

New taxa and new combinations in *Cotyledon* and allied genera

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ABSTRACT

As a result of a re-evaluation of *Cotyledon* and *Adromischus*, it was found necessary to amend the delimitation of *Cotyledon* and to describe a new genus *Tylecodon*. A summarized revision of *Adromischus* with keys to sections, species and subspecific taxa is provided. The following new names and new combinations are effected: *Adromischus* sect. *Boreali* Toelken, *A. cristatus* var. *clavifolius* (Haw.) Toelken, —var. *schonlandii* (Phill.) Toelken, —var. *zeyheri* (Harv.) Toelken, *A. fallax* Toelken, *A. filicaulis* subsp. *marlothii* (Schonl.) Toelken, *A. inamoenus* Toelken, *A. marianae* var. *hallii* (P. C. Hutch.) Toelken, —var. *kubusensis* (Uitew.) Toelken, *A. schuldianus* subsp. *juttae* (V. Poelln.) Toelken, *A. subviridis* Toelken, *A. umbraticola* subsp. *ramosa* Toelken, *Tylecodon buchholzianus* (Schuldt & Steph.) Toelken, *T. cacalioides* (L.f.) Toelken, *T. decipiens* Toelken, *T. fragilis* (Dyer) Toelken, *T. faucium* (V. Poelln.) Toelken, *T. grandiflorus* (Burm.f.) Toelken, *T. hallii* (Toelken) Toelken, *T. hirtifolium* (W. F. Barker) Toelken, *T. leucothrix* (C. A. Smith) Toelken, *T. occultans* (Toelken) Toelken, *T. paniculatus* (L.f.) Toelken, *T. pearsonii* (Schonl.) Toelken, *T. pygmaeus* (W. F. Barker) Toelken, —var. *tenuis* (Toelken) Toelken, *T. racemosus* (Harv.) Toelken, *T. reticulatus* (L.f.) Toelken, —subsp. *phyllopodium* Toelken, *T. rubrovenosus* (Dinter) Toelken, *T. schaeferanus* (Dinter) Toelken, *T. similis* (Toelken) Toelken, *T. singularis* (Dyer) Toelken, *T. striatus* (P. C. Hutch.) Toelken, *T. suffultus* Bruyns ex Toelken, *T. sulphureus* (Toelken) Toelken, *T. torulosus* Toelken, *T. tuberosus* Toelken, *T. ventricosus* (Burm.f.) Toelken, *T. viridiflorus* (Toelken) Toelken, *T. wallichii* (Harv.) Toelken, —subsp. *ecklonianus* (Harv.) Toelken.

RÉSUMÉ

NOUVEAUX TAXA ET NOUVELLES COMBINAISONS DANS COTYLEDON ET GENRES APPARENTÉS

Suite à une réévaluation des genres *Cotyledon* et *Adromischus*, il s'est avéré nécessaire de rectifier la délimitation de *Cotyledon* et de décrire un genre nouveau: *Tylecodon*. Une révision abrégée d'*Adromischus* est fournie, avec des clés pour les sections, espèces et taxa sub-spécifiques. Les noms et combinaisons nouveaux qui ont été établis sont les suivants: *Adromischus* sect. *Boreali* Toelken, *A. cristatus* var. *clavifolius* (Haw.) Toelken, —var. *schonlandii* (Phill.) Toelken, —var. *zeyheri* (Harv.) Toelken, *A. fallax* Toelken, *A. filicaulis* subsp. *marlothii* (Schonl.) Toelken, *A. inamoenus* Toelken, *A. marianae* var. *hallii* (P. C. Hutch.) Toelken, —var. *kubusensis* (Uitew.) Toelken, *A. schuldianus* subsp. *juttae* (V. Poelln.) Toelken, *A. subviridis* Toelken, *A. umbraticola* subsp. *ramosa* Toelken, *Tylecodon buchholzianus* (Schuldt & Steph.) Toelken, *T. cacalioides* (L.f.) Toelken, *T. decipiens* Toelken, *T. fragilis* (Dyer) Toelken, *T. faucium* (V. Poelln.) Toelken, *T. grandiflorus* (Burm.f.) Toelken, *T. hallii* (Toelken) Toelken, *T. hirtifolium* (W.F. Barker) Toelken, *T. leucothrix* (C. A. Smith) Toelken, *T. occultans* (Toelken) Toelken, *T. paniculatus* (L.f.) Toelken, *T. pearsonii* (Schonl.) Toelken, *T. pygmaeus* (W. F. Barker) Toelken, —var. *tenuis* (Toelken) Toelken, *T. racemosus* (Harv.) Toelken, *T. reticulatus* (L.f.) Toelken, —subsp. *phyllopodium* Toelken, *T. rubrovenosus* (Dinter) Toelken, *T. schaeferanus* (Dinter) Toelken, *T. similis* (Toelken) Toelken, *T. singularis* (Dyer) Toelken, *T. striatus* (P. C. Hutch.) Toelken, *T. suffultus* Bruyns ex Toelken, *T. sulphureus* (Toelken) Toelken, *T. torulosus* Toelken, *T. tuberosus* Toelken, *T. ventricosus* (Burm.f.) Toelken, *T. viridiflorus* (Toelken) Toelken, *T. wallichii* (Harv.) Toelken, —subsp. *ecklonianus* (Harv.) Toelken.

NOTES ON COTYLEDON, TYLECODON AND ADROMISCHUS

Linnaeus included a number of different elements in his genus *Cotyledon* and in time these were placed into separate genera such as *Kalanchoe* Adans. (1763), *Umbilicus* DC. (1801), *Orostachys* Fisch. (1808) and *Pistorina* DC. (1828). In 1852 Lemaire described the genus *Adromischus* on the basis of its spike-like inflorescence and the long corolla tube. However, only since 1930 when Berger used the name, has the genus *Adromischus* become generally accepted and the concept of the genus *Cotyledon* remained unchanged except for a few species which were at first too little known to be placed into their correct genus. Berger

accepted the genus *Adromischus*, but followed Schonland (1915) in leaving the second group of species with spirally arranged leaves within *Cotyledon* with no rank at all. De Candolle (1828) recognised the following three groups in *Cotyledon*: "(a) Foliis oppositis; (b) Foliis alternis, marcescentibus; (c) Foliis alternis, persistentibus." It is remarkable that he conceived such a simple and profound system seeing that he had knowledge of the much more complex subdivision proposed by Salm-Dyck, but only published in 1834. De Candolle's groups agree well with the proposed concepts of *Cotyledon sensu stricto*, *Tylecodon* and *Adromischus* as set out in Table 1 in which the more important characteristics of the three genera are summarized.

TABLE 1.—Comparison of the main characteristics of the genera *Adromischus*, *Cotyledon* and *Tylecodon*

	ADROMISCHUS	COTYLEDON	TYLECODON
Leaves.....	spiral, stiff, persistent.....	opposite, stiff, persistent.....	spiral, soft, herbaceous, deciduous.
Leaf epidermis.....	isodiametric cells with straight anticlinal walls	isodiametric cells with straight anticlinal walls	elongate cells with sinuate anticlinal walls.
Inflorescence.....	usually a spike-like thyrse.....	thyrse with 1-6 dichasia, each ending in a monochasium	thyrse with 1-8 monochasia.
Flowers.....	erect or spreading (pendulous in <i>A. phillipsiae</i>)	pendulous	erect or spreading (pendulous in <i>T. pearsonii</i>).
Peduncle.....	with abrupt change from leaves to bracts	with abrupt change from leaves to bracts	with gradual transition from leaves to bracts.
Sepals, adaxial surface	with club-shaped trichomes.....	glabrous	often with club-shaped trichomes.
Petals.....	fused beyond the tube.....	fused for less than the full length of the tube	fused for less than the full length of the tube.
Filaments.....	smooth or papillose.....	usually hairy towards the base....	usually hairy towards the base.
Nectary scales.....	disc-like, free.....	laterally fused to carpel to form a cup	disc-like, free.

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The inflorescence in *Cotyledon* is a thyrse with one to several dichasia in which each branch terminates in a monochasium with two bracts below each flower. The sympodial branch system from the second bract is suppressed. Species of *Cotyledon* have an opposite leaf arrangement, so that a dichasium similar to that in *Crassula* could be expected.

Tylecodon and *Adromischus* have spirally arranged leaves and, accordingly, the thyrse develops a number of monochasia spirally arranged along the central axis of the inflorescence and they reach maturity acropetally. This basic pattern, which is found for instance in *T. grandiflora*, could theoretically undergo two extreme developments:

(a) A basitonous development (Troll, 1964), which results in a shortening of the central axis of the inflorescence together with a pronounced development of the lateral part-inflorescences (monochasia) to produce a corymb-like thyrse as in *T. cacalioides*. In many plants of *T. wallichii* the central axis is even further reduced, so that 2-4 monochasia seem to branch from the same node (pleiochasia in Troll, 1964), a condition which should not be confused with the basic dichasial pattern of *Cotyledon*.

(b) An acrotonous development (Troll, 1964), in which the central axis elongates while the lateral part-inflorescences are reduced to sessile flowers, or almost so, and thus form a spike-like thyrse. Extreme forms of this development lead to the single flower per part-inflorescence in *Adromischus*, which can be deduced from the two bracts on the pedicel of each flower on the inflorescence.

A similar spike-like inflorescence is found in *Crassula capitella* subsp. *capitella* and subsp. *nodulosa*, which belong to the sect. *Rosulares* of which other members such as *C. vaginata* and *C. alba* show a basitonous development. In *Tylecodon*, however, only the latter development has produced extreme forms, while in *Adromischus* the acrotonous development is predominant except for sect. *Brevipedunculati* in which the thyrse may consist of 1-4 monochasia each with one to eight flowers.

The inflorescence alone cannot be used to separate the genus *Adromischus* from *Cotyledon* and *Tylecodon*. All representatives of *Tylecodon* and *Adromischus* investigated have spirally arranged leaves, contrary

to reports by C. A. Smith (1939) who keyed out a number of species of *Adromischus* by their opposite leaves. The leaves are often so closely packed that the spiral arrangement becomes only clearly visible in etiolated branches in which the internodes elongate somewhat. The question remains whether the two bracts below each flower on the monochasia of *Tylecodon* and *Adromischus* are comparable to those on the terminal monochasia of *Cotyledon* and thus whether these monochasia are derived from dichasia, and the spiral from the opposite leaf arrangement.

No direct affinities were found between any of the two genera and there appear to be about as many characters shared among any two of the genera as there are dissimilarities. Thus, while *Tylecodon* and *Cotyledon* agree in their karyotype (Ogawa, unpublished) and in their relatively short corolla tube, they differ in these respects from *Adromischus*. The leaves are persistent and their isodiametric epidermis cells have straight anticlinal walls in *Cotyledon* and *Adromischus*, while in *Tylecodon* the leaves are deciduous and their epidermis cells have anticlinal walls. The leaves are spirally arranged and the nectaries disc-like in *Tylecodon* and *Adromischus*, while in *Cotyledon* the leaves are opposite and the nectaries cup-shaped. Not one of the genera can apparently be derived from one of the others. None of them represents merely a group of species more highly developed than related ones in regard to a particular character as was found to be the case in groups like *Rochea*, *Rhopalota*, *Pagella* or *Globulea*, which are now again included in the genus *Crassula*. Within each one of the three genera at least one ultimate development in regard to a certain character such as pointed out in the above discussion of the inflorescence is found, but they do not merely consist of species showing this highly developed characteristic.

The three genera are obviously very similar to one another, but no indication of direct or close relationship between any two of them was found. It is significant, and particularly in the Crassulaceae where numerous hybrids between genera have been produced (Uhl, personal communication), that no natural intergeneric hybrids between any of the three genera have been recorded, although plants often grow near one another. Yet numerous natural hybrids between species of each of the genera are known.

KEY TO GENERA

- Leaves deciduous, with elongate epidermis cells with sinuate anticlinal cell walls 2. *Tylecodon*
 Leaves persistent with isodiametric cells with straight anticlinal cross walls:
 Leaves opposite (or in whorls of 3); petals fused for less than the full length of tube, nectary cup-shaped 1. *Cotyledon*
 Leaves spirally arranged; petals fused beyond the tube; nectary disc-like 3. *Adromischus*

1. COTYLEDON

Cotyledon L., Sp. Pl. ed. 1: 429 (1753), pro parte; DC., Prodr. 3: 396 (1828), pro parte; Harv., Fl. Cap. 2: 370 (1862), pro parte; Schönl. in Rec. Albany Mus. 3: 130 (1915), pro parte; V. Poelln. in Reprium nov. Spec. Regni veg. 42: 15 (1937); Friedr., in Prodr. Fl. S.W.Afr. 52: 5 (1968), pro parte; Dyer, Gen. 1: 195 (1975), pro parte, emend. Type species: *C. orbiculata* L.

Shrubs, rarely suffrutices with somewhat woody branches usually with flaking bark, without tuberous base. Leaves opposite, persistent, stiff, with smooth waxy surface. Inflorescence a thyrse with 1-6 dichasia each ending in a monochasium, usually with many pendulous flowers; bracts on peduncle few and much shorter than leaves below. Calyx glabrous or sometimes with glandular hairs on abaxial surface. Corolla fused for less than the full length of the tube, glabrous or rarely with glandular hairs on the outside, yellow

to red. Filaments hairy towards the base where they are fused to the corolla tube. Squamulae laterally fused to the carpel to form a cup in which the nectar collects. Ovary with (50-) 100 or more ovules in at least two rows on each placenta.

2. TYLECODON

Tylecodon Toelken, gen. nov. a *Cotyledone* foliis spiralibus, deciduis et squamis disciformibus; ab *Adromischo* foliis deciduis quibus gradatim brevescentibus bracteis in pedunculo differt.

Frutices vel plantae parvissimae vix altiores 30 mm, ramis succulentis rare cartilagineis et plerumque cortice chartaceo, saepe tuberibus multiramosis. Folia spiralia, decidua, molliter herbacea sine strato ceraceo et saepe epidermidis cellulosis protuberantibus. Inflorescentia thyrsum 1-8 monochasiis quoque 1-∞ flori-

bus erectis vel effusis. *Calyx* glaber vel pilis glanduliferis trichomatibus clavatis supra et/vel subtus. *Corolla* connata non per totam longitudinem tubi, glabra vel pilis glanduliferis extus, viridis, fusca vel alba et saepe suffusa rosea. *Filamenta* tomentosa ad basem. *Squamae* librae disciformae flavae vel tangerinae. *Ovarium* 4–30 (–90) ovulis plerumque una serie in quoque placenta.

Type species: *T. cacalioides* (L.f.) Toelken.

Shrubs to very small plants scarcely higher than 30 mm with succulent branches rarely cartilaginous and usually with peeling bark, often with much-branched tubers. *Leaves* spirally arranged, deciduous, soft herbaceous and without waxy layer and often with bulging epidermis cells. *Inflorescence* a thyrse with 1–8 monochasia each with one to many erect or spreading flowers; bracts on peduncle becoming gradually shorter from the leaves to the flowers. *Calyx* glabrous or with glandular hairs or with club-shaped trichomes on the abaxial and/or the adaxial surface. *Corolla* fused for less than the full length of the tube, glabrous or with glandular hairs on the outside, green, brown or white and often tinged pink rarely orange. *Filaments* hairy towards the base where they are fused to the corolla tube. *Squamae* free and disc-like, yellow to orange. *Ovary* with 4–30 (–90) ovules usually in one row on each placenta.

Occurring in an area between southern South West Africa to south-western Cape and eastern parts of the Little Karoo, but also with one outlier in the mountains around Graaff Reinet.

The name *Tylecodon* is an anagram of *Cotyledon*. *T. cacalioides* was selected as the type species as it is the only species enumerated by De Candolle (1828) of which the name has not been changed in one or other way since that time.

***T. buchholzianus* (Schuldt & Steph.) Toelken, comb. nov.**

Cotyledon buchholziana Schuldt & Steph. in Kakteenkunde (1937) 111, fig.; V. Poelln. in Kakteenkunde (1938) 111, fig.; Friedr. in Prodr. Fl. S. W. Afr. 52: 8 (1968); Jacobsen, Handb. Succ. Pl. 1: 279, fig. 274 (1960); Sukk. Lex. 132, t.38, 2 (1970). Type: Cape, 200 km from Port Nolloth, *M. Schlechter* s.n. (B†).

***T. cacalioides* (L.f.) Toelken, comb. nov.**

Cotyledon cacalioides L.f., Suppl. 242 (1781); Thunb., Prodr. 3: 397 (1800); Fl. Cap. ed. Schultes 397 (1823); DC., Prodr. 3: 397 (1828); Harv., Fl. Cap. 2: 274 (1862); Schonl. in Rec. Albany Mus. 3: 147 (1915); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 18 (1937). Type: Cape, near Olifant's Bad, Thunberg in Herb. Thunberg 10 998 (UPS, holo!).

***T. decipiens* Toelken, sp. nov. a *T. schaeferano* ramis latis (6–10 mm in diametro), foliis cymbiformibus et ovariis pilis paucibus; a *T. toruloso* corolla plerumque glabra tubo 9–11 mm longo et lobis roseis, foliis cymbiformibus differt.**

Plantae perennes ramis multiramosis 6–10 mm in diametro usque ad 0,2m longis sed plerumque brevissimis et tegetes densae formantes super basim tumidam multiramam, phyllopodiiis torulosis, cortice ramium veterium alba et confrigenti et caduco. *Folia* oblanceolata vel elliptica 4–12 (–15) mm longa, 3–8 mm lata, apicibus obtusis vel rotundatis, cuneata, cymbiformia, pilis glanduliferis paucis vel glabrescentia, viridia vel griseo-viridia. *Inflorescentia* thyrsum 1,2(3) monochasiis quoque 1,2 floribus sed 1 flore in natura; pedunculus 8–20 mm longus, filiformis; pilis glanduliferis; pedicellus 6–15 mm longus. *Calyx lobis* anguste triangulares, 2,5–3,5 mm longi, acuti, pilis glandulosi. *Corolla* tubo 9–11 mm longo, glabro, pallide flavo-viride; lobi 4–5 mm longi, lanceolati, acuti, glabri, rosei vel paene albi. *Stamina* 10–12 mm longa, antheris aequalibus 1,2–1,4 mm longis, filamentis rectis pilis tenuibus patentibus ubi connatis corollae tubo. *Squamae* oblongae, 1,2–1,4 × 0,3–0,4 mm, non constrictae ad bases, emarginatae, leviter succulentae,

pallide flavae. *Carpella* ovariis gracilibus pilis patentibus et gradatim constrictis ad stylos erectos stigmatibus terminalibus; ovarium 26–28 ovulis quoque circiter duplo longiore quam lato leviter latis factis ad funiculum et cristis verticalibus.

Type: Cape, near Grootmis, *Tölken* 5252 (PRE, holo!).

Perennials with much-branched stems 6–10 mm in diameter up and to 0,2 m long but usually very short and forming mats so dense that the branches can scarcely be distinguished from the much branched swollen base, with leaf bases giving stems a slightly knobby appearance, with bark on older branches white and flaking. *Leaves* oblanceolate to elliptic, 4–12 (–15) mm long, 3–8 mm broad, with obtuse or rounded apices, cuneate, cymbiform, covered with few glandular hairs to glabrous, green to grey-green. *Inflorescence* a thyrse with 1 or 2 (3) monochasia each with one flower (but in cultivation with one or two flowers); peduncles 8–20 mm long, thread-like, covered with glandular hairs; pedicels 6–15 mm long. *Calyx lobes* narrowly triangular 2,5–3,5 mm long, sharply acute, covered with glandular hairs. *Corolla* with tube 9–11 mm long, glabrous, pale yellowish-green; lobes 4–5 mm long, lanceolate, acute, glabrous, pink rarely almost white. *Stamens* 10–12 mm long, with anthers equally long 1,3–1,4 mm, with straight filaments covered with fine spreading hairs where fused to the petal tube. *Squamae* oblong, 1,2–1,4 × 0,3–0,4 mm, not constricted downwards, emarginate, slightly fleshy, pale yellow. *Carpels* with slender ovaries with spreading hairs and gradually constricted into erect styles with terminal stigmas; ovary with 26–28 ovules each about twice as long as broad and slightly broadened at the funicle and with vertical ridges.

In the field the branches do not elongate much and, together with the branched swollen bases, they form dense mats similar to those found in the form of *T. schaeferanus* which was described as *Cotyledon sinus-alexandri*, and with which the species has hitherto been confused.

The confusion was only cleared up when, after three years in cultivation, erect branches had developed and flowers could be investigated.

***T. fragilis* (Dyer) Toelken, comb. nov.**

Cotyledon fragilis Dyer in Flower. Pl. Afr. 41, pl. 1631 (1971). Type: Cape, near Strandfontein, *Hall* 3426 (PRE, holo!).

***T. faucium* (V. Poelln.) Toelken, comb. nov.**

Cotyledon faucium V. Poelln. in Reprim nov. Spec. Regni veg. 50: 323 (1941). Type: Cape, Verlatenkloof, *Herre* in SUG 6841 (BOL, clono!).

***T. grandiflorus* (Burm.f.) Toelken, comb. nov.**

Cotyledon grandiflora Burm.f., Prodr. Fl. Cap. 13 (1768); Schonl. & Bak.f. in J. Bot., Lond. 40: 23 (1902); Schonl. in Rec. Albany Mus. 3: 147 (1915); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 20 (1937); Adams., Fl. Cape Penins. 439 (1950); Kidd, Wild Flow. Cape Penins. pl. 2, 3 (1950). Iconotype: J. Burm., Rar. Afr. Pl. t.20, fig.1 (1738).

***T. hallii* (Toelken) Toelken, comb. nov.**

Cotyledon hallii Toelken in Bothalia 12: 193 (1977). Type: Cape, De Hoop, *Hall* 1300 (NBG, holo!).

***T. hirtifolium* (W. F. Barker) Toelken, comb. nov.**

Cotyledon hirtifolium W. F. Barker in Flower. Pl. Afr. 18, t. 690 (1938). Type: Cape, near Komaggas, *Herre* in BOL 22 165 (BOL, holo!).

***T. leucothrix* (C. A. Smith) Toelken, comb. nov.**

Adromischus leucothrix C. A. Smith in Bothalia 3: 637, pl.1 (April, 1939). Iconotype: Bothalia 3: 637, pl. 1 (lecto!).

Cotyledon swartbergensis V. Poelln. in Reprim nov. Spec. Regni veg. 47: 1 (October, 1939). Type: Cape, Klein Swartberg, *Herre* in SUG 6897 (BOL, clono!). *C. leucothrix* (C. A. Smith) Fourcade in Mem. bot. Surv. S. Afr. 20: 34 (1941).

C. A. Smith described the species only from vegetative material and apparently did not make a specimen as he had probably waited in vain for the plants to flower. The only record of the original material is the photograph published together with the original description. This was therefore chosen as lectotype.

T. occultans (Toelken) Toelken, comb. nov.

Cotyledon occultans Toelken in Bothalia 12: 191 (1977). Type: Cape, near Bitterfontein, Hall 4289 (PRE, holo!; NBG!).

T. paniculatus (L.f.) Toelken, comb. nov.

Cotyledon paniculata L.f., Suppl. 242 (1781); Thunb., Prodr. 83 (1794); Fl. Cap. ed. Schultes 396 (1823); Marl., Fl. S. Afr. 2: 14, pl. 4 (1925); Schonl. in Rec. Albany Mus. 3: 147 (1915); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 21 (1937); Adamson, Fl. Cape Penins. 439 (1950); Henderson in Flower. Pl. Afr. 1142 (1953); Friedr. in Prodr. Fl. S. W. Afr. 52: 9 (1968); Jacobsen, Handb. Succ. Pl. 1: 288, fig. 285 (1960); Sukk. Lex. 134, t. 40.1 (1970). Type, near Hartekwas Kloof, Thunberg in Herb. Thunb. 11 010 (UPS, holo; microfiche!).

T. pearsonii (Schonl.) Toelken, comb. nov.

Cotyledon pearsonii Schonl. in Ann. S. Afr. Mus. 9: 55 (1912); in Rec. Albany Mus. 3: 148 (1915); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 22 (1937); Friedr. in Prodr. Fl. S. W. Afr. 52: 9 (1968). Type: Cape, between Annenous and Chubiesis, Pearson 5981 (GRA, lecto!). *C. lutesquamata* V. Poelln. in Desert Pl. Life 11: 65, fig. (1939); in Reprim nov. Spec. Regni veg. 46: 78 (1939); Jacobsen, Sukk. Lex. 134, t. 39, 2 (1970). Type: Cape, Bushmanland, Triebner s.n. (B†).

T. pygmaeus (W. F. Barker) Toelken, comb. nov.

Cotyledon pygmaea W. F. Barker in Flower. Pl. Afr. 10, pl. 396 (1930). Type: Cape, Vanrhynsdorp, Vigne in NBG 2267/29 (BOL, holo!).

var. **tenuis** (Toelken) Toelken, comb. nov.

Cotyledon pygmaea var. *tenuis* Toelken in Bothalia 12: 192 (1977). Type: Cape, near Holrivier Station, Hall 3925 (PRE, holo!; NBG!).

T. racemosus (Harv.) Toelken, comb. nov.

Cotyledon racemosa Harv., Fl. Cap. 2: 375 (1862), pro parte, excl. specimen b; N.E.Br. in Gdnrs' Chron. ser. 3, 51: 348 (1912); Schonl. in Rec. Albany Mus. 3: 149 (1915); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 22 (1937). Type: Cape, between Kaus, Natvoet and Doornpoort, Drège s.n. (S, lecto!; BM!; K!). *C. choroleuca* Dinter ex Friedr., Mitt. Bot. Staats-samml. München 3: 597, fig. (1960); Prodr. Fl. S.W.Afr. 52: 8 (1968). Type: South West Africa, 20 km N of Sendelingsdrift, Herre in SUG 20 039 (M, holo!).

Drège's specimen from near Verleptpram, which E. Meyer named *Cotyledon racemosa* b, must be identified as *T. hallii*. However, Harvey included this collection in his citation of specimens under *C. racemosa*. The specimen of *C. racemosa* a at Stockholm Herbarium was thus chosen as lectotype.

T. reticulatus (L.f.) Toelken, comb. nov.

Cotyledon reticulata L.f., Suppl. 242 (1781); Thunb., Prodr. 83 (1794); Fl. Cap. ed. Schultes 393 (1823); DC., Prodr. 3: 398 (1828); Harv., Fl. Cap. 2: 376 (1862); Schonl. in Rec. Albany Mus. 3: 148 (1915); Marl., Fl. S. Afr. 2, 1: 17, pl. 7 (1926); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 23 (1937); Jacobsen, Handb. Succ. Pl. 1: 290, fig. 287 (1960); Sukk. Lex. 135, t. 40, 2 (1970). Type: Cape, beyond Hartekwas Kloof, Thunberg in Herb. Thunberg 11 013 (UPS, holo; microfiche!).

subsp. **reticulatus**.

Cotyledon reticulata L.f., Suppl. 242 (1781).

Young branches not less than 10 mm in diameter but usually these are so short that they are difficult to distinguish from the apex of the main stem which has several growth points and is smooth or covered with crescent-shaped leaf scars which disappear after one year when the peeling bark is produced. *Inflorescence* rigid, with flowers usually spreading; pedicels with sessile or short glands.

Occurring on lower gravelly slopes in most parts of Namaqualand as far north as the Port Nolloth area, but also in Bushmanland, the Tanqua Karoo and the southern parts of the Great Karoo as far east as

Willowmore and occasionally in the north-eastern Little Karoo.

subsp. **phyllopodium** Toelken, subsp. nov.

Rami juvenes usque ad 6 mm in diametro et saepe 15 mm longiores, phyllopodii tecti quoque folii cicatricibus plus minusve rotundis et visibilibus annis aliquot. *Inflorescentia* fragilis, floribus plus minusve ascendibus; pedicellum pilis saltem duplo longioribus quam apicibus glanduliferis latis.

TYPE: South West Africa, Numais, Dinter 8092 (BOL, holo!).

Young branches up to 6 mm in diameter and often longer than 15 mm, covered with phyllopodia each with a more or less round leaf scar and these remain visible for several years. *Inflorescence* brittle, with flowers more or less erect; glandular hairs on pedicels at least twice as long as the diameter of their glandular apex.

Found on rock outcrops or often on rock faces from just south of Komaggas to south-western South West Africa. Wherever the two subspecies occur close together, as for instance near Komaggas, they are ecologically well separated.

T. rubrovenosus (Dinter) Toelken, comb. nov.

Cotyledon rubrovenosa Dinter in Reprim nov. Spec. Regni veg. 30: 194 (1932); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 24 (1937); Friedr. in Prodr. Fl. S. W. Afr. 52: 10 (1968). Type: South West Africa, south of Warmbad, Dinter s.n. (B, holo!).

T. schaeferanus (Dinter) Toelken, comb. nov.

Cotyledon schaeferana Dinter in Reprim nov. Spec. Regni veg. 19: 145 (1923); W. F. Barker in Flower. Pl. Afr. 10, pl. 394 (1930); Friedr. in Prodr. Fl. S. W. Afr. 52: 10 (1968); Jacobsen in Sukk. Lex. 135, t. 40, 3 (1970).

Type: South West Africa, Lüderitz Bay, Dinter 4449 (B, †).

T. similis (Toelken), Toelken, comb. nov.

Cotyledon similis Toelken in Bothalia 12: 192 (1977). Type: Cape, N of Grootmis, Wisura 1303 (NBG, holo!).

T. singularis (Dyer) Toelken, comb. nov.

Cotyledon singularis Dyer in Flower. Pl. Afr. 41, pl. 1606 (1970). Type: South West Africa, near Rosh Pinah, Hardy 2632, (PRE, holo!).

T. striatus (P. C. Hutch.) Toelken, comb. nov.

Cotyledon striata P. C. Hutch. in Cact. Succ. J., Los Ang. 36: 16, figs. (1964). Type: Cape, near Garies, Rodin 1405 (Univ. Calif. Bot. Gard. 49. 1794-1: BOL, holo!; PRE!).

T. suffultus Bruyns ex Toelken, sp. nov. a *T. reticulato* ramis gracilibus laevibus (3-6 mm in diametro) et petalorum lobis roseis pilis patentibus intra; a *T. pygmaeo* et *T. simili* pilis glanduliferis gracilibus in petalis et sepalis externis et pilis brevibus paucis loborum partibus interioribus differt.

Plantae perennes ramis gracilibus procumbentibus 3-6 (-8) mm in diametro et usque ad 0,3 m longis, radicibus tuberosis saepe ramosis. *Folia* lineari-elliptica (8-) 10-20 (-25) mm longa, 2,5-4,5 mm lata, acuta, plana vel canaliculata supra, convexissima subtus, glabra atro-viridia. *Inflorescentia* thyrsus 3-5 monochasiis quoque 1-3 floribus, pedunculis rigidis et pedicellis pilis glanduliferis. *Calycis lobi* anguste triangulares, 4-5 mm longi, acuti pilis glanduliferis paucis, succulenti, flavo-virides. *Corolla* tubo 5-6 mm longo, flavo-viride, pilis glanduliferis extus; lobi 4-5 mm longi, lanceolati, acuti vel pungentes, piles glanduliferis extus et pilis gracilibus eglanduliferis intra, rosei. *Stamina* 5,5-6,5 mm longa, antheris gracilibus inaequalibus circiter 1,3 mm et 1,6 mm longis, filamentis rectis pilis tenuibus patentibus ubi connatis corollae tubo. *Squamae* oblongae, 1-1,2 x c. 0,8 mm,

emarginatae, constrictae ad bases, flavae. *Carpella* ovariis gracilibus gradatim ad stylos stigmatibus terminalibus constrictis; ovarium 16–20 ovulis leviter latis factis ad bases et cristis verticalibus.

TYPE: Cape, below Vanrhyn's Pass, *Bruyns* 1091 (PRE, holo!).

Scrambler with slender procumbent branches 3–6 (–8) mm in diameter and up to 0,3 m long, with tuberous roots often branched. *Leaves* linear-elliptic (8–) 10–20(–25) mm long, 2,5–4,5 mm broad, acute, flat or with longitudinal groove above, very convex below, glabrous, dark green. *Inflorescence* a thyrsus with 3–5 monochasia each with 1–3 flowers, with stiff peduncles and pedicels covered with glandular hairs. *Calyx lobes* narrowly triangular, 4–5 mm long, acute, with few scattered glandular hairs, fleshy, yellowish-green. *Corolla* with tube 5–6 mm long, with glandular hairs outside, yellowish-green; lobes 4–5 mm long, acute or drawn into a sharp point, with glandular hairs outside and with fine glandular hairs inside, pink. *Stamens* 5,5–6,5 mm long, with slender anthers unequal c. 1,3 mm and 1,6 mm long, with straight filaments with a tuft of hairs where fused to the corolla tube. *Squamae* oblong, 1–1,2 × c. 0,8 mm, emarginate, slightly constricted towards the base, yellow. *Carpels* with slender ovaries gradually constricted into the styles and with terminal stigmas; ovary with 16–20 ovules slightly broadened towards the base and with vertical ridges.

At present the plant is known only from one locality but it may well be more wide-spread. As the species scrambles among other succulent shrubs, it is almost impossible to find unless in flower. The calyx seems to form an abscission layer at its base, so that a loose star-shaped disc remains on the pedicels of old inflorescences similar to those found in *T. reticulatus*.

***T. sulphureus* (Toelken) Toelken, comb. nov.**

Cotyledon sulphurea Toelken in *Bothalia* 12: 191 (1977). Type: Cape, near Pofadder, *Tölken* 3676A (BOL, holo!).

***T. torulosus* Toelken, sp. nov.** a *T. decipienti* ramis robustis (8–20 mm in diametro) foliis et petalis dense tectis pilis glanduliferis; a *T. viridifloro* ramis robustis torulosis et foliis ovato-spathulatis differt.

Plantae perennes ramis erectis multis 8–20 mm in diametro et usque ad 0,3 m longis incrassatis ad bases torulosis ob phyllopodia multa, cortice in ramis juvenibus bruneo et veteribus albo. *Folia* ovato-spathulata, 20–35(–40) mm longa, 5–15 (–21) mm lata, apicibus obtusis vel rotundatis et recurvata, cuneata vel petiolata, interdum canaliculata, pilis glanduliferis dense tecta, griseo-viridia vel prasina. *Inflorescentia* thyrsus 2–5 monochasiis quoque 1–3 floribus; pedunculus 5–8 mm longus, (1–) 2–3 mm latus, pilis glanduliferis. *Calycis lobi* triangulares 2,5–3,5 mm longi, acuti vel pungentes, pilis glanduliferis. *Corolla* tubo 18–23 mm longo pilis glanduliferis praecipue in cristis inter petala flavo-viridi; lobi 4–5 mm longi, lanceolati, obtusi, pilis glanduliferis extus, pallide flavi. *Stamina* 23–24 mm longa, antheris aequalibus c. 1,8 mm longis, filamentis infra antheras recurvatis et pilis gracilibus patentibus ad basim ubi corollae tubo connatis. *Squamae* paene quadratae 1–1,2 × 0,9–1 mm, vix ad basim constrictae, emarginatae leviter succulentae, albae. *Carpella* ovariis gracilibus gradatim in stylos erectos stigmatibus terminalibus constrictis; ovarium 18–24 ovulis quoque circiter duplo longiore quam lato leviter lato facto ad funiculum et cristis verticalibus.

TYPE: Cape, Karruchab Poort, *Tölken* 5317 (PRE, holo!).

Perennial with many erect branches 8–20 mm in diameter and up to 0,3 m long becoming thicker

towards the base, with stems torulose due to the numerous leaf bases, with bark on young branches dark brown later white. *Leaves* ovate-spathulate, 20–35 (–40) mm long, 5–15(–21) mm broad, with obtuse or rounded apices usually recurved, cuneate to petiolate, sometimes longitudinally grooved, densely covered with glandular hairs, grey-green to blue-green. *Inflorescence* a thyrsus with 2–5 monochasia each with 1–3 flowers; peduncle 5–8 mm long, (1–)2–3 mm thick, with glandular hairs; pedicels 2–5(–8) mm long, with glandular hairs. *Calyx lobes* triangular 2,5–3,5 mm long, sharply acute, with glandular hairs. *Corolla* with tube 18–23 mm long with glandular hairs mainly on the ridges between petals, yellowish-green; lobes 4–5 mm long, lanceolate, obtuse, with glandular hairs on outside, pale yellow. *Stamens* 23–24 mm long, with equal anthers c. 1,8 mm long, with filaments somewhat recurved below anthers and with fine spreading hairs towards the base where fused to the petal tube. *Squamae* almost square 1–1,2 × 0,9–1 mm, scarcely constricted towards the base, emarginate, slightly fleshy, white. *Carpels* with slender ovaries gradually constricted into erect styles with terminal stigmas; ovary with 18–24 ovules each about twice as long as broad, slightly broadened towards the base and with vertical ridges.

***T. tuberosus* Toelken, sp. nov.** a *T. ventricosus* ramis 5–8 mm in diametro, foliis pilis glanduliferis 2–3 mm longis, petalis 14–17 mm longis; a *T. striato* ramis flavis levibus usque ad 50 mm longis, foliis dorsoventraliter compressis et pilis glanduliferis 2–3 mm longis differt.

Plantae perennes ramis multiramis 5–8 mm in diametro, usque ad 50 mm longis supra terram sed tegetes multiramis densae formantes infra, cortice flava levi et phyllopodiis in ramis aeriis. *Folia* elliptica vel lanceolato-spathulata, (15–) 20–50(–70) mm longa, (6–) 8–16 mm lata, acuta vel obtusa, cuneata vel petiolata, dorsoventraliter compressa et recurva, pilis glanduliferis 1,5–3 mm longis tecta, griseo-viridia vel veneta. *Inflorescentia* thyrsus (1) 2–8 monochasiis quoque 1–5 floribus; pedunculi (0,15–) 0,2–0,3 m longi rigidi, pilis glanduliferis; pedicelli 6–10(–15) mm longi. *Calycis lobi* triangulares 3–4 mm longi, acuti, dense pilis glanduliferis tecti. *Corolla* tubo 8–10 mm longo pilis glanduliferis extus et pilis tenuibus paucis intra viridi suffuso fusco; lobi 5–7 mm longi, lanceolati vel acuminati, pilis glanduliferis extus, fuscis. *Stamina* 9–13 mm longa, antheris aequalibus c. 1 mm longis et oblongis etiam post polline exutum est, filamentis flexis centrifuge et pilis glanduliferis ubi corollae tubo connatis. *Squamae* oblongae, 1–1,2 × 0,2–0,3 mm, non constrictae ad bases, vix emarginatae, leviter succulentae, pallide flavae. *Carpella* ovariis gracilibus gradatim constrictis in stylos erectos stigmatibus terminalibus; ovarium 36–40 ovulis quoque leviter latis factis ad funiculum et cristis verticalibus.

TYPE: Cape, near Steinkopf, *Marloth* 13229 (PRE, holo!).

Perennials with much-branched stems 5–9 mm in diameter up to 50 mm long above ground level but forming a dense much-branched mat underground, with smooth yellow bark and phyllopodia on aerial branches. *Leaves* elliptic to lanceolate-spathulate, (15–) 29–50 (–70) mm long, (6–) 8–16 mm broad, acute to obtuse, cuneate to petiolate, dorsoventrally compressed and recurved, covered with long glandular hairs c. 1,5–3 mm long, grey-green to blue-green. *Inflorescence* a thyrsus with (1) 2–8 monochasia each with 1–5 flowers; peduncles (0,15–) 0,2–0,3 m long, stiff, covered with glandular hairs; pedicels 6–10

(-15) mm long. *Calyx lobes* triangular 3-4 mm long, acute, densely covered with glandular hairs. *Corolla* with tube 8-10 mm long with glandular hairs outside, with few fine hairs inside, green tinged brown; lobes 5-7 mm long, lanceolate, acute to acuminate, glandular hairy outside, brown. *Stamens* 9-13 mm long, with anthers equal, c. 1 mm long and oblong even after the pollen is shed, with filaments bent outwards below anthers and with fine spreading hairs where fused to the petal tube. *Squamae* oblong, 1-1.2 x 0.2-0.3 mm, not constricted towards the base, scarcely emarginate, slightly fleshy, pale yellow. *Carpels* with slender ovaries gradually constricted into erect styles with terminal stigmas; ovary with 36-40 ovules each slightly broadened towards the funicle and with vertical ridges.

***T. ventricosus* (Burm.f.) Toelken, comb. nov.**

Cotyledon ventricosa Burm.f., Prodr. Fl. Cap. 13 (1768); DC. Prodr. 3: 397 (1828); Harv., Fl. Cap. 2: 375 (1862); Schonl. & Bak.f. in J. Bot., Lond. 40: 90 (1902); Schonl. in Rec. Albany Mus. 3: 150 (1915). Iconotype: J. Burm., Rar. Afr. Pl. t.21, fig.1 (1732). — var. *alpina* Harv., Fl. Cap. 2: 376 (1862); Schonl. & Bak.f. in J. Bot., Lond. 40: 90 (1902). Type: Cape, Elandsberg, Wallich s.n. (K, lecto!).

T. ventricosus is an extremely variable species which is distinguished from a number of very similar species by its thick stems [13-20 (-30) mm in diameter] with yellow bark and phyllopodia even when young and long brown petals 20-28 mm long. Numerous local forms occur throughout its distribution range often in isolated mountains in and around the Great Karoo. Whether some of these forms should be recognized as subspecies can not be finally decided at present because too little is known about the range of variation of the vegetative parts as these are poorly represented in herbaria. The type specimen of the var. *alpina* is a depauperate specimen of typical *T. ventricosus*.

***T. viridiflorus* (Toelken) Toelken, comb. nov.**

Cotyledon viridiflora Toelken in Bothalia 12: 193 (1977). Cape, near Modderfontein, Tölken 5327 (PRE, holo!).

***T. wallichii* (Harv.) Toelken, comb. nov.**

Cotyledon wallichii Harv., Fl. Cap. 2: 374 (1862); Schonl. in Rec. Albany Mus. 3: 148 (1915). Type: Cape, Snowy Mountains, Wallich s.n. (K, lecto!).

subsp. ***wallichii***.

Cotyledon wallichii Harv., Fl. Cap. 2: 374 (1862); Schonl. in Rec. Albany Mus. 2: 152 (1904); 3: 148 (1915); Marl. in Fl. S. Afr. 2: 4 (1925); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 25 (1937).

Peduncle and pedicels usually covered with glandular hairs. *Calyx* usually densely covered with glandular hairs. *Petals* densely covered with glandular hairs on the lobes and along the ridges on the petals but also a few smaller ones between ridges. *Corolla tube* (8-) 10-12 mm long.

Occurring on lower slopes or on gravelly or sandy soils in depressions from south-west and north-east of Kamieskroon mainly along the eastern parts of south-western Cape mountains to near Oudtshoorn.

subsp. ***ecklonianus* (Harv.) Toelken, stat. nov.**

Cotyledon eckloniana Harv., Fl. Cap. 2: 374 (1862); Schonl. in Rec. Albany Mus. 3: 148 (1915); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 20 (1937). Type: Cape, Kamiesberg, Ecklon & Zeyher 1967 (S. holo!). *C. dinteri* Bak.f. in Bull. Herb. Boissier ser. 2, 3: 818 (1903); V. Poelln. in Reprim nov. Spec. Regni veg. 42: 19 (1937); Jacobsen, Handb. Succ. Pl. 1: 281, pl. 276 (1960); Sukk. Lex. 133, t. 38.4 (1970); Friedr. in Prodr. Fl. S. W. Afr. 52: 8 (1968). Type: South West Africa, Great Namaland, Dinter 931 (B†). *C. cacalioides* sensu Eckl. & Zeyh., Enum. 307 (1837), non Thunb.

Peduncles and pedicels usually glabrous. *Calyx* glabrous or with few glandular hairs when in bud. *Petals* glabrous except for a few glandular hairs on the margins of the lobes and on the area where the

petals are fused to one another; corolla tube 5-8 mm long.

Occurring on gravelly slopes from north of Kamieskroon to Aus in south-western South West Africa.

3. ADROMISCHUS

A revived interest in the genus *Adromischus* between 1952-1960 led to the description of 15 new species, but no monograph of the genus has yet been published. A revision of the genus was attempted by C. A. Smith (1939) and von Poellnitz (1940), but due to a lack of authentic specimens and especially of adequate ranges of material it was impossible for these authors to evaluate the amplitude of the variation adequately. Therefore, a more detailed account of the genus is presented here.

The history of the nomenclature of the sections is varied, but typically shows the neglect and superficial treatment given to this genus. In the publication of the original description of the genus, Lemaire (1852) distinguished two groups of species and indicated in the text that he had envisaged sectional level for them. Since Jacobsen (1966) chose *A. hemisphaericus* as the type species of the genus, sect. *Suffruticuli* Lem. must be replaced by sect. *Adromischus*. The name of Lemaire's second section cannot be accepted, because it is a polynomial. Schonland (1915) recognized two groups in that part of *Cotyledon* which agrees with the present *Adromischus*, but the names were never taken up at sectional level. C. A. Smith (1939) proposed to divide the genus into a section with opposite leaves and one with spirally arranged leaves. These characters, however, are very difficult to recognize and von Poellnitz (1940a) already pointed out that he could not place many of his plants clearly into either of the categories. The names proposed by Smith were, however, not validly published, because he did not add Latin diagnoses of these sections. The sections *Brevipedunculati* V. Poelln. and *Longipedunculati* V. Poelln. are also not based on floral morphology. Uitewaal (1952, 1963) again ignored all previous proposals when he divided the genus into sections *Inscisilobati* and *Connatilobati*, but these sections were for the first time based on floral morphology. Finally, Jacobsen (1966, 1970) in his review of the genus did not validly publish his subsect. *Pendenti*, because he omitted to add a Latin diagnosis.

The importance of floral characters in the classification of this genus was only recently recognized so that many interpretations in older literature cannot be evaluated. The absence of voucher specimens for the species of Haworth and de Candolle makes it impossible to check their identifications. For instance, the name *A. mammillaris* L.f. had been accepted for a long time for plants with decumbent stems and terete leaves. It was only now found that the type of this species represents an extremely rare species from the vicinity of Calitzdorp, while Thunberg apparently never collected the very common species which was known by this name for about two hundred years.

The criticism has been raised that types of flowers considered to be typical of a certain section are merely flower types with a specific pollination syndrome. This can easily be refuted by pointing out that although species with the same flower type may occur in different sections of *Adromischus*, they are in other respects typical of their section. The salver-shaped flowers of *A. leucophyllus*, for instance, superficially resemble those found in sect. *Brevipedunculati*, but the whole plant is densely covered with a bloom, club-shaped trichomes are restricted to the throat and the

squamae are not oblong. All these characters place *A. leucophyllus* rather into the sect. *Longipedunculati*. Even more obvious are the red pendulous flowers of *A. phillipsiae*, which seem to simulate those of *Cotyledon orbiculata*.

Most flowers in *Adromischus* are, however, superficially similar and are pollinated according to the *Thunbergia-grandiflora*-syndrome (Faegri & van der Pijl, 1971). Although the flowers of *Adromischus* are morphologically different and much less showy than *T. grandiflora*, they are visited, and most probably pollinated by bees and wasps. The extra-floral nectar attracts ants and their presence prevents the pollinators from piercing the corolla at the base in order to get more readily at the nectar inside. This was often observed in the field and there seems to be no specificity in the type of bee or wasp that is attracted to the flowers. The ants move continuously from one extra-floral nectary to another, but they have never been observed to enter the flowers or even to be attracted to the nectar inside them, as was often seen in species of *Cotyledon*.

Adromischus Lem., Jard. Fleur. 2, Misc. 60 (1852); Berger in Pflanzenfam. ed. 2, 18a: 415 (1930); C. A.

Smith in Bothalia 3: 613 (1939); V. Poelln. in Reprum nov. Spec. Regni veg. 48: 89 (1940); Jacobsen in Kakteen, Berl. 17: 189 (1966); Friedr. in Prodr. Fl. S. W. Afr. 52: 1 (1968); Dyer, Gen. 1: 198 (1975). Type species: *A. hemisphaericus* (L.) Lem.

Shrublets rarely up to 0,25 m high without inflorescence, with cartilaginous branches usually with peeling bark on very old stems, often with much branched tuberous base. *Leaves* spirally arranged, persistent, stiff or rarely softly herbaceous and with smooth waxy surface. *Inflorescence* usually a spike-like thyse with 1 — numerous monochasia each with 1 (–5) erect or spreading flowers; bracts on peduncle much shorter than and not grading gradually into the leaves below. *Calyx* glabrous on abaxial surface (often hairy in *A. cristatus*) and usually with club-shaped trichomes on adaxial surface. *Corolla* fused beyond the tube, glabrous (rarely hairy in *A. cristatus*), with green to white lobes often tinged pink to deep mauve (orange in *A. phillipsiae*). *Filaments* glabrous or papillose along the whole length. *Squamae* a free disc, white or pale yellow. *Ovary* with 20–30 (–50) ovules in one row along each placenta.

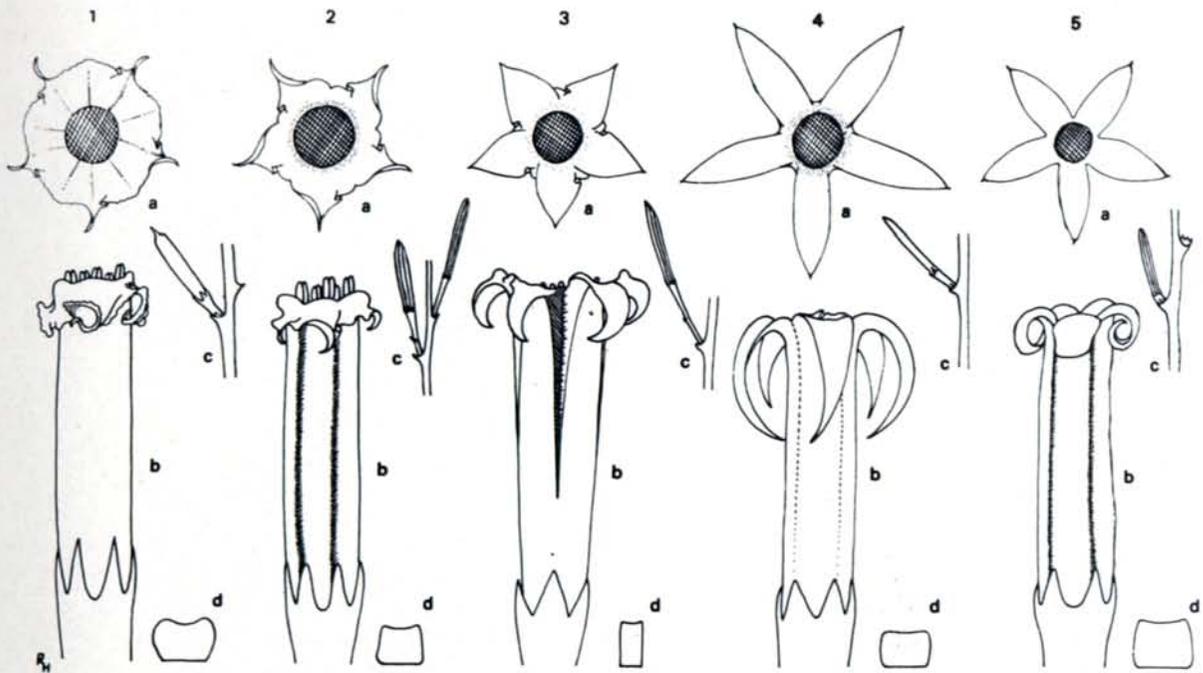


FIG. 1.—Diagrams of floral characteristics of the sections of *Adromischus*: 1, *A. filicaulis* subsp. *marlothii*, sect. *Adromischus* (Tölken 5504); 2, *A. trigynus*, sect. *Boreali* (Tölken 5416); 3, *A. humilis*, sect. *Brevipedunculati* (Marloth 4689); 4, *A. maculatus*, sect. *Inscisilobati* (Tölken 5493); 5, *A. subviridis*, sect. *Longipedunculati* (Tölken 5349). 1–5a, opening flower from above ($\times 2$); 1–5 b, mature flower in side view ($\times 4$); 1–5 c, mature bud ($\times 1$); 1–5 d, nectary scale ($\times 1$).

Key to Sections (see also Fig. 1)

- Anthers protruding above the corolla tube; corolla lobes at least as broad as long:
 - Corolla lobes abruptly constricted into apical point, undulate and frilled.....1. sect. *Adromischus*
 - Corolla lobes gradually constricted into acute apex, undulate.....2. sect. *Boreali*
- Anthers included in corolla tube; corolla lobes up to 3 times longer than broad:
 - Corolla tube obconical in flowers; squamae about twice as long as broad.....3. sect. *Brevipedunculati*
 - Corolla tube cylindrical in flowers; squamae usually broader than long, up to as long as broad, rarely slightly longer:
 - Buds distinctly grooved between petals and until flowering adpressed to central axis; club-shaped trichomes only in throat of corolla tube.....5. sect. *Longipedunculati*
 - Buds cylindrical or slightly angular and spreading; club-shaped trichomes on lower parts of lobes and in throat of corolla tube.....4. sect. *Inscisilobati*

1. Sect. *Adromischus*. Jacobsen in Kakteen, Berl. 17: 189 (1966); Sukk. Lex. 27 (1970).

Adromischus Lem., Jard. Fleur. 2, Misc. 60 (1852); Berger in Pflanzenfam. ed. 2, 18a: 415 (1930); Friedr. in Prodr. Fl. S.W. Afr. 52: 1 (1968). *A. sect. Suffruticuli* Lem., Jard. Fleur. 2, Misc. 60 (1852). Type species: *A. robustus* Lem. *A. sect. Connatilobati* Uitew. in Natn. Cact. Succ. J. 7: 70 (1952). Type species; *A. filicaulis* (Eckl. & Zeyh.) C. A. Smith [= *A. mammillaris* sensu Uitew., non (L.f.) Lem.]. *A. [sect. Longipedunculati* V. Poelln. in Reprim nov. Spec. Regni veg. 48: 89 (1940)] subsect. *Hemisphaericus* (Schonl.) V. Poelln. in Reprim nov. Spec. Regni veg. 48: 89 (1940); Jacobsen in Kakteen, Berl. 17: 190 (1966); in Sukk. Lex. 27 (1970). Type species: *A. hemisphaericus* (L.) Lem.

Cotyledon [sect. *Spicatae* Harv., Fl. Cap. 2: 370 (1862)] group *Hemisphaerica* Schonl. in Rec. Albany Mus. 3: 151 (1915).

Inflorescence straight, with mature buds and flowers usually spreading at about right angles and with extra-floral nectaries present on pedicels. *Buds* with almost cylindrical tube and abruptly constricted into a short but acute apex. *Corolla* with tube green often tinged red, glabrous; lobes with very broad base abruptly constricted into often short apical points and usually reflexed against the tube, with undulate and frilled margins, rough but usually without trichomes, white, pale pink rarely red except for the midrib and continued into the acumen. *Stamens* unequally long, with anthers of outer whorl slightly longer and just protruding above the throat or rarely enclosed, with filaments usually papillose. *Squamae* about square, broadest at about the middle.

Represented by a number of species in the area between south-western South West Africa and the South-Western Cape, but *A. bicolor* has been recorded a few times east of Steytlerville.

Key to Species and Subspecies

- Leaves linear-elliptic rarely linear-lanceolate, terete or almost so:
 Stems erect or decumbent and rarely with fibrous adventitious roots..... *A. filicaulis* subsp. *filicaulis*
 Stems prostrate or decumbent and with stilt roots unbranched for about 10–20 mm *A. filicaulis* subsp. *marlothii*
 Leaves oblanceolate, obovate to orbicular and more or less dorsiventrally compressed:
 Leaves petiolate:
 Leaf blade deltoid to obtriangular..... *A. liebenbergii*
 Leaf blade oblanceolate to obovate:
 Stems with leaves (3–) 4–6 mm in diameter and usually somewhat zig-zagging; leaf blade oblanceolate to obovate..... *A. roaneanus*
 Stems with leaves (6–) 7–10 mm in diameter and straight; leaf blade oblong-oblanceolate..... *A. filicaulis* subsp. *filicaulis*
 Leaves sessile:
 Leaves (30–) 40–80 (–110) mm long:
 Stems with leaves (3–) 4–6 mm in diameter and usually somewhat zig-zagging..... *A. roaneanus*
 Stems with leaves (6–) 8–12 mm in diameter and more or less straight but sometimes very short and much branched:
 Namaqualand to SW South West Africa; stems becoming woody and little branched..... *A. alstonii*
 Eastern Cape, east of Steytlerville; stems much branched and tough cartilaginous..... *A. bicolor*
 Leaves (8–) 20–30 (–35) mm long:
 Inflorescence (40–) 80–100 (–150) mm long; northern Richtersveld and SW South West Africa..... *A. montium-klinghardtii*
 Inflorescence (150–) 200–400 (–450) mm long; South-Western Cape mountains up to Nieuwoudtville and Eastern Cape:
 Leaves densely covered with red spots and wax which on old leaves become powdery; eastern Cape, east of Steytlerville..... *A. bicolor*
 Leaves rarely with purple spots and wax which on old leaves breaks into angular pieces larger than 2 mm square; South-western Cape:
 Leaves acute and with a sharply-edged margin; mountains between Clanwilliam and Nieuwoudtville..... *A. roaneanus*
 Leaves usually rounded, rarely bluntly obtuse or emarginate; mountains between Worcester and Cape Town..... *A. hemisphaericus*

A. alstonii (Schonl. & Bak.f.) C. A. Smith in Bothalia 3: 638 (1939). Type: Cape, Namaqualand *Alston* s.n. (GRA, holo!; SAM!).

Cotyledon alstonii Schonl. & Bak.f. in J. Bot., Lond. 40: 93 (1902).

Adromischus triebneri V. Poelln. in Beitr. Sukkulantenk. (1939) 18; Friedr. in Prodr. Fl. S. W. Afr. 52: 5 (1968.) Type: Cape, Springbok, *Triebner* 1331 (B†). *A. subrubellus* V. Poelln. in Reprim nov. Spec. Regni veg. 50: 319 (1941). Type: Cape, 30 km NW Vanrhynsdorp, *Triebner* 1351 (B†). *A. pulchellus* P. C. Hutch. in Cact. Succ. J., Los Ang. 31: 118, figs 52–4 (1959). Type: Cape, Bowesdorp, *Hall* in NBG 761/53 (Univ. Calif. Bot. Gard. 54.110–1: BOL, holo!; PRE!).

The illustration of the flower of *A. robustus* Lem. with its original description indicates that this species belongs into this section, but neither is the description specific enough nor has a type specimen been preserved, so that it is impossible to identify the species. The name infers a robust habit and, as *A. alstonii* is the most common species north of Garies, it is likely that *A. robustus*, being an older name, may have to replace the present name if more evidence can be found.

Similarly, no isotypes of *A. triebneri* and *A. subrubellus* could be traced, so that these species are included

here on the strength of their fairly large leaves and on the evidence of specimens found at the type localities.

A. bicolor P. C. Hutch. in Cact. Succ. J., Los Ang. 29: 15 (1957). Type: Cape, near Steytlerville, *Hall* in NBG 914/47 (Univ. Calif. Bot. Gard. 53.1109–1: BOL, holo!; PRE!; UC!).

This species is only known from a few localities east of Steytlerville. The specimen *Flanagan* 1113 from near Komga has unusually long cuneate leaf bases but no plants of that taxon have been found in recent years in that area.

A. filicaulis (Eckl. & Zeyh.) C. A. Smith in Bothalia 3: 630 (1939). Type: Cape, Kamiesberg, *Ecklon & Zeyher* 1975 (S!).

Cotyledon filicaulis Eckl. & Zeyh., Enum. 307 (1837).

The range of variation in size, shape and colour of the leaves, in the habit and in the colour of the petals observed in specimens from the area between Springbok, Kamieskroon and Komaggas is so wide that it is impossible to distinguish the species described within the present circumscription of subsp. *filicaulis*. Yet at no single locality within this area is an extensive range found which would suggest a hybrid swarm.

subsp. *filicaulis*.

Cotyledon filicaulis Eckl. & Zeyh., Enum. 307 (1837). *C. fusiformis* Rolfe in Kew Bull. (1916) 229. Type: Cape, sine loc., Pearson 5585 (K, holo!).

Adromischus filicaulis (Eckl. & Zeyh.) C. A. Smith in Bothalia 3: 630 (1939). *A. fusiformis* (Rolfe) Berger in Pflanzenfam. ed. 2, 18a: 416 (1930). *A. mammillaris* var. *rubra* V. Poelln. in Desert Pl. Life 10: 112, fig. (1938); in Reprim nov. Spec. Regni veg. 40: 109 (1940). Iconotype: Bot. Mag. 99, t.6020 (1873).—var. *filicaulis* (Eckl. & Zeyh.) Jacobsen, Sukk. Lex. 29 (1970), nomen non rite publicatum quoad sine typo. —var. *fusiformis* (Rolfe) Jacobsen, Sukk. Lex. 29 (1970), nomen non rite publicatum quoad sine typo.—var. *marlothii* (Schonl.) Jacobsen, Sukk. Lex. 29 (1970), nomen non rite publicatum quoad sine typo. *A. kleinioides* C. A. Smith in Bothalia 4: 631 (1939). Iconotype: Bot. Mag. 99, t.6020 (1873). *A. fragilis* P. C. Hutch. in Cact. Succ. J., Los Ang. 31: 167 (1959). Type: Cape, Richtersveld, Hellsberg, *Rodin* 1620 (Univ. Calif. Bot. Gard. 50.1180: BOL, holo!).—var. *numeesensis* P. C. Hutch. in Cact. Succ. J., Los Ang. 31: 169 (1959). Type: Cape, Richtersveld, Numees, *Hall* in NBG 692/53 (Univ. Calif. Bot. Gard. 54.113-1: BOL, holo!; PRE!).

subsp. *marlothii* (Schonl.) Toelken, stat. nov.

Cotyledon marlothii Schonl. in Rec. Albany Mus. 1: 59 (1903); 3: 153 (1915). Type: Cape, near Laingsburg, *Marloth* 2520 (GRA, holo!). *C. mammillaris* sensu Harv., Fl. Cap. 2: 377 (1862), pro parte, excl. *C. filicaulis*; sensu Schonl. in Rec. Albany Mus. 3: 153 (1915), pro parte, non L.f.

Adromischus marlothii (Schonl.) Berger in Pflanzenfam. ed. 2, 18a: 416 (1930). *A. tricolor* C. A. Smith in Bothalia 4: 632 (1939). Type: Cape, Brandvlei, *Schlechter* 9933 (PRE, holo!; K!). *A. mammillaris* sensu Berger in Pflanzenfam. ed. 2, 18a: 416 (1930); sensu V. Poelln. in Desert Pl. Life 10: 112 (1938); in Reprim nov. Spec. Regni veg. 48: 109 (1940); sensu C. A. Smith in Bothalia 3: 631 (1939), non (L.f.) Lem.

The type specimen of *Adromischus mammillaris* L.f. clearly shows that this species must be placed into the sect. *Inscisilobati*.

A. hemisphaericus (L.) Lem., Jard. Fleur. 2, Misc. 60 (1852); C. A. Smith in Bothalia 3: 625 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 48: 105 (1940). Iconotype: Dill., Hort. Eltham. t.95, fig. 111 (1732).

Cotyledon hemisphaerica L., Sp. Pl. ed. 1, 429 (1753); DC., Pl. Hist. Succ. t.87 (1802); Prodr. 3: 398 (1828); Eckl. & Zeyh., Enum. 307 (1837), pro parte; Harv., Fl. Cap. 2: 376 (1862), pro parte; Schonl. in Rec. Albany Mus. 3: 152 (1915), pro parte; excl. *C. triflora*. *C. crassifolia* Salisb., Prodr. 307 (1796). Type: unknown. *C. rotundifolia* Haw. in Phil. Mag. (1827) 273; Schonl. & Bak.f. in J. Bot., Lond. 40: 91, t.435 (1902); Dyer in Bot. Mag. 157, t.9368 (1934). Type: sine loc., *Haworth* s.n. (OXF, holo!).

Adromischus rotundifolius (Haw.) C. A. Smith in Bothalia 3: 627 (1939); V. Poelln. in Kakteenkunde (1940) 17, fig.

A characteristic of this species is that the wax layer covering the epidermis of the leaves breaks into large isodiametric pieces. Similar leaves may also be found in *A. roaneanus* and a few other species of this section when grown under adverse conditions, but the phenomenon is then usually restricted to a few leaves.

Plants from the Cape Peninsula tend to have smaller leaves often with an obtuse apex, and club-shaped trichomes are absent on the corolla lobes. Plants from the mountains to the east of the Cape Peninsula, and especially in the vicinity of Worcester, however, tend to have larger leaves with rounded or emarginate apices and, in contrast to all other species in the section, a few club-shaped trichomes are present on the throat of the corolla. Formal rank was not given to the latter form because of a range of intermediates in collections such as *Esterhuysen* 23 898 and 27 599.

A. liebenbergii P. C. Hutch. in Cact. Succ. J., Los Ang. 31: 81, fig. 40 (1959). Type: Cape, Varsbokkraal near Laingsburg, *Liebenberg* 6186 (BOL, holo!).

Except for the very markedly convex base of the expanded leaf blade, vegetative material of *A. liebenbergii* cannot be distinguished from the local form of *A. triflorus* (sect. *Inscisilobati*), which tends to have petiolate leaves in the eastern parts of its distribution range.

A. montium-klingshardtii (Dinter) Berger in Pflanzenfam. ed. 2, 18a: 416 (1930); Friedr. in Prodr. Fl. S.W. Afr. 52: 4 (1968). Type: South West Africa, Klingshardt mountains, *Dinter* 4265 (B†).

Cotyledon montium-klingshardtii Dinter in Reprim nov. Spec. Regni veg. 19: 147 (1923).

This species has often been linked with *A. hemisphaericus* on account of its similar small leaves, but apart from the different habitat and distribution, it is distinguished by the absence of the cracked wax layer on the leaves and its very short inflorescence. The latter character may also be induced by adverse conditions in plants of *A. hemisphaericus*, but the inflorescence of *A. montium-klingshardtii* is always markedly shorter.

A. roaneanus Uitew. in Natn. Cact. Succ. J. 7: 69, figs (1952). Type: Cape, Vanrhyn's Pass, *Herre* in SUG 6058 (AVU 10011, holo).

P. C. Hutchinson has annotated herbarium specimens of this species as *A. grasbergensis*, or, in the case of more vigorous plants as *A. violaceus*. Neither of these names has, however, been validly published.

2. Sect. **Boreali** Toelken, sect. nov. a sect. *Adromischo* corollae lobis late triangularibus et trichomatibus claviformibus differt.

Inflorescentia recta alabastris semper plus minusve adpressis rami dum ante florentibus, plerumque sine nectariis extrafloralibus in pedicellis. *Alabastra* tubis plus minusve cylindricis sed aliquantum sulcatis inter petala et gradatim constricta ad apices acutos. *Corolla* tubo glauco vel rubro; lobi ovato-triangularis et gradatim constricti ad apices acutos et plerumque reflexi et plus minusve adpressi tubem, asperi et trichomatibus claviformibus praecipue in fauce, albi vel rosei et atro-rosei in parte aperta exterior. *Stamina* paene simile longa, antheris papillosis et circiter simile longis et plerumque leviter protrusis super tubem corollae, filamentis glabris. *Squamae* plerumque quadratae vel oblongae et latissimae ad bases.

Type species: *A. umbraticola* C. A. Smith

Inflorescence straight with buds always more or less adpressed to the stem until just before flowering, usually without extra-floral nectaries on pedicels. *Buds* with more or less cylindrical tube but somewhat grooved between petals and gradually constricted into acute apices. *Corolla* with tube glaucous-pink or red; lobes ovate-triangular and gradually tapering into an acute apex, usually reflexed against the tube which thus appears to have an undulate fringe without lobes, rough and usually with some club-shaped trichomes mainly in the throat, white or pink and dark pink on the exposed part of the outside. *Stamens* almost equally long, with anthers papillose and about equally long, usually slightly protruding above the reflexed petals, with filaments glabrous. *Squamae* square to oblong and broadest towards the base.

Occurring in dryer mountainous areas to the east, south and west of the Kalahari basin. All species are found in the summer rainfall area to the north of all the other species of *Adromischus*.

Key to Species and Subspecies

- Leaves elliptic to orbicular with a marked marginal ridge extending to its base..... *A. trigynus*
 Leaves oblanceolate to obovate, with marginal ridge rarely extending beyond the middle, or if so then narrow and not horny:
 Corolla with club-shaped trichomes in throat and on lower parts of lobes..... *A. umbraticola* subsp. *umbraticola*
 Corolla without club-shaped trichomes in throat or on lobes:
 Stems up to 30 mm long, much branched..... *A. schuldtianus* subsp. *schuldtianus*
 Stems 40–120 mm long, little branched:
 Branches sinuous; northern Transvaal..... *A. umbraticola* subsp. *ramosus*
 Branches spreading; Karas Mountains in South West Africa..... *A. schuldtianus* subsp. *juttiae*

A. schuldtianus (*V. Poelln.*) *V. Poelln.* in Reprim nov. Spec. Regni veg. 48: 110 (1940); Friedr. in Prodr. Fl. S.W. Afr. 52: 4 (1968). Type: sine loc. et leg. (B†).

A. schuldtianus is found widespread in the mountains of central South West Africa. In cultivation the longer branches of the subsp. *juttiae* remain distinctive, similar to those in *A. umbraticola* subsp. *ramosus*.

A particularly narrow-leaved form of the subsp. *schuldtianus* was described by Nordenstam (1974) from the upper Brandberg, but even the few records of the species known at present show considerable range of variation in the shape and size of the leaves.

subsp. *schuldtianus*.

Cotyledon schuldtiana *V. Poelln.* in Jb. dt. KaktGes. 1: 95 (1936). *C. trigynus* sensu Schonl. in Ann. Bolus Herb. 1: 15 (1914).

Adromischus schuldtianus (*V. Poelln.*) *V. Poelln.* in Reprim nov. Spec. Regni veg. 48: 110 (1940); Friedr. in Prodr. Fl. S.W. Afr. 52:4 (1968); Nordenstam in Dinteria 11: 15, fig. 1 (1974).

subsp. *juttiae* (*V. Poelln.*) *Toelken*, stat. nov.

Adromischus juttiae *V. Poelln.* in Kakteenkunde (1939) 52, fig. Syntypes: South West Africa, Garub, *Triebner* 1305 (B†); Norachus, *Triebner* 1315 (B†).

A. trigynus (*Burch.*) *V. Poelln.* in Reprim nov. Spec. Regni veg. 44: 61 (1938); 48: 111 (1940), pro parte; *C. A. Smith* in Bothalia 3: 642 (1939). Type: Cape, near Griqua Town, *Burchell* 1898 (K, holo!).

Cotyledon trigynus *Burch.*, Trav. 2: 226 (1824); DC., Prodr. 3: 398 (1828); Schonl. & Bak.f. in J. Bot., Lond. 40: 91 (1902); Schonl. in Rec. Albany Mus. 3: 153 (1915). *C. rhombifolia* var. *spathulata* N.E. Br. in Marloth, Fl. S. Afr. 2:1: 15, t. 2D (1925), nom nud.

Adromischus subcompressus *V. Poelln.* in Reprim nov. Spec. Regni veg. 44: 62 (1938), pro parte quoad *Triebner* 1330. *A. rupicola* *C. A. Smith* in Bothalia 3: 642 (1939). Type: Cape, Fauresmith, *Smith* 5603 (PRE, holo!). *A. nanus* sensu *C. A. Smith* in Bothalia 3: 640 (1939), non (N.E. Br.) *V. Poelln.*

Widespread, but never common in rock outcrops in the northern Karoo and in Bushmanland. The leaves are tough and remarkably uniform in shape and size on the same plant in contrast to *A. umbraticola* and *A. schuldtianus*.

C. A. Smith described *A. rupicola*, because he could not clearly interpret *Burchell's A. trigynus*. However, the fragmentary type specimen together with a collection from the type locality (*Liebenberg* 5955) leave no doubt about the identity of the species.

A. umbraticola *C. A. Smith* in Onderstepoort J. vet. Sci. Anim. Ind. 1: 174 (1933); in Bothalia 3: 643 (1939). Type: Transvaal, Silkaatsnek, *Smith* 3432 (PRE, holo!).

The species usually grows in somewhat shaded localities but it may also be found on exposed rock faces with a south-eastern aspect. *A. saxicola* grades into *A. umbraticola* as can be observed when studying the wide range of variation in the size and shape of leaves of *Tölken* 5435 from the Magaliesberg. *A. saxicola* is thus placed into the synonymy of *A. umbraticola*.

It stands to reason that plants in a shaded position will produce longer stems but the absence of club-

shaped trichomes on the throat of the corolla tube will always identify plants of the subsp. *ramosa*.

subsp. *umbraticola*.

Adromischus umbraticola *C. A. Smith* in Onderstepoort J. vet. Sci. Anim. Ind. 1: 174 (1933); in Bothalia 3: 643 (1939); Letty, Wild Flow. Transv. fig. 75,4 (1962). *A. saxicola* *C. A. Smith* in Bothalia 3: 647 (1939). Type: Transvaal, Baviaanspoort, *Smith* 3424 (PRE, lecto!).

Cotyledon trigyna sensu *Burt Davy*, Fl. Transv. 143 (1926), non *Burch.*

Branches 20–40 (–60) mm long, much branched. Leaves grey-green or glaucous often tinged brown and sometimes faint purplish spots. Corolla with many club-shaped trichomes.

subsp. *ramosa* *Toelken*, subsp. nov.

Rami 60–120 mm long, pauciramiosi. Folia viridia saepe suffusa fusca, rare viridi-grisea, immaculata. Corolla sine trichomatibus clavatis.

Type: Transvaal, Chunies Poort, *Tölken* 1215 (PRE, holo!).

Branches 60–120 mm long, little branched. Leaves green often tinged brown, rarely grey-green and without spots. Corolla without club-shaped trichomes.

Occurring in the mountains from Middelburg to the Zoutpansberg.

3. Sect. *Brevipedunculati* *V. Poelln.* in Reprim nov. Spec. Regni veg. 48: 89 (1940), pro parte; *Jacobsen* in Kakteen, Berl. 17: 189 (1966), pro parte; in Sukk. Lex. 27 (1970), pro parte. Type species: *A. humilis* (*Marl.*) *V. Poelln.*

Cotyledon [sect. *Paniculatae* *Harv.*, Fl. Cap. 2: 370 (1862)] group *Caryophyllacea* *Schonl.* in Rec. Albany Mus. 3: 150 (1915). Type species: *C. caryophyllacea* *Burm. f.*

Adromischus [sect. *Adromischus*. *Jacobsen* in Kakteen, Berl. 17: 190 (1966)] subsect. *Pendenti* *Jacobsen* in Kakteen, Berl. 17: 191 (1966); in Sukk. Lex. 27 (1970), nomen non rite publicatum. Type species: *A. phillipsiae* (*Marl.*) *V. Poelln.*

Inflorescence more or less straight and often branched, with spreading, rarely pendulous flowers, usually without extra-floral nectaries on the pedicels. Buds cylindrical, grooved between the upper parts of the petals and gradually constricted into blunt apices. Corolla with tube glaucous-green rarely tinged pink, glabrous; lobes ovate to lanceolate but usually with a broad base, spreading to recurved, rough and usually with club-shaped trichomes on the lobes and in the throat, white to deep mauve or purple (rarely orange), or mauve along the middle of the petals. Stamens unequal, longer ones with anthers up to twice as long as shorter ones, enclosed in corolla tube, with filaments usually glabrous. Squamae oblong, at least twice as long as broad, not bulging.

Recorded mainly from areas just south of the Great Karoo except for *A. humilis*, which occurs in the Nieuweveld Mountains, and *A. nanus* which is found near Steinkopf. Most species have a very restricted distribution.

Species in this section often have soft herbaceous leaves without a horny marginal ridge, and are thus reminiscent of the leaves of species in *Tylecodon*, but they are not seasonal although their number is usually drastically reduced during the dry period. Most of the species have tuberous roots similar to

A. marianae (sect. *Longipedunculati*).

The subject. *Pendenti* was not validly described with a Latin diagnosis in either of the publications in which Jacobsen expounded his classification of the genus.

Key to Species

- Leaves tough, dorsiventrally compressed..... *A. caryophyllaceus*
 Leaves soft herbaceous, grooved, concave to cymbiform above:
 Flowers pendulous, orange-red..... *A. phillipsiae*
 Flowers spreading, white tinged pink to purple:
 Inflorescence with 1 (-3) flowers..... *A. nanus*
 Inflorescence with 5-12 flowers:
 Stems short (up to 40 mm long), much branched; corolla with few or no club-shaped trichomes..... *A. humilis*
 Stems long (up to 150 mm), little branched; corolla with many club-shaped trichomes..... *A. fallax*

***A. caryophyllaceus* (Burm.f.) Lem., Jard. Fleur. 2, Misc. 60 (1852); C. A. Smith in Bothalia 3: 629 (1939), pro parte excl. *Bolus* 758; V. Poelln. in Reprim nov. Spec. Regni veg. 48: 107 (1940). Iconotype: J. Burm., Rar. Afr. Pl. t.17 (1738).**

Cotyledon caryophyllacea Burm. f., Prodr. Fl. Cap. 13 (1768); DC., Prodr. 3: 398 (1828); Schonl. & Bak.f. in J. Bot., Lond. 40: 93 (1902), pro parte; in Rec. Albany Mus. 3: 151 (1915), pro parte, excl. *Bolus* 758. *C. jasminiflora* Salm-Dyck, Obs. 38 (1820); Haw., Rev. Pl. Succ. 20 (1821); DC., Prodr. 3: 398 (1828). Type: sine loc., *Salm-Dyck* sub Haworth (OXF, lecto!). *C. bolusii* Schonl. in Rec. Albany Mus. 1: 59 (1903); 3: 154 (1915). Type: Cape, Mosselbaai, *Bolus* 8648 (BOL, holo!).

Adromischus jasminiflora (Salm-Dyck) Lem in Jard. Fleur. 2, Misc. 60 (1852). *A. bolusii* (Schonl.) Berger in Pflanzenfam. ed. 2, 18a: 416 (1930). *A. grandiflorus* Uitew. in Succulentia (1953) 8. Type: Cape, Bonnievale, sine leg. in SUG 6879 (AVU 10013, holo).

The leaves of this species are usually spatulate-oblongate but under adverse conditions their bases become abruptly cuneate. *A. grandiflorus* is an extreme form with all its leaves abruptly cuneate and the plants have a more erect habit. Intermediates between this form and typical *A. caryophyllaceus* have been recorded in collections from Touwsberg, *Esterhuysen* 25 879, Bonnievale, *Van der Merwe* 97; Hermanus, *Kriege* in SUG 5360 and others. Judging by specimens from these localities it seems that plants from the western parts of the distribution range of *A. caryophyllaceus* show a tendency to have more abruptly cuneate leaf bases.

***A. fallax* Toelken, sp. nov. ab *A. humili* plantis grandioribus et trichomatibus clavatis multis in fauce corollae; ab *A. caryophyllaceo* staminibus longioribus antheris duplo longioribus staminibus brevibus differt.**

Cotyledon caryophyllacea sensu Schonl. & Bak.f. in J. Bot., Lond. 40: 93 (1902), pro parte; Schonl. in Rec. Albany Mus. 3: 151 (1915), pro parte quoad *Bolus* 758.

Adromischus caryophyllaceus sensu C. A. Smith in Bothalia 3: 629 (1939), pro parte quoad *Bolus* 758.

Suffrutex ramis decumbentibus 5-15 mm in diametro. *Folia* oblongata vel elliptica, 20-40 (-50) mm longa, 8-15 (-20) mm lata, acuta vel obtusa, cuneata, quoque sine crista marginali. *Inflorescentia* thrysus spiciformis 1-3 (-5) floribus, pedicellis 10-15 mm longis. *Sepala* triangularia, 4-5 mm longa, acuta, viridia. *Petala* 14-17 mm longa, connata et formantia tubum 10-13 mm longum; lobi ovato-triangulares, 3-4,5 mm longi, acuti, asperi cum trichomatibus clavatis in fauce. *Stamina* 12-14 mm longa, antheris inaeque longis, filamentis laevibus inclusis. *Squamae* oblongae, 1,8-2 x 0,6-0,8 mm, plerumque pennitus emarginatae. *Carpella* ovarii tenuibus gradatim in stylis et stigmatibus terminalibus constricta; ovarium 35 ovulibus quoque 3-plo longiore latum et cristis verticalibus.

Type: Cape, near Graaff Reinet, *Bolus* 758 (BOL, holo!; K!; SAM!).

Suffrutex with decumbent branches 5-15 mm Ø diameter. *Leaves* oblanceolate to elliptic, 20-40 (-50) mm long, 8-15 (-20) mm broad, acute to obtuse, cuneate, each without horny marginal ridge. *Inflorescence* a spike-like thyrse with 1-3 (-5) flowers, with pedicels 10-15 mm long with fleshy bracts widely spaced. *Sepals* triangular, 4-5 mm long, acute, green. *Petals* 14-17 mm long, fused into a tube 10-13 mm long; lobes ovate-triangular, 3-4,5 mm long, acute, with club-shaped trichomes around the throat. *Stamens* 12-14 mm long, with anthers of longer outer whorl 1,8-2 mm long while those of inner whorl are 1-1,1 mm long, all included. *Squamae* oblong, 1,8-2 x 0,6-0,8 mm, usually deeply emarginate. *Carpels* with slender ovaries gradually constricted into erect styles with terminal stigmas; ovary with 35 ovules at least three times longer than broad and covered with vertical ridges.

Bolus mentioned that this plant was very rare and restricted to the one locality, all attempts to rediscover the species have failed.

***A. humilis* (Marl.) V. Poelln. in Reprim nov. Spec. Regni veg. 48: 91 (1940). Type: Cape, near Beaufort West, *Marloth* 4689 (PRE, holo!).**

Cotyledon humilis Marl. in Schonl. in Rec. Albany Mus. 3: 151 (1915); Fl. S. Afr. 2,1: 17, t.3D (1926). *C. nana* sensu Marl. in Trans. Roy. Soc. S. Afr. 2: 33 (1910), non N.E. Br.

This plant has been collected only twice by *Marloth* in the Nieuweveld Mountains and it could not be relocated.

***A. nanus* (N.E. Br.) V. Poelln. in Desert Pl. Life 10: 222 (1938). Type: Cape, sine loc., *MacOwan* s.n. (K, holo!).**

Cotyledon nana N.E. Br. in Gdnr's Chron. 30: 270 (1901); Schonl. & Bak.f. in J. Bot. Lond. 40: 93 (1902).

Adromischus pauciflorus P. C. Hutch. in Cact. Succ. J., Los Ang. 32: 63, fig. 32,33 (1960). Type: Cape, near Steinkopf, *Hall* in NGB 205/56 (Univ. Calif. Bot. Gard. 56.711-2: BOL, holo!; UC!).

This miniature species is known only from the vicinity of Steinkopf but this restricted distribution may be attributable to insufficient collecting in the northern Cape.

***A. phillipsiae* (Marl.) V. Poelln. in Reprim nov. Spec. Regni veg. 48: 88 (1940). Type: Cape, southern Roggeveld, *Marloth* 3912 (PRE, lecto!; BOL!; GRA!; SAM!).**

Cotyledon phillipsiae Marl. in Trans. S. Afr. Phil. Soc. 18. 46 (1907); Fl. S. Afr. 2,1: 17, t.3C, fig. 5 (1925); Schonl. in Rec. Albany Mus. 3: 151 (1915).

The pendulous red flowers simulate those of species of *Cotyledon*, and the similarity is so striking that early taxonomists placed this species rather hesitantly into the genus *Adromischus*. A lectotype was selected, because the sheet of the holotype contains a few flowers of *Cotyledon orbiculata*.

4. **Sect. Inscilobati** *Uitew.* in *Natn. Cact. Succ. J. 7: 70* (1952), pro parte. Type species: *A. maculatus* (Salm-Dyck) Lem.

Inflorescence straight, with mature buds and flowers erect and with extra-floral nectaries on the pedicels. *Buds* with almost cylindrical tube gradually constricted into an acute apex. *Corolla* with tube pale green, glabrous; lobes narrowly lanceolate but scarcely constricted at the base, spreading to recurved, rough and with club-shaped trichomes on lower lobes and in throat, white or pale pink and usually deep mauve on the exposed part on the outside. *Stamens* unequally long, with anthers of shorter inner ones longer than those of the longer outer stamens, rarely of equal

length, enclosed in tube, with filaments usually papillose. *Squamae* about square, broadest usually below the middle.

Occurring from the Eastern Cape to the South-Western Cape as far north as the Gifberg but rarely west of the mountains of that area.

The flowers of species of this section are superficially similar to those of the sect. *Longipedunculati* except that the club-shaped trichomes are not restricted to the throat. In live material the dense waxy bloom on the flowers and the pronounced grooves between the petals immediately distinguish flowers of the sect. *Longipedunculati*.

Key to Species

- Leaves terete or almost so, fusiform..... *A. mammillaris*
 Leaves dorsiventrally compressed, oblanceolate to obovate:
 Marginal ridge of leaves winged and continued to the base (auriculate):
 Leaves evenly and gradually constricted towards the base, i.e. oblanceolate, never with spots:
 Corolla tube 8–9 mm long; mountains between Clanwilliam and Vanrhynsdorp..... *A. maximus*
 Corolla tube 10–11 (–12) mm long; karroid vegetation between Graaff Reinet, Steytlerville and East London..... *A. sphenophyllus*
 Leaves abruptly constricted and subpetiolate, i.e. obovate-spathulate to oblanceolate-spathulate, often with purple spots..... *A. maculatus*
 Marginal ridge of leaves keeled and rarely continued beyond the middle of the leaf:
 Mature buds curved outward towards the apex..... *A. triflorus*
 Mature buds straight:
 Leaves 20–30 mm long; between Grahamstown, Alicedale and Port Elizabeth..... *A. inamoenus*
 Leaves 40–130 (–160) mm long; between Clanwilliam and Vanrhynsdorp..... *A. maximus*

A. inamoenus *Toelken*, sp. nov. ab *A. sphenophyllo* foliis parvioribus cristis marginalibus brevibus ad apices; ab *A. trifloro* alabastris rectis et foliis non angulato-oblanceolatis, immaculatis differt.

Cotyledon rhombifolia sensu Schönl. & Bak.f. in *J. Bot., Lond.* 40: 92 (1902), partly, as for live plant.

Suffrutex ramis decumbentibus vel prostratis (4–) 6–10 mm in diametro. *Folia* oblanceolato-spathulata, 20–28 (–32) mm longa, 15–25 mm lata, obtusa vel rotundata interdum mucronata, cuneata vel subpetiolata, cristis marginalibus ad apices, griseo-viridia interdum suffusa fusca et immaculata. *Inflorescentia* thyrus spiciformis 1 (2) floribus in quoque cyma, pedicellis (1–) 2–3 (–4) mm longa. *Sepala* triangularia, 1,5–2 mm longa, aceria, griseo-viridia. *Petala* 11–15 mm longa, connata et formantia tubos 8–10 mm longos et virides; lobi elliptico-oblongi, 2–3,5 mm longi, acuti, asperi cum trichomatibus clavatis corollae expansae in partibus demissis et in fauce, nivei suffusi rosei vel malvini praecipue in partibus apertis exterioris. *Stamina* 9–10 mm longa; antheris circiter aequantibus longitudine; filamentis leviter papillosis. *Squamae* plus minusve quadratae, 1–1,2 mm longae et latae, emarginatae et latissimae ad medium vel infernae. *Carpella* ovariis tenuibus gradatim in stylos stigmatibus terminalibus constrictis; ovarium 22–28 ovulis cristis verticalibus.

Type: Cape, 1 km north of Salem, *Tölken* 5508 (PRE, holo!).

Suffrutex with decumbent to prostrate branches (40) 6–10 mm in diameter. *Leaves* oblanceolate-spathulate, 20–28 (–32) mm long; 15–25 mm broad, obtuse or rounded and sometimes mucronate at the apex, cuneate to subpetiolate, with horny margin at the apex and rarely beyond the middle, grey-green sometimes tinged brown and without purple spots. *Inflorescence* a spike-like thyrse with 1 (2) flowers in each cyme, with pedicels (1–) 2–3 (–4) mm long. *Sepals* triangular 1,5–2 mm long, sharply acute, grey-green. *Petals* 11–15 mm long, fused into a tube 8–10 mm long and green; lobes elliptic-oblong, 2–3,5 mm long, acute, rough and with club-shaped trichomes on lower parts of expanded corolla and in throat, white tinged pink or mauve especially on exposed part

on the outside. *Stamens* 9–10 mm long, with anthers of about equal length, with filaments slightly papillose. *Squamae* about square, 1–1,2 mm long and broad, emarginate, broadest at the middle or below. *Carpels* with slender ovaries gradually constricted into styles with terminal stigmas; ovary with 22–28 ovules with vertical ridges.

Occurring on somewhat sheltered rock outcrops usually associated with False Macchia in the vicinity of Grahamstown.

A. maculatus (*Salm-Dyck*) *Lem.*, *Jard. Fleur.* 2, *Misc.* 60 (1852); *Illustr. Hort.* 7, *Misc.* 70 (1870); *C. A. Smith* in *Bothalia* 3: 622 (1939); *V. Poelln.* in *Reprint nov. Spec. Regni veg.* 48: 99 (1940); *Uitew.* in *Succulenta* (1949) 37. Type: sine loc., *Salm-Dyck* sub *Haworth* s.n. (OXF, lecto!).

Cotyledon maculata *Salm-Dyck*, *Obs.* 5 (1820); *Haw.*, *Rev. Pl. Succ.* 21 (1821); *DC.*, *Prodr.* 3: 398 (1828); *Schönl. & Bak.f.* in *J. Bot., Lond.* 40: 92 (1902). *C. alternans* *Haw.*, *Suppl.* 26 (1819), non *Vahl*. Type: unknown.

Adromischus rhombifolius sensu *C. A. Smith* in *Bothalia* 4: 625 (1939).

A poorly recorded species which seems to occur only on rock outcrops in Mountain Renosterbosveld and in drier parts of Cape Macchia from near Worcester eastwards mainly along the mountains south of the Little Karoo to near Uniondale.

Although species in this section are often not easy to distinguish, the type specimen, and in particular the illustration prepared for *Haworth*, which is now housed in Kew Herbarium, leave no doubt about the identity of the species. The undulate apices of young leaves are characteristic of that species.

A. mammillaris (*L.f.*) *Lem.*, *Jard. Fleur.* 2, *Misc.* 60 (1852). Type: Cape, near Olifantsbad, *Thunberg* in *Herb. Thunberg* 11006 (UPS, holo!).

Cotyledon mammillaris *L.f.*, *Suppl.* 242 (1781); *Thunb.*, *Prodr.* 83 (1800); *Fl. Cap. ed. Schultes* 397 (1823); *Haw.*, *Suppl.* 22 (1819); *Rev. Pl. Succ.* 21 (1821).

Thunberg's type specimen does not seem to have been consulted since the younger *Linnaeus* published the original description. It is not possible to establish when the much more common but also terete-leaved

A. filicaulis reached Europe and the confusion between the two species started. In all the earlier publications specimens were distinguished by their leaves only.

The hybrid *A. filicaulis* var. *marlothii* × *A. maculatus* is superficially very similar to *A. mammillaris* but can be distinguished by its somewhat dorsiventrally compressed leaves, by the anthers protruding above the corolla tube and by the petal lobes having a broader expanding base between them.

A. maximus P. C. Hutch. in Cact. Succ. J., Los Ang. 31: 133, fig. 59, 60 (1959). Type: Cape, Gifberg, Hall in NBG 475/53 (Univ. Calif. Bot. Gard. 53. 1106-1: BOL, holo!).

This very robust species is found on lower mountain slopes between Clanwilliam and Vanrhynsdorp, so that it cannot be confused with the very similar *A. sphenophyllus* from the eastern Cape if the locality is known.

A. sphenophyllus C. A. Smith in Bothalia 3: 624 (1939). Type: Cape, sine loc., Cooper 2338 (K, lecto!).

Cotyledon rhombifolia sensu Bak.f. in Bot. Refug. 1, t.36 (1869); sensu Schonl. & Bak.f. in J. Bot., Lond. 40, 92 (1902), pro parte; sensu Schonl. in Rec. Albany Mus. 3: 154 (1915), non Haw.

Adromischus rhombifolius var. *bakeri* V. Poelln. in Reprim nov. Spec. Regni veg. 48: 102, 110 (1940). Type: same as for *A. sphenophyllus*. —var. *sphenophyllus* (C. A. Smith) Jacobsen, Sukk. Lex. 30 (1970), nomen non rite publicatum quoad sine typo.

This species usually occurs in dry karroid vegetation between Steytlerville, Graaff Reinet and East London, but it is often also found on exposed rock outcrops in or near False Macchia. It is in these transitional areas that it hybridizes with *A. inamoenus*, which accounts for the intermediate plants which are occasionally found. However, the leaves of *A. inamoenus* are usually much shorter, so that the two species can be readily distinguished.

A. triflorus (L.f.) Berger in Pflanzenfam. ed. 2: 18a: 416 (1930); C. A. Smith in Bothalia 3: 623 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 48: 103 (1940). Type: Cape, Zeko River, Thunberg in Herb. Thunberg 11016 (UPS, holo!).

Cotyledon triflora L.f., Suppl. 242 (1781); Thunb., Prodr. 83 (1800); Fl. Cap. ed. Schultes 396 (1823); Salm-Dyck, Obs. 6 (1820); Haw., Rev. Pl. Succ. 19 (1821); Schonl. & Bak.f. in J. Bot., Lond. 40: 91 (1902). *C. bolusii* Schonl. var. *karroensis* Schonl. in Rec. Albany Mus. 1: 119 (1904); 3: 154 (1915). Type: Cape, Laingsburg, Marloth 2519 (GRA, holo!). *C. procurva* N.E. Br. in Kew Bull. (1912) 276; Schonl. in Rec. Albany Mus. 3: 154 (1915). Type: South Africa, sine loc. et leg. (K, holo!).

Adromischus subcompressus V. Poelln. in Reprim nov. Spec. Regni veg. 44: 62 (1938), pro parte quoad *Lauder* s.n. *A. subpetiolatus* V. Poelln. in Reprim nov. Spec. Regni veg. 44: 61 (1938). Type: unknown. *A. procurvus* (N.E. Br.) C. A. Smith

in Bothalia 3: 641 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 48: 109 (1940).

This species occurs in arid vegetation in the Little Karoo and in areas further north and east from near Ceres to east of Oudtshoorn.

5. Sect. Longipedunculati V. Poelln. in Reprim nov. Spec. Regni veg. 48: 89, 95 (1940). Type species: *A. cristatus* (Haw.) Lem.

Cotyledon [sect. *Spicatae* Harv, Fl. Cap. 2: 370 (1862)] group *Cristata* Schonl. in Rec. Albany Mus. 3: 152 (1915). Type species: *A. cristatus* (Haw.) Lem.

Adromischus [sect. *Longipedunculati* V. Poelln. in Reprim nov. Spec. Regni veg. 48: 89 (1940)] subsect. *Cristati* (Schonl.) V. Poelln. in Reprim nov. Spec. Regni veg. 48: 89 (1940).

Inflorescence more or less zig-zagging at least when young, with buds at first adpressed to the stem but later erect to somewhat spreading, with extra-floral nectaries usually absent. Buds almost cylindrical but with a distinctly grooved tube, gradually constricted into bluntly acute apices. Corolla with tube glaucous-green, glabrous or hairy; lobes lanceolate, often slightly constricted at the base, erect, spreading or recurved, rough and with club-shaped trichomes restricted to the throat, white and usually deep red on the exposed part on the outside. Stamens of different length, with anthers more or less equally long, with filaments rarely slightly papillose. Squamae usually transversely oblong to almost square and broadest at about the middle.

One group of species occurs from just east of the south-western Cape to the eastern Cape and another group is found mainly in Namaqualand and extends into south-western South West Africa, with a few populations occurring along the Roggeveld escarpment.

The taxa in this section appear to be rather heterogeneous when compared with other sections of *Adromischus*. *A. leucophyllus* from the south-western Little Karoo has large flowers strongly resembling those found in sect. *Brevipedunculati*. It appears, however, that the species merely simulates the flower type of that section. The following characters indicate that it should be rather placed in the sect. *Longipedunculati*: the corolla tube is scarcely widened towards the apex, a thick bloom is found on the flowers, and the club-shaped trichomes are restricted to the throat of the corolla. Furthermore, the closely related *A. subviridis* has flowers which are typical of sect. *Longipedunculati*.

The flowers of species from the north-western Cape are usually more rigidly succulent than those of species from the eastern Cape.

Key to Species and Varieties

Leaves dorsiventrally compressed, i. e. at least 3 times broader than thick at the middle of the leaf:

Corolla lobes (3-) 4-5 mm long; leaves round or almost so *A. leucophyllus*

Corolla lobes 1, 5-3 mm long; leaves oblanceolate to obovate but with a distinctly cuneate base:

Leaves oblanceolate and with long cuneate base; apical gland on anthers sessile *A. subviridis*

Leaves obovate abruptly constricted to subpetiolate; apical gland on anthers raised about 0,5 mm above pollen sacs *A. marianae* var. *hallii*

Leaves distinctly convex on both surfaces i.e. about as broad as thick, rarely up to twice as broad as thick at the middle of the leaf:

Leaves usually acute, convex towards the apex on both surfaces or canaliculate above; apical gland on each anther raised above pollen sacs:

Roots tuberous:

Leaves smooth with marginal ridge horny and usually undulate *A. marianae* var. *hallii*

Leaves verrucose (sometimes only visible under 10 times lens) with marginal ridge slightly raised but indistinct, not horny and undulate *A. marianae* var. *immaculatus*

Roots fibrous:

- Leaves concave above, marginal ridge horny and raised.....*A. marianae* var. *marianae*
 Leaves convex above (rarely somewhat concave towards the apex) and marginal ridge never
 horny and raised.....*A. marianae* var. *kubusensis*

Leaves obtuse, truncate and/or dorsiventrally compressed towards the apex; apical gland on each anther sessile:

Club-shaped trichomes in throat and on corolla lobes; brown aerial adventitious roots absent on glabrous stems (rarely with adventitious roots which grow into the soil); leaves glabrous....*A. cooperi*

Club-shaped trichomes usually only in the corolla throat; brown aerial adventitious roots densely covering the stems (if absent then stems hairy); leaves usually with glandular hairs:

Stems 40–80 mm long, without adventitious roots, covered with glandular hairs.....

A. cristatus var. *zeyheri*

Stems 20–40 mm long, covered with aerial adventitious roots:

Ridge at apex of leaves narrower than broadest point on leaf; inflorescence and petals with glandular hairs.....*A. cristatus* var. *schoenlandii*

Ridge at apex of leaf constitutes the broadest point on leaf; inflorescence and petals glabrous, rarely with a few hairs when young:

Leaf blade 1–1½ times longer than the apical ridge is broad; leaves obtriangular-spathulate usually with distinct petiole.....*A. cristatus* var. *cristatus*

Leaves 2–5 times longer than the apical ridge is broad, narrowly oblanceolate to narrowly obtriangular, glabrous, rarely with few hairs.....*A. cristatus* var. *clavifolius*

A. cooperi (Bak.) Berger in Pflanzenfam. ed. 2, 18a: 416 (1930); C. A. Smith in Bothalia 3: 632 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 49: 60 (1940). Iconotype: Saund. Refug. Bot. t.72 (1869).

Cotyledon cooperi Bak. in Saund. Refug. Bot. t.72 (1869); Schonl. & Bak.f. in J. Bot., Lond. 40: 91 (1902); Schonl. in Rec. Albany Mus. 3: 153 (1915).—var. *immaculata* Schonl. & Bak.f. in J. Bot., Lond. 40: 91 (1902). Type: Cape, Graaff Reinet, Rattray s.n. (GRA, holo!).

Adromischus pachylophus C. A. Smith in Bothalia 3: 633 (1939). Type: same as *C. cooperi* var. *immaculata*. *A. festivus* C.A. Smith in Bothalia 3: 633, fig. 3 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 49: 60 (1940). Type: Cape, Graaff Reinet, Smith in PRE 8876 (PRE, holo!). *A. cuneatus* V. Poelln. in Reprim nov. Spec. Regni veg. 48: 102 (1940), non (Thunb.) Lem. Type: Cape, Halesowen, Herre in SUG 6866 (B†). *A. halesowensis* Uitew. in Desert Pl. Life 20: 142 (1948); in Succulenta (1950) 36. Type: same as for *A. cuneatus* V. Poelln.

Plants from near Graaff Reinet (Tölken 5534) show some variation in the shape of the leaves and the presence or absence of spots on them. However, all plants have scattered club-shaped trichomes on the corolla lobes, and even on the specimens investigated by C. A. Smith the reported absence could not be confirmed. *A. pachylophus* is thus relegated to the synonymy of *A. cooperi*.

Typical *A. cooperi* in which the apical ridge is somewhat wider than the remainder of the leaf, has been recorded from near Aberdeen (Pringle in NBG 779/59) but, except for that character, which is also somewhat variable in the plants from Graaff Reinet (Tölken 5534), the plant cannot be distinguished from the rest of the species.

A. cristatus (Haw.) Lem., Jard. Fleur. 2, Misc. 60 (1852); C. A. Smith in Bothalia 3: 635 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 49: 60 (1940). Type: sine loc., Haworth s.n. (OXF, holo!).

Cotyledon cristata Haw. in Phil. Mag. (1827) 274; DC., Prodr. 3: 399 (1828); Harv., Fl. Cap. 2: 376 (1862); Schonl. in Rec. Albany Mus. 3: 155 (1915).

A. cristatus is widespread in the eastern Cape Province and is often locally common, but these populations are far apart and not easy to find. A continuous variation could not be found. In contrast to *A. marianae*, the variation is restricted to local populations. Nevertheless, the variation is considerable depending on environmental conditions and the age of the plants as has been recorded for var. *clavifolia* by Dyer 5438 from near Bathurst, and for var. *cristata* by Tölken 5407, 5408 and 5522 from near Graaff Reinet.

var. *cristatus*.

Cotyledon cristata Haw. in Phil. Mag. (1827) 274; DC., Prodr. 3: 399 (1828); Harv., Fl. Cap. 2: 376 (1862); Schonl. in Rec. Albany Mus. 3: 155 (1915); Marl., Fl. S. Afr. 2, 1: 20, t.9, 5 (1925).

Adromischus cristatus (Haw.) Lem., Jard. Fleur. 2, Misc. 60 (1852); C. S. Smith in Bothalia 3: 635 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 49: 60 (1940).

Occurring in widely scattered localities between Port Elizabeth, Uniondale and Graaff Reinet.

var. *zeyheri* (Harv.) Toelken, stat. nov.

Cotyledon zeyheri Harv., Fl. Cap. 2: 377 (1862); Schonl. & Bak.f. in J. Bot., Lond. 40: 91 (1902); Schonl. in Rec. Albany Mus. 3: 155 (1915). Type: Cape, Kenko River, Zeyher 2571 (K, lecto!; S!; SAM!).

Adromischus zeyheri (Harv.) V. Poelln. in Cact. J. 6: 68 (1938); in Reprim nov. Spec. Regni veg. 48: 98 (1940); C. A. Smith in Bothalia 3: 635 (1939).

This variety is known only from the type collection on the Kenko River near Riversdale and is the only representative of the species so far recorded west of Uniondale

var. *clavifolius* (Haw.) Toelken, stat. nov.

Cotyledon clavifolia Haw. in Phil. Mag. (1827) 274; DC., Prodr. 3: 399 (1828); Schonl. & Bak.f. in J. Bot., Lond. 40: 92 (1902). Iconotype: Haworth plate (K, lecto!). *C. nussbaumerana* V. Poelln. in Jb. dt. KaktGes. 1: 95 (1936). Type: Cape, sine loc. et leg. (B†).

Adromischus clavifolius (Haw.) Lem., Jard. Fleur. 2, Misc. 60 (1852); V. Poelln. in Reprim nov. Spec. Regni veg. 49: 60 (1940); Uitew. in Natn. Cact. Succ. J. 7: 33 (1952). *A. poellnitzianus* Werderm. in Reprim nov. Spec. Regni veg. 39: 270 (1936); V. Poelln. in Cactus J. 6: 68, fig. (1936); in Reprim nov. Spec. Regni veg. 48: 97 (1940). Type: Cape, near East London, Kluth s.n. (B†). *A. nussbaumeranus* (V. Poelln.) V. Poelln. in Reprim nov. Spec. Regni veg. 48: 109 (1940). *A. kesselringianus* V. Poelln. in Kakteenkunde (1940) 64, fig. Type: Cape, sine loc. et leg. (B†).

Occurring on rocky outcrops between Alexandria, Grahamstown and East London. Near Grahamstown the leaves become more hairy, but the shape remains unlike that of var. *cristata* (Liebenberg 6007).

The combination *A. nussbaumeranus*, like that of *A. schuldianus*, was not validly published until 1940, because in 1936 von Poellnitz merely cited the combination in the synonymy of *Cotyledon nussbaumerana*.

var. *schoenlandii* (Phill.) Toelken, stat. nov.

Cotyledon schoenlandii Phill. in Flower. Pl. S. Afr. 9, t.328 (1929). Type: sine loc. et leg. in PRE 7944 (PRE, holo!).

Adromischus schoenlandii (Phill.) V. Poelln. in Cactus J. 6: 68 (1938); in Reprim nov. Spec. Regni veg. 48: 97 (1940); Uitew. in Natn. Cact. Succ. J. 7: 33 (1952).

Found on sheltered and shaded rock outcrops in ravines in the Langkloof.

A. leucophyllus Uitew. in Natn. Cact. Succ. J. 9: 58, fig. (1954). Type: Cape, Montagu, Hall in NBG 855/33 (AVU 10015, holo.).

A very distinct species known from the western parts of the Little Karoo. The salvershaped corolla with the tube not broadened towards the apex and the club-shaped trichomes restricted to the throat distinguish this species from those of sect. *Brevipedunculati*.

A. marianae (Marl.) Berger in Pflanzenfam. ed. 2, 18a: 416 (1930); C. A. Smith in Bothalia 3: 639 (1939). Type: Cape, Clanwilliam, *Marloth* 3489 (PRE, holo!; GRA!; K!).

Cotyledon marianae Marl. in Trans. S. Afr. Phil. Soc. 18: 47 (1907); Schonl. in Rec. Albany Mus. 3: 153 (1915).

An extremely variable species occurring from near Clanwilliam to just north of the Orange River. Recent collections show a continuous range of variation leading to distinct extreme forms in isolated localities. After considerable field studies, it was found that most of the transitional ranges between extreme forms are restricted to areas where taxa apparently come into close contact with one another. As whole ranges of variation are found within these areas introgressive hybridization is considered to be taking place. Fig. 2 shows a selection of the full range of variation and the geographic distribution of certain characteristics, but it also illustrates why certain species have been relegated to the synonymy of the four varieties recognized. The following species, listed with the number by which they are indicated on Fig. 2, fall within the range of variation of the specimens cited in the captions: 2, *A. hallii*; 5, *A. geyeri*; 6, *A. kubusensis*, *A. rodinii*; 9, *A. blosianus*; 13, *A. antidorcadum*, *A. alveotatus*; 14, *A. herrei*; 18, *A. marianae* var. *immaculatus*; 25, *A. marianae* var. *marianae*.

var. *marianae*.

Cotyledon marianae Marl. in Trans. S. Afr. Phil. Soc. 18: 47 (1907); Fl. S. Afr. 2, 1: 17, t. 3A (1925); Schonl. in Rec. Albany Mus. 3: 153 (1915).

Adromischus marianae (Marl.) Berger in Pflanzenfam. ed. 2, 18a: 416 (1930); C. A. Smith in Bothalia 3: 639 (1939); V. Poelln. in Reprim nov. Spec. Regni veg. 48: 109 (1940), partly.

Var. *marianae* is found on dry lower slopes from Clanwilliam to just south of Vanrhynsdorp. Plants from Clanwilliam are all spotted on the leaves, but along the Doring River plants with spotted or unspotted leaves are found.

var. *immaculata* Uitew. in Succulenta (1953)

10, fig. Type: Cape, Vredendal, sine leg. in SUG 5932 (AVU 10014, holo.).

Cotyledon herrei W. F. Barker in S. Afr. Gard. 21: 247 (1931). Type: Cape, Nutabooi, *Herre* in SUG 5800 (BOL, holo!; GRA!; K!).

Adromischus herrei (W. F. Barker) V. Poelln. in Reprim nov. Spec. Regni veg. 44: 62 (1938); 48: 90 (1940). *A. antidorcadum* V. Poelln. in Reprim nov. Spec. Regni veg. 44: 61 (1938), "anticordatum"; in Cact. J. 7: 19 (1938), "antidorcadum"; in Reprim nov. Spec. Regni veg. 47: 2 (1939), "antidorcadum"; Airy Shaw in Kew Bull. 14: 310 (1960). Type: Cape, 48 km S of Springbok, *Triebner* 1324 (BOL, clono!). *A. aveolatus* P. C. Hutch. in Cact. Succ. J., Los Ang. 28: 183, fig. 150, 1 (1956). Type: Cape, 14 km N of Concordia, *Hall* in NBG 194/52 (Univ. Calif. Bot. Gard. 54.1161: PRE!; UC!).

Widespread in southern Namaqualand and extending its distribution range to the western slopes of the Roggeveld Mountains.

Neither the verrucose surface of the leaves nor the tuberous roots, the characters by which the taxon is at present distinguished, are mentioned in the original description of the var. *immaculata*. However, the figure clearly shows that the roots are swollen and the leaves are without a horny ridge, which distinguishes it from var. *marianae* the only other variety known to occur near Vredendal.

var. *kubusensis* (Uitew.) Toelken, stat. nov.

Adromischus kubusensis Uitew., Succulenta (1953) 7 (Jan. 1953). Type: Cape, Kubus, *Herre* in SUG 6104 (AVU 10012, holo.). *A. rodinii* P. C. Hutch. in Cact. Succ. J., Los Ang. 25: 136, fig. 106-8 (Sept./Oct. 1953); Friedr. in Prodr. Fl. S. W. Afr. 52: 4 (1968). Type: Cape, near Hellsberg, *Rodin* 1617 (Univ. Calif. Bot. Gard. 50.1181: UC; holo!). *A. blosianus* P. C. Hutch. in Cact. Succ. J., Los Ang. 29: 35, fig. 23.4 (1957). Type: Cape, Holgat River, *Hall* in NBG 723/53 (Univ. Calif. Bot. Gard. 54.111-1: BOL, holo!; NBG!; K!; PRE!; UC!).

A. geyeri P. C. Hutch. in Cact. Succ. J., Los Ang. 32: 89, fig. 45, 47 (1960); Friedr. in Prodr. Fl. S. W. Afr. 52: 3 (1968). Type: South West Africa, Sperrgebiet S of Lüderitz, *Geyer* in SUG 30216 (Univ. Calif. Bot. Gard. 56.826-1: BOL, holo!; UC!).

Restricted to the western slopes of the mountains in Richtersveld and south-western South West Africa.

var. *hallii* (P. C. Hutch.) Toelken, stat. nov.

Adromischus hallii P. C. Hutch. in Cact. Succ. J., Los Ang. 28: 144, fig. 111-5 (1956). Type: Cape, Buchu Twins, *Hall* in NBG 75/33 (Univ. Calif. Bot. Gard. 53.1115-2: BOL, holo!; PRE!; UC!). *A. nanus* (N.E. Br.) V. Poelln. in Desert Pl. Life 10: 228, fig. (1938), pro parte; in Reprim nov. Spec. Regni veg. 48: 92 (1940), pro parte quoad *Triebner* 1318. *A. casmithianus* V. Poelln. in Beitr. Sukkulenteuk. (1940) 64, nomen non rite publicatum.

Occurring mainly in rock crevices of hills within 30 km from the coast of the northern Richtersveld and south-western South West Africa.

The dorsiventrally compressed leaves and the almost square squamae described for *A. casmithianus*, indicate that the collection *Triebner* 1318 must be identified as var. *hallii*. However, it must have been a very depauperate plant as its leaves are very small and single-flowered inflorescences are rare in *A. marianae*. It is unfortunate that no further specimens of this plant could be traced and that consequently some uncertainty remains about the identity of the species concerned. However, the collection *Roux* 525 (BOL) would suggest that *A. casmithianus* belongs to the *A. marianae*-complex rather than to *A. nanus*. The detailed descriptions of *A. nanus* published in 1938 and 1940 were obviously based on the collection *Triebner* 1318, the type of *A. casmithianus*. As both publications are later than 1935 and not accompanied by a Latin diagnosis, the new combination *A. casmithianus*, which is based on a wrong identification without a Latin diagnosis, cannot be accepted.

A. subviridis Toelken, sp. nov. ab *A. leucophyllo* foliis oblanceolatis basibus longis cuneatis et tubo corollae cylindrico; ab *A. marianae* var. *hallii* foliis oblanceolatis basibus longis cuneatis ramis decumbentibus longis usque ad 0,25 m longis et in quoque anthera glande apicali magna et sessili differt.

Suffrutex multiramis, ramis decumbentibus vel erectiusculis usque ad 0,25 m longis et radicibus fibrosis. *Folia* oblanceolata, 30-55 (-60) mm longa, 14-20 (-25) mm lata, acuta, cuneata, crista marginale cornea pallida, dorsoventraliter compressa sed leviter convexa supra et subtus, subviridia vel flavo-viridia, glauca et maculatis rubellis inordinatis vel absentibus. *Inflorescentia* thyrsus spiciformis, cymis 1 (2) floribus, pedicellis 4-6 mm longis. *Sepala* triangularia, 2-3 mm longa, acuta, glauco-viridia. *Petala* 12-13 mm longa, connata tubo 9-10 mm longa, glauco-viridia; lobi lanceolati et leviter constricti ad basim, acuti, succulenti, asperi cum trichomatibus clavatis fauce, albi, pallide flavi vel leviter suffusi rosei. *Stamina* 7-10 mm longa, inaequalia, antheris circiter aequantibus longitudine et glandibus terminalibus sessilibus. *Squamae* transverse oblongae 1-1,3 x 1,3-1,6 mm, leviter emarginatae et latissimae ad medium. *Carpella* ovariis tenuibus, gradatim in stylos stigmatibus terminalibus constricta; ovarium 26-30 ovulis cristis verticalibus.

Type: Cape, Bloukrans Pass, *Tölken* 5349 (PRE, holo!).

Suffrutex much branched and mainly from the base with decumbent or scrambling branches up to 0,25 m long and with fibrous roots. *Leaves* sessile, oblanceolate, 30-55 (-60) mm long, 14-20 (-25) mm broad, cuneate, acute, with pale marginal ridge horny, dorsiventrally compressed but slightly convex on both surfaces, pale green to yellowish-green with

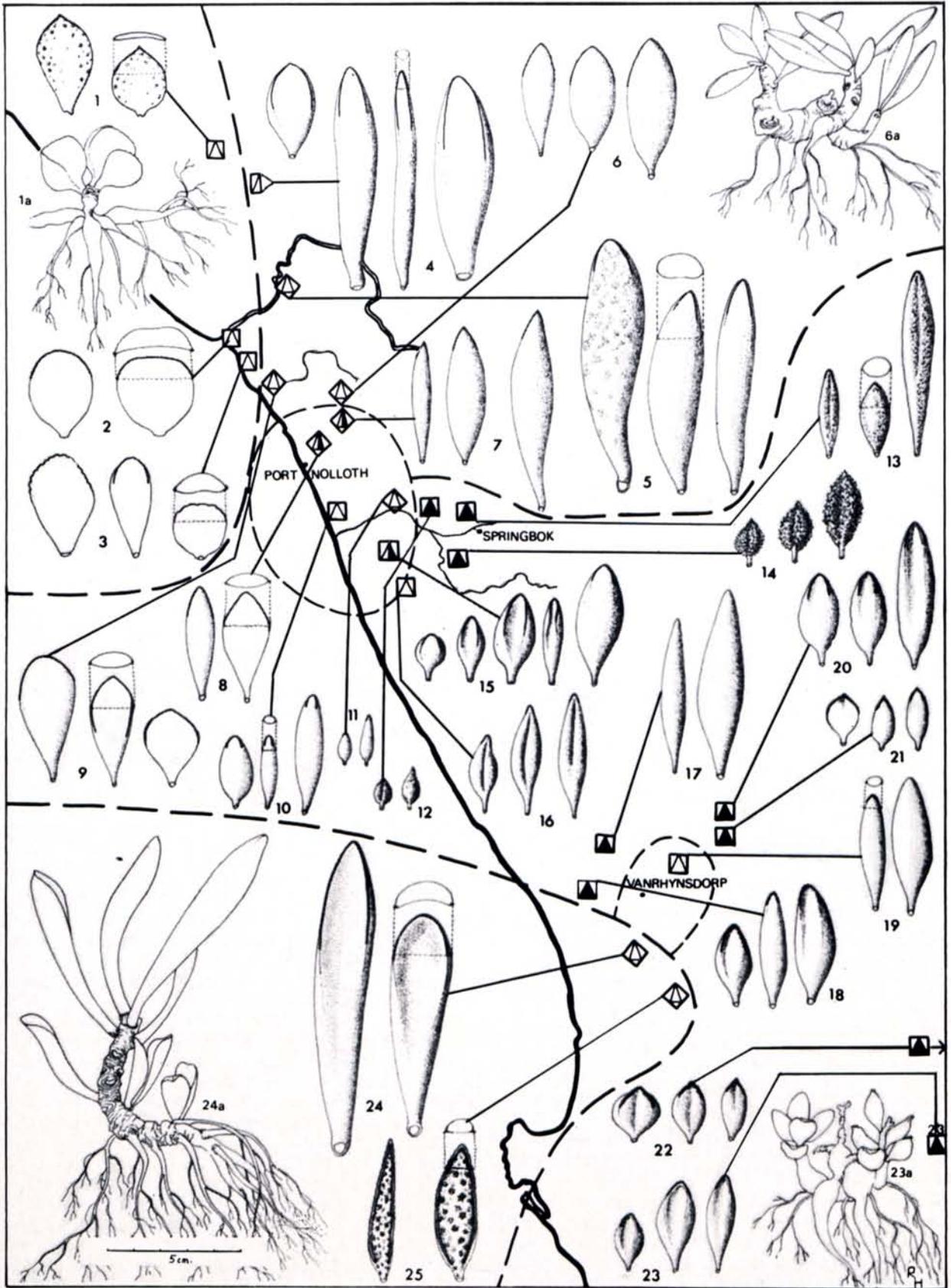


FIG. 2.—Amplitude of variation in shape, size and surface structure of leaves and the type of roots in *Adromischus marianae*.—var. *hallii*: 1, van der Merwe in PRE 57 053; 2, 2a, Hall in NBG 75/53; 3, Tölken 5274.—var. *kubusensis*: 4, Tölken 5292; 5, Tölken 5305; 6, 6a; Tölken 5313; 7, Tölken 5318; 8, Tölken 5260; 9, Tölken 5269.—var. *immaculatus*: 10, Tölken 5258; 11, Tölken 5250; 12, Tölken 5488; 13, Tölken 5200; 14, Acocks 19422; 15, Tölken 5478; 16, Tölken 5473; 17, Tölken 5452; 18, Tölken 5492; 19, Tölken 5444; 20, Bruins s.n.; 21, Bruins s.n.; 22, Hanekom 1447; 23, 23a Tölken 5353.—var. *marianae*: 24, 24a Tölken 5144; 25, Tölken 5136 (□ roots tuberous; > roots fibrous; △ leaf surface smooth; ▲ leaf surface verrucose).

faint bloom and with irregular reddish spots present or absent. *Inflorescence* a spike-like thyrse with 1 (2)-flowered part-inflorescences, with pedicels 4–6 mm long. *Sepals* triangular, 2–3 mm long, acute and covered with a thick bloom. *Petals* 12–13 mm long fused into a tube 9–10 mm long, green and covered with a thick bloom; lobes lanceolate and slightly constricted at the base, acute, slightly fleshy, rough and with club-shaped trichomes in the throat, pale yellow often with slight pink tinge. *Stamens* unequally long, 7–10 mm, with anthers equally long and each with a large sessile apical gland. *Squamae* transversely oblong, 1–1,3 × 1,3–1,6 mm, faintly emarginate and broadest at about the middle, white. *Carpels* with slender papillose ovaries gradually constricted into erect styles with terminal stigmas; ovary with 26–30 ovules each with vertical ridges.

The shape and the pale glaucous colour of the leaves are so distinctive in this section that the species was described from a single collection.

Species insufficiently known

Adromischus rhombifolius (Haw.) Lem., Jard. Fleur 2, Misc. 60 (1852).

Cotyledon rhombifolia Haw. in Phil. Mag. (1825) 33; DC., Prodr. 3: 398 (1828); Schönl. & Bak.f. in J. Bot., Lond. 40: 92 (1902).

No specimen or illustration was preserved of a plant which Haworth identified as *Cotyledon rhombifolia*. He had not seen flowers and the description of the leaves could refer to those of *A. alstonii*, *A. liebenbergii*, *A. roaneanus* or *A. triflora*.

A. robustus Lem., Jard. Fleur. 2, Misc. 60, fig. 1–5 (1852).

Several illustrations of the flower of *A. robustus* indicate that the species belongs to sect. *Adromischus*. Unfortunately, no specimen could be traced and the leaves are merely described as broad. This could apply to *A. alstonii*, *A. roaneanus* or even forms of *A. hemisphaericus*, depending on which other plants Lemaire compared his material with.

UITTREKSEL

As 'n gevolg van 'n herwaardering van *Cotyledon* en *Adromischus* is dit nodig geag om die afbakening van *Cotyledon* te wysig en die nuwe genus *Tylecodon* te beskryf. 'n Verkorte hersiening van *Adromischus* tesame met sleutels tot die seksies, spesies en subspesifieke taksons word aangebied. Die volgende nuwe

name en nuwe kombinasies word publiseer: *Adromischus* sect. **Boreali** Toelken, *A. cristatus* var. **clavifolius** (Haw.) Toelken, — var. **schonlandii** (Phill.) Toelken, — var. **zeyheri** (Harv.) Toelken, **A. fallax** Toelken, *A. filicaulis* subsp. **marlothii** (Schönl.) Toelken, *A. inamoenus* Toelken, *A. marianae* var. **hallii** (P. C. Hutch.) Toelken, var. **kubusensis** (Uitew.) Toelken, *A. schuldianus* subsp. **juttiae** (V. Poelln.) Toelken, *A. subviridis* Toelken, *A. umbraticola* subsp. **ramosa** Toelken, *Tylecodon buchholzianus* (Schudt & Steph.) Toelken, **T. cacalioides** (L.f.) Toelken, **T. decipiens** Toelken, **T. fragilis** (Dyer) Toelken, **T. faucium** (V. Poelln.) Toelken, **T. grandiflorus** (Burm.f.) Toelken, **T. hallii** (Toelken) Toelken, **T. hirtifolium** (W. F. Barker) Toelken, **T. leucothrix** (C. A. Smith) Toelken, **T. occultans** (Toelken) Toelken, **T. paniculatus** (L.f.) Toelken, **T. pearsonii** (Schönl.) Toelken, **T. pygmaeus** (W. F. Barker) Toelken, — var. **tenuis** (Toelken) Toelken, **T. racemosus** (Harv.) Toelken, **T. reticulatus** (L.f.) Toelken, — subsp. **phyllopodium** Toelken, **T. rubrovenosus** (Dinter) Toelken, **T. schaeferanus** (Dinter) Toelken, **T. similis** (Toelken) Toelken, **T. singularis** (Dyer) Toelken, **T. striatus** (P. C. Hutch.) Toelken, **T. suffultus** Bruyns ex Toelken, **T. sulphureus** (Toelken) Toelken, **T. torulosus** Toelken, **T. tuberosus** Toelken, **T. ventricosus** (Burm.f.) Toelken, **T. viridiflorus** (Toelken) Toelken, **T. wallichii** (Harv.) Toelken, — subsp. **ecklonianus** (Harv.) Toelken.

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