus* (Salm Dyck), *A. Cooperi* (Baker), *A. festivus*, *A. Bolusii* (Schonl.), *A. Marianae* (Marl.), etc.

For further subdivision each of the two sections may be divided on the shape presented by the leaves in cross-section, a character already employed by Berger (<sup>1</sup>), who did not, however, employ sectional or subsectional names. Thus he separated those species with

\* In some of the species belonging to this section, the leaves are apparently sub-opposite, but then the one leaf is always much shorter than the one sub-opposite to it.

flattened leaves as one group, and all the other species known to him fell into another group which he further subdivided according as to whether the leaves had a semiterete or terete cross-section. Utilising the characters here noted under each of the two sections above proposed, it follows that two subsections of each section are distinguished from one another on the same character, as will be seen from the following :

Sect. ALTERNIFOLII :

**A. Platyphylli**, Subsect. nov.—Leaves flattened (i.e. breadth in anterior half much exceeding the thickness, as seen in cross-section).

e.g. *A. rupicolus*, *A. rotundifolius* (Haw.), *A. humilis* (Marl.), *A. nanus* (N. E. Br.), *A. umbraticolus* C. A. Sm.

**B. Heterophylli**, Subsect. nov.—Leaves terete or more or less semicircular (i.e. breadth more or less equal to the thickness, as seen in cross-section).

e.g. *A. cristatus* (Haw.), *A. clavifolius* (Haw.), *A. mammillaris* (Linn. f.), *A. pachylophus*, *A. fusiformis* (Rolfe), *A. leucothrix*, *A. kleinioides*, *A. hemisphaericus* (Linn.), etc.

Sect. OPPOSITIFOLII :

**A. Planifolii**, Subsect. nov.—Leaves flat (i.e. breadth in anterior half much exceeding the thickness, as seen in cross-section).

e.g. *A. Bolusii* (Schonl.), *A. Alstoni* (Schonl. & Bak. f.), *A. sphenophyllus*, *A. maculatus* (Salm Dyck), *A. triflorus* (Linn. f.), etc.

**B. Crassifolii**, Subsect. nov.—Leaves terete or semiterete (i.e. breadth more or less equal to the thickness, as seen in cross-section).

e.g. *A. festivus*, *A. Mariana* (Marl.), *A. Cooperi* (Baker), etc.

Using the above as a basis, the species falling under each subdivision may very readily be distinguished from one another by utilising such characters as are afforded by indumentum, blotching of the leaves, flower colour, etc. This article is not offered as a revision of the whole genus, so that several species mentioned in the above general survey are not mentioned further on again, the following notes referring only to such species as (in the author's opinion) were wrongly interpreted, and such as may be regarded as hitherto undescribed, the tentative key being supplied for further discrimination between the species dealt with, and to indicate the rôle leaves and flowers play in the distinctions drawn.

In order to facilitate references to specimens dealt with, the herbarium in or from which a particular specimen has been examined is indicated by the following abbreviations, but those not seen, but cited, have the herbarium names only slightly abbreviated :

Pa, National Herbarium, Division of Plant Industry, Pretoria.

K, Herbarium of the Royal Botanic Gardens, Kew.

These abbreviations are inserted in brackets after each citation. This has the advantage of indicating to others where types are preserved, and tends to eliminate confusion in the interpretations of specific names assigned to the specimens examined.

## KEY TO THE SPECIES.

Leaves opposite and decussate :

Leaves markedly flattened on both sides :

Corolla-tube green ; limb white or pale rosy :

Leaves blotched or spotted :

Leaves minutely dotted in the upper half.

Leaves with large blotches all over.

Leaves neither spotted nor blotched :

Leaves thickest in middle and upper half.

Leaves thickest in the lower half :

Flowers in 1-flowered cymules only.

Flowers typically in 3-flowered cymules :

Corolla-lobes ovate, obtuse, white above.

Corolla-lobes deltoid acuminate, rosy above.

Corolla-tube never green, but usually dull purple-mauve ; limb pale purple-mauve or mauve.

Leaves not flattened on both sides :

Leaves terete or subterete :

Apex of leaf expanded into a deltoid-ovate part broader than the leaf itself ; limb of corolla wine-red and papillose in the throat.

Apex of leaf not as above ; limb of corolla white or rosy :

Leaves constricted at the base into a short petiolar portion, and flattened at the apex, ashy-grey between the large blotches.

Leaves fusiform, the apex not flattened, green between the blotches.

Leaves oblong, flattened and subconcave above, convex below, thus semiterete in cross-section.

Leaves alternate and scattered or crowded :

Leaves markedly flattened on both sides :

Leaves closely spotted, especially in the upper half, and with firm white cartilagineous margins.

Leaves not as above :

Corolla-tube green ; limb white to rosy or deep maroon above, scarlet or maroon below ;

Plants acaulescent, tuberous-rooted, with rosulate leaves.

Plants distinctly caulescent, fibrous-rooted, with the leaves crowded below the apices.

Corolla-tube never green, usually purplish-brown to -mauve ; limb mauve to purple on both sides :

Corolla-tube somewhat curved.

Corolla-tube straight :

Leaves subrosulate ; stems obsolescent.

Leaves linear-oblong to elliptic-oblong sometimes crowded, but scattered ; stems welldeveloped :

Leaves " ovate-cuneate or suborbicular "

Leaves oblong to oblong-cuneate or obovate-cuneate.

Leaves not as above :

Leaves flattened or subconcave or subconvex above, but always markedly rounded below :

Leaves with a distinct indumentum :

Leaves elongate and deeply sulcate on the upper face, closely covered with rigid white bristly hairs.

Leaves not as in the former, " almost spherical," pubescent.

Leaves glabrous, at most with a waxy bloom :

Leaves semiglobose, papillose, with acute margins, at most 1.5 cm. long.

Leaves obovate or spatulate to oblong-elliptic, epapillose and glossy green, with rounded margins, up to 3 cm. long.

4. *A. rhombifolius*.

1. *A. maculatus*.

3. *A. sphenophyllus*.

\* *A. Bolusii*.

2. *A. triflorus*.

20. *A. alston*.

26. *A. rupicolus*.

13. *A. Cooperi*.

15. *A. festivus*.

12. *A. tricolor*.

21. *A. Mariana*.

23. *A. nanus*.

22. *A. humilis*

6. *A. rotundifolius*.

24. *A. procurvus*.

28. *A. saxicolus*.

25. *A. trigynus*.

27. *A. umbraticolus*.

19. *A. leucothrix*.

*A. Schaeferianus*.

5. *A. hemisphaericus*.

7. *A. caryophyllaceus*.

\* The specific names not numbered are not referred to in the text.

Leaves more or less terete :

Leaves abruptly narrowed into a much thinner "petiolar" part in the lower third :

Stems densely covered with rusty- to red-brown aerial roots :

Leaves flabelliform with a flattened crisped apex, and nearly as broad as long in the thick part.

17. *A. cristatus*.

Leaves elongate and subcylindric, slightly crisped at the narrow flattened apex, the thicker part very much longer than broad.

18. *A. clavifolius*.

Stems at most with nodal tufts of adventitious roots :

Leaves glabrous, expanding into a broad ovate apical part much wider than the leaves.

14. *A. pachylophus*.

Leaves pubescent, at most with a flattened but not expanded apex.

16. *A. Zeyheri*.

Leaves without a definite "petiolar" part, at most only insensibly tapering at the base :

Leaves 1-2, "almost spherical".

*A. sphaerophyllus*.

Leaves numerous :

Stems prostrate and rooting at the nodes, the vegetative parts very like those of *Kleimia radicans*.

11. *A. mammillaris*.

Stems (where developed) erect :

Stems simple or many, tall and over 10 cm. high :

[*hardtii*.

"Semi-shrub, with many stems ; flowers greenish-red."

*A. montium-king-*

Plants not as above ; stems simple and elongated :

Corolla limb pallid ; leaves flecked with purple.

*A. fusiformis*.

Corolla limb deep maroon to red-brown on both sides ; leaves unspotted.

10. *A. kleinioides*.

Stems very dwarf (or almost to absent) :

Leaves oblong, narrowed to the base.

9. *A. Marlothii*.

Leaves fusiform ("tereti-acuminata"), tapering at both ends.

8. *A. filicaulis*.

Leaves "pea-shaped," with red dots.

*A. Keihackii*.

### 1. *A. maculatus* (*Salm Dyck*) *Lem. ex Berger*.

Of this species there is a very fine coloured figure of a complete plant in the collection of drawings at Kew, dated "February 15, 1824," when it was made from "a typical plant received from Salm Dyck. Compared with an authentic specimen in Haworth's Herbarium at Oxford. Oct. 31, 1901. N. E. Br." In the above collection there is also a very careful drawing of Haworth's specimen, showing a complete inflorescence and two leaves, and against the former Haworth noted "Kew Sept. 28, 1824," while against the two leaves he noted "Hot ironed. Ex. horto, Apr. 1827." The inflorescence of Haworth's specimen thus in all probability came from the specimen "received from Salm Dyck," and from the extremely close match of the illustrations, there can be little doubt that they all represent the same species, viz. *Cotyledon* \* *maculata* Salm Dyck [Obs. Bot. in Cat. Hort. Dyck. 5 (1820), ex Haw., Rev. Pl. Succ. 21 (1821)]. Now the figure of *C. maculata* in Saund., Ref. Bot. I. t. 35 (1869), agrees exactly with the figures already cited, except that the flowers are always in pairs (one of which is generally a bud) in the lower part of the inflorescence, but are singly disposed at the nodes in the apical part, whereas Haworth's specimen and the figures just cited all show the sessile flowers to be singly disposed along the rhachis, i.e. in the form of a simple spike. Specimens, again, collected by the writer at Robertson in April, 1926, flowering at the Division of Plant Industry in December of the same year, and undoubtedly referable to this species from their close match with the Kew plate, also showed single flowers at the nodes of the inflorescence rhachis, as will be seen in the accompanying Figure 1.

\* For convenience, the species in these notes are cited in the text hereafter by their old name under *Cotyledon* (*C.*).





FIG. 1.—*A. maculatus* (Salm Dyck) Lem. ex Berger. See text.

Thus it would appear that the plant may show a variation of from 1-2 (apparently never more) flowers at the nodes, with the 1-flowered nodal condition as the more typical. Such variation in what must be regarded as an originally 3-florous cymule is by no means uncommon in the genus, occurring, for example, in *A. sphenophyllus*, the next species but one. However, in selecting the type of the name *C. maculata* Salm Dyck, the choice lies between the coloured plate made at Kew and Haworth's specimens, since Salm Dyck does not appear to have kept a specimen of the plant originally described by him. Haworth's specimens are made up of parts introduced, as noted above, at different dates, and the leaves "ex horto" were (in view of the different labelling) certainly not obtained from the same plant as the inflorescence. The coloured plate in the Kew collection should therefore be selected as representing the typical plant, the more so since it was made from specimens named and sent as *C. maculata* by Salm Dyck himself.

With reference to the "Refugium Botanicum" plate (t. 35), identified with this species above, Schonland and Baker fil. (4): state that it "may represent a spotted variety of *C. rhombifolia* Haw.", as typified (on their authority) by t. 36 of the same work. The latter, however, cannot be regarded as that species (see No. 3). Then, again, in his last paper on the genus *Cotyledon* Linn. (sensu Fl. Cap.), Schonland (3), regards "*C. maculata* Salm Dyck" as a doubtful synonym of "*C. rhombifolia* Haw.", stating: "It is . . . a little doubtful whether the plant he [Baker] figured [Ref. Bot. t. 35] as *C. maculata* Salm Dyck is really that species," but does not advance any reasons for this statement, though he further suggests (3) that "the true *C. maculata* Salm Dyck may be identical [sic!] with *C. trigyna* Burch." In both statements Schonland erred through erroneously identifying specimens of *C. nana* N. E. Br. as *C. maculata* Salm Dyck, from which it differs conspicuously in the structure of its flowers, though agreeing with *C. trigyna* Burch. in habit and floral characters.

For convenience Salm Dyck's original diagnosis may be here inserted:

"*C. suffrutescens*, foliis ovato-spathulatis basi subauriculatis, carnosis, nitidis, utrinque maculis atro-rubentibus notatis. Floribus spicatis, subalternis." Schonland and Baker fil. (*loc. supra cit.*) giving the following notes made from Haworth's specimens: "Leaves few, obovate or obcordate emarginate, apex obtuse with a short acumen, margin cartilagineous sometimes undulate, base cuneate, 4.2-4.5 cm. long, 2.3-3.3 cm. broad at the broadest point which is about one fourth of the total length from the apex. Flowers sessile, solitary, numerous, erecto-patent, alternate, arranged in a lax spike. Peduncle terminal, terete, of a purplish colour. Calyx-lobes short (about 1 mm. long). Corolla tubular, somewhat ventricose above the calyx,  $\pm$  8 mm. long; lobes erect or erecto-patent,  $\pm$  3 mm. long, acute." With this description to go by, especially that part relating to the flowers, it is difficult to understand how the above errors cropped up in Dr. Schonland's paper.

The following represents the revised synonymy for the species:

**A. maculatus** (*Salm Dyck*) Lem. in Jard. Fleur. II. Misc. 60 (1852), ex Berger in Engl. and Prantl, Nat. Pflanzenfam, Vol. 18, a. 416 (1930).

*Cotyledon maculatus* Salm Dyck, Obs. Bot. 5 (1820), ex Haw., Rev. Pl. Succ. 1821; Eckl. & Zeyh., Enum. No. 1973 (1836); Harv. in Harv. & Sond., Fl. Cap. II. 378 (1861-62); Baker in Saund., Ref. Bot. I. t. 35 (1869); Schonl. & Bak. f. in Journ. Bot. Vol. 40. 92 (1902).

*C. alternans* Salm Dyck ex Haw., Suppl. Pl. Succ. 26 (1819); non Willd. (1799).

*A. mucronatus* Lem. in Jard. Fleur. II. Misc. 60 (1852), ex Ind. Kew. & Berger (*loc. cit.*).

*C. hemisphaerica* Harv. in Harv. & Sond., Fl. Cap. II. 376 (1861-62), partim; non Linn. (1762).

SOUTH WESTERN REGION—Worcester distr. : “ In aridis in convalle flum. Hex River, prope De Doorns, 1600 ped., Jan. 1908,” *Bolus* 13044! (K.). Robertson distr. : Near Robertson Station, on the western slope of a rocky hill, associated with *Gasteria carinata* Haw. in shady places, April 1926, flowering at Division Plant Industry, Dec. 1926, *Smith in Nat. Herb.* 8875! (Pa).

CENTRAL REGION—Oudtshoorn distr. : In a poort on shale of the Bokkeveld series, between Oudtshoorn and Montagu Pass, April 1930, *van Nouhuys*! s.n. (Pa).

**2. *A. triflorus* (Linn. f.) Berger.**

The type specimen of this species was collected by Thunberg “ prope Zekorivier ” [Zeekoerivier] in the Clanwilliam district, during Dec.–Jan. 1774–75, and a much more detailed and amplified description given by him (Fl. Cap. Ed. Schult. 396 : 1823) than was first supplied by the younger Linnaeus (1781), and is here quoted for purposes of reference : “ Caulis carnosus, crassus, herbaceus, glaber. Folia : inferne sessilia, crassa, obtusissima, subtruncata, inferne attenuata, basi teretiuscula, approximata, erecta, subincurva, glabra, bipollicaria, ultra pollicem lata, pallida viridia. Omnino referunt folia Cotyledonis orbiculatae. Flores subterni, spica longa, spithamea, rhachis angulata. Bractea sub singulo flore minuta. Perianthium monophyllum, 5-dentatum, erectum, viride, brevissimum. Corolla 1-petala, tubulosa ; tubus cylindricus, striatus, viridi-rufescens, subunguicularis, glaber : Limbus 5-partitus patens : Lacinae ovatae, obtusae, intus albae, extus rufescentes, lineam longae. Filamentae 10, tubo inserta, paulum adnata, subulata erecta, viridia, tubo breviora. Antherae ovatae, minutae, flavae. Nectarii squamae 5, ad fundum geminis, subexcisae, albae. Germina supera 5, subulata, glabra, viridia. Stigmata acuta. Capsula 5, subulata.”

So far as is known, the species appears not to have been found since Thunberg’s time, though a specimen described by Lemaire in 1852 (*loc. infra cit.*) as *Adromischus robustus* Lem., is regarded by Berger (*loc. infra cit.*) as conspecific with Thunberg’s plant, though it is not known from what locality Lemaire had his plant(s). Both Salm Dyck (Obs. Bot. 6 : 1820) and Haworth (Rev. Pl. Succ. 19 : 1821) described what they took to be *C. triflora* Linn. f., but were guided probably more by the 3-florous condition of the cymules in the inflorescence of their plants, which these exhibited in common with Thunberg’s specimen, and their erroneous identifications were perhaps natural in view of the inadequate diagnosis of *C. triflora* given by both the younger Linnaeus (*loc. infra cit.*) and Thunberg (Prodr. Pl. Cap. 83 : 1794), which they must have consulted, since the latter’s “ Fl. Cap. Ed. Schultes ” did not appear till 1823 (see also note under the next species, No. 3).

Then Harvey (<sup>2</sup>), for no clear reason, reduced *C. triflora* Linn. f., the type specimen of which he had seen, under *C. hemisphaerica* Linn., though he cites the typical plant of the latter as figured in Dill. Hort. Eltham. t. 95, f. 111 and DC. Hist. Pl. Grass. t. 87! The leaves of the former species, however, differ so profoundly in shape size and cross-section from those of the latter, that Harvey’s reduction is wholly unwarrantable (see also note under No. 5).

*A. triflorus* (Linn. f.) comes closest to *A. sphenophyllus* (the next species), but differs from this in several characters, such as size and leaf-shape, colour of flowers and shape of its corolla-lobes, smaller and less excised nectarial scales, which taken in conjunction with its “ western ” distribution, as opposed to the “ south-western ” distribution of the other, have led the writer to keep the two species apart. The following embraces the synonymy treated above :

***A. triflorus* (Linn. f.) Berger** l.c. (416).

*Cotyledon triflora* Linn. f., Suppl. 242 (1781) ; Murr., Syst. Ed. xiv. 429 (1784) ; Thunb., Prodr. 83 (1794) ; & Fl. Cap. Ed. Schultes, 396 (1823) ; *non auct. alior.*

*C. hemisphaerica* Harv. l.c. 376, partim ; non Linn. (1762).

*A. robustus* Lem. in Jard. Fleur. II. Misc. 60 (1852), ex Berger l.c.

WESTERN REGION—Clanwilliam Div.: Near the Zeekoerivier, Dec.—Jan., 1774–75, Thunberg. (Type in Herb. Thunb., Upsala).

**3. *A. sphenophyllus* C. A. Sm., nom. nov.**

A dried specimen of the type gathering of the species, figured as *C. rhombifolia* Haw. in Saund., Ref. Bot. I. t. 36 (1869), is in Herb. Kew., having been presented by W. W. Saunders in 1877. In this the inflorescence is simple and the flowers singly disposed at the nodes. Cooper's original specimen, i.e. the wild plant (*Cooper* 2338! C. B. S., *sine loc. exact.*) is also in Herb. Kew., and the inflorescences mounted on the sheet show one with 1-, and the other with 1–3-flowered cymules. Neither, however, represents the typical form of Haworth's species (*v. seq.*), but they both match a fine coloured illustration (in the collection of drawings at Kew) of a plant which is, however, without inflorescence "received [as *C. triflora*] from the Prince of Salm in the year 1823," and against which N. E. Brown has noted: "This quite agrees with the leafy part of the specimen of *C. triflora* in Haworth's Herb. at Oxford. Compared Oct. 30, 1901." There can be no doubt that the specimen in Haworth's herbarium was sent him by Salm Dyck at the same time that the latter sent the specimen to Kew, and that they came from the same original gathering. This is further borne out by the fact that both Salm Dyck and Haworth describe "*C. triflora* Linn. f.," and their descriptions agree very closely, while there can be no doubt that also in inflorescence details the latter species [i.e. *C. triflora* Salm Dyck (non Linn. f.)] agrees with those in *C. rhombifolia* Baker (non Haw.), though the inflorescence of the former in Haworth's herbarium shows signs of having been injured by mechanical or biotic agencies. From the descriptions and specimens available, however, it would appear that the cymules may be 1–3-flowered in this species.

Since neither of the two specific names may validly be applied to the species under consideration, the following new name (with details of synonymy) is proposed for it under *Adromischus*:

***A. sphenophyllus* C. A. Sm., nom. nov.**

*Cotyledon triflora* Salm Dyck, Obs. Bot. 6 (1820); Haw., Rev. Pl. Succ. 19 (1821); Schonl. & Baker f. l.c. (91), non Linn. f. (1781).

*C. rhombifolia* Baker in Saund., Ref. Bot. I. t. 36 (1869); Schonl. & Baker f. l.c. (92); Schonl. in Rec. Alb. Mus. Vol. 3, 154 (1915), excl. syn.; non Haw. (1825).

*A. rhombifolius* Berger l.c. (416); non *C. rhombifolia* Haw. (1825).

"C. B. S." (*sine loc. exact.*): *Cult. spec. e Hort. Saund. leg. Cooper!* Type (K); *Cooper* 2338! Syn-type (K).

CENTRAL REGION—Willowmore distr.: On hillside near Willowmore, anno 1931, *Steyn!* s.n. (Pa).

N.B.—The specimen referred to under "*C. rhombifolia* Haw." by Schonl. & Baker f. (*loc. supra cit.*) as having "flowered at Grahamstown in the Spring of 1898" no doubt belongs here.

**4. *A. rhombifolius* (Haw.) Lem. ex Berger.**

This species was originally described by Haworth (*loc. infra cit.*) from a non-flowering specimen which was apparently never kept, since there is no plant so named in Haworth's herbarium at Oxford. From his description, however, there can be little doubt that the

specimen figured and described by Baker under the name *C. rhombifolia* in Saund., Ref. Bot. I. t. 36, is distinct in habit and shape of its leaves from Haworth's plant. Fresh specimens from between Oudtshoorn and Montagu Pass, and recently examined by the writer, agree perfectly with Haworth's description, so far as this goes, and serve still further to distinguish Baker's plant from the species under discussion. Unfortunately it has not been possible to give an amended description of the species from the fresh material available, but this defect may be rectified at a later date.

**A. rhombifolius** (Haw.) Lem. in Jard. Fleur. II, Misc. 60 (1852), *ex Berger*, l.c. 416, *quoad nom. sol.*

*Cotyledon rhombifolia* Haw. in Phil. Mag. 1825, 33; DC., Prod. Vol. 3, 398 (1828); Harv. l.c. 378; Schonl. l.c. 154, partim, et excl. syn.

CENTRAL REGION—Oudtshoorn distr.: Between Oudtshoorn and Montagu Pass, 7 miles from North Station, in Bokkeveld series on outcrops of Table Mountain Sandstone, April 1930, *van Nouhuys!* s.n. (Pa).

Originally described from specimens sent from the Cape to Kew by James Bowie in 1823, but there is no record so far known of where he collected his specimens, nor has a single specimen been kept.

**5. A. hemisphaericus** (Linn.) Lem. *ex Berger*.

This species has apparently never been correctly interpreted by monographers of the South African species of *Cotyledon* Linn. (sensu Fl. Cap.), except perhaps by Berger. It was originally based by Linnaeus on a Dillenian figure—Hort. Eltham. t. 95, f. 111 (1738), where it is named as "*Cotyledon Capensis, folio semiglobato.*" According to Druce and Vines (Dillen. Herb. 165: 1907), there is no specimen of the species in the Dillenian Herbarium at Oxford, nor is there such a specimen either in Herb. Cliff. or Herb. Linn. in London, but Dillenius' figure (which thus represents the type figure) is accompanied by such an excellently drawn up description of the plant that, in view of the statement in the first sentence above, this description is here given in full, the more so since the original work may not readily be accessible to others: "Cauliculi carnosi lenti sunt, non recta protensi, sed incurvi & pleurumque tortuosi, laeves, spadicei, variis lineis cinereis, nunc rectis, nunc transversis, nunc inaequali ordine connexis distincti, quibus hinc inde folia singularia, in summitato vero plura temere apposita sunt, levi tactu decidentia colorem, tenuibus punctis undique notata, crassa; inferius, seu ad basim cauliculorum, rotundiora, superius seu versus summitatem magis plana, lenius nempe parte interiori elevata, exteriori vero, ut in illis, protuberante & pulvinata, succulenta, sapore acerbo & adstringente praedita.

"A palmari ad dodrantalem & pedalem subinde nascitur altitudinem, & caules carnosolignosos, magis ramosos, acquirit, sed longo temporis spatio indiget, ut adhanc altitudinem perveniat; lente enim nascitur, & facile ob succositatem putrescit.

"Porro flores aegre fert, nec eos una vice amplius vidisse memini, eosque imperfectos: scapus erat dodrantalis subteres, glaber, obsolete virescens, secundum cujus longitudinem gemmae quaedam tenues, in summitate vero flores oblonges sex septemve nascebantur, quinque lineis impressis notati, virescentes, in extremitate purpurascens, calyce monophyllo, in quinque laciniae diviso excepti, & hujus ope scapo annexi, tenui ligula ab basim praedita, qui quales suturi essent, dicere non habeo, cum apertos videre non contingerit. . . . Haec Augusto mense observare licuit."

Two other published figures of the above species, both in colour and both correctly identified specifically, are known to the writer: Roth, Bot. Abhandl. & Beob. t. 6 (1787) and DC., Hist. Pl. Grass. t. 87 (1799-1829).

Roth's figure is excellent for the habit and leaves of the plant and typical of the species as represented by the type figure. He figures the flowers, however, as being borne in sessile pairs among the apical leaves on the short and podgy lateral upper branches of the stem, and does not give a detailed description of the plant in the text, but in the index to the plates in the work he describes the flowers as "in capituli speciem collecti, quorum bini hic [i.e. in the plate] conspiciuntur," and "initia forte spicatum, quae tamen absque mutatione molis perierunt." The young inflorescence is frequently (especially in cultivated specimens) injured by aphids, and so gives rise to various teratological forms, such as suppression of the main axis of the inflorescence, oppositely borne 1-6-flowered cymules, etc. Hence the condition figured by Roth.

De Candolle's exquisite plate again is perfect for the species, though not illustrating the characteristic habit so well as Dillenius' or Roth's figure does, but showing the shape, colouration and papillose texture of the leaves exceptionally well, these being further described as "sparsa, sessilia, ovato-rotunda, subtus valde convexa et inde semiglobata, subobtusa, pinguia, glabra, furfure punctata."

In the Kew collection there is a fine coloured illustration of the type plant of *C. cuneiformis* Haw. (Phil. Mag. 1828, 185), which is noted as "Received from the Cape of Good Hope in 1823 from Mr. Bowie." Though not in flower at the time of figuring, the plant agrees in all essential vegetative characters with the three plates of *C. hemisphaerica* Linn., and there can be very little doubt that Haworth's plant is conspecific with the latter.

None of these plates presents any difficulty since they clearly represent one and the same plant, yet so consistently has the species under review been misinterpreted by various authors that one can only conclude that (excluding for the moment Haworth's and Roth's figures as being less readily accessible) the Dillenian and De Candollean plates were never properly referred to. Thus Schonland<sup>(3)</sup> reduces "*C. triflora* Linn. f." and "*C. rotundifolia* Haw.", both of which he had wrongly interpreted, under "*C. hemisphaerica* Linn.", also stating (*loc. cit.* 153) that *C. nana* N. E. Br. "evidently [*sic!*] belongs to this species though it has only a one-flowered peduncle," and this in spite of the very different and distinctive type of flowers produced by the latter and the conspicuous blotching of its leaves. Of Haworth's *C. rotundifolia* there is an exact drawing in the Kew collection of drawings (a photo of the type specimen is given in Journ. Bot. Vol. 40, t. 435), and comparison of this taken in conjunction with the existing descriptions of the species, indicates clearly the very distinct specific differences between *C. rotundifolia* Haw. and *C. hemisphaerica* Linn. The differences in foliage characters may best be illustrated by cross-sections as shown in the following figure :

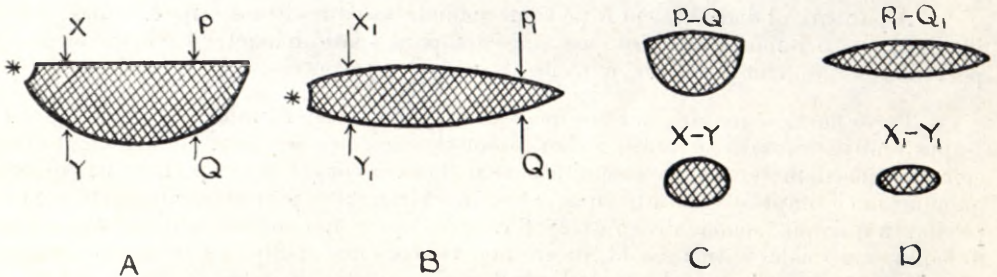


FIG. 2.—A. Median longitudinal section through the fresh leaf of *A. hemisphaericus* (Linn.), with transverse sections in the regions X—Y and P—Q indicated by C; B. Median longitudinal section through the fresh leaf of *A. rotundifolius* (Haw.), with transverse sections in the regions X<sub>1</sub>—Y<sub>1</sub> and P<sub>1</sub>—Q<sub>1</sub> indicated by D. The base is marked by an asterisk.

[*C. triflora* Linn. f. similarly differs from *C. hemisphaerica* Linn. in having leaves which are flat, i.e. their thickness in the anterior half (as seen in cross-section) much exceeds the breadth, apart even from the fact that they are opposite in that species and its flowers are arranged in 3-flowered cymes along the inflorescence rhachis.]

Harvey (<sup>1</sup>) also reduces *C. triflora* Linn. f. (of which he had actually seen the type, and which he cites as of "Thunb. Fl. Cap. p. 396") under *C. hemisphaerica* Linn., and in this he may have been followed by Schonland, but from the previous paragraph it is evident that this reduction is quite untenable. From the fact that Harvey describes the leaves as "flat, 1-2 inches long, 1-1½ inches wide," as well as other details, it would appear that he based his description of "*C. hemisphaerica* Linn." for the greater part on the type specimen (Thunberg's) of *C. triflora* Linn. f. and Ecklon & Zeyher's specimens of *C. maculata* and *C. rhombifolia*. Baker had also, as far back as 1869, pointed out that Harvey's synonymy for *C. hemisphaerica* Linn. was erroneous, correctly laying stress on the shape, relative size and colouration of the leaves of the latter species, of which he had himself seen live cultivated specimens as well as de Candolle's fine plate above noted, though Baker, like Harvey, omitted to note the all important fact that in *C. hemisphaerica* Linn. the leaves are alternate, and opposite in the other three species regarded as conspecific with it.

The writer has also examined the type plant of *C. nana* N. E. Br. (see No. 12) at Kew and cannot endorse Dr. Schonland's statement previously quoted. In habit and foliage it approaches *C. maculata* Salm Dyck, but its leaves are alternate, while its floral characters, as noted above, readily remove it from the group to which *C. hemisphaerica* Linn. belongs.

The revised synonymy for the latter species would then be as follows :

**A. hemisphaericus** (Linn.) Lem. in Jard. Fleur. II, Misc. 60 (1852), ex Berger, l.c. (416).

*Cotyledon hemisphaerica* Linn., Sp. Pl. Ed. ii. I. 614 (1762); Roth, Bot. Abhandl. & Beob. t. 6 (1787); Willd., Sp. Pl. II. 756 (1799); DC., Hist. Pl. Grass. t. 87 (1799-1832); Dryand. in Ait., Hort. Kew. Ed. ii. III. 109 (1812); Haw., Syn. Pl. Succ. Ed. Germ. 116 (1819); Harv. l.c. (376), *pro minime parte, excl. syn. Thunb., E. & Z., et spec. Zeyh. et Drège*; Baker in Saund., Ref. Bot. I. sub. t. 36 (1869), in obs.; Schonl. l.c. 152, *pro minime parte, et excl. syn. Linn. f. et Haw.*

*C. cuneiformis* Haw., in Phil. Mag. 1828, 185.

*Cotyledon capensis foliis semiglobosis* Dill., Hort. Eltham. t. 95, f. 111 (1738).

The writer has so far not seen a single dried or living specimen of this interesting species, which is historically the oldest in the genus, and no one appears to have re-discovered the plant during the last 70 odd years.

E. & Z. (Enum. 307: 1836) quote their No. 1970 as "*C. hemisphaerica* Linn.," and as being collected "inter saxa . . . laterum montis 'Leeuwenberg' (Cap.)," but the writer has not seen these specimens, and believes these to belong to *A. rotundifolius* (Haw.), the next species, of which specimens have been collected in the same locality (=Lions Head).

**6. A. rotundifolius** (Haw.) C. A. Sm., comb. nov.

There is an accurate drawing of Haworth's type in the collection of drawings at Kew, a fair photographic reproduction of the type being also given by Schonl. & Bak. f. (<sup>4</sup>). These authors state (*loc. cit.* 91) that this species is "probably not specifically distinct from *C. hemisphaerica* Linn.," but that "the leaves are broader, branches less erect, and the caudex thicker" than in the latter. The last two characters are of doubtful value, since the branches in typical specimens of *C. hemisphaerica* Linn. are frequently spreading and the caudex up to 3 cm. in diam. The leaves, however, afford the best and most ready characters for distinguishing between these two species (see Fig. 2, and note under previous species), those of the latter being semiglobose and not obovate to rotund and flat.

The following notes made from Haworth's type by the above two authors will serve to supplement Haworth's description: "Leaves subrotund, apex rounded, margin sometimes somewhat undulate, 2.5-3.5 cm. long, 2-2.5 cm. broad, glabrous. Flowers sessile, solitary or rarely in twos, patent or erecto-patent, spicato-racemose. Calyx-lobes deltoid, short, about 1 mm. long. Corolla tubular, tube  $\pm$  1.1 cm. long, lobes ovate, subacuminate, finally reflexed or subreflexed." In addition may be given the following details drawn up from fresh specimens cited below and collected by the writer: "Succulent perennials growing socially in close masses between rocks and in fissures of rocks and other crevices, usually in shady situations. Stems several from the crown of the rather shallow growing fibrous root system, or single, usually very short and stout, with or without short stubby branches which bear the leaves, rigid, terete, with numerous more or less concave protuberances marking the old leaf bases and thus giving the stems an irregular outline, leafy only in the upper third, and covered with a thin chartaceous greyish skin, glabrous. Leaves alternate, scattered, very fleshy, suborbicular to obovate or obovate-cuneate, always rounded at the flat or slightly crinkled apices, thickest at the flattened expanded base, becoming thinner towards the apex, greyish-green in colour and unspotted."

**A. rotundifolius** (Haw.) C. A. Sm., comb. nov.

*Cotyledon rotundifolia* Haw., in Phil. Mag. 1827, 273; Schonl. & Bak. f. l.c. 91; R. A. Dyer in Bot. Mag. t. 9368 (1934).

*C. hemisphaerica* Harv. l.c. 376, *partim*; Schonl. l.c. 152, *partim*; non Linn (1762).

*C. Bolusii* Schonl, l.c. 59.

*A. Bolusii* (Schonl.) Berger l.c. 416.

*A. hemisphericus*, Jacobsen, Succ. Pl. (Engl. trans.), 17 (1935); non Lem.

SOUTH WESTERN REGION—Cape distr.: Rocky crevices on west side of Lion's Head, above Capetown, *Wolley Dod* 2279! (K). Stellenbosch distr.: In fissures of rocks and in crevices between rocks on the western slopes of the Hottentots Holland Mountains at Sir Lowry's Pass, near the tunnel, March 1931, *Smith* 6000! (Pa) *et spec. cult.* (Pa).

Here may probably also be referred *Cooper* 3628! (C. B. S., *sine loc. exact.*), preserved in Herb. Kew.

This is the only species of the genus so far known, to reach the Cape South-West (see also last paragraph under the preceding species).

## 7 **A. caryophyllaceus** (Burm. f.) Lem.

This is one of the earliest known species of the genus, being fairly well figured and described by the elder Burmann in his *Rar. Pl. Afr.* p. 39, t. 17, published in 1738, a year after Dillenius published his figure of *C. hemisphaerica*, and specifically named by the younger Burmann in 1768 (see also p. 615). It still remains, like the latter, one of the rarest of South African plants, having apparently been collected only twice since 1738. In 1818 Salm Dyck had it from the Cape and described it as *Cotyledon jasminiflora* Salm Dyck (Obs. 30: 1820), under which name Haworth also received it about the same time from Salm Dyck, neither recognising the much earlier name for the species in Burmann's *C. caryophyllacea*. And it was not until c. 1878 that Bolus rediscovered the plant "in fissuris rupium in monte Tandjiesberg, prope Graaff-Reinet," and for the first time definitely identified the wild plant with that figured by Burmann nearly a century and a half earlier. Schonland and Baker fil. were the first to point out, however, as a result of examining Haworth's specimens of *C. jasminiflora* Salm Dyck in his herbarium at Oxford (1902), that the latter plant was conspecific with *C. caryophyllacea* Burm. f., both these specific names being referred to by Harv.<sup>(2)</sup> under the heading of "Imperfectly known and doubtful species" of *Cotyledon*.



In as much as no complete description has as yet been drawn up from living specimens of the species, Burmann's original account is here given in full for purposes of ready reference and convenience: "*Cotyledon foliis ad genicula plurimis planis, oblongis; floribus gemellis, erectis, Caryophyllaeis.* Ex plurimis fibrillis tenuibus, flexuosis, intricatis, nigricantibus, ex uno centro prorumpentibus oritur caulis unus alterve, qui in ejus summo folia gerit plurima collecta, & ex uno quasi centro provenientia, quae sunt plana, obliqua, ex tenuiori basi in latum apicem desinentia, crassa, venosa, glauca, limbo purpureo; ex horum centro erigitur caulis florifer tenuis, rotundus, viridis, qui ultra dimidium divaricatur, & in ejus summo gerunt flores utcumque gemellos, singuli tamen suo petiolo proveniunt; suisque calicibus tenuibus, oblongis, quinquefidis continentur; flores hi sunt tenues, oblongi, tubulosi, forma fructus Caryophylli arboris referentes, in summo quinquefidi, segmentis planis, angustis, acutis carneis, in singulo segmento linea rubra distinctis, seu variegatis. Post hos sequuntur fructus teretes, in quinque loculamenta perpendiculariter sissi, quinqueloculares, in singulo loculo continentis semina minima subrotunda, fusca". In addition to the above the following notes, made by Schonland and Baker fil.<sup>(4)</sup> from authentic specimens in Haworth's herbarium, will serve to amplify Burmann's description: "Stem rather thick, branching, 6.0 cm. long, suffrutescent. Leaves fleshy, oblanceolate or oblong-spathulate (convex above, rounded below, thickish), green, shining, 1.3-3.0 cm. long, and .9-1.3 cm. broad at the broadest part, obtuse. Scape 13-15 cm. long, 4-6-flowered, sometimes the scape branches, and branches reach 5.5 cm. long, ascending. Pedicels sometimes rather short, thickened obclavate, 3-5 mm. Flowers erect, with a green tube and a revolute purple and white limb. Calyx lobes triangular, acute, 1.5 mm. long. Corolla tube 1.4 cm. long, lobes ovate acute, nearly 5 mm. long. Stamens included. Squamae longer than broad".

The joint authors of these notes (*cit. i f.*) regard this plant to be allied to *C. hemisphaerica* Linn. "in the structure of its flowers", but the flower is almost exactly that of *C. rotundifolia* Haw. (the previous species), *C. maculata* Salm Dyck, etc., which all certainly have the same fundamental floral structure as that of *C. hemisphaerica* Linn., but the flowers are much larger in size and of quite different colouration than those of this species. On the whole this is one of the most well marked species in the genus, with a possible affinity, as far as habit and floral characters are concerned, with *C. rotundifolia* Haw. The following synonymy must supplant that so far given by authors:

**A. caryophyllaceus** (*Burm. f.*) Lem. in Jard. Fleur. II., Misc. 60 (1852) ex Berg. l.c. 416.

*Cotyledon caryophyllacea* Burm. fil., Prod. Fl. Cap. 13 (1768); DC., Prod. III. 398 (1828); Harv. l.c. 378, Schonl. & Baker f. l.c. 93; Schon. l.c. 151.

*C. jasminiflora* Salm Dyck, Obs. 38 (1820); Haw., Rev. Pl. Succ. 20 (1821); DC., Prod. III. 398 (1828); Harv. l.c. 378.

*A. jasminiflorus* (Salm Dyck) Lem. in Jard. Fleur. II. Misc. 60 (1852), ex Berger l.c. 416.

*C. foliis ad genicula plurima planis, oblongis; floribus gemellis, erectis, caryophyllaeis*, Burm., Rar. Afr. Pl. 39, t. 17 (1738).

"C. B. S." (*sine loc. exact.*): *Cult. spec. e Hort. Dyck!* Type, in Herb. Haw. Oxon.

CENTRAL REGION—Graaff-Reinet distr.: In rocky fissures on the slopes of the Tandjesberg, near Graaff-Reinet, anno 1878, *Bolus* 758! (K).

Bolus states that the plant is extremely rare.

**Cotyledon mammillaris** Auct. non Linn. f.

Schonland<sup>(3)</sup> considers the plant figured in Bot. Mag. t. 6020 as representing the typical *C. mammillaris* Linn. f., but, in as much as Thunberg (Fl. Cap. Ed. Schult. 397) describes the stem as "repens, radicans, . . . crassitie dimidia calmi . . ." and the leaves as "secunda, verticellata, instar mammillae . . . unguicularia . . .", the corolla-tube as "viridis . . . unguicularis" and the limb as "plicatus . . . albido-purpureus . . .", there can be no doubt that the Botanical Magazine plant (description below) is quite distinct from the species described by Linnaeus fil. and is thus without a valid name, unless either of the two synonyms cited by Schonland (*loc. supra cit.*), viz. *C. filicaulis* E. & Z. and *C. Marlothii* Schonl., may be resuscitated for the Botanical Magazine plant, this depending on whether these plants are conspecific with the latter.

A comparison of Harvey's<sup>(2)</sup> description of *C. mammillaris* Linn. f. with that of the type of this name as given by Thunberg (*loc. supra cit.*) immediately shows that Harvey must have described almost exclusively from E. & Z. 1975, the type of *C. filicaulis* E. & Z., cited by Harvey as a synonym of the former, and Zeyher 2897. Thus Harvey gives "stems very short or scarcely any; leaves crowded round the apex, or scattered along the short stem . . . 1½–2 inches long", and these details certainly exclude the specimens cited from *C. mammillaris* Linn. f. Moreover, the two species come from very different botanical areas—the former from the Khamiesberge in Little Namaqualand, and the latter from the Oudtshoorn div. in the southern limits of the Central Region, and from the latter, as well as from the Robertson district the writer has seen a number of fresh specimens which agree perfectly in every detail with Thunberg's description of his type specimen of *C. mammillaris* Linn. f. but certainly not with the Ecklon and Zeyher type material. The latter also differs very markedly from the Botanical Magazine plant in its very much dwarfer habit, much shorter racemose inflorescence in which the flowers are borne in 1-flowered cymules at the nodes, and in the colour of its flowers. Hence *C. filicaulis* E. & Z. ranks as a species by itself which, under *Adromischus* Lem. will bear the following name (with details of synonymy):

**8. A. filicaulis** (E. & Z.) C. A. Sm., comb. nov.

*Cotyledon filicaulis* E. & Z., Enum. 307 (1836).

*C. mammillaris* Harv. l.c. 377, *pro majore parte, sed excl. syn. Thunb., et DC., non Linn. f.*

WESTERN REGION—Namaqualand Minor: Sides of the Khamiesberge, Ecklon and Zeyher 1975, type (Herb. Sond.); near Springbokkuil, Zeyher 2897! (Herb. Sond.).

*C. Marlothii* Schonl.<sup>(3)</sup> was described by its author from specimens gathered at Laingsburg (Central Region) by the late Dr. R. Marloth in 1902. In habit and leaf shape it comes nearest to *C. filicaulis* E. & Z., from which it differs among others in the shape of its leaves, differing also from *C. mammillaris* Linn. f. in the same characters already noted for the former, as well as in habit. In this character, too, it resembles *C. hemisphaerica* Linn., but differs from this in its fusiform terete leaves. From the Botanical Magazine plant it differs by its very much shorter racemose inflorescence in which the flowers are singly borne at the nodes and differently coloured, and by its much dwarfer habit. Berger<sup>(1)</sup> was therefore correct in regarding *C. Marlothii* Schonl. as a distinct species under *Adromischus* Lem.:

**9. A. Marlothii** (Schonl.) Berger l.c. 416.

*Cotyledon Marlothii* Schonl. l.c. 59.

*C. mammillaris* Schonl. l.c. 153, *in part. non Linn. f.*

CENTRAL REGION—Laingsburg distr.: Near Laingsburg, July 1902 (*flor. in Hort. Alb. Mus.*, Feb. 1903), Marloth 1520! Type (Herb. Alb. Mus.).

The Botanical Magazine plant thus appears to be distinct from all three species treated above, and must therefore under International Rules have a new name, for which the following, with details of synonymy, is proposed:

10. *A. kleinioides* C. A. Sm. nom. nov.

*Cotyledon mammillaris* Hook. f. in Bot. Mag., Vol. 99, t. 6020 (1873); Schonl. l.c. 153, *partim*; non Linn. f.

*Stem* up to 50 cm. high and 2 cm. thick, ascending erect or ascending, sparingly branched, with decurved tips, glabrous. *Leaves* alternate and scattered, spindle-shaped, acute, narrowed to a broad base, up to 6 cm. long and 1.3 cm. thick, terete, glaucous-green, glabrous. *Spike* up to 30 cm. long, at length pendulous, glabrous in all parts; flowers in 3-flowered nodal cymules in the lower part, with only the middle flower evident in the younger stages of development in the upper part, the lateral flowers strongly divergent. *Corolla-tube* dull yellowish-green or brown, up to 1.5 cm. long; limb dull reddish-brown, on both surfaces, up to 6 mm. in diam., spreading-reflexed, with the lobes undulate and furnished with long apical subulate processes. *Nectarial scales* minute, orbicular and notched.

WESTERN REGION—Namaqualand Minor (*without precise locality or collector*).

This exceedingly handsome species is thus far apparently known only from the fine coloured plate in the Botanical Magazine, the original specimen not being kept.

11. *A. mammillaris* (Linn. f.) Lem. ex Berger.

It is difficult to understand how this species, even though considered only from Thunberg's fairly detailed description, could have been confused with the three preceding (see also notes under these), so that for purposes of ready comparison with the notes made under them, the original description of the type by Thunberg (though first shortly described and named by the younger Linnaeus) is here given in full: "*Caulis* repens, radicans, carnosus, teres, glaber, crassitie dimidia calmi, ramosus, cinereus. *Folia* subpetiolata, secunda, verticellata, instar mammillae, utrinque attenuata, obtusa, carnososa, unguicularia, cinerea. *Pedunculus* longus, filiformis, spithameus. *Flores* patentes, subpedunculati; pedunculi breves. *Tubus* cylindricus, angulatus, viridis, glaber, unguicularis. *Limbus* 5-lobatus, plicatus, patenti-reflexus, albido-pupureus, vix lineam longus. *Filamenta* 10, quorum 5 longitudine tubi et 5 breviora, tubo inserta, capillaria, albida. *Antherae* minutae, ovatae, pallidae. *Stigmata* 5, truncata. *Styli* 5, subulati, longitudine staminum, breviorum. *Capsulae* quinque."

*A. mammillaris* (Linn. f.) Lem. in Jard. Fleur. II, Misc. 60 (1852), ex Berger, l.c. 416.

*Cotyledon mammillaris* Linn. f., Suppl. 242 (1781); Thunb., Prod. 84 (1794); & Fl. Cap. Ed. Schult. 377 (1823); DC., Prod. Vol 3, 398 (1828); non Haw. (1821).

CENTRAL REGION—Oudtshoorn distr.: "Olifantsbad", Dec., Thunberg! Type (Herb. Upsala); in a poort on Bokkeveld series, between Oudtshoorn and Montagu Pass, April 1930, van Nouhuys! s.n. (Pa). Robertson distr.: On karoo-like hills, near Robertson, March, Galpin 10334! (Pa). Ladismith distr.: On hills near Ladismith, Dec. 1926, Liebenberg 620! (Pa).

N.B.—The plant (Herb. Norm. Austro-Afr. 1860!) distributed by Macowan as "*C. mammillaris* L. f.", is *A. Marianae* (Marl.) Berger.

The leaves of the above species are unspotted, Berger (*loc. cit.*) erroneously placing the species in his key under the group with richly spotted leaves, and so close is the resemblance of the plant in habit and foliage to some specimens of *Kleinia radicans* (Thunb.) Haw. [Phil. Mag. Vol. 62, 381 (1823)] and *K. gonoclada* DC. (Compositae), that distinction between non-flowering specimens of these species is nearly impossible. In the fresh condition, however, the species are readily distinguished by the turpentine-like flavour of the broken leaves of the two species of *Kleinia* and the pale greyish-green longitudinal band which marks their "midrib." These characters are not met with in *A. mammillaris* (Linn. f.).

The inflorescence described in detail by Haworth (Rev. Pl. Succ. 21 : 1821) as belonging to *C. mammillaris* is clearly that of another species of *Cotyledon*. This inflorescence, which Haworth had "ex horto regio Kewense . . . in Junio 1819", showed the following outstanding features: "*Flores* terminales in racemo 3-4-floro parum paniculato . . . *Pedunculi* graciles 6-12 lineares, erecti nutantesve, cum calycibus uti corollis, ramematiceo-pubescentes . . . *Corolla* ventricosa . . . sordide fulvescens, laciniis 5 subrevolutis acutis . . . *Filamenta* 10, sordide flavescentia, lente villosa . . ."—characters which agree perfectly with those observed in the inflorescence of typical *Cotyledon ventricosa* Burm. f.

**12. *A. tricolor* C. A. Sm., sp. nov.**

*Planta* perennis, succulenta, in omnibus partibus glabra. *Caules* breves (ad 3 cm. alti, ut videtur), crassi, simplices. *Folia* opposita et decussata, oblongo-cylindrica ad oblongo-elliptica, teretes, ad basin molliter angustata, apice subobtusata, ad 6 cm. longa et 7 mm. lata, carnosa, in medio parte crassissima, cinereo-viridia sed maculis purpureo-brunneis omnino notata. *Inflorescentia* terminalis, spicata, simplex, vel 1-2-ramosa; rhachis rigida, erecta, ad apicem subcernua, ad 25 cm. longa (pedunculus inclusus); ramuli ascendentes, breves, pauciflori. *Flores* in cymulis 1-floris laxè dispositi, bracteis patentibus lanceolato-subulatis membranaceis. *Calyx* carnosus, viridis; dentes ovato-deltaidei, acuminati, ad. 1.5 mm. longi, saepe post fructus persistentes et spinescentes. *Tubus corollae* cylindricus, rectus, obscure 5-angulatus, ad 1.5 cm. longus, viridis; lobi ovato-lanceolati, acuminati, superne albi vel purpureis suffusi, inferne rubri; limbus patens, deinde subreflexus. *Ovaria* oblique-ovata, in stylo subulato longe angustata. *Squamae nectarii* obovato-cuneatae, e marginatae, plus minusve dentibus calycis aequantes.

WESTERN REGION—Clanwilliam distr.: On dry hills near Brandvlei, 1,200 ft., Jan. 1896, *Schlechter* 9933! Type (Pa).

**13. *A. Cooperi* (Baker) Berger.**

First described from material collected by Thomas Cooper on the Zuurberg Range (Uitenhage distr.) in 1860, and so far apparently known only from the excellent type figure in Saunders' Refugium Botanicum, Vol. I. t. 72 (1869), made from Cooper's specimens which flowered at Reigate. It is certainly one of the most distinct in the genus, being characterised by its terete or subterete leaves which are markedly blotched all over and uniquely flattened into a broader ovate-rotundate ("spathulately dilated", Baker) spotted apical portion, and by the beautiful wine-red corollas with little papillae on the upper face of the basal parts of the lobes. Yet Schonland and Baker f. (*loc. infra cit.*) suggest that it "may only be a varietal of *Cotyledon maculata* Salm Dyck"! of which incidentally Schonland had anything but the correct conception (see note under No. 1). It is far more nearly allied to the next species and *A. festivus* C. A. Sm., the next but one, but from the former it is readily known by its spotted opposite leaves, while the latter differs in the curious apical portion of its alternate leaves, as well as in floral characters—wider and shorter corolla-tube, differently coloured parts, and absence of papillae.

***A. Cooperi* (Baker) Berger, l.c. 416.**

*Cotyledon Cooperi* Baker in Saund., Ref. Bot. I. t. 72 (1869); Schonl. & Bak. f. l.c. 91; Schonl. l.c. 153.

SOUTH EASTERN COASTAL REGION—Uitenhage distr.: On the Zuurberg Range, anno 1860, *Cooper*! *s.n.* Type (*ic. col. tant. vidi*).

14. *A. pachylophus* C. A. Sm., sp. nov.

*Cotyledon Cooperi* var. *immaculata* Schonl. & Bak.f. l.c. 92.

*Planta* perennis, succulenta, in omnibus partibus glabra. *Rudices* ab eis origionibus tuberosi, in ramulis fibrosis angustati. *Caules* breves (ad 3·5 cm. alti) crassique (ad 1·3 cm. diam.), simplices vel ad apicem bifurcati ramulis brevissimis crassis, ad apices foliosi. *Folia* 4-6 alterna et subdecussata, laxe disposita, oblongo-cylindrica sed ad basin in parte breve terete crasso abrupter angustata instar petiolata, et tertia parte superiore in apice ovato-rotundata ad 3·5 cm. lata obtusa immaculata depressissima et expansa, ad 7 cm. longa, carnosissima, glauco-viridia, immaculata. *Infeorescentia* laxe spicato-racemosa, ad 30-flora; rhachis simplex vel ramosa, erecta, ad 30 cm. longa (pedunculus inclusus). *Flores* sessiles vel subsessiles, in cymulis 1-floris laxe dispositi, bracteis patentibus deltoideo-acuminatis membranaceis. *Calyx* subcylindricus, carnosus, glauco-viridis; dentes ovato-acuminati, ad 2 mm. longi. *Tubus corollae* cylindricus, rectus, ad 1 cm. longus, viridis sed superiore dimidia parte pallido rubro suffusus; lobi ovati, acuminati, ad 4 mm. longi, epapilloso, pallidi rubri. *Ovaria* 4-5, obliqueter oblonga, in stylo subulato longe angustata, stigmatis capitatis. *Squamae nectarii* obovato-cuneatae, emarginatae, dentibus calycis in dimidio parte aequantes.

CENTRAL REGION—Graaff-Reinet distr.: Mountain side near Graaff-Reinet, Nov. 1897, Rattray! s.n. Type (*cult. Hort. Alb. Mus. annis sequentis*). Queenstown distr.: On Bowker's Kop, near Queenstown, 3,800 ft., Nov. 1896, Galpin 2209! (Pa).

Galpin's material here cited showed one of the uppermost leaves on each of the specimens on his sheet, and these were distinctly smaller than the dimensions given by Schonland and Baker f.<sup>(4)</sup> for the leaves of their material. In other details, however, Galpin's specimens agreed very well with the rather scanty details given by the authors cited, and the writer has little doubt as to the conspecificity of the Rattray and Galpin specimens. Both localities should again be combed for additional material for purposes of verification, and for further amplifying the description. In the above, inflorescence details and basal parts were taken from Galpin's specimens and the leaves only described from the Rattray plant.

This species is most closely allied to the previous one, but from this it is readily known by its unspotted alternate leaves of which the apical crest is far more markedly expanded, and by the epapillose bases of the corolla lobes.

15. *A. festivus* C. A. Sm., sp. nov. (Fig. 3).

*Planta* perennis, succulenta, in omnibus partibus glabra, sed omnino pulvo albescente (Anglice "bloom" dicta) tenuiter obtecta. *Caules* robustus, ad 4 cm. alti, sed speciminibus cultis multo altior et saepe ad basin foliorum nodis radices adventitiosas emittentes. *Folia* opposita decussataque, ovoideo-cylindrica, gradatim et obtuse ad basin tertia parte inferiore in parte breve multo angustiore terete circa 5 mm. longe angustata instar crassiter petiolata, deinde abrupter in amplo basi amplectente expansa, molliter ad apicem deltoideum vel rotundatum vel obtusum saepe crispulatum maculatum depressissimum attenuata, ad 5 cm. longa et 1·5 cm. lata, carnosissima, teretia vel subteretia, cinereo-viridia, maculis purpureo-brunneis pulchriter omnino notata (maculae frequenter infra apicem mergentes), patenti-ascendentia et saepe incurvata. *Inflorescentia* laxe spicata, simplex; rhachis erecta, ad 35 cm. longa (pedunculus inclusus). *Flores* in cymulis 1-floris laxe dispositi, bracteis deltoideo-ovatis acuminatis membranaceis. *Calyx* viridis, carnosus, cupuliformis; dentes deltoidei, subacuminati, ad 1·5 mm. longi. *Tubus corollae* cylindricus, viridis vel brunneo-viridis, ad 8 mm. longus; lobi ovato-acuminati, ad 2 mm. longi, superne alba vel pallido roseo suffusi, inferne rubri. *Ovaria* semi-ovoidea, longe in stylo acuminato angustata; stigmata capitata. *Squamae nectarii* obovato-cuneatae, emarginatae, calycis dentibus subaequantibus.



FIG. 3.—*A. festivus* C. A. Sm. (see text).

CENTRAL REGION—Graaff Reinet distr. : Near Graaff Reinet, on slopes of rocky hill above the reservoir, April 1926 (flowering at the Division of Plant Industry, Dec. 1926), *Smith in Nat. Herb.* 8876! Type (Pa).

The accompanying plate (Fig. 3) was made from the type specimen at the time of flowering (Dec. 1926).

The type agrees exactly with a photograph of a specimen cultivated by the late Dr. N. E. Brown in his conservatory at Kew during July 1920, and sent by him to the Division of Plant Industry, Pretoria, sometime after the specimen had flowered in January of the following year, together with the name which is here taken up for the first time.

It is most closely allied apparently to *A. Cooperi* (Baker), but may be readily known from this by the shape and colouration of the leaves and their different apices, as well as the absence of the peculiar papillae on the corollas of its ally.

**16. *A. Zeyheri* (Harv.) von Poellnitz** in *Cactus Journ.*, 1938, 68.

This species was regarded by Berger<sup>(1)</sup> as conspecific with *C. cristata* Haw., probably following on a note by Schonl. & Baker f.<sup>(4)</sup> The absence, however, of the very characteristic shaggy reddish aerial roots from the stems and the pubescent peduncles and corollas easily serve to distinguish it from the latter. The stems of the type plant are also "half-recumbent, rooting at the nodes" (Harv.), a condition not observed in *C. cristata* (Haw., so that the plant will bear the following name under *Adromischus* Lem. :

***A. Zeyheri* (Harv.) von Poellnitz** l.c.

*Cotyledon Zeyheri* Harv. l.c. 397 ; Schonl. & Baker f. l.c. 91 ; Schonl. l.c. 155.

SOUTH WESTERN REGION—Swellendam distr. : "Rocky places on the Kenko Rivier, east of the Buffeljachts Rivier", *Zeyher* 2571! Type (Herb. S. Afr. Mus.).

Schonl. and Baker f. also cite *Ratray* (*sine num.*) from Graaff-Reinet and *Schonland* 709 from "rocky places near Grahamstown" under the above species, stating "they have been compared with *Zeyher*, no. 2571, . . . and also with the type of *C. cristata* Haworth (Phil. Mag. 1827, 274), and we think these two species should be united".

The differences between the two species have been indicated above, and the writer has no hesitation in referring the two specimens just cited to *A. cristatus* (Haw.) ; *v. seq.*

**17. *A. cristatus* (Haw.) Lem. ex Berger.**

See also note under the previous species for distinguishing features between it and *A. Zeyheri* (Harv.), and under the following species for other differences between it and *A. clavifolius* (Haw.), with both of which it has been confused. Thus, as previously noted, Schonland and Baker f. (4) unite it with *A. Zeyheri* (Harv.)—as species of *Cotyledon*. However, so doubtful was Schonland himself of this that in his last paper on *Cotyledon*<sup>(3)</sup> he resuscitates *C. Zeyheri* Harv., but unites *C. clavifolia* Haw. with *C. cristata* Haw., keeping up the latter name. The following are the full details of synonymy and citations for the species under *Adromischus* Lem. :

***A. cristatus* (Haw.) Lem.** in *Jard. Fleur.* II, Misc. 60 (1852), *ex Berger*, l.c. (416), *excl. syn. Zeyh.* Jacobsen, *Succ. Pl.* (Eng. trans.), 17 (1935), incl. fig. 2 *sed excl. syn. C. Zeyheri* "Haw."

*Cotyledon cristata* Haw. in *Phil. Mag.* 1827, 274 ; DC., *Prod.* Vol. 3, 399 (1828) ; Eckl. & Zeyh., *Enum.* 307 (1836) ; A.P. & A. DC. in *Mem. Soc. Phys. Hist. Gen.* Vol. 7 t. 7 (1836), *bona* ; Harv. l.c. 376 ; *partim, excl. syn. Haw.* ; Schonl. l.c. 155, *partim. et excl. syn. Haw.* ; Marl., *Fl. S. Afr.* Vol. 2, 1-20, t. 9-5 (1925) ; Phill. in *Flow. Pl. S. Afr.* Vol. 9, t. 325 (1929). *C. Zeyheri* Schonl. & Baker f. l.c. 91, *excl. spec. Zeyh.* ; non Harv. (1861-62).

SOUTH-EASTERN COASTAL REGION—Uitenhage distr.: (*sine loc. exact.*), Bowie! *s.n.* Type in Herb. Haw., Oxon.; dry hills on the Zwartkops Rivier, E. & Z. 1974, *partim* (Herb. Sond.); Port Elizabeth distr.: At Redhouse on dry hills, April 1915, Mrs. Paterson 442A! (Pa).

CENTRAL REGION—Albany distr.: In rocky places, near Grahamstown, Schonland 709! (Herb. Alb. Mus.). Graaff-Reinet distr.: At Graaff-Reinet, *cult. spec. plur. e Hort. Div. Pl. Ind. in Nat. Herb.* 7945! *et viv. spec.!* (Pa); dry hills near Graaff-Reinet, Nov. 1897, Rattray! *s.n.* (Herb. Alb. Mus.); occasional along basal slopes of mountain, near Graaff-Reinet, March 1930, Galpin 10275! (Pa).

Haworth's type specimen is preserved in his herbarium at Oxford, and is represented in the Kew collection of drawings by an exceedingly fine accurate coloured plate (No. 264) made from specimens sent by Bowie from the Cape (undoubtedly from the Uitenhage division) to Kew in 1823, the plate being prepared when the plants flowered in September 1826. That the original of the plate and Haworth's specimen both came from the type gathering is evident from the date of flowering cited and the fact that Haworth notes that his specimen flowered at Kew (Sept. 1826), N. E. Brown noting that he compared the plate with Haworth's type and found them to agree perfectly (Oct. 1901). Moreover, there is ample reason to believe that, in view of the rarity of the material sent by Bowie, a single specimen was figured and this same specimen passed on to Haworth.

This plate has also been very carefully compared with the original of the "Flowering Plants" coloured figure and found to match exactly, both also agreeing in every respect with A. P. & A. De Candolle's fine plate cited above.

#### 18. *A. clavifolius* (Haw.) Lem. ex Berger.

This species was regarded by Harvey<sup>(2)</sup> as doubtfully conspecific with the previous species, but, though regarded as distinct, from *C. cristata* Haw., with which Schonland and Baker f.<sup>(4)</sup> had united *C. Zeyheri* Harv., Schonland<sup>(3)</sup> reversed this by excluding the last species, but united *C. clavifolia* Haw. with the former under that name. This latter step is by no means justified by reference to the type material and excellent figures, for they show most marked foliage and even floral differences. This was already noted by Haworth (Phil. Mag, 1827, 274) where he states "Priori (i.e. *C. cristata* Haw.) valde affinis at abunde distincta videtur. Folia subtriangularia, plusquam duplo angustiora, petiolo [*sic!*] incurvo, vix puberulo, ramentis caulinis forte paucioribus; cum eodem modo florendi; tubo subincurvo robustiore, viridi; laciniis intus albis, extus (uno latere) purpureis, et basi undulato-sublobulatis ut in priori". There is no specimen of *C. clavifolia* Haw. in Haworth's herbarium at Oxford, but there is a very fine coloured plate of a plant so-named in the collection of drawings at Kew, and, as explained under the previous species, there is every reason to believe that the plate represents Haworth's type, or at least an identical specimen, the material coming from the same source as the former species and flowering at Kew at the same time, Sept. 1826. This coloured plate must therefore, in the absence of a type specimen be chosen as the type.

The original specimen of the plate given in "Flowering Plants" (cited below) agrees perfectly with this plate, having been compared with it at Kew by the writer, and, as the original collections from which tt. 325, 328 of this publication were made, are still (1932) in cultivation at the Division of Plant Industry, Pretoria, where they had then been growing in the same greenhouse under similar conditions for nearly 6 years, typical specimens of the two Hawthornian species were available for comparison. Thus the longer ovoid-elliptic to subcylindric terete dark green "body" of the leaves of *C. clavifolia* Haw., with their flattened but scarcely or not crisped and more or less abruptly constricted apices, contrast markedly with the much shorter dorso-ventrally somewhat compressed obovoid-cuneiform



to flabelliform paler green "body" of the leaves of *C. cristata* Haw. with their flattened and conspicuously crisped or undulate scarcely or not at all constricted apices. Their floral differences can best be seen by comparison of the two plates already cited.

Schonland and Baker f. (4) have suggested that in leafshape "it is more nearly allied to *C. Cooperi*", but in this character it is far more nearly allied to *A. festivus* C. A. Sm., which has the same type of leaf apex. In the possession of the peculiar "petiolar" leaf base, however, *A. clavifolius* (Haw.) is far more nearly related to *A. cristatus* (Haw.) and *A. Zeyheri* (Haw.), with which it also agrees in indumentum and inflorescence characters, so that these two species would seem to be its closest affinities. The following would be the synonymy and citations under *Adromischus* Lem. :

**A. clavifolius** (Haw.). Lem. in Jard. Fleur. II, Misc. 60 (1852), ex Berger, l.c. 416, f. 199, B—E (1930); Jacobsen, Succ. Pl. (Eng. trans.), 16, excl. ref. fig. 6, 1, quae est spec. distincta.

*Cotyledon clavifolius* Haw. in Phil. Mag. 1827, 274; DC., Prod. Vol. 3, 399 (1828); Schonl. & Bak. f. l.c. 92; Schonl. l.c. 155.

*C. cristata* Harv. l.c. 376, pro parte; non Haw. (1827).

*C. Schonlandii* Phill. in Flow. Pl. S. Afr. Vol. 9, t. 328 (1929).

"*A. van der Heydeni* Hort." ex Berger (loc. supra cit.).

*A. Schonlandii* (Phill.) von Poellnitz in Cactus Journ. 1938, 68.

SOUTH EASTERN COASTAL REGION—Uitenhage distr.: (sine loc. exact.), Bowie! Type (ic. col. ined. tant. Herb. Bot. Reg. Kew. vidi); on dry hills on the Zwartkopsrivier, Dec., Eckl. & Zeyh. 1974, partim (Herb. Sond.).

CENTRAL REGION—Graaff Reinet distr.: Near Graaff Reinet, cult. spec. plur. e Hort. Div. Pl. Ind. in Nat. Herb. 7944! (Pa, K).

In Harvey's description of *C. cristata* Haw., principally drawn from E. & Z. 1974 (Herb. Sond.), he states "leaves 1–1½ inches long . . . varying in breadth from 2 to 6–8 lines; the narrower forms answer to the description of Haworth's *C. clavifolia*". Both these two species grow in the same locality, and, though the writer has not seen the Herb. Sond. specimens of E. & Z.'s gathering, there can be no doubt that this number is composed of a mixture of the two plants, a point sufficiently evident from Harvey's observations. E. & Z. (Enum. 307: 1836) only list "*C. cristata* Haw." under their number 1974, but without descriptive detail.

#### 19. *A. leucothrix* C. A. Sm., sp. nov. (Plate I.)

*Planta* nana, succulenta, perennis. *Caules* crassi, ad 4 cm. alti et 3 cm. diam. eis basibus tuberosis sed gradatim ad apicem foliosum angustati e parte supra basin nudo ad 6 mm. diam. subcylindrico, simplices vel ramis e basi brevibus paucis, laeves, glabri. *Folia* alternata et circum apices caulium vel ramorum dense aggregata, lineari-oblonga ad oblanceolata vel elliptico-oblonga, vix basin angustata, sed gradatim ad apicem obtusum angustata, ad 3.5 cm. longa et 5 mm. lata, ascendenti-erecta vel inferiores patentia, carnosissima, saturato-viridia et immaculata, prope basin subteretia, profunde in facie superiore sulcata sed inferire convexa, omnino crinibus hispidis albidis dense obiecta ut in foliis *Cras-sulae mesembrianthemoidis* (Haw.) D. Dietr. *Inflorescentia* simplex, pauciflora, racemoso-spicata; rhachis erectus vel ascendenti-erectus, debilis, in inferiore parte dense sed breviter crinibus hispidis albidis obiectus. *Flores* non visi. *Carpellae* modo generis.

CENTRAL REGION—Ladismith distr. : On the eastern slope of a hill along the Ladismith-Calitzdorp road, Dec. 1926, *Liebenberg!* s.n. Type (Pa).

The above species differs from all the other known species of the genus in the conspicuous white bristly unicellular hairs on the deeply sulcate leaves and lower part of the peduncles, thus giving these organs a distinct hoary appearance.

Described in greater part from notes made on the fresh type plant shortly after planting at Pretoria (Dec. 1926), and from the original photograph taken by the writer at that time and reproduced as Plate 1.

A later examination (April 1931) of the same plants (i.e. after they had been in cultivation in a warm green house for nearly five years) showed no variation in the density and character of the hairs on the leaves and peduncles, but the following dimensions will indicate the influence of green house conditions on a plant coming from an area with a mean annual rainfall of 15 inches. : *Stems* up to 15 cm. high and 1.5 cm. thick, with the bulbous swollen base 6 cm. in diam. *Leaves* up to 11 cm. long, 1 cm. wide and 8 mm. thick, and still with the deep sulcus on the upper face.

Apart from the character of the leaf indumentum, the species also exhibits other leaf characters (shape, cross-section, the deep groove) which make it unique in the genus, since none of the other species shows any character like it, but the nearest approach to the type of leaf in the above species is met with in *Cotyledon Wallichii* Harv., some narrow leaved forms of *C. ventricosa* Burm. f., *C. Dinteri* Bak. f., and *C. cacalioides* Linn. f., though, of course, the leaves of none of these in the fresh state show the grooving or indumentum which characterises the *Adromischus*. The non-flowering plant also bears a strong superficial resemblance to *Crassula mesembrianthemoides* (Haw.) D. Dietr. =(Cr. *trachysantha* E. & Z.); but from this it is readily known by its succulent (not shrubby) stems, alternate (not opposite) leaves and their shape (not triangular in cross-section).

**20. A. Alstoni** (Schonl. & Bak. f.) C. A. Sm., comb. nov.

Described from a specimen collected by G. Alston in Namaqualand and cultivated by Dr. Schonland in the Albany Museum Herbarium garden, where it flowered in Jan. 1901. It is very closely related to *A. triflorus* (Linn. f.), from which it appears to differ in its longer but narrower leaves, in the colouration of the flowers, and in the shape of the corolla-lobes. Unfortunately, the type of *A. triflorus* (Linn. f.), Thunberg's Zeekoerivier specimen, was not available for examination, so the characters in the following table under this name were taken from Thunberg's excellent description made obviously (in greater part at least) from notes on the fresh plant at the time of collection :

<i>A. Alstoni.</i>	<i>A. triflorus.</i>
<i>Folia</i> ad 7 cm. longa et 2.5 cm. lata.	<i>Folia</i> ad 5.5 cm. longa et 2.5 cm. lata.
<i>Corollae tubus</i> viridis, ad 1.5 cm. longus.	<i>Corollae tubus</i> "viridi-rufescens, subungicularis."
<i>Corollae lobi</i> deltoideo-acuminati, pallide rosei vix 2 mm. longi.	<i>Corollae lobi</i> "ovatae, obtusae, intus albae, extus rufescentes, lineam longi."

Thunberg's description does not include the leaf shape of his plant, though he says : "folia . . . obtusissima, subtruncata, inferne attenuata, basi teretiuscula", and from the dimensions above given, this would indicate an obovate leaf long-cuneate to the base, Alston's specimens also having the leaves obovate and long cuneate to the base and rounded at or only very slightly tapering to an obtuse apex. In the latter, too, the flowers are sometimes singly disposed along the rhachis, or in 3-flowered cymules, whereas in the Thunberg specimens, the 3-florous condition seems consistently to obtain, at least in the maturer basal half of the inflorescence.

The species appears to have been omitted by Berger (1), hence the following new combination is proposed for it under *Adromischus* Lem. :

**A. Alstoni** (*Schonl. & Bak. f.*) *C. A. Sm.*, comb. nov.

*Cotyledon Alstoni* Schonl. & Bak. f. l.c. 93 ; Schonl l.c. (154).

*A. Cooperi* Jacobsen, succ. Pl. (Engl. trans.) 16 (1935) excl. syn. ; non Berger.

WESTERN REGION—Namaqualand Minor (*sine loc. exact.*), anno 1900, *G. Alston!* *s.n.* Type (Herb. alb. Mus., K).

Of this plant the writer has only seen the dried specimens taken from the type collection at the time of flowering. Jacobsen (*loc. supra cit.*) described a plant which appears beyond doubt to be *A. Alstoni*.

**21. A. Marianae** (*Marl.*) Berger.

This is another of the species confined to the western area (Clanwilliam distr.) of the Cape Province, and is well characterised by its oblong greyish-green fleshy leaves which show a more or less semicircular cross-section and are conspicuously marked with purple-brown flecks and blotches over their whole surface. The fine coloured plate of the plant cited below also shows a rooting leaf, which had originally broken off from a fresh specimen and left lying on a shelf in the late Dr. R. Marloth's laboratory. Here, after a period of several months, the leaf developed adventitious roots and new leaves at its base.

**A. Marianae** (*Marl.*) Berger, l.c. 416.

*Cotyledon Marianae* Marloth in Trans. S. Afr. Phil. Soc. Vol. 18, 47 (1907) ; Schonl. l.c. 153 ; Marl., Fl. S. Afr. Vol. 2, 1. 14. t. 3, f. A (1925), *bona*.

WESTERN REGION—Clanwilliam distr. : Stony slopes of a mountain near Clanwilliam, 1,000 ft., March 1898, *Leipoldt in Herb. Norm. Austro-Afr. Cent. XIX*, 1860 ! (K, Pa).

Leipoldt's specimen was erroneously distributed by MacOwan in 1899 as "*Cotyledon mammillaris* Linn. f.," but agrees with every detail of the fine plate of the type plant, of which, however, the writer has not seen the dried material.

**22. A. humilis** (*Marl.*) Berger.

One of the most distinct species in the genus, with the following most outstanding characters : A dwarf succulent perennial without any sign of a stem. *Root* tuberous below the crown. *Leaves* flat, rosulate, alternate. *Peduncle* very short, laxly 2-5-flowered, the 7-flowered condition only found in cultivated specimens. *Corolla-tube* yellowy-green and slightly tapering to the base ; limb stellately spreading or at length reflexed, deep purple to maroon.

**A. humilis** (*Marl.*) Berger, l.c. 417.

*Cotyledon nana* Marl. in Trans. Roy. Soc. S. Afr. Vol. 2, 33 (1910) ; non N. E. Br. (1902).

*C. humilis* Marl. apud. Schonl. l.c. 151 and Fl. S. Afr. Vol. 2, 1. 16, 17. t. 3, f. D (1925), *bona*.

CENTRAL REGION—Beaufort West distr. : On the Nieuweveld Mtns., Dec. 1909, *Marloth* 4689 ! Type (Pa).

So far only recorded from this locality, which in the early half of last century was one of the fruitful collecting grounds of Marloth's countryman, the equally energetic J. F. Drége, but he appears to have missed the plant altogether.

**23. *A. nanus* (N. E. Br.) von Poellnitz (Pls. II., III.)**

This species was first described (as *C. nana* N. E. Br.) in 1902 from a plant sent "in 1899 by Prof. MacOwan from South Africa to Kew" where it is still alive and flourishing (1930), being for some time cultivated in the late Dr. Brown's conservatory at Kew, and there photographed in Sept., 1920. An authenticated photo of the plant (Plate II) was shortly afterwards sent to the Division of Plant Industry, Pretoria, but the original description appears to lack some of the details which are evident even in the photo, such as the subdistichous arrangement of the leaves which are among the smallest in the genus.

The locality from which MacOwan originally obtained his plant (the type) is not known, but almost certainly it came from Middelburg (Cape), whence he had plants sent him in 1898-99. That this part of the central region may be involved is further indicated by the fact that a plant collected by Dr. T. R. Sim in January, 1902 at Hanover, in the district adjoining Middelburg, agrees in every essential detail as far as vegetative parts are concerned with N. E. Brown's type. The latter, however, at the time it was described, bore only a very short ("½ inch long") peduncle, with a single, apparently terminal, flower, whereas Sim's specimen shows the typical raceme found in the species belonging to the northern group (cf. p. 615). That the inflorescence of the type plant is not a normal one is amply borne out by the fact that even in the wild state, this group is frequently seen to produce abnormal floral features, a condition even more frequently met with in cultivation, where soil, water, or biotic factors may even retard flowering for several years! Some, or all of these factors seem to have operated in the type plant, since it has not flowered once again so far as observation at Kew has shown during the last 30 years, and even its leaves remain far smaller than those of wild specimens which are beyond doubt conspecific. As Brown also cautiously observes (*loc. infra cit.*), "the one-flowered peduncle may not be a constant character, as other species of the group have a spicate [or racemose] inflorescence". The following description, which will serve to amplify the original in further leaf and inflorescence detail, was drawn largely from flowering specimens (seen in Plate III) collected by the writer, and from Sim's excellently dried material, parts of the original incorporated being indicated in inverted commas :

*Plant* a dwarf succulent perennial, glabrous in all parts, but the leaves and inflorescence covered with a thin waxy bloom. *Stem* at most 2 cm. high, stout and fleshy, very slightly and inconspicuously 2- (or not at all) branched at the apex. *Leaves* closely crowded at the apical part of the stem (or crown of the rootstock in the subcaulescent forms), alternate (frequently apparently opposite), distichous, or subdistichous owing to overcrowding at the apices, broadly oblong-elliptic to orbicular or reniform, broadly rounded at, and never tapering to the base and apex (the latter very rarely, and then only casually, subacute), up to 1.5 cm. wide and about as much long, erect or ascending-erect, very thickly fleshy, with the thickest part (up to 3.5 mm.) in the middle, convex on either side, whence narrowly elliptic or oblong-elliptic in cross-section, thinnest towards the apical margin, the margin itself white and cartilaginous, greyish-green in colour, invariably spotted with numerous purple-red to purply-brown flecks (especially in the upper half), the blotches flowing into a continuous irregular blotch under the apex. *Inflorescence* single and simple, terminal and up to 25 cm. long (or more ?), including the nude lower peduncular part, laxly racemose in the upper half or third. *Flowers* generally spreading on their short pedicels and subsecundly arranged when opening, erect or ascending-erect after fertilisation and in the bud stage. *Pedicels* up to 5 m.m. long in the fruiting stages, arising in the axils of much reduced ovate acute membranous spreading bracts, terete, more or less insensibly widening into the calyx. *Calyx* fleshy, with narrowly ovate-deltoid, very acute up to 2 mm. long teeth. *Corolla tube* cylindrical, "slightly clavate", straight, obtusely 5-angled, up to 1.2 cm. long, "reddish-brown with . . . greenish-angles", or purplish-brown, and purplish in the throat; lobes reflexed, ovate-acute, up to 2 mm. long, "rosy-purple with whitish margins

and with the mouth of the tube at the sinuses somewhat membranous and whitish". "*Stamens* included; anthers ochreous-yellow". Ovaries 5, oblong-ovoid, up to 8 mm. long, and tapering insensibly into their subulate styles. *Nectarial scales* obovate to oblong-obovate, deeply notched at the apex.

The following are the details of synonymy and citations for the species which appears to have been missed by Berger (Engl. & Prantl., Nat. Pflanzenfam. XVIII, a. 416: 1930):

**A. nanus** (*N. E. Br.*) von Poellnitz comb. nov. in Desert Plaut Life 227 (1938).

*Cotyledon nana* N. E. Br. in Gard. Chron. Ser. 3, vol. 30, 280 (1901); non Marl. (1910).

"C. B. S."—(*sine loc. exact.*, sed forsan in ditone Middelburg dicta), anno 1899, *Spec. cult. leg. MacOwan!* Type (Hort. Reg. Bot. Kew.).

CENTRAL DIV.: Hanover distr.: Hillside at Hanover, Jan., 1902, *Sim in Herb. Galpin* 5975! Lecto-type (Pa).

ORANGE FREE STATE—Fauresmith distr.: Upper half of western slope of hill on the Fauresmith Botanical Reserve, east of the town, April, 1927, *Spec. cult. leg. Smith!* (Pa).

In view of the uncertainty attendant upon cultivation and the fact that no dried specimen of the original type is preserved in Herb. Kew., the writer would suggest that Sim's specimen above cited be chosen as the type of the specific name, the specimen being perfectly complete in all details.

The following are the associated plants shown in the photograph reproduced as Plate III, reading from left to right: *Crassula obvallata* L., *Adromischus nanus* (N. E. Br.) von Poelln., \* *Kleinia radicans* (Thunb.) Haw., lying prostrate in the foreground, *Crassula obvallata* Linn., with the dried remains of the previous season's inflorescence, *Euphorbia aggregata* Berg. (spiny), *Haworthia tessellata* Haw., with its fruiting inflorescence lying over the *Crassula* just obliquely above it, † *Cotyledon toxicaria* C. A. Sm., with a dried inflorescence on it, and ‡ *Eustachys paspaloides* (Vahl) Lanza & Matti in the right background. The dried objects in the foreground are leaves of the *Haworthia* and the *Cotyledon*, together with 3 old capsules of the latter.

**24. A. procurvus** (*N. E. Br.*) C. A. Sm.

Known so far only from a single cultivated specimen, the type being preserved in Herb. Kew., being chiefly characterised by its curved corolla-tube. In a genus of some 30 species, all with straight corolla-tubes, an unusual character such as a curved corolla-tube is of special interest, but, in as much as many of the species are subjected to teratological modifications resulting from mechanical or biotic (e.g. aphid) injury, the curvature of the corolla tube in this particular case may have been due to such injury. In the meantime, until experimental evidence has been obtained in this direction, and for the purpose of calling attention to the plant, its specific rank is here maintained under *Adromischus* Lem., from which it was omitted by Berger (Engl. & Prantl, Nat. Pflanzenfam, Vcl. 18, a. 416: 1930).

**A. procurvus** (*N. E. Br.*) C. A. Sm., comb. nov.

*Cotyledon procurva* N. E. Br. in Kew Bull. 1912, 276; Schoul. l.c. 154.

"C. B. S."—(*sine loc. exact.*), *Spec. cult. Hort. Bot. Reg. Kew!* (K). Type.

It is most closely allied to the next two species, from which, however, it must, at least for the present, be excluded by its curved corolla tube, if not on foliage characters also.

\* Erroneously cited as of "DC." by Harv. l.c. (317).

† *C. decussata* Phill. & C. A. Sm. in Flow. Pl. S. Afr. Vol. 8, t. 289 (1928); non Sims (1824).

‡ *Eustachys* (*Chloris*) *petraea* Auct.; non *Chloris petraea* Swartz.

25. *A. trigynus* (Burch.) von Poellnitz.

Known only from a few specimens collected in Griqualand West by Burchell in Dec. 1811, but they are incomplete as to leaves, these having apparently been lost, so that the species requires to be recollected in the type locality (*v. infra*), when a fuller description of the vegetative as well as floral parts may be drawn up, and its specific identity determined in terms of the preceding and the next species. The specific epithet "trigyna" is inappropriate and misleading, since in the type specimens the number of carpels vary from 3-4-5, with the last number probably the more usual as in the other species of the genus. Thus Baker fil. & Schonland<sup>(5)</sup> also observe that in the flower dissected by them from the type, the normal number of carpels was found. In the matter of descriptive detail, the following, a copy of Burchell's original field label, represents all that is known as to leaf characters:

" 1898—

*Cotyledon trigyna* B. folia cuneato-ovata (vel suborbiculata), glabra complanata carnosae. Acaulis. Flores scapo elongato simplici (rarissimo bifido), basi nudo alterni erecti. Corolla cylindrica purpurascens limbo albo brevi reflexo. Faux purpurea. Capsula tres.

Dec. 14, 1811.

At Klairwater, in the kloof near the Burying Ground."

Burchell's final published description was no more than a re-arrangement of the characters already noted on his field label, with the addition "flores erecti alterni", and to these the above two authors added "Calyx lobes lanceolate subacuminate,  $\pm 2$  mm. long. Corolla tubular, much longer; the tube (sphalm. "calyx")  $\pm 1.3$  cm. long; lobes reflexed or sub-reflexed, about 2 mm. long, acute."

*A. trigynus* (Burch.) von Poellnitz in Fedde Rep. 44, 60 (1938).

*Cotyledon trigyna* Burch., Trav. Vol. 2, 226 (1824); DC., Prod. Vol. 3, 398 (1828); Harv. l.c. 378; Schonl. & Bak. f. l.c. 91; Schonl. l.c. 153.

GRIQUALAND WEST—Hay distr.: At Klairwater (= Griquatown) "in the Kloof near the Burying Ground", Dec. 1814, Burchell 1898! Type (K & Herb. DC.).

Those plants, chiefly from the Transvaal Highveld, which have been identified as this species, belong to the next but one.

26. *A. rupicolus* C. A. Sm., sp. nov. (Fig 4.)

*Cotyledon trigyna* Marl., Fl. S. Afr. Vol. 2, 1. t. 2, f. D (1925); non Burch. (1824).

*C. rhombifolia* var. *spathulata* N. E. Br. ex Marl. (*loc. cit. in icon.*).

*Planta* humilis, succulenta, perennis, in partibus omnibus glabra. *Caules* ad 4.5 cm. alto, crassi, simplices vel ramis brevissimis crassissimis, circum apices dense foliosi, et parte inferiore frequenter prostrati, tum ad 2.5 cm. crassi et terra semi-obtecti. *Folia* opposita decussata, late oblongo-elliptica ad suborbicularia, vix ad basin late amplexentem angustata, apice rotundata, rarissime emarginata vel mucromata, ad 5 cm. longa et 2 cm. lata, carnosissima, superne inferneque convexa, ad 4 mm. in medio crassa, sed ad apicem et margines cartilagineas angustiora, viridia, semper irregulariter maculis saturatoris viridibus maculata, sed maculis purpurascensibus vel purpureo-brunneis sub marginibus apicis dense collectis. *Inflorescentia* ex planta singula 1-2, simplex, racemosa, ad 50 cm. longa (pedunculo nudo incluso); rhachis subflexuosus vel rectus, plus minusve rigidus sed prope apicem

subcernuus, brunneus vel purpureus, teres. *Flores* longe pedicellati, postanthesin subsecundi, sed post florentem ascendentes. *Pedicelli* ad 1 cm. longi, post florentem ad 4 cm. elongati, debiles, teretes, pedunculo concolorosi, bracteis ad 1 mm. longis ovatis carnosis. *Calyx* viridis, carnosus; dentes ovato-lanceolati, acutissimi, ad 2 mm. longi, carnosi. *Tubus corollae* cylindricus, rectus, ad 1.5 cm. longus, obtuse 5-angulatus, rubro-purpureus, fauce purpureus vel saturate ruber; lobi ovati, acuti, ad 2 mm. longi, reflexi, pallidissimi purpurei vel in senioribus albescentes, inferne saturate purpurei, marginibus undulatis vel crispulatis. *Stamina* 2-seriata, plerumque 4 exserta, alia inclusa; filamenta saturate purpurea, plerumque 4 paululum altiora in tubus corollae quam aliis inserta; antherae ovoideae, albescentes. *Ovaria* 4-5, oblongo-ovoidea, ad 1 cm. longa, ad basin paululum cuneata, in stylo subulato ad apicem angustata; styli sub antheras staminum exsertorum breviter excurvati. *Squamae nectarii* obovatae, manifeste emarginatae.

CENTRAL REGION—De Aar distr.: On the slope of a hill to N.W. by W. of De Aar, in rocky crevices almost right under stones, Nov. 1926, *Liebenberg* 263! (Pa).

ORANGE FREE STATE—Fauresmith distr.: On the Fauresmith Veld Reserve, near the crest of the hill among rocks and in crevices of rocks, 4,650 feet, Dec. 1937, *Smith* 5203! Syn-type (Pa), & in *eod. loc.*, Jan., 1928, *Smith* 5603! Type (Pa).

WESTERN TRANSVAAL—Marico distr.: Among rocks at Zeerust, 4,000 feet, Dec. 1926 *van der Merwe* 37! (Pa).

This species, figured in the accompanying illustration (Fig. 4), is locally known as "plakkie" or "bontplakkie", and invariably, unlike *A. nanus* (N. E. Br.) von Poellnitz grows socially in crevices and in the shade of rocks, with the long graceful inflorescences projecting well above their immediate rocky environment and so readily accessible to insect visitors. The plant is common on the hillsides, usually in the upper half of the western slopes near the crest, round the Fauresmith in the district, and, judging from the above, appears to be one of the few with a relatively wide distribution.

On the Fauresmith Reserve, the plant is very generally found among rocks under taller shrubs and bushes such as *Rhus Burchellii* Sond., \**Ehretia rigida* (Linn. f.) Druce, *Rhigozum obovatum* Burch., along with other such dwarf social succulents as *Kleinia radicans* (Thunb.) Haw. and *Haworthia tessellata* Haw. mixed with it, or in shady places not under other plants and associated with other succulents such as *Euphorbia aggregata* Berger, *Cotyledon toxicaria* C. A. Sm. (see p. 641), *Crassula obvallata* Linn. and *Mesembryanthemum saxicolum* † (L. Bolus) N. E. Br., *Stapelia flavirostris* N. E. Br. Marloth's fine coloured plate cited above agrees in all essential detail with a partly coloured plate made from the type specimen of which Fig. 4 is the rendering in monochrome.

## 27. *A. umbraticolus*, C. A. Sm. (Pls. IV, V.)

This species was first described in connection with toxicological experiments carried out at Onderstepoort (near Pretoria) by Dr. D. G. Steyn (see p. 615), and as the Journal containing the publication may not be readily accessible to other workers in the field of systematic botany, the description is given here in full:

*Plant* a succulent sometimes acaulescent perennial, glabrous in all parts, but covered on the leaves and inflorescence parts with a thin white waxy bloom. *Stem* (where present) stout and well-developed, up to 12 cm. high and 2 cm. thick, erect, simple or usually dichotomously branched in the upper half, terete, closely leafy toward and round the apices, with knobby excrescences marking the old leaf scars on the lower nude part, and covered

\* *E. hottentotta*, Burch. of Thiselt.-Dyer, Fl. Cap. IV, 2.5 (1904).

† *Ruschia saxicola*, L. Bolus. The above determination was made for the writer by the late Dr. N. E. Brown at Kew from Dr. L. Bolus' type number, also collected by the writer on the Fauresmith Reserve.

with a thin greyish- or ashy- to yellowish-green skin. *Branches* resembling the stems, but thinner, up to 3 cm. long, simple or again shortly branched. *Leaves* alternate, occasionally pseudopposite at the apices of the branches, decussately arranged or somewhat scattered, oblong to obovate-cuneate, gradually narrowed from near, and toward, the base, usually rounded at the apex (or casually abruptly narrowed to a subacute, often in the younger stages, slightly crisped apex), up to 5 cm. long and 2 cm. wide, erect or ascending-erect, frequently (the lower) incurving-erect, very fleshy and up to 4 mm. thick in the middle near the base, gradually thinner towards the apical margin, green, often purple-red flushed at the apex, but never spotted, convex on the outer, and convex or flattened on the inner face in the upper half, convex on both surfaces in the lower half, and hence elliptic to oblong-elliptic in cross-section. *Inflorescence* apparently terminal or axillary, simple or with 2-3 branches, laxly racemosely-flowered in the upper half, nude, or with a few scattered and much reduced sterile scale-like bracts in the lower half; rachis rigidly erect or subcervuous near the apex, up to 35 cm. long, terete, brownish-purple. *Flowers* subsecund when open, and spreading, erect after fertilisation and in the bud stage. *Pedicels* up to 6 mm. long prior to, and 1 cm. long during the fruiting stage, most usually with 1-3 much-reduced lanceolate-ovate bracteoles, the lower occasionally with a sessile non-maturing flower from the upper bracteole, terete, and insensibly widening into the calyx, arising from the axils of much reduced ovate to ovate-lanceolate acute up to 1.5 mm. long bracts. *Calyx* purply-brown, fleshy; teeth ovate-deltoid, acuminate, up to 2.5 mm. long, fleshy and convex on the outer face and adpressed to the corolla. *Corolla-tube* cylindric, straight, obtusely 5-angled and marked with 5 evident sulci between the angles, up to 1 cm. long, purple to mauve-purple on the outer face deep mauve to maroon-coloured in the throat, scarlet to deep coral-red in the bud; lobes ovate-deltoid, acuminate, up to 2 mm. long, purple to mauve, thin and delicate; the limb at first spreading but at length reflexed. *Filaments* filiform, inserted as in the former species, purplish-mauve at the apex. *Anthers* ovoid, creamy-white or purple-flushed before dehiscence. *Ovaries* 4-5, oblong-ovoid, up to 5 mm. long, tapering into the subulate green styles. *Nectarial scales* oblong, up to 1.5 mm. long, very slightly notched at the apex, pale green.

**A. umbraticolus**, *C. A. Sm.*, in *Onderstepoort Journ. Vet. Sc. & An. Ind.* Vol. I, 174 (1933).

*Cotyledon trigyna* Burt Davy, *Fl. Transv. & Swaz.* Vol. I, 142, 143 (1925), *pro majore parte, sed. excl. syn. et non-Tvl. exsicc.; non Burch.* (1824).

TRANSVAAL HIGHVELD—Pretoria distr.: On the Magaliesberg at Silikaatsnek, in rocky crevices in shady places along the northern slopes, 5,000 ft., Nov. 1926, *Smith* 3432! (Pa); at Wonderboom, along rocky ledges and in crevices of precipitous sides of cliffs in the northern entrance to the Poort, 4,650 ft., Dec. 1925, *Smith* 1766! (Pa); On the farm "Witfontein", along upper half of northern slopes of the Magaliesberg, about 2 miles west of Wonderboom Poort, 4,600 ft., July 1933, *Smith* 6272! (Pa); at Pretoria, along northern slopes (upper half) of Meintjeskop range, below the crest near the old Fort in rocky crevices, 4,800 feet, Sept. 1925, *Smith* 693A! (Pa), and in rocky fissures and crevices in rich humus on the same range below the Reservoir, 4,800 ft., Nov. 1926, *Smith* 3456! (Pa), & *eod. loc.*, June 1931, *Smith & Ward* 3! (Pa). Witwatersrand distr.: Rocky crevices on a koppie at Braamfontein, near Johannesburg, 6,000 ft., Nov.-Dec. 1898, *Gilfillan* 60! (Pa).

A very common plant on the ranges round Pretoria and along the northern slopes of the Magaliesberg, invariably found growing socially (like the last species) in rocky crevices and fissures, with the vegetative parts in shade of other plants (Plate IV) and the rootsystem under rocks or often firmly wedged into the crevices, the inflorescence being exposed to the open where the flowers are more readily accessible to insect visitors. Fig. 5 shows a typical specimen:



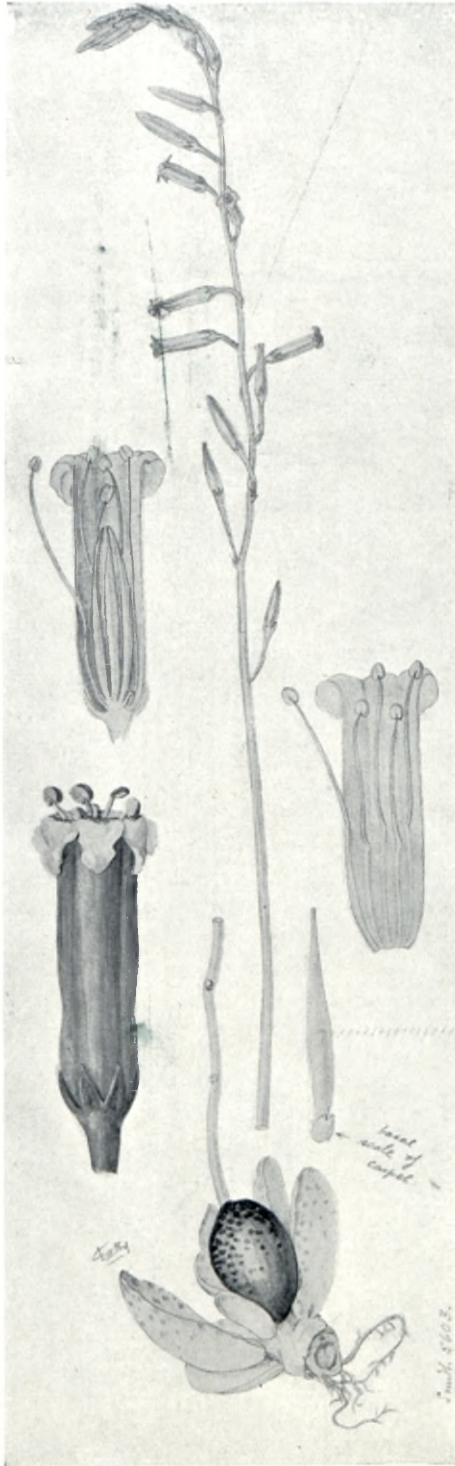


Fig. 4.—*A. rupicolus* C. A. Sm. Sketched from the living plant (the type) collected by the writer (Smith, 5603). See text.

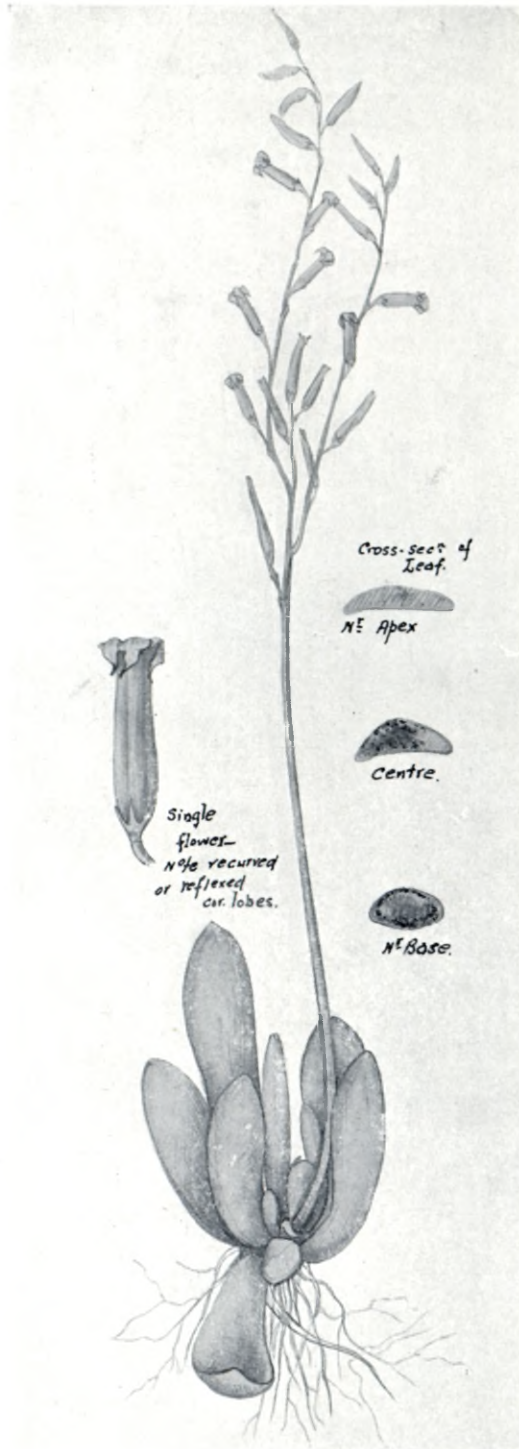


FIG. 5.—*A. umbraticolus*, C. A. Sm. Sketched from the living plant, the type. See text.

In the Meintjeskop localities the plants were found forming practically pure stands under dwarf arborescent specimens of *Strychnos pungens* Sol. (Plate IV), *Vangueria infausta* Burch., *Combretum Gueinzii* Sond., and very commonly also under tangled masses of *Landolphia capensis* Oliv., or in other cases associated with one or very generally more of the following: *Crassula argyrophylla* Diels (commonly so), *Euphorbia Schinzii* Pax, *Salacia Rehmannii* Schinz, *Kalanchoe paniculata* Harv., *Aloe Davyana* Schoul., *A. transvaalensis* O. Ktze., *Becium angustifolium* Benth., *Pachystigma Zeyheri* Sond., *Lanea edulis* (Sond.) Engl., *Leonotis microphylla* Skan and *Cotyledon leucophylla*, C.A. Sm. *Huernia Loesneriana* Schltr.

The accompanying photo (Plate IV), taken by the writer in Nov. 1926, shows *Smith 3456* growing under a specimen of *Strychnos pungens* Sol., with trailing branches of *Landolphia capensis* Oliv. (to the left and top right of the photo), the numerous erect peduncles with their long racemes forming an interlaced mass above the plants.

The next photo (Plate V) shows the plant in more open situations due to removal during the previous year or two of the sheltering *Landolphia capensis* Oliv. (seen to left and bottom right of photo) by nocturnal hunters for the notorious but legendary "Kruger millions" (note the hole in the centre).

This species is of interest in that the pedicels bear 1-3 bracteoles along the lower pedicels, from one of which (the upper) a sessile and generally abortive flower may arise, thus indicating an approach to the 3-florous condition seen in other species of the genus already noted (see p. 617), though in the former the pedicelled condition prevails, and it is a feature of further interest to note that the bracteoles with barren flowers were seen only in cultivated specimens thus far.

The leaves of this species also behave like those of *A. Marianae* (Marl.), i.e. when they drop or are broken off from the parent plant desiccation does not follow immediately, but adventitious roots are developed at the base, followed in time by tufts of leaves, the genesis of one or more new plants. Both the two leaves seen in the foreground in Plate V had started to root in this manner, the one on the right having also produced new leaves.

## 28. *A. saxicolus*, C. A. Sm.,

*Planta* nana, succulenta, perennis, in partibus omnibus glabra, locis apricosis crescens. *Radix* plerumque multus incrassatus et succulentus, ad 2 cm. diam., basi nodulis rotundatis. *Caulis* e corona radiceis 1-3 (vel plus), breves (ad 2.5 cm. alti), crassi (ad 1 cm. diam.), ad apices dense foliosi, vel caules 0, foliis tum circum coronam rotundatam aggregatis. *Folia* dispersa, vel summa pseudopposita, dense congesta et subrosulata, lineari-oblonga ad oblongo-elliptica, plus minusve ad basin et apicem auctum equaliter angustata, ad 3.5 cm. longa et 1 cm. lata, carnosissima et ad 5 mm. in medio crassa, superne inferneque convexa, viridia, immaculata, pallide rosea in superiore parte. *Inflorescentia* simplex; rhachis rigide erectus, ad 25 cm. longus, simplex. *Flores* pedicellati, in cymulis 1-floris dispositi, post anthesin patentes et subsecundi, postquam impregnationem ovariorum erecti. *Pedicelli* ad 5 mm. longi, vel 7 mm. in fructu, teretes, saepe bracteola membranacea subulata onusti. *Calyx* cinereo-viridis, carnosus; dentes lanceolato-deltaidei, acuminati, ad 1.5 mm. longi. *Tubus corollae* cylindricus, rectus, obtuse 5-angulatus, ad 8 mm. longus, purpurascens, in fauce purpureus vel saturate ruber; lobi ovato-deltaidei, acuminati, ad 1.5 mm. longi, purpurei, sed pallidioribus marginibus, deinde reflexi. *Filamenta* filiformia, ut more sectionis in tubo corollae inserta, ad apices purpurea, infra viridescenti-lutea. *Antherae* ovoideae, post anthesin lutescentes vel purpureae. *Ovaria* 5, oblongo-ovoidea, ad 5 mm. longa, in stylo viride subulato angustate. *Squamae nectarii* oblongo-cuneatae, ad 1 mm. longae, apice breviter emarginatae, pallido-virides.

TRANSVAAL HIGHVELD—Pretoria distr.: At the southern entrance to Baviaanspoort, on the Magaliesberg, growing socially on rocky ledges and in crevices filled with black humus, 4,500 ft., Nov. 1926, *Smith* 3424! Syntype (Pa); at Premier Mine, in open places on a koppie to east of the mine, growing in rocky depressions and crevices, June 1931, *Smith & Ward* 5! Type (Pa).

The plant is closely related to the previous species, but from this it is readily known by its rootstock, the acute leaves (only very casually obtuse), as well as by their shape, and its consistently dwarf habit. Found only in one locality at the Premier Mine associated with *Crassula argyrophylla* Diels, *Euphorbia truncata* N. E. Br., *E. Schinzii* Pax, *Lopholaena coriifolia* (Sond.) Phill. & C. A. Sm., *Selaginella rupestris* Spreng., *Parinarium capense* Harv., and the very dwarf forms of *Burkea africana* Hook.

#### SPECIES EXCLUSA.

The *Cotyledon* described by Haworth (Misc. Nat. 180: 1903) as *C. caespitosa* Haw. with "Habitat ad Cap. Bon. Sp." is not a Cape plant at all, but, as later corrected by Haworth himself (Syn. Suppl. Succ. Ed. Germ. 117: 1819), is a Californian plant, said to be conspecific with *C. linguiformis* (Ait. Hort. Kew. Ed. 2. Vol. 3, 109: 1812), which was obtained from California (see Saund., Ref. Bot. I. t. 69: 1869). It belongs to a genus now excluded from *Cotyledon* Linn. (emend.).

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Plate I.—*A. leucothrix* C.A. Sm. Type plant.



Plate II.—*A. nana* (N. E. Br.) von Poellnitz Type plant photographed by Miss. Brown, Sept., 1920 (see text).



Plate III.—*A. nanus* (N.E. Br.) von Poell., photographed in its native habitat with a group of associated succulents by the writer in April, 1927. (See text.)



Plate IV.—*A. umbraticolus* C.A. Sm., in its natural habitat. (See text.)



Plate V.—*A. umbraticolus* C.A. Sm., with associated plants. Photo taken by the writer (Nov., 1926), slightly to the right of the one shown in plate IV. (See text.)





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