

Flowering Plants of Africa

Volume 65

June 2017



Flowering Plants of Africa

Since its inception in 1921, this serial, modelled on the former *Curtis's Botanical Magazine*, has published well over 2 000 colour plates of African plants prepared by some 80 artists.

The object of the journal is to convey to the reader the beauty and variety of form of the African flora, to stimulate an interest in the study, conservation and cultivation of African plants, and to advance the science of botany as well as botanical art.

The illustrations are mostly prepared by artists on the staff of the South African National Biodiversity Institute (SANBI), but we welcome other contributions of suitable artistic and scientific merit. Please see *Guide for authors and artists* on page 159.

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(note Afrikaans translation and changes in title)

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Cover illustration: *Protea namaquana* (Plate 2327)

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Flowering Plants of Africa

A peer-reviewed journal containing colour plates with descriptions of flowering plants of Africa and neighbouring islands

Edited by

Alicia Grobler

with assistance of

Gillian Condry

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Contents

Volume 65

2321. <i>Codonorhiza azurea</i> . P. Goldblatt and John C. Manning	2
2322. <i>Gladiolus crassifolius</i> . J.C. Manning, P. Goldblatt and Gillian Condry	8
2323. <i>Aloe braamvanwykii</i> . G.F. Smith, E. Figueiredo, R.R. Kloppe, N.R. Crouch and Gillian Condry	14
2324. <i>Tinospora fragosa</i> subsp. <i>fragosa</i> . E.J. van Jaarsveld and Marieta Visagie	26
2325. <i>Cissampelos hirta</i> . M. Struwig, H. de Wet and Gillian Condry	34
2326. <i>Protea foliosa</i> . C.I. Peter, A.P. Dold, C. Melidonis and Susan Abraham	42
2327. <i>Protea namaquana</i> . J.P. Rourke and Ellaphie Ward-Hilhorst	50
2328. <i>Kalanchoe leblanciae</i> . G.F. Smith, E. Figueiredo, N.R. Crouch and Gillian Condry	56
2329. <i>Senna didymobotrya</i> . T.P. Jaka and Gillian Condry	68
2330. <i>Caesalpinia bracteata</i> . E.J. van Jaarsveld and Gillian Condry	76
2331. <i>Eriosema distinctum</i> . T. Nkonki, S.M. Serumula and Gillian Condry	84
2332. <i>Adenia wilmsii</i> . E.J. van Jaarsveld and Gillian Condry	90
2333. <i>Esterhuysenia lucilleae</i> . E.J. van Jaarsveld and Marieta Visagie	96
2334. <i>Pisonia aculeata</i> . M. Struwig and Gillian Condry	106
2335. <i>Schizostephanus alatus</i> . E.J. van Jaarsveld and Marieta Visagie	112
2336. <i>Gomphocarpus glaucophyllus</i> . S.P. Bester and Gillian Condry	120
2337. <i>Ipomoea bolusiana</i> . W.G. Welman and Gillian Condry	132
2338. <i>Ipomoea cairica</i> . W.G. Welman, P.P.J. Herman and Gillian Condry	138
2339. <i>Rotheca myricoides</i> . P.P.J. Herman and Gillian Condry	146
2340. <i>Ruellia kaokoensis</i> . E.J. van Jaarsveld and Marieta Visagie	154
Guide for authors and artists	159
Index to Volume 65	163

New taxa published in this volume

Esterhuysenia lucilleae Van Jaarsv. sp. nov., p. 96

Ruellia kaokoensis Van Jaarsv. sp. nov., p. 154

This volume is dedicated to

ABRAHAM ERASMUS [BRAAM] VAN WYK



Plant taxonomist, incumbent of the Louis Botha Chair and curator of the H.G.W.J. Schweickerdt Herbarium, University of Pretoria, in recognition of his inspiring teaching, training of a considerable number of students, wide-ranging research outputs, and substantial community service that have contributed significantly to botany in general, and that of southern Africa in particular. A staunch supporter of botanical art, over the years he has contributed to numerous species monographs that accompanied plates in *Flowering Plants of Africa*. He is commemorated, among others, in the species name *Aloe braamvanykii*, a plant treated and illustrated in this volume.

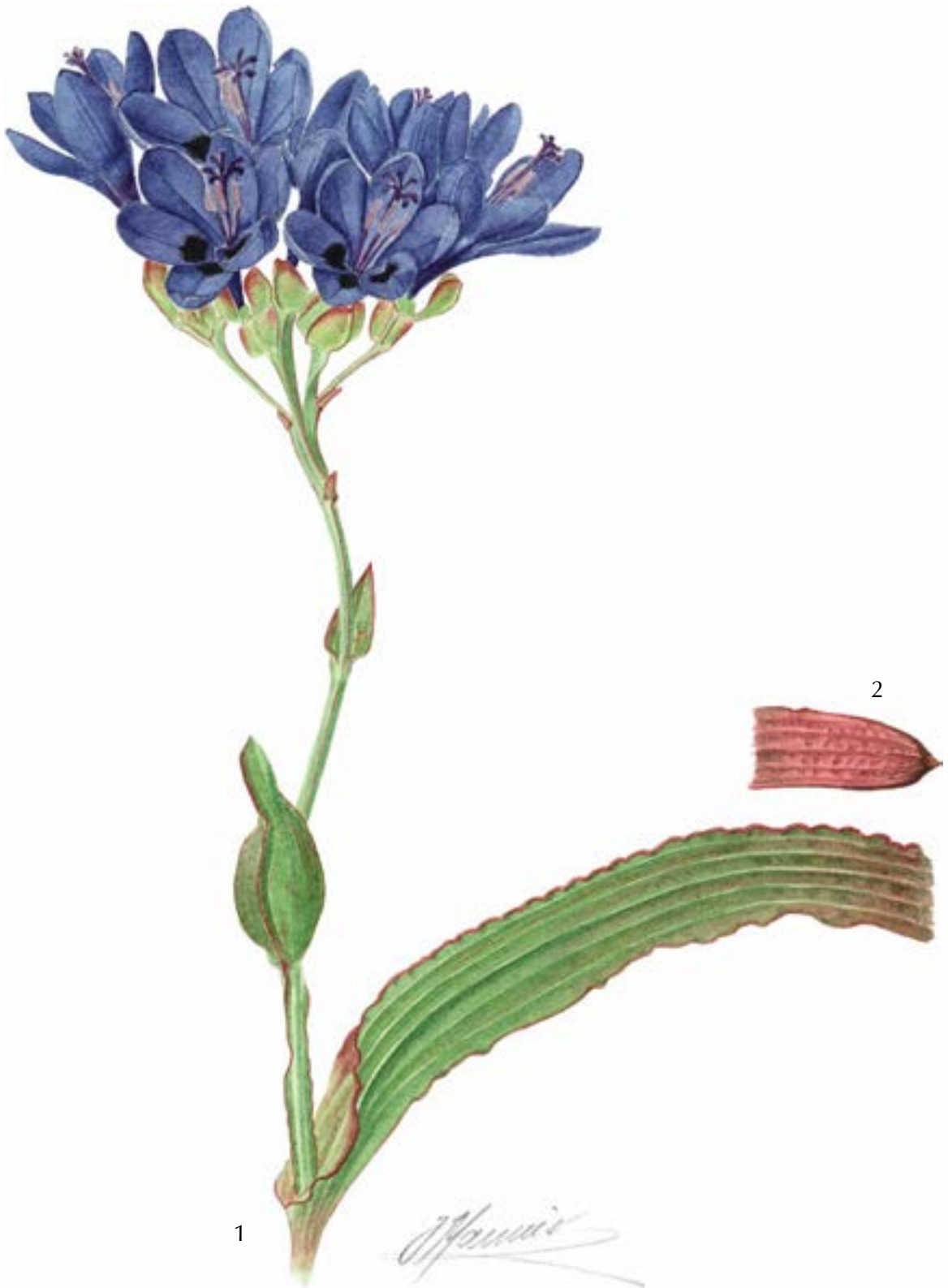


PLATE 2321 *Codonorhiza azurea*

Codonorhiza azurea

Iridaceae: Crocoideae: Watsonieae

South Africa

Codonorhiza azurea (Eckl. ex Baker) Goldblatt & J.C.Manning in Strelitzia 35: 93 (2015). *Lapeirousia corymbosa* var. *azurea* Eckl. ex Baker: 90 (1896). *Lapeirousia azurea* (Eckl. ex Baker) Goldblatt in Goldblatt & Manning: 333 (1992). *Lapeirousia azurea* Eckl.: 31 (1827), nom. nud. *Meristostigma azureum* Eckl. ex Steud.: 131 (1841), nom. nud.

Until the recent publication of a monograph of *Lapeirousia* Pourr. and related genera by Goldblatt & Manning (2015), which included the new genus *Codonorhiza* Goldblatt & J.C.Manning, *C. azurea* was regarded as a member of *Lapeirousia*, either as the independent species *L. azurea* or included in *L. corymbosa* var. *fastigiata* (Lam.) Goldblatt. The new genus *Codonorhiza* was erected for an exclusively Western Cape group of species that was shown by molecular study (Forest et al. 2014) to comprise a monophyletic assemblage related to *Lapeirousia* itself. A second group of species, now the genus *Afrosolen* Goldblatt & J.C.Manning (Goldblatt & Manning 2016), includes the tropical and eastern southern African members of *Lapeirousia*. The taxonomically isolated relict species, *L. neglecta* Goldblatt, is now treated as the only species of *Schizorhiza* Goldblatt & J.C.Manning. Nested between these genera are the Socotran genus *Cyanixia* Goldblatt & J.C.Manning and the tropical African *Savannosiphon* Goldblatt & Marais. The splitting up of *Lapeirousia sensu lato* was deemed necessary in order that its constituent genera were natural, or monophyletic (sharing a single common ancestor) (Goldblatt & Manning 2015). The name *Codonorhiza* literally means bell [shaped] root and alludes to the bell-shaped corm.

Codonorhiza is readily recognised by the bell-shaped corms with flat bases that are covered by dark grey to almost black tunics of compressed fibres, flowers with deeply forked style branches, and green, somewhat leathery floral bracts, the inner and outer of which are more or less equal in size (Goldblatt & Manning 2015). *Codonorhiza* also stands out from other genera in the *Lapeirousia* alliance in its distinctive seeds, small in size and ovoid in shape with a prominent funicular collar, and in having pollen with a single opercular band. The operculum is two-banded in almost all other members of the group and is the ancestral condition for subfamily Crocoideae. Divided style branches are a common, but not unique character in the tribe Watsonieae, to which *Codonorhiza* and *Lapeirousia* belong. Undivided style branches are characteristic of *Cyanixia*, the tropical African *Zygotritonia* Mildbr., and several species of *Afrosolen*. Flat-based, bell- or cone-shaped corms also characterise several genera of Crocoideae of the Iridaceae, including *Lapeirousia* and *Afrosolen*. The differences between *Codonorhiza* and *Lapeirousia* are also reflected in their chromosomes. Although both have bimodal karyotypes (chromosome complements) consisting of one long and many smaller chromosome pairs, *Codonorhiza* has a basic chromosome number of $n = 10$, whereas *Lapeirousia* has $n = 9$ or 8 and *Schizorhiza* has $n = 6$.

Provisional dating of molecular-based plant phylogenies indicate that the *Lapeirousia* group of genera diverged from the remaining Watsonieae in the Miocene, about 25 million years ago (Goldblatt et al. 2006). *Codonorhiza* may date from 16–20 million years ago (Goldblatt et al. 2008) but the extant species are considerably younger, probably having evolved after the establishment of a summer-dry Mediterranean-type climate in western southern Africa some 6–10 million years ago.

Codonorhiza azurea is recognised by the dark blue, zygomorphic flowers with the three abaxial tepals bearing dark red or black markings near the base, and either dark purple or red-brown pollen. The flowers are tilted backwards so that the unilateral stamens lie almost horizontally above the adaxial (or dorsal) tepal. The paired green floral bracts are subequal in length and characteristic of the genus, as is the very large basal foliage leaf. The remaining leaves are much shorter and grade into bract-like structures at the upper nodes of the stem. The related *C. corymbosa* (L.) Goldblatt & J.C.Manning has smaller, radially symmetric flowers with the stamens held erect and surrounding the upright style. Vegetatively, the two species are similar but the leaves and other organs of *C. corymbosa* are consistently smaller. A second related species, *C. elandsmontana* Goldblatt & J.C.Manning, has flowers similar to those of *C. azurea* in floral presentation, thus with tilted flowers with unilateral stamens arching above the adaxial tepal, but the tepals are paler blue and the abaxial tepals have white, bracket-shaped markings edged in dark blue.

Pollination of *Codonorhiza azurea* is somewhat puzzling. The flowers lack scent and the dark-coloured pollen is unusual for species pollinated by bees, yet the large anthophorine bee *Anthophora diversipes* (Anthophoridae) has been recorded visiting the flowers and presumably foraging for nectar present in the base of the short perianth tube. Hopliine beetles have also been documented as insect visitors to *C. azurea*, and the flowers not only provide a platform for assembly but have the dark tepal markings typical of flowers pollinated by hopliine beetles. Absence of scent is likewise typical of hopliine-pollinated flowers. At a site in Malmesbury large, buff-brown hopliines were the only insects that we recorded on the flowers, using the flowers as sites of assembly and mating. The report of visits to flowers of *C. azurea* (as *Lapeirousia*) by *Anthophora diversipes* suggests a possible bimodal pollination system for the species, using both large-bodied bees and hopliine beetles.

Codonorhiza azurea is a narrow endemic of the Western Cape, centred on the Paardeberg and surroundings, where it extends from near Paarl north to Malmesbury and Riebeeck-Kasteel (Figure 1). It is especially prominent in burned or cleared slopes in *Elytropappus*-dominated renosterveld, on heavier soils, either on clay or granite-derived gravels. Much of its original habitat has been given over to agriculture and its range is now much reduced so that the species is regarded as Endangered (Raimondo et al. 2009). In 1992, Goldblatt & Manning (1992) considered that the species was probably not in immediate danger of extinction, as it was then still known from sites away from cultivation. Several of these are now lost to urban expansion and some of its remaining sites are being developed for vineyards.

Codonorhiza azurea was first figured in a fascicle of N.L. Jacquin's *Icones plantarum rariorum* (Jacquin 1791) under the name *Ixia corymbosa* L., in a composite painting that

included true *C. corymbosa* as well. The earliest extant herbarium records appear to be the collections of C.F. Ecklon and C.L. Zeyher, made in the late 1820s, and those made by J.F. Drège at about the same time or shortly thereafter. It is not entirely clear whether Ecklon considered *C. azurea* distinct from *C. corymbosa*, for although he mentioned both names in his *Topographisches Verzeichniss* (1827) (*C. azurea* without description), some of his collections of both species bear the latter manuscript name. *Codonorhoza azurea* was regarded as a variety of *C. corymbosa* (as *Lapeirousia*) by Baker (1896) and later as conspecific with *C. corymbosa* subsp. *fastigiata* by Goldblatt (1972). Later field studies have helped establish the status and rank of *C. azurea* as a separate species (Goldblatt & Manning 1992). Although *C. fastigiata* (Lam.) Ker Gawl. is vegetatively virtually identical to *C. azurea*, it has radially symmetric flowers with pale yellow tepals, each of which usually bears small dark blue, triangular markings. Thus both flower colour and symmetry of the two species differ. In the molecular phylogenetic study using several plastid genes, *C. azurea* was not retrieved as directly related to *C. fastigiata* despite their comparably large perianth but was placed as sister to *C. corymbosa* and *C. micrantha* (E.Mey. ex Klatt) Goldblatt & J.C.Manning (Forest et al. 2014).

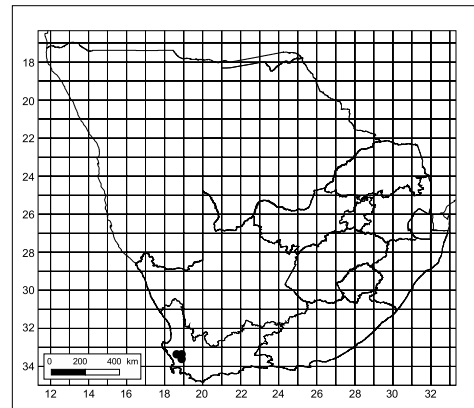


FIGURE 1.—Known distribution of *Codonorhoza azurea*.

Description.—Deciduous geophyte, 70–180(–260) mm high, 5- to 7-branched, stem compressed and winged, branches subtended by bracts (1–)2–5 mm long, those below appearing leaf-like. *Corm* 12–16 mm in diameter; tunics blackish, basal rim split vertically. *Leaves* 2, lowermost inserted at ground level, largest, falcate, 50–120(–240) × (6–)10–15 mm, obtuse to subapiculate, margins undulate and crisped, with prominent main vein and a pair of secondary veins (rarely one) on either side almost as prominent; second leaf inserted near middle of stem, 20–70 mm long, oblong-lanceolate, margins ± straight, not or hardly sheathing at base. *Inflorescence* a congested, flat-topped false panicle, flowers crowded at branch tips, ultimate branchlets 1- or 2-flowered; bracts green, firm-textured, 9–11 mm long, outer folded in midline, margins often red, inner obtuse or slightly emarginate. *Flowers* zygomorphic, tilted backward, dark blue to violet, with triangular, dark blue-black or red-purple blotch at base of lower 3 and sometimes adjacent upper lateral tepals; perianth tube funnel-shaped, 10–12 mm long; tepals elliptic-ovate, obtuse, mostly 17–20 × 7–8 mm. *Stamens* unilateral, ascending or extended horizontally due to adaxial tilting of flower, 11–15 mm long, exerted for 8–10 mm; anthers 3–5 mm long, pollen dark blue or red-brown. *Style* unilateral, dividing opposite upper third of anthers; branches 2.5–3.0 mm long, divided for ± half their length. *Capsules* turbinate and 3-lobed, ± 6 mm long, with up to 8 seeds per locule. *Seeds* red-brown, ovoid, truncate at chalazal end, rugulo-reticulate, ± 1 × 1.0–1.3 mm, with funicular appendage 0.2–0.4 mm long. *Chromosome number* $2n = 20 + 0-2B$. *Flowering time*: late September to late October. Plate 2321.

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PLATE 2322 *Gladiolus crassifolius*

Gladiolus crassifolius

Iridaceae: Crocoideae: Gladioleae

South Africa, Lesotho, Swaziland

***Gladiolus crassifolius* Baker** in Journal of Botany (London) 14: 334 (1876); Baker: 215 (1892); Baker: 150 (1896); Lewis et al.: 60 (1972); Goldblatt: 94 (1996); Goldblatt & Manning: 74 (1998). *Gladiolus rachidiflorus* Klatt: 339 (1882). *Gladiolus thomsonii* Baker: 223 (1892). *Gladiolus masukuensis* Baker: 283 (1897). *Gladiolus tritoniiformis* Kuntze: 308 (1898). *Gladiolus junodii* Baker: 866 (1901). *Gladiolus conrathii* Baker: 1005 (1904). *Gladiolus dieterlenii* Phillips: 282 (1917).

Gladiolus L. is one of the two largest genera in Iridaceae, as rich in species as *Iris* L. and probably equally as popular in horticulture and the cut flower trade. It is also one of the few genera of subfamily Crocoideae to have radiated significantly outside the Greater Cape Floristic Region. Of some 270 species recognised in the genus, 170 occur in southern Africa, where they are concentrated in the winter-rainfall zone in the extreme southwest of the subcontinent (Goldblatt & Manning 1998). The genus has undergone a secondary radiation in the temperate, summer-rainfall grasslands along the eastern highlands, and *G. crassifolius* Baker is one of the more common species found here.

Species of *Gladiolus* are strikingly variable in their vegetative and floral morphology and the genus is essentially recognised by its disc-like seeds with a papery, circumferential wing. These are carried in leathery, somewhat inflated capsules that open widely when dry, each segment ultimately recurving to expose the seeds. A few species have the seed wings reduced. The expanded stigmatic branches are also characteristic, and most species are diploid, $2n = 30$, with the unusually high basic chromosome number of $x = 15$.

The genus has no evident close relatives within Crocoideae and a recent phylogenetic analysis of DNA sequence data suggested that its closest relative is the monotypic *Melasphaerula* Ker Gawl. (Goldblatt et al. 2008). This unusual species has several unique features that find no parallel in *Gladiolus* or in any other genus in the family, including its bell-shaped corms with tunics splitting radially from the centre of the flattened base, a lax, highly branched inflorescence, and depressed-obcordate capsules dehiscing along their upper edges.

An analysis of speciation and diversification rates in *Gladiolus* suggests that the diversity of species in southern Africa stems from an early origin of the genus in the winter-rainfall region, followed by active speciation in the summer-rainfall parts of the subcontinent (Valente et al. 2011). This study proposes a southern African origin of the genus during the Miocene, followed by radiation into tropical Africa, Madagascar, the Mediterranean Basin and western Asia. It also supports a relationship between *G. crassifolius* and other multi-leaved summer-rainfall species in the genus, including *G. densiflorus* Baker.

PLATE 2322.—1, plant in flower, much reduced; 2, inflorescence, $\times 1$; 3, flower, $\times 1.5$; 4, fruit, $\times 1$. Voucher specimen: Condý 255 in National Herbarium, Pretoria. Artist: Gillian Condý.

Gladiolus crassifolius is widely distributed through eastern southern Africa and is still relatively common in South Africa, Swaziland and Lesotho (Figure 1). It is one of the few southern African species shared with tropical Africa, where it extends through southern and eastern Zimbabwe and central Mozambique, northward to Malawi and southwestern Tanzania, with isolated populations in western Angola. Plants almost always grow in hilly country, favouring well-drained, rocky grassland habitats, usually in full sun but occasionally in light shade. Typically a late summer-flowering species, *G. crassifolius* most commonly blooms from the end of February to late April, but plants are occasionally seen in flower in late January, even at high elevations. The specimen illustrated here was collected in stony grassland on the Mpumalanga Escarpment east of Carolina near Lochiel.

The flowers of *Gladiolus crassifolius* are fairly typical of several smaller-flowered grassland species in the genus but it is usually readily recognised by the combination of an inclined, many-flowered spike, and basal fan of several, tough leaves with conspicuously thickened margins, midribs and secondary veins. The specific epithet *crassifolius*, meaning thick-leaved, alludes to the thick, leathery, strongly ribbed leaves. The flowers are most frequently light pink or salmon with darker pink to purple nectar guides highlighted with yellow. However, plants with striking orange, red, and coral-pink flowers occur locally in Mpumalanga.

Like other small-flowered species of *Gladiolus*, *G. crassifolius* is adapted for pollination by long-tongued bees, most commonly species of *Amegilla* (family Anthophoridae). The bees make rapid visits to flowers to feed on nectar, small quantities of which are located in the lower half of the perianth tube (Goldblatt & Manning 1998).

The species was recorded as used traditionally by the Basotho, under the name *kxahla-ya-maloti*, with other plants as an enema, and alone as a remedy for headache and lumbago (Watt & Breyer-Brandwijk 1932).

Gladiolus crassifolius is most commonly confused with *G. densiflorus* from the far eastern escarpment and coastal lowlands of southern Africa. The critical difference between the two is in their foliage. Both species have the midrib and margins heavily thickened but the leaves of *G. crassifolius* have one or two pairs of secondary veins more conspicuously thickened than the remaining veins, whereas the leaves of *G. densiflorus* have numerous, equally fine, closely spaced minor veins between the midrib and the margins. This distinction is more easily seen in dried than in living plants. The distribution of the two species is largely complimentary, with *G. crassifolius* typically a highland species ranging west and south of the Mpumalanga Escarpment and *G. densiflorus* east of the escarpment onto the KwaZulu-Natal coastal plain and north into lowland Swaziland and Mozambique. Their ranges overlap along the Mpumalanga Drakensberg but *G. crassifolius* usually blooms a few weeks later than *G. densiflorus*. In the field *G. crassifolius* can usually also be distinguished by the pink to salmon flowers strongly marked with purple on the lower tepals. The flowers of *G. densiflorus* vary widely in colour but are typically finely speckled with dark spots, and the lower tepals do not have conspicuous dark markings.

Gladiolus crassifolius is not a particularly variable species but was poorly understood for many years. The species was based on a collection made by Thomas Cooper in the eastern Free State in 1862 (Baker 1876), but may have been first collected in 1832 by J.F. Drège in

the vicinity of Durban, then called Port Natal. Drège's collection was described under the name *G. rachidiflorus* (Klatt 1882). We have not been able to examine the duplicate collection said to be in the Herbar National de Paris (P) and have only seen a fragment of the type, comprising a few flowers and a tracing of the whole plant, in the Swedish Museum of Natural History (S). We must therefore accept the opinion of Lewis et al. (1972) that it is conspecific with *G. crassifolius*, although the locality is more consistent with *G. densiflorus*. Plants from tropical Africa, collected as early as 1880 in southwestern Tanzania and from northern Malawi in 1895, were described by Baker as *G. thomsonii* and *G. masukuensis* in 1892 and 1897 respectively. Both match *G. crassifolius* from southern Africa fairly closely. Other synonyms include *G. tritoniiformis* Kuntze and *G. conrathii* Baker from South Africa and *G. dieterlenii* from Lesotho. The last, described by Phillips in 1917, represents a particularly narrow-leaved race of the species. The others do not differ in any taxonomically significant way from the type of *G. crassifolius* and were described before the extent of the variation in the species was appreciated.

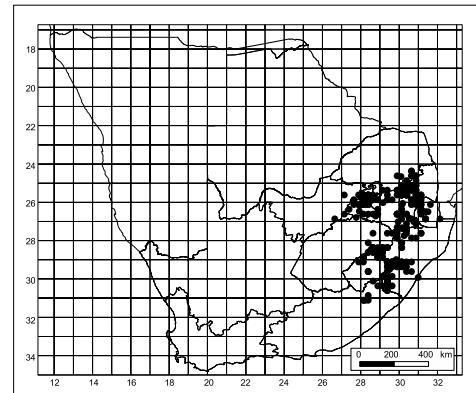


FIGURE 1.—Known distribution of *Gladiolus crassifolius* in South Africa.

Spring-flowering *Gladiolus mosambicensis* Baker (= *G. gazensis* Rendle [1911]) from eastern Zimbabwe and Mozambique has sometimes been treated as conspecific with *G. crassifolius* (Goldblatt 1996) but is clearly a distinct species, flowering before the leaves have developed fully, and producing a lax spike of smaller flowers with shorter, often obtuse bracts 9–15 mm long, and larger capsules 12–16 mm long containing broadly winged seeds (Goldblatt 2008).

Description.—Cormous geophyte, (250)350–900(–1 200) mm high. *Corm* 18–30 mm in diameter, tunics coriaceous to $\pm$ coarsely fibrous. *Leaves* 4–8, mostly basal, blades narrowly lanceolate to linear, reaching to the base of the spike or exceeding it, 5–12 mm wide, midrib and margins and 2 or more pairs of secondary veins hyaline and moderately thickened; cauline leaves 2 or 3, with progressively shorter blades, the upper sometimes entirely sheathing. *Stem* erect below, usually flexed outward above uppermost leaf, simple or with 1–3, rarely up to 5 branches, $\pm$ 2 mm in diameter below base of spike. *Spike* suberect or weakly inclined, (12–)16–22(–40)-flowered; *bracts* usually pale green or flushed purple, initially soft-textured, becoming dry and membranous above in fruit, acute and attenuate or apiculate, 25–28(–40) mm long, inner slightly shorter, forked apically. *Flowers* pale to deep pink or light purple, occasionally orange-red or cream, the lower lateral, and sometimes the lowermost tepals each with a dark band of colour across lower half of limbs, the dark band often edged with cream, unscented; *perianth tube* obliquely funnel-shaped, cylindric below, widening and curving outward near the apex, 9–17 mm long; *tepals* broadly ovate, unequal, dorsal largest and arched to hooded over stamens, 18–22 $\times$ 10–12 mm, upper laterals directed forward and curving outward above, 18–20 $\times$ 16–18 mm, lower 3 tepals directed downward, united below for 2–3 mm and narrowed into channelled claws below, lower laterals 12–16 $\times$ 5–7 mm, lower

median 15–20 × 12 mm. *Filaments* unilateral and arcuate, 12–14 mm long, exerted 6–7 mm from tube; *anthers* 7–8 mm long, pale lilac to purple, pollen whitish to pale yellow. *Style* usually dividing opposite lower half of anthers, branches ± 3 mm long, seldom reaching past middle of anthers. *Capsules* obovoid, 9–12(–14) mm long, 3-lobed above and retuse. *Seeds* elliptic, broadly winged, 4–6 × 2.5–4.0 mm. *Flowering time*: mainly February and March, occasionally later or earlier at higher elevations; in tropical Africa usually April to June but sometimes August to November, especially after fires. Plate 2322.

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PLATE 2323 *Aloe braamvanwykii*

Aloe braamvanwykii

Asphodelaceae

South Africa

Aloe braamvanwykii Gideon F.Sm. & Figueiredo in *Bradleya* 30: 162–166 (2012); Van Wyk [B-E.] & Smith: 216–217 (2014).

Within the genus *Aloe* L. a number of groups are acknowledged as being rather challenging from a taxonomic point of view. The grass and slender aloes, *Aloe* sect. *Graminaloe* Reynolds and *Aloe* sect. *Leptoaloe* A.Berger, respectively, are two such groups (Smith 2005). However, no other infrageneric unit in *Aloe* has defied easy and accurate classification more than the maculate aloes, *Aloe* sect. *Pictae* Salm-Dyck. These aloes are generally characterised by having white or whitish H-shaped spots on one or both leaf surfaces, and their flowers have a perianth tube that is basally swollen. However, even these two characters show considerable variation. For example, *A. immaculata* Pillans includes several populations that have somewhat striated, but generally uniformly green leaves, while the flowers of *A. prinslooii* I.Verd. & D.S.Hardy are rather club-shaped and hardly swollen basally. Representatives of *Aloe* sect. *Pictae* are not the only aloes that have distinct whitish markings on their leaves. *Aloe microstigma* Salm-Dyck and *A. pictifolia* D.S.Hardy, both named for this character, as well as several other species unrelated to the maculate aloes, also have spotted leaves.

The adaptive significance of pale or dark spotted leaves, such as those of *Aloe braamvanwykii* (Figure 1), is not well understood and has been the subject of much speculation and several hypotheses (Farmer 2014). In addition to their presence in some mature aloes, spotted leaves are a common feature in the juvenile forms of numerous unrelated species of *Aloe*, such as *A. microstigma* (Figure 2). This character is thought to assist young plants to avoid herbivore attention by enabling them to better blend into seedling establishment sites in the dappled shade and protection provided by nurse plants. A further explanation for the spots on the leaves of aloes, and other alooid species, for example of *Gasteria* Duval and *Haworthia* Duval, is that they mimic damage caused by feeding insects. Such mimicry is observed across diverse plant groups, and is particularly well exemplified by *Asystasia varia* N.E.Br. (Acanthaceae), a forest understory herb from KwaZulu-Natal and the Eastern Cape. This species has irregular silvery patches along the midrib and lateral veins of leaves which strongly resemble insect leaf-mining activity. It is hypothesised that spotted leaves may serve as warning signals (albeit by deceit) to would-be leaf eaters. This possibility is based on the observation that following damage by leaf eaters, many plants respond by inducing a chemical defence in the same or other leaves (Karban 2015).

As is the case with a number of South Africa's botanists, Prof. Braam (Abraham Erasmus) van Wyk (1952–) of the Department of Plant and Soil Sciences, University of Pretoria, was also fascinated by succulents, including species of *Aloe*, as a child. He grew up on a



FIGURE 1.—The light green leaves of *Aloe braamvanwykii* are white-spotted in irregular bands on both upper and lower surfaces. Photographed on 4 January 2012 next to the Bloemhof road near Wolmaransstad, North-West Province, South Africa. Photograph: G.F. Smith.

farm in the North-West Province (then the Western Transvaal), South Africa, and during summer trips from the farm to the towns of Wolmaransstad and Schweizer-Reneke in North-West, he regularly noticed the flowering of a bright red form of a summer-flowering maculate aloe growing in patches along the road. Naturally this aloe became part of his succulent collection. It was the mid-1960s and literature on aloes was not readily available in the local town and school libraries. He did, however, manage to obtain a copy of *The aloes of South Africa* (Reynolds 1950) and was intrigued by the fact that no mention was made of a summer-flowering maculate aloe in that part of the country that had flowers with distinctive basal swellings in the flowers (Figure 3). The nearest record of such a species according to Reynolds's book was for *A. transvaalensis* Kuntze at Ottoshoop, quite some distance to the north. According to the available lit-



FIGURE 2.—Seedlings of *Aloe microstigma*, here growing in the extensive leaf litter of *Euclea undulata* Thunb., carry numerous small, white spots on the leaves. Photographed on 23 February 2016 north of Calitzdorp, Little Karoo, Western Cape, South Africa. Photograph: G.F. Smith.



FIGURE 3.—The red flowers of *Aloe braamvanwykii* have distinct basal swellings, unlike those of the sympatric *Aloe grandidentata*. Photographed on 5 January 2012 next to the Leeufontein road, near Wolmaransstad, North-West Province, South Africa. Photograph: G.F. Smith.

erature, the winter- to spring-flowering *A. grandidentata* Salm-Dyck (Figure 4) was the only species of maculate *Aloe* known to grow in the vicinity of Wolmaransstad and Schweizer-Reneke. In addition to its later flowering time, *A. grandidentata* is readily identified by a perianth tube that is rather weakly, but still noticeably, constricted above the base (Figure 5). Braam was familiar with the latter species as it often grows together with the summer-flowering plants, thus reinforcing his suspicion that two different species were involved.

Over a period of many years, Braam regularly mentioned this summer-flowering aloe to a number of aloe experts, and also took live plants for cultivation to the then Botanical Research Institute in Pretoria (later National Botanical Institute, now the South African National Biodiversity Institute). However, publications on *Aloe*, including the treatment of *Aloe* in the *Flora of South Africa* (Glen & Hardy 2000), still failed to account for the presence of this particular aloe in North-West. When this state of affairs was perpetuated in the first and second editions of Van Wyk [B-E.] & Smith's *Guide to the aloes of South Africa* (Van Wyk & Smith 1996, 2003), Braam again brought the existence of this particular aloe to the attention of one of us (GFS).

An opportunity finally arose for two of us (GFS and EF) to more closely examine the North-West plants just after New Year's Day in 2012. During this trip the populations, especially around Wolmaransstad, were studied in detail. This study prompted a more thorough investigation of other summer-flowering maculate aloes. It soon became apparent that the



FIGURE 4.—In general appearance, plants of *Aloe grandidentata*, which grows socially with *Aloe braamvanwykii*, resemble the latter species. Photograph: G.F. Smith.

taxon that Braam had noticed several decades ago warranted description as new. We therefore described Braam's aloe as *Aloe braamvanwykii* Gideon F.Sm. & Figueiredo (Smith et al. 2012), so honouring Prof. Van Wyk. Braam is an exceedingly productive and respected botanist who has authored or co-authored several books and many papers on aspects of the flora and natural history of southern Africa. His long-standing interest in the genus *Aloe* is exemplified, inter alia, by his co-authoring of a book on aloes in southern Africa (Smith & Van Wyk [A.E.] 2008). Over several decades Braam has been a staunch supporter of botanical art, and a regular contributing author to *Flowering Plants of Africa*, and this volume of the journal is respectfully dedicated to him.

It is tempting to regard *Aloe braamvanwykii* as simply an aberrant form of *A. transvaalensis*, a species that is rather plentiful along the Witwatersrand – Johannesburg and surrounding areas – as well as Pretoria. *Aloe braamvanwykii* is allied to other summer-flowering maculates in the *Aloe zebrina*-complex, with *A. transvaalensis* indeed probably its closest relative. It differs from *A. transvaalensis* in that plants of *A. braamvanwykii* usually form large, dense clumps (Figure 6) of rather small rosettes (up

to 220 mm in diameter), as opposed to small clumps or often large, solitary rosettes (up to 400 mm in diameter). Inflorescences of *A. braamvanwykii* are short (0.65–0.75 m high) with small (20–25 mm long), unusually intense red flowers. Inflorescences of *A. transvaalensis*, on the other hand, are tall (1.0–1.5 m high) with larger (up to 36 mm long), pale flesh pink to light coral red flowers.

Aloe braamvanwykii has a rather brief and concentrated flowering period in mid-summer, from end-November to February. Plants have consistently been observed to bloom on Christmas Day (25 December) and New Year's Day. In years of extreme mid-summer drought (as has been the case in 2015/2016), many plants in a colony skip flowering. Fruit set is very quick and mature-sized green fruit are often present while flowers on an inflorescence are still opening (Figure 7). This character, however, is not unique to *A. braamvanwykii*, and has also been observed in other maculate aloes, such as *A. maculata* All. (Figure 8).



FIGURE 5.—Flowers of *Aloe grandidentata* lack prominent basal swellings. Photograph: G.F. Smith.



FIGURE 6.—Plants of *Aloe braamvanwykii* often form dense clumps consisting of scores of rosettes. Photograph: E. Figueiredo.



FIGURE 7.—In *Aloe braamvanwykii* fruit-set is very quick such that mature-sized, green fruit develop while there are still open flowers and buds on an inflorescence. Photograph: A.E. van Wyk.

Aloe braamvanwykii is only known from the Wolmaransstad, Schweizer-Reneke, Delareyville and Stella areas in the North-West Province of South Africa (Figure 9). It is found in relict stands of Klerksdorp Thornveld (Gh 13) (Mucina et al. 2006) where it grows in full sun in open grassy areas, often among woody vegetation (Figure 10). When first described in 2012, populations of *A. braamvanwykii* appeared to not have been under immediate conservation threat, even though it was noted that its area of occurrence was extensively cultivated for agricultural purposes (Van Wyk & Smith 2014). More recently the species was assessed as Endangered A2c owing to habitat loss for agricultural expansion in its habitat (Von Staden 2014). A potential future threat to the type locality, which has one of the largest known populations of the species, is the rapidly expanding township and informal settlements on the western outskirts of Wolmaransstad.



FIGURE 8.—As is the case with *Aloe braamvanwykii*, *Aloe maculata* also carries mature, bright green fruit in its clustered, head-shaped inflorescences, along with flowers that are still in bud, and at anthesis. Photograph: G.F. Smith.

When established from whole rosettes, *Aloe braamvanwykii* is easy to cultivate in open beds in the summer-rainfall region of South Africa. It prefers a well-drained, friable soil.

Type specimen examined: South Africa: North-West Province, on the farm Leeuwnfontein 185, near Baskop alongside the tarred Leeuwnfontein road, about 4 km from Wolmaransstad, 05 January 2012, *Abrie Steyn, Gideon F. Smith & Estrela Figueiredo* 1 (PRE, holo.).

Description.—Small to medium-sized, herbaceous, slow-growing, succulent, perennial, maculate aloe, total height excluding inflorescence 0.17–0.28 m, sometimes solitary, usually clumped, 5–70 heads, a single head up to (170–)220 mm in diameter. *Roots* cylindrical, 5 mm in diameter. *Stems* absent or, if rarely present, very short. *Leaves* few, 12–15, rosulate, rigidly spreading to erect, persistent when dry, dull light green to mid-green, upper surface slightly concave, hardly canaliculate, with numerous scattered white spots throughout, spots arranged in irregular transverse bands; lower surface convex, white spots more distinctly arranged in transverse bands,

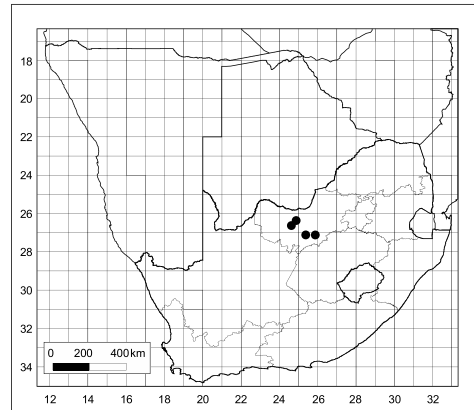


FIGURE 9.—Known geographical distribution range of *Aloe braamvanwykii* in South Africa.



FIGURE 10.—*Aloe braamvanwykii* flowering on 26 December 2015 in Klerksdorp Thornveld (Mucina et al. 2006) near Wolmaransstad, North-West Province, South Africa. Photograph: A.E. van Wyk.

sometimes confluent yielding milky green surface, texture smooth, linear-attenuate, tapering to apex, 170–260 mm long, 35–55 mm broad at base, basally sheathing; margins very thin, brown, with triangular marginal teeth, green with light brown tips, ± 4 mm long, same length throughout, evenly spaced at 10–13 mm apart; exudate pale yellowish, drying purple. *Inflorescence* 1–3, successively, 0.65–0.75 m tall, far exceeding height of rosette, central raceme longest, 5- to 7-branched from above middle, branches arcuate-erect. *Peduncle* 270–420 mm long, 8–14 mm broad at base, basally plano-convex, cylindrical above, light greenish brown with white, powdery bloom; not sterile bracteate; bracts subtending racemes narrowly triangular, 15–65 mm long, 6–8 mm broad at base, straw-coloured to light brown, papery, rarely fleshy, many nerved. *Racemes* cylindrical, 140–170 mm long, 30–50 mm wide; buds erect to suberect, flowers horizontal to drooping when mature. *Floral bracts* narrowly triangular, long attenuate, amplexicaul around pedicel, 5–9 mm long, 4–5 mm wide, straw-coloured, papery, 3- or 4-nerved. *Pedicels* 10–12 mm long, pinkish brown. *Flowers*: actinomorphic to slightly zygomorphic, unscented, nectariferous; *perianth* greenish tipped in buds, somewhat bicoloured when mature, light pink to mainly orange-red to bright red with whitish to yellowish longitudinal stripes, tip extremity purplish brown



FIGURE 11.—a, fruit capsules of *Aloe braamvanwykii*, $\times 1$; b, habit, much reduced. Voucher specimen: A.E. van Wyk 14132 in H.G.W.J. Schweickerdt Herbarium, Pretoria. Artist: Gillian Condy.

or whitish, lightly pruinose, 20–25 mm long, flattened at base, $\pm$ 6 mm across ovary, distinctly narrowed above ovary to $\pm$ 3 mm to form globose basal swelling, enlarging to 6–7 mm towards throat and wide open mouth, tubular-cymbiform; *outer segments* larger than inner segments, lorate, free for $\pm$ 7 mm, free portion centrally pinkish red, borders white or light yellowish, acute, segment margins straight, tips slightly recurved; *inner segments* narrower than outer, with white or yellowish border and more obtuse apex, free for upper two-thirds of their length; *stamens* with cylindrically thread-like to very slightly flattened, light yellow filaments, 25–28 mm long, all 6 of $\pm$ equal length, exerted for 2–5 mm; anthers small, 1–2 mm long, dark brown, versatile; *ovary* 5–6 mm long, 3 mm in diameter, light green; *style* as long as or slightly longer than stamens, minutely capitate, with small stigma, exerted 1–2 mm. *Fruit* an erect, bright green, cylindrical, trilocular capsule, 17–22 mm long, 9–11 mm in diameter, apically truncate, dry remains of tepals shed from around fruit early on, dehiscing loculicidally, chartaceous when dry, apically valves sigmoidally curved outwards. *Seeds* dark greyish brown, angled, laterally compressed, 2.5–3.0 mm long, with up to 1 mm wide off-white wing stretching around periphery of seed. *Chromosome number* unknown. Plate 2323; Figure 11.

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PLATE 2324 *Tinospora fragosa* subsp. *fragosa*

Tinospora fragosa* subsp. *fragosa

Menispermaceae

Angola, Botswana, Namibia, South Africa, Zimbabwe

Tinospora fragosa* (l.Verd.) l.Verd & Troupin subsp. *fragosa, in *Memoires de l'academie Royale des Sciences d'Outre-Mer, Classe des sciences naturelles et medicales* 13: 1–312 (1962); Van Jaarsveld: 28 (2016). *Desmonema fragosum* l.Verd.: 209 (1941).

Tinospora fragosa subsp. *fragosa* is a remarkable, summer-deciduous, succulent-stemmed twiner restricted to the Limpopo and Mpumalanga provinces of South Africa, as well as Zimbabwe, Botswana, northern Namibia and southern Angola (Figure 1). When its growth is disturbed in one point, it can regenerate roots from distances of up to 10 m away, which ensures its survival in a grazing-dominated bushveld environment (Van Jaarsveld 1981; De Wet et al. 2016).

Tinospora fragosa subsp. *fragosa* belongs to the Menispermaceae, a small family of mainly lianas with a few shrubby exceptions, such as the *dawidjieswortel* (*Cissampelos capensis*) in the Western Cape (South Africa). It has a distribution which includes most of the world's tropics and with more or less 350 species in 65 genera. The genus *Cocculus* is the largest genus in the family. The family also has some useful members such as curare (*Curarea toxicofera* and *T. tecunarium*) a muscle relaxant, a substitute for sarsaparilla and which is used in hunting fish (picrotoxin) (Heywood 1978). Diagnostic features of this family are their alternate leaves without stipules and very small, inconspicuous unisexual flowers borne on different plants (dioecious). The flowers consist of two to three fleshy petals and two rows of three sepals per row. Stamens are free or united. The family has been divided into eight tribes based on seed structure. Our species belongs to the tribe Tinosporae with a straight sculptured endocarp. *Tinospora* was named by Miers in the *Annals and Magazine of Natural History* in 1851. It consists of about 35 species, of which most are African, but with members also from Madagascar, some Pacific Islands, and with two species in Asia and Australia. The origin of the genus name is somewhat unclear, with *teino* Greek for 'to stretch' and *spora* meaning 'seed' (Jackson 1990).

There are three species of *Tinospora* indigenous to South Africa, *Tinospora caffra* (Miers) Troupin, *T. tenera* Miers and *T. fragosa* subsp. *fragosa*. The genus was recently revised acknowledging three species in South Africa (De Wet et al. 2016). *Tinospora fragosa* subsp. *kaokoensis* van Jaarsv. was recently named from plants on the Namib margin in Kaokoveld, Namibia. This subspecies differs from the typical one by its ability to flower on younger stems, its swollen roots, and its distinctly striated stems that taper at intervals with the thinner portions desiccating spontaneously and acting as a vegetative propagation back-up (Van Jaarsveld 2016).

PLATE 2324.—1, young branches with leaves, × 1; 2, seed, × 1.5; 3, female fruiting branch, × 1; 4, branch with shortened, often rounded female inflorescence, × 1; 5 inner sepals, × 4; 6, outer sepals, × 4; 7, petals, × 4; 8, opened flower from side, × 4; 9, opened flower from top, × 4; 10, flower with sepals and petals removed, × 4; 11, branch with elongated male inflorescence, × 1; 12, opened flowers, × 4; 13, outer sepals, × 4; 14, inner sepals, × 4; 15, petals, × 4; 16, stamens, × 4. Voucher: Van Jaarsveld 25946 in Compton Herbarium, Cape Town. Artist: Marieta Visagie.

Frederik van der Merwe (1894–1968), a medical inspector of schools, had a passion for indigenous plants especially *Aloe* and *Ledebouria* (Gunn & Codd 1981). He had a keen eye for the unusual and, a true plant connoisseur, rapidly spotted the unknown species of succulent-stemmed *Tinospora* growing in trees and shrubs on well-drained, warm sites and which the local bushveld farmers called *Aäron-se-staf* (Aaron's rod). His scientific background ensured that he documented the preserved specimen of *Tinospora* that he collected (male and female specimens) on the northern slopes of the Zoutpansberg at Waterpoort (Limpopo Province), where he found them commonly growing (Verdoorn 1941).

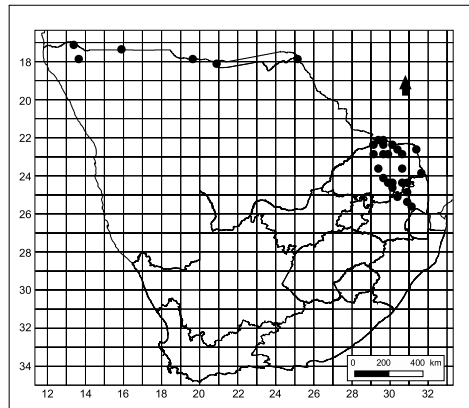


FIGURE 1.—The distribution of *Tinospora fragosa* subsp. *fragosa* in southern Africa (from De Wet et al. 2016).

Van der Merwe further noticed the species' peculiar mode of regeneration from aerial roots where the plant had been severed, losing contact with the ground. When the local farmers observed this, they were prompted to name the sprouting *Tinospora fragosa* subsp. *fragosa* Aaron's rod, in reference to the biblical account: Aaron was chosen leader of the 12 tribes of Israel, but this was disputed by the other tribes. He then asked the tribal leaders to each bring their walking sticks to be placed in the tent of gathering. The next morning it was only Aaron's rod that had sprouted with his authority firmly established.

The plant also came under the attention of the botanist Inez Verdoorn at the Botanical Research Institute in Pretoria, who was in charge of the National Herbarium from 1944–1951 (Gunn & Codd 1981). Realising it was a new species, she named it *Desmonema fragosum* I.Verd. in 1941. However, in 1962 Troupin, in his treatment of *Tinospora*, rightfully transferred it to this genus.

The savannas of Africa are known for their herbivores, as well as fires, and succulent plants need specific strategies to survive in this type of environment with its particular disturbance regime. Plants have to either stand their ground where they germinate (defence mode) or move away somehow. In an attempt to avoid predation, succulents have a vast number of strategies, consisting mostly of mechanical, chemical and camouflage defensive modes. Aloes, for example, have a combination of chemical and mechanical defence (bitter sap and thorns) and, in spite of this, are still grazed during severe droughts. *Tinospora fragosa* subsp. *fragosa* grows in dry river valleys, rocky sites and on flats. The species has the special ability to rapidly twine, enabling it to mobilise and displace itself to a new position. It thus follows a path of passive resistance by growing away from danger (i.e. out of reach of grazing animals). The stems of *T. fragosa* subsp. *fragosa* are succulent and juicy, but with bitter sap. If it is grazed and subsequently loses contact with the soil, it has sufficient reserves in its succulent stems to grow a survival root – a true life line – re-rooting the plant to ensure its long-term survival, unlike most other creepers that would die upon loss of soil contact (Van Jaarsveld 2015). The root will only appear during the growing sea-

son (November to April), to give it its best chance of survival.

The plant produces large heart-shaped leaves to maximise photosynthesis and fasten the lengthening of its twining stems. During autumn the greyish-brown stems become exposed as the leaves start to drop. The bitterness of the stem sap provides some form of protection and may deter primates such as vervet monkeys and baboons. *Tinospora fragosa* subsp. *fragosa* plants have been observed by one of us (EJvJ) from various sites in the Limpopo Province (South Africa), Angola, northern Namibia and eastern Zimbabwe. In the Gonarezhou National Park, in the south-eastern corner of Zimbabwe and just north of the Kruger National Park, *T. fragosa* subsp. *fragosa* plants are grazed by larger herbivores such as elephant, sometimes leaving the fibrous stems behind (Van Jaarsveld 2015).

The pollinator of the inconspicuous unisexual flowers is unknown, but it is probably attracted by the floral scent. *Tinospora fragosa* subsp. *fragosa* is hysteranthous, flowering in winter (when the leaves have dropped) and also during spring or rarely in summer. The fruits are carried in clusters of conspicuous red berries, relished and spread by frugivorous birds. Twiners, creepers and climbing plants, such as *T. fragosa* subsp. *fragosa*, do not have to rely on woodiness and direct all their energy to lengthening and taking advantage of other plants for support. Climbing to the top of the mopane (*Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard), helicopter tree (*Gyrocarpus americanus* Jacq. subsp. *africanus* Kubitzki) and white syringa (*Kirkia acuminata* Oliv.), one of us (EJvJ) was able to observe the plant and its flowers at close range. Here lichens establish on the stems of *T. fragosa* subsp. *fragosa* (see plate) due to moisture-laden winds from the warm Indian Ocean along the subtropical Mozambique coast.

The ability to sprout from aerial roots is not only confined to *Tinospora* and has been observed in other succulent plants, such as *Cissus tuberosa* DC. from Mexico.

Tinospora fragosa subsp. *fragosa* is at once distinguished from the other two *tinosporas* by its much thicker stems of 30–50 mm in diameter, and abbreviated side branches from where



FIGURE 2.—The male inflorescence of *Tinospora fragosa* subsp. *fragosa* (Gonarezhou National Park, Zimbabwe). Photograph: E.J. van Jaarsveld.

the male or female flowers appears. The short elongated inflorescences are oblong in male plants (Figure 2) and somewhat rounded in female plants. The heart-shaped leaves of the others are more or less similar to our species and they also have the ability to grow aerial roots when soil contact is lost. *Tinospora caffra* (KwaZulu-Natal and further north) has thinner and knobbly stems, whilst *T. tenera* has yellowish striated stems.

The plants are used locally as medicine by various indigenous peoples. The Sotho named it *penualeng* in the Lydenburg district where stems and leaves are used against rheumatism and sore bodies (Verdoorn 1941). De Wet & Van Wyk (2008) reported that the twigs are chewed and sap swallowed to relieve sore throats and treat coughs (De Wet et al. 2016), and the plant is fed to cattle to prevent anthrax. In Ovamboland, Namibia the Kwanyama people knows the plant by the name *omaposa* or *omaphsha* (Rodin 1985). It is also used as a good luck charm to prevent snakes from entering their dwellings (De Wet & Van Wyk 2008).



FIGURE 3.—*Tinospora fragosa* subsp. *fragosa* in habitat growing on a mopane tree (*Colophospermum mopane*) in the Gonarezhou National Park, Zimbabwe. Photograph: E.J. van Jaarsveld.

The vegetation over most of the habitat of *Tinospora fragosa* subsp. *fragosa* consists of mopaneveld (Figure 3), which is part of the Savanna Biome (Mucina & Rutherford 2006). Plants grow at an altitude of 450 to 1 000 m above sea level. However, near Polokwane (Limpopo Province) plants have been observed on granite outcrops and also east of Chuniespoort in the dry savanna of the Olifants River Valley and near Steelpoort. The region is dry in winter, with cool evenings, and very high summer temperatures (sometimes up to 40°C) with associated humidity. The average daily summer maximum is 26–29°C and the average daily winter temperature about 13–17°C. Rainfall is mainly from late spring through summer, November to May, and ranges between 300 and 500 mm per annum. *Tinospora fragosa* subsp. *fragosa* plants sprout during November and during times of very hot conditions, with temperatures above 35°C, their leaves may change, becoming smaller, more coriaceous and pointed, and slightly glaucous with the margin undulating and crisped (Figure 4). The plant becomes deciduous during April or May when the leaves turn yellow, continuing its growth in November.

At Gonarezhou Nature Reserve (Figure 5) one of us (EJv) has observed *Tinospora* sharing its habitat with various other succulents at the Chivilila Falls on the banks of the Runde River. Associated succulents includes *Adansonia digitata* L., *Sterculia rogersii* N.E.Br., *Aloe globuligemma* Pole-Evans, *A. chabaudii* Schönland, *Pachypodium saundersii* N.E.Br. and



FIGURE 4.—The leaves of *Tinospora fragosa* subsp. *fragosa* become coriaceous and glaucous with crisped margins during very hot weather. Photograph: E.J. van Jaarsveld.



FIGURE 5.—Adventitious roots from *Tinospora fragosa* subsp. *fragosa* growing in a mopane tree (*Colophospermum mopane*) at Gona-rezhu National Park. Photograph: E.J. van Jaarsveld.

Sansevieria hallii Chahinian. Our species is not a soil specialist and grows in various types, including granite-, dolerite- and shale-derived soils. Their arboreal nature also ensures that they are less affected by occasional fires.

Tinospora fragosa subsp. *fragosa* grows well as a curiosity plant such as on a protected window sill in warmer climates. The stems can be hung and when the root appears, it is best to place a pot below it, allowing the plant to establish. Provide enough moisture during the active growing phase, but also withhold water during the dry winters to enable the plants to rest. One of us (EJv) has been growing the plants at the Botanical Society Conservatory at Kirstenbosch National Botanical Garden for more than 20 years. Stems were hung up near the roof of the building and the growth rate of the roots measured at about 10–20 mm per day. The plant rapidly establishes and continues its growth once it comes in contact with soil. The initial root gradually thickens (flaking longitudinally) becoming stem-like. It is best grown in bushveld gardens (Van Jaarsveld 2010). Stems can be placed in trees or fences and growth is rapid. Once fruits are set it should attract frugivorous birds. Propagation is easily achieved by pruning the stem into various parts, of which each should sprout during the growing season.

Description.—Winter deciduous, sparingly branched succulent-stemmed dioecious twining liana in trees and shrubs, growing to 15 m high or higher. Roots fibrous, initial aerial

root free-hanging, 1 mm in diameter at first, fast growing (10–15 mm per day), gradually thickening to 10 mm in diameter, greyish-green and developing longitudinally peeling bark with age. *Young branches* initially green, smooth, becoming grey, later becoming greyish-brown to dark brown and scaling periderm, covered in lenticels, scars and sometimes lichens, 30–50 mm in diameter, the distal part with abbreviated ascending to spreading lateral branches up to 10 mm long from where the flowers appear. *Mature branches* fragile, becoming detached with aerial root that grows only during rainy season, free hanging, re-establishing the plant. *Leaves* simple, greyish green, alternately arranged, firm, coriaceous, broadly ovate, often v-shaped and cordate at base, 30–80(100) mm long, 30–80(100) mm broad, petioles to 100 mm long, pulvinus yellowish green, margin entire, sometimes wavy (during hot spells), glabrous, nerves palmate. *Inflorescence* racemose, up to 50 mm long, cauliflorous. *Bracts* 1–3, 5 mm long, linear. *Flowers* small, greenish, inconspicuous, 1–3 per bract. *Male inflorescence* a simple false raceme 40–50 mm long; sepals 6, ovate, outer three 1.5 mm long, 1 mm broad, inner three 3.5 mm long, 2.5 mm broad; petals 6, obovate, 2 mm long 1.5 mm broad, often obscurely subcrenate; stamens 6, connate at the base, 2.5 mm long; filaments 1.5 mm long; anthers longitudinally fissured, dehiscing from the side. *Female flowers* on shorter racemes, 20 mm long; sepals 6, outer three 2 mm long, 1.25 mm broad, inner three concave, 4 mm long, 3 mm broad; petals 6, obovate, 2 mm long, 1.5 mm broad; staminodes 6, opposite petals, 2 mm long; carpels 3, abbreviated stipitate; ovary stipitate at base, articulated, obliquely ovoid; stigma sessile, terminal. *Fruit* ripen after leaves appear, reddish, bean-shaped drupe, 8–10 mm long, 5–7 mm in diameter, exocarp a fleshy pulp; endocarp cartilaginous, smooth. Plate 2324.

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Cissampelos hirta

Menispermaceae

Tropical and Southern Africa

Cissampelos hirta Klotzsch in Peters, *Naturwissenschaftliche Reise nach Mossambique*: 174 (1862). *Cissampelos tamnifolia* Miers: 185 (1871). *Cissampelos pareira* L. var. *klotzschii* Th.Durand & Schinz: 51 (1898). *Cissampelos pareira* L. var. *mucronata* (A.Rich.) Engl. subvar. *hirta* (Klotzsch) Engl.: 395 (1899).

The Menispermaceae is a very old angiosperm family of about 70 genera and 450 species in the order Ranunculales (APG III 2009; Hoot et al. 2009). Molecular dating has shown that this family originated 116–105 million years ago (Anderson et al. 2005), and that the different tribes recognised in the family differentiated either during the Cretaceous period (145–66 million years ago) or the Palaeocene epoch (66–56 million years ago) (Jacques & Bertolino 2008).

Members of the Menispermaceae are either herbaceous or woody climbers with dioecious and small, inconspicuous flowers (Kessler 1993). A peculiarity of the anatomy of the family is the medullary rays that separate the vascular bundles in the stems and rhizomes (De Wet et al. 2002). The family is distributed throughout the tropical lowland rainforests, although there are a few species adapted to cooler and drier climates (Hoot et al. 2009). It is commonly known as the moonseed family, as the shape of the seeds is reminiscent of a crescent moon (Doria et al. 2008).

The family is rich in bisbenzylisoquinoline alkaloids and is used worldwide in traditional medicines (Barbosa-Filho et al. 2000). The family is, however, better known for curare, the deadly arrow poison used by the South American indigenous tribes. Curare is a mixture of the bark of various Menispermaceae species (species of *Curarea* Barneby & Krukoff, *Chondrodendron* Ruiz & Pav., *Sciadotenia* Miers, *Telitoxicum* Moldenke and *Abuta* Aubl.), and that of *Strychnos castelnaeana* Wedd. and *S. toxifera* R.H.Schomb. ex Lindl. (Loganiaceae) (Kessler 1993). Curare is considered relatively safe to use as long as the extracts are ingested, but becomes deadly when introduced directly into the bloodstream. Compounds of curare have been widely used as muscle relaxants in general anaesthesia during certain types of surgical procedures (Foster & Johnson 2008).

Menispermaceae is represented by seven genera and 13 species in southern Africa (Table 1) (Glen 2003; Kloppe et al. 2006). A comparison of the characters of the seven Menispermaceae genera is given in De Wet et al. (2016). *Cissampelos* L. is the largest genus in southern Africa with four species (Table 1) (Glen 2003).

Cissampelos hirta is a herbaceous liana with deltate to cordate, subpeltate leaves (Figure 1). The small, dioecious flowers are subtended by foliaceous bracts, which persist below the red drupes.

PLATE 2325.—1, flowering stem, × 1; 2, female inflorescence, × 4; 3, fruiting stem, × 1. Voucher specimen: Struwig 184 in University of Zululand Herbarium, KwaDlangezwa. Artist: Gillian Condy.



PLATE 2325 *Cissampelos hirta*

Table 1.—The genera and species of the Menispermaceae in southern Africa and their distribution within the region. Endemic taxa are indicated by *. N, Namibia; B, Botswana, LIM, Limpopo; NW, North-West; G, Gauteng; M, Mpumalanga, S, Swaziland; FS, Free State; KZN, KwaZulu-Natal; L, Lesotho; NC, Northern Cape; WC, Western Cape; EC, Eastern Cape

Genera	Species	Distribution
<i>Albertisia</i> Becc.	<i>A. delagoensis</i> (N.E.Br.) Forman	KZN
* <i>Antizoma</i> Miers	* <i>A. angustifolia</i> (Burch.) Miers ex Harv.	N, B, LIM, NW, G, M, FS, KZN, NC
	* <i>A. miersiana</i> Harv.	N, NC, WC
<i>Cissampelos</i> L.	* <i>C. capensis</i> L.f.	N, NC, WC, EC
	<i>C. hirta</i> Klotzsch	KZN
	<i>C. mucronata</i> A.Rich.	N, B, LIM, M, S, KZN
	<i>C. torulosa</i> E.Mey. ex Harv.	LIM, M, S, KZN
<i>Cocculus</i> DC.	<i>C. hirsutus</i> (L.) Diels	N, B, L, M, S, KZN
<i>Stephania</i> Lour.	<i>S. abyssinica</i> (Quart.-Dill. & A.Rich.) Walp.	L, M, FS, KZN, EC
<i>Tiliacora</i> Colebr.	<i>T. funifera</i> (Miers) Oliv.	M, S, KZN
<i>Tinospora</i> Miers	<i>T. caffra</i> (Miers) Troupin	N, B, M, KZN
	<i>T. fragosa</i> (I.Verd.) I.Verd. & Troupin	N, B, L, M
	<i>T. tenera</i> Miers	L, M, KZN

Cissampelos hirta can easily be confused with *C. mucronata* A.Rich. and *C. torulosa* E.Mey. ex Harv. based on habit and leaf shape. The leaves of *C. hirta* are, however, coriaceous, while those of *C. mucronata* are puberulent to tomentose and therefore velvety to the touch. The leaves of *C. torulosa* have a distinct tuft of hair at the petiolar attachment, which is absent from *C. hirta*. *Cissampelos capensis* L.f. is a woody shrub and not likely to be confused with the other *Cissampelos* species. A detailed comparison of the morphology and anatomy of the four *Cissampelos* species is given in De Wet et al. (2002). A key to distinguish the southern African *Cissampelos* species is given below:

Key to the southern African *Cissampelos* species

- 1a. Leaves subpeltate 2
- 1b. Leaves basifixed. 3
- 2a. Stems and leaves glabrescent; leaves deltate to cordate, base cordate to truncate, dark green in colour and glossy, coriaceous *C. hirta*
- 2b. Stems and leaves pubescent to subtomentose; leaves ovate, cordate, suborbicular or reniform, base cordate to deeply cordate, pale green in colour and not glossy, velvety *C. mucronata*
- 3a. Plant a woody shrub; leaves ovate to deltate, base cuneate to truncate, sometimes cordate, greyish-green in colour, coriaceous, glabrous at petiolar attachment. . . *C. capensis*
- 3b. Plant a liana with herbaceous stems; leaves reniform to deltate, base cordate to truncate, dark green in colour, papery, tuft of hair at petiolar attachment *C. torulosa*

Cissampelos hirta is distributed in northern KwaZulu-Natal in South Africa (Glen 2003) (Figure 2) and in Mozambique (Troupin & Gonçalves 1973; Klopper et al. 2006). It grows in forests (especially along the edges), grassland and bushveld in full sun or semi-shade in sandy soil. The plants twine around other shrubs, but never form a dense cover.

Cissampelos hirta was first collected by the German naturalist and explorer, Wilhelm Karl Hartwich Peters (1815–1883), during his exploration of the coastal regions and the Zambezi River in Mozambique (1842–1848). Peters did not describe *C. hirta*, as he was a zoologist, but it was done by his colleague, Johann Friedrich Klotzsch (1805–1860), curator of the Royal Herbarium in Berlin (Peters 1862; Stafleu & Cowan 1981, 1983).

Cissampelos is derived from the Greek *kissos* (ivy) and *ampelos* (vine), referring to the trailing habit of the plants and the fruits that resemble bunches of grapes (Pooley 1998). The specific epithet, *hirta*, means hairy (Stearn 1992). This plant is known in the Zulu culture as *khalimelo*, *indlebelenkawu*, *intandela*, *umanyokane*, or *unukani* (De Wet & Van Wyk 2008).

Cissampelos hirta is used medicinally in the Zulu culture. A root extract is drunk to relieve stomach ache and to stop vomiting in babies (De Wet & Van Wyk 2008). The sap of the leaves can be used to treat ringworm, and a tea made from the leaves and the bulb of the African potato (*Hypoxis hemerocallidea* Fisch., C.A.Mey. & Avé-Lall.) is drunk to treat itching skin. It is also believed that a mixture of the leaves of *C. hirta* and *C. mucronata* in water can be used as drops to cure so-called 'craziness' (De Wet & Van Wyk 2008).

Cissampelos hirta produces flowers from August to January.

Description.—Liana; stems herbaceous, branchlets striate, glabrescent. Leaves simple, alternate; petioles up to 45 mm long, glabrous to pilose, with geniculate pulvinus slightly swollen; lamina deltate to cordate, 25–100 × 35–90 mm; subpeltate; apex acuminate to retuse, mucronate; base cordate to truncate; margins entire or rarely crenate; venation palmate, 5–7 veins, visible on both sides; adaxial side shiny green; coriaceous, glabrous to puberulent. *Male inflorescence* of two types: (i) dichasia with an irregular pattern; peduncle of first branch 10–22 mm long; bracts sessile, 0.8–2.5 mm long; second and third branches single, axillary, 1.0–7.5 mm long; (ii) racemes; peduncle up to 35 mm long, glabrous, 3–5 axillary inflorescences; bracts shaped like foliar leaves. *Male flower* with pedicel 0.18–9.00 mm long; with prominent circular groove at base of the flower; glabrous; sepals 4(5), obovate-unguiculate, 0.7–1.2 × 0.6–0.7 mm, black spots with a few single hairs on abaxial side; petals fused, cupuliform, glabrous, brownish-black spots; synandrium 4–6-locular, extrorse, 0.5 × 6–7 mm, glabrous. *Female inflorescence* with peduncle up to 100–120 mm



FIGURE 1.—*Cissampelos hirta* climbing up against a fence. Photograph: M. Struwig.

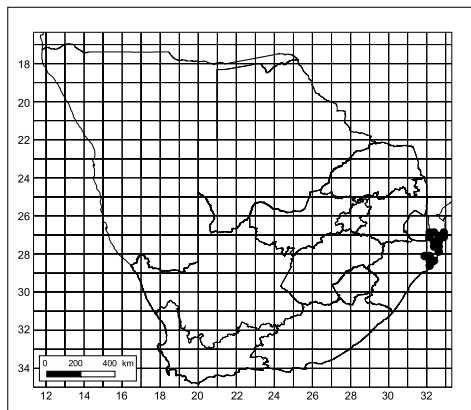


FIGURE 2.—Known distribution of *Cissampelos hirta* in the FSA region based on herbarium specimens housed in various herbaria.

4.5 × 4.5 mm, glabrous; fruit stalk 1–3 mm long; endocarp horseshoe-shaped, dorsal ridge inconspicuous or absent; radial ridges ± perpendicular to surface of endocarp, or flattened and wrinkled with lateral girdle adjacent to condyle fairly smooth; condyle narrowly obovate, septum somewhat rough. Seed with sparse endosperm, embryo curved, cotyledons appressed. Plate 2325.

long; axillary, solitary; 5–6(–10)-flowered, arranged in 2 rows, oldest flowers closest to peduncle; bracts sessile or with petioles up to 1 mm long, broadly ovate, cordate or reniform, frequently large and foliaceous, entire, mucronate, 16 × 23 mm, frequently grading to minute, membranous, glabrous to pilose. Female flower with pedicel up to 15 mm long; receptacle concave; sepals 1, ovate to elliptic, 1.0–1.5 × 1 mm, glabrous, involute and somewhat carnos, without spots; petals 1, opposite sepal, fused at base with calyx, obovate to deltate, 0.5 × 0.7–1.0 mm, glabrous, somewhat involute; carpel 1, 0.5–0.8 mm long, glabrous; style terminal divided in 3, stigmas 3. Fruit a drupe, red, obovoid-compressed,

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PLATE 2326 *Protea foliosa*

Protea foliosa

Proteaceae

South Africa

Protea foliosa Rourke in Journal of South African Botany 41,2: 53–62 (1975); Rourke: 178 (1980); Vogts: 94 (1982); Rebelo: 64 (1995); Vanderplank: 94 (1999). *P. magnoliifolia* H.Buek ex Meisn. in Drège: 118; 127; 213 (1843), nom. nud. *P. caulescens* E.Mey. ex Meisn. in DC.: 244 (1856), nom. nud. *P. tenax* (Salisb.) R.Br. var. *latifolia* Meisn. in DC.: 244 (1856); Hutchinson et al.: 587 (1912).

Protea foliosa is a small, rounded shrub up to 1.5 m tall, but typically shorter than 1 m tall in populations around Grahamstown. It has many erect, seldom-branched, glabrous stems arising from a large woody rootstock, giving it a high degree of fire resistance. The lanceolate, oblanceolate or broadly elliptic leaves are 90–160 mm long, 15–70 mm broad, narrowed towards the petiole, coriaceous and glabrous, although young leaves are pubescent at first. The upright inflorescences are usually hidden by enfolding leaves. The involucral bracts are greenish yellow, often flushed reddish, and described as rust-coloured (Vanderplank 1999) or dull carmine (Rourke 1975), in the distal half.

William Burchell first discovered *Protea foliosa* in the Swartberg Mountains near Riebeeck East in 1813 and collected specimens again on the Van Stadensberg a year later. There has been much confusion regarding the correct name for the species. Various invalid names were applied in the past and at one time it was considered to be a variety of *P. tenax* (Salisb.) R.Br.. John Rourke finally resolved the difficulties by describing it anew as *P. foliosa* in 1975.

Protea foliosa can be distinguished from related species in the section *Crinitae* (Eastern Ground Sugarbushes) (Rebelo 1995) by its shrubby, upright growth habit, erect, rarely branched, stout (60–80 mm in diameter) stems, and prominent lanceolate to broadly elliptic glabrescent mature leaves that completely surround and obscure the small globose, multiple-clustered, above-ground inflorescences (Rourke 1975). *Protea intonsa* Rourke and *P. vogtsiae* Rourke are dwarf shrubs with underground, scaled stems. *Protea montana* E.Mey. ex Meisn. is a prostrate, many-branched mat-forming shrub. *Protea intonsa* and *P. montana* have needle-like to linear leaves and *P. vogtsiae* also has longer (120–250 mm) and narrower (8–30 mm) leaves than *P. foliosa*. The species was previously much confused with *P. tenax*, but that species has decumbent or trailing, rarely branched, stems (3–6 mm in diameter), secund or subsecund linear-lanceolate to oblanceolate leaves, pointing vertically from the horizontal stem, and wide, shallowly crateriform, seldom clustered inflorescences borne at ground level. The species are largely allopatric. *Protea foliosa* occurs from near Patensie and Uitenhage in the west to Riebeeck East and Grahamstown in the east,

PLATE 2326.—1, foliose, low growing branches bearing terminal inflorescence with carmine-flushed, green involucral bracts, × 1; 2, florets, × 1; 3, cross section of inflorescence, × 1; 4, mature infructescences persist on branches, × 1; 5, fire-stimulated infructescence open to expose achenes × 1; 6, empty involucral receptacles × 1; 7, sterile achenes, × 1; 8, fertile achenes, × 1.5. Voucher specimen: Dold TD16009 in Selmar Schonland Herbarium, Grahamstown. Artist: Susan Abraham.

while *P. tenax* occurs from Waboomskraal in the Outeniqua Mountains eastwards to the Cockscomb near Uitenhage (Rourke 1975).

Although *Protea foliosa* germinates easily and grows vigorously, it is described as 'unpretentious' (Vogts 1982) and 'dowdy at best' (Rourke 1980) with little to commend it as a garden subject.

Protea derives from Proteus, a highly mutable god in Greek mythology, alluding to the great variety of form in the genus. The species epithet means leafy, referring to the prominent leaves that conceal the flowers (Rourke 1980), and the species is commonly known as the leafy protea (Rebello 1995). We have not found an Afrikaans common name. *Protea* species are generally called *isiqwane* in Xhosa (Dold & Cocks 1999) but Kropf & Godfrey (1915) give the name *isad-lunge* for 'a kind of *Protea*, larger than *isiqwane*'. Pahl (1989) attributes the name *isiqwane* to all *Protea* and *Leucospermum* species, as well as *Oldenburgia arbuscula* DC., and *isiqwane sehlathi* (meaning *Protea* from the forest) to *Rapanea melanophloeos* (L.) Mez.

Protea foliosa is most frequently encountered along the crests of ridges and southern slopes in grassy fynbos where it grows in poor sandstone and quartzitic soils. It is common in its restricted range, sometimes locally abundant on moist sites. This species is distributed from Patensie in the west to Grahamstown in the east with an interruption of this distribution range inland of Algoa Bay (Figure 1).

Protea foliosa may begin flowering as early as March and continue until September. Peak flowering occurs between May and June (Rourke 1980; Melidonis & Peter 2015). Like other species in the family, pollen is aggregated as tetrads and deposited on the outside of the stigma, the gynoeceum acting as a pollen presenter.

Motion sensing camera traps were used to observe visits to inflorescences of *Protea foliosa* at the farm Upper Gletwyn near Beggars Bush east of Grahamstown. This revealed that *P. foliosa* is pollinated primarily by a single species of rodent, *Rhabdomys pumilio* (Melidonis & Peter 2015). Unusually, for a rodent pollinated plant (Wiens & Rourke 1978; Biccard & Midgley 2009; Johnson & Pauw 2014), all recorded visits to the inflorescences occurred during daylight hours, mainly between 07:00 and 12:00. Rodents clambered on the inflorescences (Figure 2) or surrounding grass tussocks in order to probe inflorescences in search of nectar, resulting in pollen being loaded onto the rodents' rostrum and subsequently onto stigmas with successive visits (Melidonis & Peter 2015).

Other potential pollinators observed at the site include *Otomys irroratus* and the shrew, *Crocidura cyanea*. Both were found to have *Protea foliosa* pollen tetrads on their rostra and

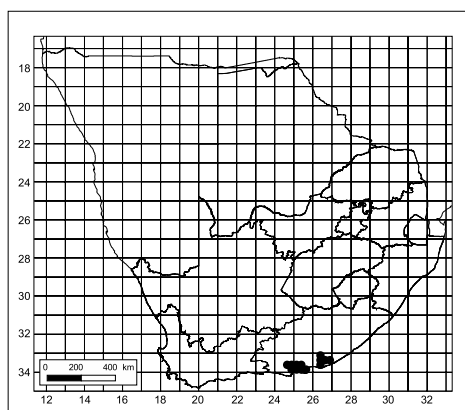


FIGURE 1.—Geographical distribution of *Protea foliosa* based on specimens in the National Herbarium, Pretoria, and Selmar Schonland Herbarium, Grahamstown.



FIGURE 2.—Motion detecting camera traps reveal that *Rhabdomys pumilio* (Striped Field Mouse) is the primary pollinator of *Protea foliosa* and all recorded visits occurred during the day. Photographs: C.I. Peter.

in their scat, although to a much lesser extent than *Rhabdomys pumilio*. *Otomys irroratus* and *C. cyanea* were not captured on camera interacting with *P. foliosa* inflorescences, further supporting the idea that *R. pumilio* is the primary pollinator of *P. foliosa* at this site.

The low occurrence of pollen grains in the scat of *Otomys irroratus* and *Crocidura cyanea* relative to those of *Rhabdomys pumilio* suggests that pollen-preening is reduced in these two species, or that absolute pollen loads are lower resulting in less pollen ingestion. Wester et al. (2009) drew similar conclusions with other rodent species based on their lack of interaction with the flower and lack of pollen grains found in their scat. The presence of a large number of pollen grains in the scat of captured *R. pumilio* individuals provides evidence that this species routinely visit *Protea foliosa* flowers under natural conditions at this site.

To determine the dependence of *Protea foliosa* on rodents for pollination, Melidonis and Peter (2015) undertook a series of enclosure experiments. Three treatments were applied randomly to various budding inflorescences. Inflorescences were either marked and left open as controls, enclosed in 13 mm wire mesh cages (allowing access to insects but excluding rodents and birds) or covered with stiff shade-cloth bags (ca. 1 mm mesh) to exclude both insects and small mammals. After two months the inflorescences were harvested and seed set determined.

There is no evidence of autonomous self-pollination in *Protea foliosa* and enclosure experiments suggest that insects are not important pollinators of this species as only the open, unbagged treatments, exposed to rodents, set viable seeds (Melidonis & Peter 2015). Natural seed set of *P. foliosa* is low with a mean seed set of just 1.8 seeds per infructescence out of the mean number of florets per inflorescence of 96 (Melidonis & Peter 2015).

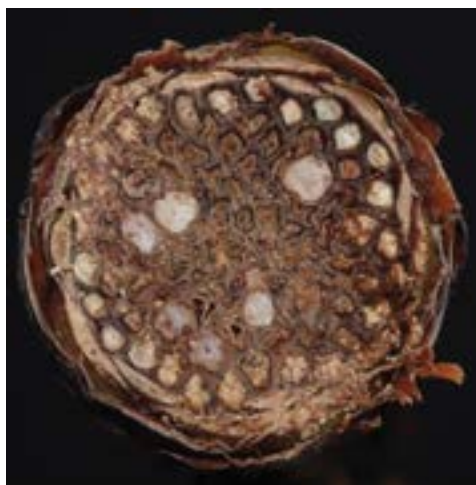


FIGURE 3.—Cross section of an infructescence shows different morphology of fertile (plump and milky-white) vs. infertile (shrivelled and brown) achenes. Photograph: C.I. Peter.



FIGURE 4.—A single brief visit by a male Malachite Sunbird (*Nectarinia famosa*) was recorded with a motion detecting camera trap. Photograph: C.I. Peter.

However, quantifying seed set in *Protea* species is difficult, as individual ovules remain attached to the inflorescence regardless of whether or not they have been fertilized (Wiens 1983; Biccard & Midgley 2009). In addition, sterile and viable achenes do not differ morphologically, which makes them difficult to distinguish externally. Cross-sections of viable endosperm-containing seeds are swollen and solid white in colour, in contrast to dull-coloured and fibrous sterile seeds (Figure 3) (Wiens 1983; Biccard & Midgley 2009; Melidonis & Peter 2015).

Infructescences appear to persist for a number of years in the plant (serotiny) suggesting the possibility of fire-triggered seed release (pyriscence). To test this possibility a number of infructescences were harvested randomly from numerous plants. Half of these were left to dry naturally while the others were placed on a concrete floor and lightly covered with hay which was then set alight. Within six hours, the infructescences exposed to the fire had opened completely. Unburnt infructescences took over a week to open to the same degree.

Over the course of the study by Melidonis & Peter (2015), a large number of inflorescences were inspected and numerous ants were encountered, presumably attracted by the nectar. A single unidentified monkey beetle (Scarabaeidae: Hopliini) was also recorded in an inflorescence. In addition, a camera trap recorded a very brief visit by a male Malachite Sunbird (*Nectarinia famosa*) to a *Protea foliosa* inflorescence (Figure 4). On more than one occasion, camera traps recorded the presence of small antelope in close proximity to the plants, but direct feeding was not observed. Many inflorescences and infructescences were found to contain the frass and larvae of parasitizing insects although these were not identified.

Description (after Rourke 1975, 1980).—Rounded shrub to 1.5 m tall with numerous straight, erect stems arising from a woody subterranean rootstock. Stems stout, 60–80 mm

in diameter, erect, glabrous, rarely branched. *Leaves* lanceolate, oblanceolate or broadly elliptic, 90–160 mm long, 15–70 mm broad, narrowed in petiolar region; apex acute to obtuse; margins occasionally undulate; coriaceous, surface minutely granulate, pubescent at first, soon glabrous. *Inflorescence* ovoid to globose, cyathiform, 30–40 mm wide, hidden by large overtopping leaves, typically close to the ground; terminal but occasionally axillary. *Involucral receptacle* broadly convex, 15 mm in diameter. *Involucral bracts* 4–5-seriate; innermost series oblong-spathulate, 30–35 mm long, 10 mm wide, apex broadly obtuse, concave; outer series ovate to broadly ovate, obtuse, 7–15 mm long, 7–12 mm wide; outer surface minutely fimbriate; usually greenish yellow, occasionally flushed with dull carmine, particularly along margins. *Perianth* straight to very slightly adaxially arcuate, 25–30 mm long; tube 8–10 mm long, glabrous; claws slender with strongly undulate margins, glabrous; limbs 8–10 mm long, linear, apices acuminate, glabrescent to glabrous for greater part of their length but apex thickly lanate with a white or brown indumentum. *Style* 25 mm long, straight to slightly adaxially curved. *Pollen presenter* linear, acute, 5 mm long. *Ovary* obovoid, 3–4 mm long covered with long tawny trichomes. *Hypogynous scales* ovate acute, 1.5 mm long. Plate 2326.

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PLATE 2327 *Protea namaquana*

Protea namaquana

Proteaceae: Proteoideae

South Africa

Protea namaquana Rourke in South African Journal of Botany 56,2: 261–265 (1990); Rebelo: 73 t.28 (1995).

The Kamiesberg Mountains are by far the most impressive geographical feature in the landscape of Namaqualand: a great chaotic jumble of huge granite boulders and colossal granite bornhardts erupting into several peaks over 1 500 m in altitude with Rooiberg in the south, at 1 706 m, the highest of all. With an average annual winter rainfall of some 350 mm, it is the best watered part of Namaqualand and botanically the most diverse, known to vegetation ecologists as Kamiesberg Granite Fynbos (Mucina & Rutherford 2006), while plant geographers have recognised the Kamiesberg as an important centre of endemism for over a century (Marloth 1908; Weimarck 1941; Van Wyk & Smith 2001). Hilton-Taylor (1996) reported that the Kamiesberg is home to 79 endemic plant species, a figure that is almost certain to rise as more intensive collecting is undertaken.

The soil throughout is granite-derived. This is a harsh environment almost inimical to the survival of Proteaceae, yet two tenacious species, *Vexatorella alpina* (Salisb. ex Knight) Rourke and *Protea namaquana*, both hardy granite endemics, are able to tolerate this specialised habitat's associated aridity and solar insolation.

Here on the upper slopes of Rooiberg, and adjacent peaks at Esels Kop, Rhebokskloof, Karas and Welkom, *Protea namaquana* occurs, usually on south- but occasionally on north-facing slopes, in small fragmented populations of a few dozen plants (Figure 1). Despite the fact that the upper reaches of the Kamiesberg is largely undisturbed, the increased frequency of fire due to growing human influence has had the most dramatic effect on this very slow-maturing species, which may take up to ten or more years from seedling to first flowering. The species' assessed Red List status is Critically Endangered (Raimondo et al. 2009). A rough count by one of us (JPR) in 1980 suggested there were about 300 living adult specimens. This is not necessarily an accurate assessment, as some populations on Rooiberg had been burnt prior to that count, leaving a few charred adult specimens as evidence. Due to patchy burning it was difficult to establish more precise population figures, which could be higher. Furthermore, plant and population numbers are a dynamic situation, with figures sometimes changing every few years. *Protea namaquana* is a serotinous reseeders, but upon investigating burnt areas in the 1980s, seedling recruitment was observed to be disappointingly low. A further problem was that some adult populations near Welkom were suffering from very bad witches broom infestations. This debilitating plant growth disease that affects leaves and stems is possibly caused by mycoplasma-like organisms, transmitted by mites, and gives rise to dense bunches of miniature leaves among the normal foliage, weakening the adult plant.

PLATE 2327.—1, flowering branches with open inflorescence and immature inflorescence bud, much reduced; 2, open perianth and curved style, $\times 2$. Voucher specimen, *J.P.Rourke 1680* in Compton Herbarium, Cape Town. Artist: Ellaphie Ward-Hilhorst.

Perhaps the most critical factor in determining the survival of this exceptionally rare species is the restricted area of suitable habitat above 1 200 m where the microclimate is favourable for seedling recruitment. *Protea namaquana* is slow growing and long lived. Fully mature specimens develop into robust erect shrubs up to two metres in height with a similar spread, supported by a well-developed, stout, upright trunk, often as much as 200 mm in diameter at the base. Hoary old specimens like these are well over 50 years old. Some may even be octogenarians or older.

It was Elsie Esterhuysen, the greatest twentieth-century botanical collector in the Cape Floristic Region, who made the first recorded collection of this species in 1954. Yet, for a long time it remained unrecognised, being confused with its vicarious equivalent, *Protea sulphurea* E. Phillips, so named for its yellowish involucre bracts. *Protea sulphurea* is readily recognised by its procumbent, horizontally sprawling mode of growth and small, elliptic, glaucous leaves. *Protea namaquana*, on the other hand, is an upright shrub with considerably longer (30–60 mm long), narrowly oblanceolate to linear-spathulate leaves with a distinctive pale, dusty green colour and carmine flushed involucre bracts. Though the distribution areas of these two taxa are today widely separated by several hundred kilometres, they are clearly vicariads, almost certainly derived from a common ancestral population which differentiated into two distinct components as a result of geographical isolation brought about by increasing aridification in the western parts of southern Africa since the Pleistocene.

Flowering peaks in late autumn and winter with a few inflorescences occasionally opening as late as September. The downwardly facing pendent inflorescences tend to be partly concealed within the foliage. On opening, each shallowly bowl-shaped inflorescence produces a strong odour resembling a sweetish, yeasty fermentation, the characteristic syndrome of rodent-pollinated proteas (Rourke & Wiens 1977; Wiens & Rourke 1978; Wiens et al. 1983). Though yet to be confirmed by field observations, rodent pollination in this species is probably one method of achieving pollen transfer, with the nocturnally active Namaqua Rock Rat (*Aethomys namaquensis*) – a widespread and well-known pollinator of some proteas – being a likely candidate.

Bird pollination is more readily discernible. One of us (JPR) has personally observed two species of sunbird, the Dusky Sunbird (*Nectarinia fusca*) and the Malachite Sunbird (*Nectarinia famosa*) feeding on open inflorescences. Nevertheless, as in the related *Protea sulphurea* where pollination by both birds and rodents is known to occur, the same situation is likely to prevail in *P. namaquana*.

Thus far, *Protea namaquana* has not been successfully cultivated. At Kirstenbosch National Botanical Garden, Cape Town, seed from the type collection germinated well. In 1983 140 seedlings were planted out in the protea garden but numbers declined to 120 in 1984 dropping to a mere 25 in February 1986. By 1989 all were dead. The low light intensity, high rainfall and excessive dampness of Kirstenbosch probably contributed to the failure of this species which is clearly better suited to sunny, semi-arid inland sites.

Description.—Erect rounded shrub 1–2 m in height, 1–2 m in diameter, compact, densely branched. *Trunk* stout, up to 200 mm in diameter. *Flowering branches* erect, gla-

brous. Leaves ascending, narrowly oblanceolate to linear-spathulate, glabrous, pale dusty green in live state, $30\text{--}60 \times 4\text{--}9$ mm, apices obtuse, minutely mucronate. Inflorescences pendulous, spherical in bud, shallowly crateriform at anthesis, $90\text{--}100$ mm in diameter; involucrel receptacle very prominent, conic-acute, $20\text{--}25 \times 30$ mm. Involucrel bracts glabrous, 6–7-seriate; outer series tightly imbricate, ovate acute, $8\text{--}10 \times 10\text{--}15$ mm; inner series oblong to broadly oblong, $20\text{--}25 \times 15\text{--}20$ mm, apices incurved, rounded, margins scarious. Perianth $25\text{--}33$ mm long, strongly incurved; tube region glabrous, 10 mm long, inflated, quadrangular; claws narrowing abruptly, glabrous, but upper part sparsely tawny setose; limbs linear, 10 mm long, sparsely setose with tawny trichomes, apices uncinately to acuminate. Anthers 4, subsessile, filaments 2–3 mm long. Style very strongly adaxially arcuate, ancipitous proximally, tapering and terete terminally, $30\text{--}33$ mm long. Pollen presenter straight, linear acute, 8 mm long, clearly differentiated from style. Ovary obconic, 3 mm long covered with long tawny trichomes. Hypogynous scales ovate to acute, 1 mm long. Plate 2327.

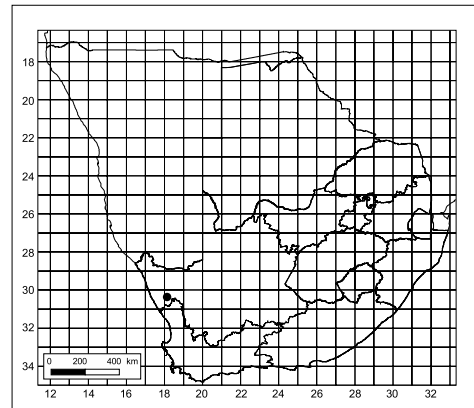


FIGURE 1.—Known distribution of *Protea namaquana*.

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PLATE 2328 *Kalanchoe leblanciae*

Kalanchoe leblanciae

Crassulaceae

South Africa, Mozambique

Kalanchoe leblanciae Raym.-Hamet (as '*leblancae*') in *Repertorium specierum novarum regni vegetabilis* 11: 294 (1912); Fernandes: 396 (1980); Fernandes: 64 (1983); Descoings: 162 (2003); Bandeira et al.: 83–84, 138 (as '*leblancae*') (2007); Crouch et al.: 70–76 (2016).

The Crassulaceae, a near-cosmopolitan family of about 1 400 species, are well represented in southern Africa, which, along with Mexico, is recognised as a major centre of present-day species diversity for the family ('t Hart & Eggli 1995; Thiede & Eggli 2007). Five crassuloid genera are recognised in southern Africa, with *Crassula* L., with over 150 species, being the most diverse (Dreyer 1997). The genera *Adromischus* Lem., *Cotyledon* L., and *Tylecodon* Toelken have similarly diversified extensively in the region. However, this is not so for the essentially Old World genus *Kalanchoe* Adans. *sensu lato*, which with just fewer than 150 species globally, is the third largest genus in the Crassulaceae (Descoings 2003). In southern Africa, *Kalanchoe* is relatively poorly represented, with fewer than 15 indigenous species, all of which are placed in *Kalanchoe* sect. *Kalanchoe*. The greater proportion of genus members is found naturally occurring in tropical Africa, Madagascar and Asia. Several species, such as *K. delagoensis* Eckl. & Zeyh., figured in *The Flowering Plants of Africa* as *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz (Plate 1938) (Tölken & Leistner 1986), and hybrids, such as *K. ×houghtonii* D.B.Ward, are well known internationally as horticultural subjects. A number of them, especially in *Kalanchoe* sect. *Bryophyllum* (Salisb.) Boiteau, tend to naturalise, becoming weedy and invasive in countries with a mild to temperate climate (Given 1984; Kapitany 2007; Walters 2011; Smith & Figueiredo 2013; Silva et al. 2015; Smith et al. 2015).

Kalanchoe leblanciae was described by Raymond Hamet just over 100 years ago, based on material from 'Delagoa Bay', in what is today Maputo, Mozambique (Hamet 1912). [Shortly after this species was described, Raymond Hamet changed his name by hyphenating his given name and surname to 'Raymond-Hamet'; therefore his publications are here cited under either 'HAMET, R.', or 'RAYMOND-HAMET'.] The first gathering of *K. leblanciae* that we can trace is by Henri-Alexandre Junod, a Swiss Romande missionary, who in October of 1893 pressed what would become the holotype, noting that it was rare. Despite this observation, most other Mozambique collections accessioned in South Africa are from the same general locality as the type. Junod also collected the holotype of *K. luciae* Raym.-Hamet, and was commemorated in *K. junodii* Schinz, which is generally considered conspecific with *K. lanceolata* (Forssk.) Pers. (Descoings 2003).

Kalanchoe leblanciae was stated by Fernandes (1980: 396–397) to be endemic to Mozambique (one of the countries covered by the *Flora zambesiaca* [FZ] region), specifically to the Manica, Sofala, Sul do Save, and Maputo districts. However, it had already been

recorded in Natal [now KwaZulu-Natal] in South Africa by Ross (1972). Evidently, Fernandes (1983: 65) was alerted to this reference and, in amending the distribution range for the FZ treatment of the Crassulaceae, indicated that the species occurred also in South Africa. With some hesitation she gave the distribution in that country as '(Natal, Orange Free State?)'. Apart from noting its presence in Mozambique, Descoings (2003) also reported it from 'RSA [Republic of South Africa]' (Crouch et al. 2016). However, *K. leblanciae* did not receive any mention in Tölken's (1985) *Flora of Southern African (FSA)* treatment of the Crassulaceae. Consequently it was omitted from all recent catalogues of South and southern African plants in general (Burgoyne 2003, 2006), and succulent plants specifically (Dreyer 1997), as well as from a preliminary checklist of Mozambican plants (Silva et al. 2004). In the north, the FZ region is geographically abutted by the *Flora of Tropical East Africa* region, an area from which the species has not been reported (Wickens 1987).

Apart from doubts about its geographical distribution range, the taxonomic status of *Kalanchoe leblanciae* has also been questioned. In The Plant List (see: www.theplantlist.org) the name is regarded as being unresolved, based on the World Checklist of Selected Plant Families in review. When Hamet (1912: 292) described *K. leblanciae* he noted that in his previous monograph on the genus (Hamet 1907), the species would key out as the Indian *K. grandiflora* Wight & Arn., but that *K. leblanciae* was quite distinct. Mixed gatherings on herbarium sheets have further contributed to problems encountered in determining and identifying specimens of *K. leblanciae* (see for example Fernandes 1980). In the protologue, Hamet (1912: 292) also noted that *K. leblanciae* could be confused with a number of other *Kalanchoe* species. These include *K. sexangularis* N.E.Br., *K. paniculata* Harv., *K. rotundifolia* (Haw.) Haw., *K. longiflora* Schltr. ex J.M.Wood and *K. brachyloba* Welw. ex Britten. *Kalanchoe leblanciae* may be readily distinguished from particularly *K. brachyloba*, *K. hirta* Harv. and *K. longiflora*, all of which have clasping leaf bases. He regarded it as similar to *K. rotundifolia*, from which it differs in several leaf and flower characters. Fernandes (1980: 397) further distinguished *K. leblanciae* from the polymorphic *K. rotundifolia* on account of its thicker, sessile leaves that are of a different shape, as well as various flower characters on which she did not elaborate, but would likely have included at least features provided by Table 1. It is worth

TABLE 1.—Characters on which *Kalanchoe leblanciae* can be distinguished from *K. rotundifolia* (see Hamet 1912; Fernandes 1983)

Character	<i>Kalanchoe leblanciae</i>	<i>Kalanchoe rotundifolia</i>
Leaf blade	Oblong or narrowly oblong	Ovate, ovate-oblong, oblong or oblong-suborbiculate
Leaf margin	Crenate with few, large, obtuse divisions	Mostly entire, sometimes repand-sinuate
Petiole	Indistinct; lamina base attenuate forming a broad short pseudopetiole	Present; with distinct narrow petiole
Corolla shape	Corolla tube wider, not bent in upper part and less swollen in lower part	Corolla tube narrower, bent in upper part and swollen in lower part
Corolla twisting	Neither tube nor lobes twist in bud, nor after flower is spent	Pronounced in bud and after flower is spent
Petal lobe shape	Suboblong	Obovate, obovate-oblong, oblong or ovate-oblong
Petal lobe apex	Very obtuse and cuspidate	Acuminate, acute and subcuspidate

noting here that *K. rotundifolia*, as currently circumscribed with more than half a dozen synonyms, is exceedingly variable. Although the flower colour of *K. leblanciae* has been reported as ranging from ‘...yellow-green, yellow, salmon to bright red...’ (Fernandes 1983; Descoings 2003; Bandeira et al. 2007), we have yet to encounter specimens with flowers that are not yellow (free portions of petals) and yellowish-green (floral tube). However, in *K. rotundifolia* flower colour ranges from salmon through orange to bright red, sometimes even bicoloured, but all characteristically show pronounced twisting of the corollas (Figure 1). In fact, Fernandes (1983: 42) distinguished *K. rotundifolia* from the group consisting of *K. brachyloba*, *K. paniculata* and *K. leblanciae* on the pink to brick flowers of the former species, whereas the latter three have yellow corollas. Nevertheless, in the same publication, Fernandes (1983: 65) described *K. leblanciae* as having a corolla ‘yellow-green to yellow or salmon to bright red, reddish-brown throughout or with the lobes darker than the tube on drying’. It is accordingly unclear whether she had ascertained that non-yellow corollas are observed only once specimens are dry; we note though that one specimen from Inhaca Island in Maputo Bay was documented as having red flowers (Mogg 28346 in PRE).

Fernandes (1980) further noted that *Kalanchoe leblanciae* differed from *K. paniculata* (Smith et al. 2003) in having smaller leaves that have a different shape, leaf margins that are not entire, and smaller flowers. In Fernandes (1983: 42) a key to the *Kalanchoe* spe-



FIGURE 1.—In the extraordinarily variable *Kalanchoe rotundifolia* flower colour ranges from salmon through orange to bright red. However, all forms demonstrate twisting of the corollas as the flowers senesce and start setting fruit, a feature not shared with *K. leblanciae*. Photograph: N.R. Crouch.

cies occurring in the FZ region separates *K. leblanciae* from the other species on a combination of characters, including smaller, sessile leaves that narrow below into a wide petiolar base, smaller flowers with corolla lobes not twisted, and the presence of a waxy bloom on the stems (Figure 2). In the treatment of this species, Fernandes (1983: 65) noted that it is similar to *K. brachyloba* but differs in being ‘not so stout, with the stem $\pm$ 4-angled, smaller leaves, inflorescences with rather smaller flowers whose corolla lobes are not connivent, etc.’. She also provided a suite of characters to further distinguish *K. leblanciae* from *K. sexangularis*, with which it has commonly been confused in South Africa. The former has shorter (up to 1.2 mm long) styles, rather than longer than 2 mm, and its corolla tube and lobes dry to the same colour, instead of contrasting. The flowers of *K. leblanciae* are carried in clusters – smaller than those of the related *K. sexangularis* – atop long, erect to patent-erect inflorescence branches. Instead, the inflorescence branches of *K. sexangularis* are more spreading and gracefully arched upwards (Figueiredo et al. 2016).

The material illustrated here was collected during a field trip to southern Mozambique arranged under the auspices of the Southern African Botanical Diversity Network Project (SABONET) (Siebert et al. 2002), which is regarded as one of the most successful herbarium and plant taxonomic capacity building projects ever concluded globally (Steenkamp et al. 2006). The field trip emphasised the flora of the unique Licuáti Forest Reserve in Matutuine District, Maputo Province, and took place from November to December 2001. Interesting material collected on that expedition is recounted by Siebert et al. (2002), and also revealed in volume 58 of *Flowering Plants of Africa* (Van Wyk 2003). Prof. Braam [A.E.] van Wyk, to whom this volume of *Flowering Plants of Africa* is respectfully dedicated, revisited the sand forest site in October 2002. Together with Ms Samira Izidine, then attached to the Herbarium of the National Institute of Agronomic Research (LMA) in Maputo, he encountered a specimen of *Kalanchoe leblanciae* with an inflorescence of well over 1.5 m tall (Figure 3). The vegetation type in which the species was growing is categorised as Licuáti Thicket (Izidine 2003), Sand Forest Thicket (Bandeira et al. 2014), or Sand Forest (FOz 8) (Rutherford et al. 2006), which is endemic to the Maputaland Centre of Endemism within the Maputaland-Pondoland Region of Endemism (Van Wyk & Smith 2001).



FIGURE 2.—Bloom on the 4-angled stem of *Kalanchoe leblanciae*, a feature shared neither with *K. sexangularis* nor with *K. brachyloba*. Photograph: N.R. Crouch.



FIGURE 3.—This specimen of *Kalanchoe leblanciae* was photographed in the Licuáti Forest Reserve in southern Mozambique on 8 October 2002 where it grew in Licuáti Thicket. The inflorescence is over 1.5 m tall. The specimen is held aloft by Mr Abilio Manhique, Department of Botany, National Institute of Agronomic Research (LMA), Maputo, Mozambique. Photograph: A.E. van Wyk.

By far the best known and most widely grown species of *Kalanchoe* in southern Africa is the red-leaved *K. sexangularis*, earlier figured as Plate 1875 of *The Flowering Plants of Africa* (Tölken 1983). It is very popular as a groundcover in domestic and public gardens, especially in summer-rainfall regions, where it thrives in full sun or dappled shade. In contrast to *K. sexangularis*, *K. leblanciae* has slimmer proportions overall and much greener leaves, but in its natural habitat its leaves will take on a purplish colour when highly drought-stressed. Given that it is little known in South Africa, and has a narrower distribution range (Figure 4) than *K. sexangularis*, *K. leblanciae* is less cultivated, but like most species of *Kalanchoe* presents few growing challenges. If the soil is well-drained, plants can be readily established in the sites where they are intended to be raised, through the planting of stem cuttings.

In its natural habitat in Mozambique *Kalanchoe leblanciae* often occurs in low, forest-like savanna (bushveld) with sparse, open canopies, in shrubby grasslands, or in sparse to dense coastal dune scrub established on very sandy soils (Bandeira et al. 2007). These authors note the occurrence of the species in the Maputo, Gaza, Inhambane and Sofala provinces in Mozambique, a geographic distribution that is in accordance with the collections from the Maputo herbaria (LMA and LMU). The species is an

obvious component of Sand Forest in South Africa (Rutherford et al. 2006) (Figure 5), in both the Tembe Elephant Reserve (Figure 6) and Ndumo Game Reserve. This forest type houses not only a number of local Maputaland endemics (e.g. *Crassula maputensis* R.Fern.; Burgoyne & Van Wyk 1999), but is also the habitat of various tropical elements that reach their southernmost distribution here. With the exception of the westernmost location given in Figure 4, all range records for *K. leblanciae* fall within the Maputaland Centre of Endemism (Van Wyk & Smith 2001: 87, Map 14). Pooley (1978) recorded that in Ndumo plants took two to three years to mature, and after flowering would die right back before resprouting. In more mesic situations plants behave similarly, as observed over a period of ten years in Kloof, KwaZulu-Natal. Tölken (1985) described how in some species this regeneration occurs through the production of slender underground branchlets from the stem base. This would appear to be the case for *K. leblanciae*, as it is with the likes of *K. hirta*. In full sun gar-

den positions plants sprout profusely from the base and attain a height of only about 1 m, whereas in more shaded situations specimens have fewer stems, are taller, and appear more wispy (Figure 3).

Kalanchoe leblanciae was named after Alice Leblanc, an intimate friend of Raymond-Hamet, who is commemorated in several species of Crassulaceae. *Kalanchoe aliciae* Raym.-Hamet (see Raymond-Hamet & Marnier-Lapostolle 1964: 29, Plate VIII [Figures 18–19]) was also named for her, and in *Sedum* L., *S. celiae* Raym.-Hamet [Celia being an anagram for Alice] and *S. leblanciae* Raym.-Hamet both honour her. Somewhat mischievously, Alice Leblanc is a co-author with Raymond-Hamet of *Kalanchoe mitejea* Leblanc & Raym.-Hamet ['mitejea' being an anagram of *je t'aime*] (see Raymond-Hamet & Marnier-Lapostolle 1964: 81, Plate XXIX [Figures 96–97]; Figueiredo & Smith 2010). In the case of the subject of this account the original epithet *leblancae* has been corrected to *leblanciae* under the provisions of Article 60, Recommendation 60C.1 of McNeill et al. (2012).

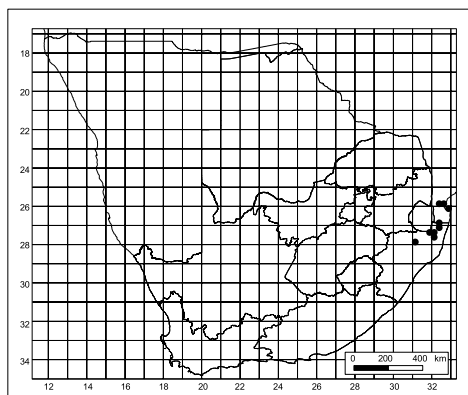


FIGURE 4.—Known geographical distribution range of *Kalanchoe leblanciae* in southern Africa.



FIGURE 5.—Typical Sand Forest habitat of *Kalanchoe leblanciae*, Ndumo Game Reserve, northern Maputaland, South Africa. Photograph: G.R. Nichols.

Somewhat surprisingly, no synonyms have been recorded for *Kalanchoe leblanciae*. As is the case in virtually all groups of plants that appeal to collectors, not least succulents, species have been given multiple names, especially if they occur in several countries where taxonomists have independently worked on the same groups. However, for *K. leblanciae* this is fortunately not the case. Nevertheless, names appear in synonymy *pro parte*, due to several mixed collections that include fragments of *K. leblanciae*. For example, material of *K. leblanciae* was in fact preserved as one of the original isotypes of *K. mossambicana* Resende & Sobr. [LISC002355], which is now a synonym of *K. sexangularis*.

TYPE SPECIMENS EXAMINED

Delagoa Bay [Mozambique], October 1893, *Junod 443* (holo-: G G00418140!, in 2 sheets; iso-: G G00418141!, P not seen and image not available online, BR BR0000008886750!, Z Z-000101954!).



FIGURE 6.—Flowering plant of *Kalanchoe leblanciae* emergent from low scrub, seen together with the succulent creeper *Cissus rotundifolia* (Vitaceae) which bears much broader leaves, Tembe Elephant Reserve, South Africa. Photograph: M. Hickman.

ADDITIONAL SPECIMENS EXAMINED

SOUTH AFRICA. KWAZULU-NATAL.—2632 (Ndumo): Ndumo Game Reserve, (–CD), 26°54'S 32°15'E, 22-06-1988, *M.C. Ward 2346* (NH); Ndumo Game Reserve, Ingwavuma, 15-06-1939, *J. Gerstner 3456* (NH); Ndumo Game Reserve, Ndumo Hill, Ingwavuma District, 08-06-1969, *E.S. Pooley 580* (NU). 2731 (Louwsburg): Jozini Dam (–BD), 28-06-1964, *R.G. Strey 5293* (NH). 2731 (Louwsburg): Louwsburg District, 16 km west of intersection on Ingwavuma Road, (–CC), 25-11-1982, *D.S. Hardy 6186* (sub PNBG 27344) (PRE). 2732 (UBombo): Tembe Elephant Park, Sihangwane, (–AB), 27°01'S 32°24'E, 17-06-1985, *M.C. Ward 984* (NH). 2732 (UBombo): Jozini, cliffs above dam, (–AC), 07-09-1971, *R.G. Strey 10421* (NH). 2732 (UBombo): UBombo, (–CA), 05-1933, *J. Gerstner s.n.* (sub NH22855) (NH).

MOZAMBIQUE.—2532: Vila Louisa [Vila Luisa] [Marracuene], *J. Gerstner 6618* (PRE). 2632: Inhaca Island, *A.O.D. Mogg 27233* and *A.O.D. Mogg 8346* (PRE); Lourenço Marques [Maputo], Inhaca Island, *A.O.D. Mogg 28093* (PRE).

Description.—Perennial, glabrous, succulent herb, 0.3–1.6 m tall, with slight whitish bloom on preserved specimens. *Stems* simple or once-branched, erect to leaning, woody at the base, $\pm$ distinctly 4-angled, 5–9 mm in diameter, tapering upwards. *Leaves* up to 100 $\times$ 10–30 mm, $\pm$ sessile, narrowing basally to a subpetiolar base, not amplexicaul, flat to slightly lengthwise-folded, fleshy, gracefully recurved to completely down-curved, oblong to oblong-spathulate, tip rounded or obtuse, base attenuate, mid-green, sometimes with a purplish hue during periods of environmental stress; margins crenate, sinuate-

crenate, or serrate-lobed, reddish-brown tinted. *Inflorescence* 0.3–1.6 m tall, narrow, much elongated, apically dense, many-flowered corymbose cymes or panicles, branches opposite, erect to erect-patent, subtended by leaf-like bracts, with small, leafy shoots often produced in axils, greenish-yellow; *pedicels* $\pm$ obsolete, slender, 3.0–4.5 mm long when present. *Flowers* erect; *calyx* consisting of 4 $\pm$ separate sepals, basally adnate; *sepals* 1.2–1.8 $\times$ 0.8–1.0 mm, triangular-lanceolate, acute-tipped, shiny mid-green, contrasting darker green against corolla tube; *corolla* 8–12 mm long, not twisted apically after anthesis, yellowish-green and yellow [reportedly also varying from salmon to bright red, but these colours not observed]; *corolla tube* 6–8 mm long, distinctly 4-angled, box-shaped-square when viewed from below, yellowish-green; *corolla lobes* 2–3 $\times$ 1.8–2.0 mm, suboblong to ovate, tip pointed, rounded or obtuse, bright yellow, faintly brown-tipped. *Stamens* inserted in or slightly above the middle of the corolla tube, included; *filaments* $\pm$ 1.5 mm long, thin, light green; *anthers* $\pm$ 0.5 mm long, brownish-yellow. *Pistil* consisting of 4 carpels; *carpels* 5–6 mm long, light yellowish green; *styles* 1.0–1.5 mm long; *stigmas* very slightly capitate, light yellow; *scales* $\pm$ 1 mm long, linear. *Follicles* not seen. *Flowering time*: June–October, peaking in July. Plate 2328.

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PLATE 2329 *Senna didymobotrya*

Senna didymobotrya

Fabaceae: Caesalpinioideae

Northwestern, eastern and southern Africa, and Madagascar

Senna didymobotrya (Fresen.) H.S.Irwin & Barneby in *Memoires of the New York Botanical Garden* 35: 467 (1982); Lock: 37 (1989); Pooley: 154 (1993). *Cassia didymobotrya* Fresen.: 53 (1839); Oliver: 276 (1871); Taubert: 201 (1895); Harms: 498 (1915); Baker: 62 (1911); Brenan & Greenway: 97 (1949); Steyaert: 504, fig.36 (1952); Mendonça & Torre: 177 (1956); White & Angus: 120 (1962); Drummond: 243 (1975); Ross: 195 (1972); Gordon-Gray: 79 (1977). *Cassia verdeckii* De Wild.: 49, t.16 fig.6–11 (1902); Harms: 498 (1915); Baker: 638 (1930).

Senna Mill. is a large genus in the Fabaceae family, subfamily Caesalpinioideae, tribe Cassieae with approximately 350 species. The subfamily is usually divided into five tribes: Cercideae, Caesalpineae, Cassieae, Detarieae and Macrolobieae (Tucker 2003; Resende et al. 2013). Irwin & Turner (1960) included the species of *Senna* among the approximately 600 species of the genus *Cassia sensu lato*. In their taxonomic treatment, Irwin & Barneby (1981 & 1982) subdivided the genus *Cassia* into *Cassia* L. emend. Gaertn. sensu stricto, *Chamaecrista* Moench and *Senna*; these three genera were ascribed to subtribe Cassiinae. Irwin & Barneby (1982) further divided the genus *Senna* into six sections (*Astroiles* [1 species], *Chamaefistula* [c. 140 species], *Paradictyon* [1 species], *Peiranisia* [c. 55 species], *Psilorhagma* [c. 30 species] and *Senna* [c. 20 species]) distinguishing them mainly on stem, leaf and flower characters. This classification has been supported by a number of studies of these three genera based on morphology, ontogenetic characteristics, molecular systematics and cytogenetics (Resende et al. 2013). Many species of *Senna* exhibit enantiostyly floral symmetry, meaning that the deflection of the style is either to the left or to the right within the same inflorescence (Marazzi et al. 2006).

The genus *Senna* is pantropic in distribution but also occurs in most subtropical regions. Its distribution includes North America, South America, Asia, Australia and Africa (Irwin & Barneby 1981; Henderson 2001; Du Puy et al. 2002; Marazzii et al. 2006; Orwa et al. 2009). It is paraphyletic and amongst the largest genera in the Caesalpinioideae. In southern Africa *Senna* is the largest genus in the subtribe Cassiinae, followed by *Chamaecrista* and *Cassia* (Nkonki et al. 2003). Species vary, from trees and shrubs to woody herbs (some monocarpic) and occur mainly in tropical seasonal vegetation and occasionally in forests, especially along forest margins. There are about 18 species of *Senna* present in southern Africa, of which the majority are naturalised aliens and have been cultivated for their attractive flowers. Only *S. italica* subsp. *arachoides* (Burch.) Lock and *S. petersiana* (Bolle) Lock are indigenous (Germishuizen et al. 2006). According to Brummitt et al. (2007), none of the species in the genus is known to form root nodules. *Senna didymobotrya* is morphologically similar to *S. alata* (L.) Roxb. The former can be distinguished by its oblong-elliptic leaflets that are shorter than 65 mm, bright yellow flowers with darker veins, and pods that are not winged; whilst the latter has oblong leaflets that are longer than 60 mm, deep yellow or orange flowers, and pods that are 4-winged (Brummitt et al. 2007). The genus is character-

ised by a distinctive floral morphology and the presence of extrafloral nectaries. These organs attract ants (e.g. in *S. occidentalis* (L.) Link) that feed on the nectar and, in turn, protect the plant against herbivory (Marazzi et al. 2006; Marazzi & Sanderson 2010).

Senna didymobotrya has various common names, including African senna, African wild sensitive plant, candelabra tree, peanut butter cassia, peanut butter tree, popcorn bush, popcorn cassia, popcorn senna, wild senna and *grondboontjiefbotter kassia* in Afrikaans (Environmental Weeds of Australia [EWA] 2016; Invasive Species South Africa 2016).

Senna didymobotrya, illustrated here, is native to tropical Africa including Kenya, Tanzania and Uganda, and widely cultivated in tropical areas around the world. In its natural range the species is found at elevations from sea level to 2 500 m altitude. In South Africa it is widely distributed in the coastal areas of the Western Cape, Eastern Cape, KwaZulu-Natal and northeasterly towards the highveld region of Mpumalanga, Gauteng and Limpopo provinces. According to EWA (2016), *S. didymobotrya* is naturalised in Australia (mainly in Queensland and New South Wales) and parts of America (Mexico, southern USA). It is also naturalised in several Pacific Ocean islands (e.g. Hawaii). The distribution of *S. didymobotrya* in Africa, based on the Botanical Database of Southern Africa (BODATSA), Southern African Plant Invaders Atlas (SAPIA) and Global Biodiversity Information Facility (2016) databases, is illustrated in Figure 1.

The genus name is derived from the Arabic word *sana* or *sanna* for species with leaves and pods with cathartic and laxative properties. *Senna didymobotrya* is a popular medicinal plant within its native range, where it is commonly used as a purgative, an antimalarial medicine, and used to treat other fevers and jaundice. A decoction of the leaves, stems and roots is used for the treatment of stomach problems such as diarrhoea, intestinal worms and general abdominal pains. Higher doses are, however, reported to be toxic and in some cases may cause vomiting and may be fatal. Root powder mixed in water or infusions of the fresh parts are known to treat some skin diseases. Sometimes the concoction may cause the patient to be weak if not taken with milk (Tabuti 2007). When treating children, the young leaves are cooked in banana leaves to lower toxicity levels and given orally. For livestock, a decoction made from leaves is used to treat external parasites such as ticks. The species is also used to preserve milk for longer periods (up to a year) by coating the inside of the vessel to be used for storing milk with ash of burnt twigs. In the craft industry the wood is used to make handicrafts. Outside of its native range (e.g. tropical Asia, America),

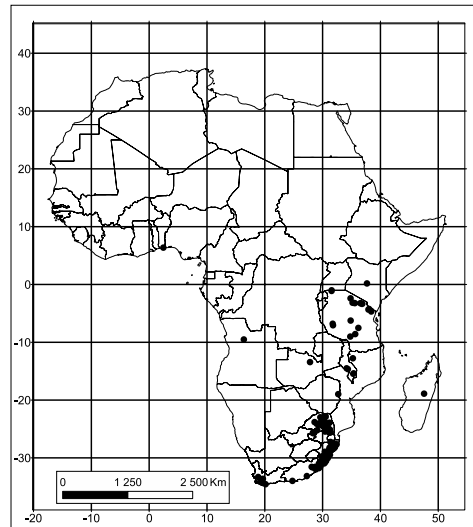


FIGURE 1.—Distribution of *Senna didymobotrya* in Africa based on the Botanical Database of Southern Africa (BODATSA), the Southern African Plant Invaders Atlas (SAPIA) and the Global Biodiversity Information Facility database.

S. didymobotrya is reported to be used as a fodder, green manure, cover crop and shade tree in tea plantations. The species is also known to contain bioactive metabolites, including anthraquinone, choline, triterpenoids and raffinose (Tabuti 2007; Mining et al. 2014). In their findings, Mining et al. (2014) concluded that the root bark of *S. didymobotrya* contains anthraquinone and triterpenoids and can be used as biopesticides against a bean weevil beetle (*Acanthoscelides obtectus* Say) to improve grain production in Kenya.

In South Africa *Senna didymobotrya* occurs in a variety of habitats (Figure 2) including riparian areas, riverine forests (for example along the edges of damp forests in the Kruger National Park) and along forest margins, riverbanks, wastelands, woodlands, grasslands, coastal scrublands and roadsides (Henderson 2001; Foxcroft & Richardson 2003). In its native region the species occurs in swamps and beside seasonal rivers, on roadsides and in waste places, mainly in tropical seasonal vegetation but also in forest (Brummitt et al. 2007). In some parts of the world the species prefers typical savanna habitats, exposed rocky slopes, disturbed sites, grasslands and rarely in moister habitats such as dense thickets and forests (Randell 1990; EWA 2016). In other areas where it has been introduced, the species is regarded as a minor weed or potential environmental weed that has escaped cultivation (EWA 2016). Females of the carpenter bee, *Xylocopa pubescens* Spinola, are known to exclusively pollinate species of *Senna* and *Cassia* (Dulberger 1981).

According to the National Environmental Management: Biodiversity Act (2004), *Senna didymobotrya* is a declared category 1b invader in the Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga and Western Cape provinces. Category 1b means that the species must be controlled and, wherever possible, removed and destroyed, and that any trade or planting is strictly prohibited. The species was probably introduced to South Africa as an ornamental and hedging plant. Its robust growth habit and rapid, easy seed germination give it a competitive advantage over indigenous species allowing it to form dense impenetrable thickets (Figure 2) that impede the growth and regeneration of native plants and affects the movement of wildlife. In some parts of its native range, *Senna didymobotrya* can be a bush encroacher especially in disturbed areas such as overgrazed land.

Description (compiled from specimens examined in the National Herbarium, Pretoria, and based on Brenan 1967; Irwin & Barneby 1981; Brummitt et al. 2007).—Shrub, 1–4(6) m tall or more, evergreen, unarmed, unpleasant smelling when fresh. *Branchlets* dark brown, mostly ascending, sparsely pubescent, with scattered, inconspicuous glandular hairs. *Stems* cylindrical, straight; young stems pubescent, sometimes villous. *Leaves* paripinnate; stipules (7)12–20 × 5–13 mm, broadly ovate, cordate at base, acuminate at apex, palmately veined from the broad base; persistent; petioles 17–40(85) mm long, pubescent; rachis 150–270(300) mm long, pubescent to pilose; brownish to dark purplish-red hairs between leaflet pairs, without extrafloral nectaries; petiolules 1–2 mm long; leaflets in 14–18 pairs, spaces 8–20 mm apart along rachis, opposite, 21–55(60) × 10–20 mm, oblong, slightly oblique at base, margins entire, acute and mucronate at apex, mucro 1–3 mm long, pinnately veined with midrib raised on lower surface, pubescent on both sides. *Inflorescence* a dense axillary raceme, axis 220–340 mm long, 14–55-flowered, densely pubescent and glandular hairy, peduncle 35–70 mm long; bracts present in bud, falling before anthesis, 10–16(20) × 8–13 mm, dark brown to dark olive brown, broadly ovate, pubescent, base cordate, apex acute, apiculate. *Flower* bisexual, slightly bilateral,



FIGURE 2.—*Senna didymobotrya* at Mokopane in Limpopo: a and b, in habitat; c, flowers and fruits; d, plants form dense thickets. Photographs: T.P. Jaka.

14–18 mm across, cup-shaped; nectar-producing receptacle below ovary. *Sepals* 5, unequal 12–15 × 4.5–7.0 mm, obovate to elliptic, narrower from outermost to innermost sepal, dark yellowish green to brownish yellow-green, light yellow-green on margins and tip, apically rounded, lower surface puberulent, somewhat glandular. *Petals* 5, bright yellow, cupuliform, with prominent darker (pinnate) veins particularly when dry, shortly clawed up to 1.6 mm, (14)20–25 × 10–14 mm, standard petal somewhat wider, broadly oblong to obovate, glabrous. *Stamens* 10, free, heteromorphous, 7 fertile, 3 probably sterile staminodes, filaments 2.0–2.8 mm long, greenish at base grading to yellow above, anthers 5–10 mm long. *Ovary* 12 mm long, densely pubescent; stipe ± 5 mm long; style ± 12.5 mm long, glabrous. *Pods* blackish or dark brown, 80–110 × 19–24 mm, oblong, corrugated on the flat surface, very tardily dehiscent along both sutures, shortly pubescent and foul-smelling, not winged. *Seeds* slightly oblong, tapered at base, dull brown, 7–9 × 3.6–5.0 mm, flattened, apiculate at proximal end, with narrowly obovate to oblong areole in the centre of each face, hilum laterally sub-basal. Flowering time: all year in South Africa. Plate 2329.

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Caesalpinia bracteata

Fabaceae: Caesalpinioideae

*Namibia, South Africa**Caesalpinia bracteata* Germish. in Bothalia 21,2: 152–154 (1991).

Caesalpinia bracteata, locally known as the *Gariëp pronkstert* in Afrikaans, is a rare thorny shrub known only from a few gatherings on both sides of the dry, semi-desert, lower Orange River in South Africa and Namibia (Figure 1). The species' distribution falls within the Gariëp Centre of Endemism (Van Wyk & Smith 2001). It appears to be restricted to the Naros Granite geological formation.

The genus *Caesalpinia* was established by Linnaeus in 1753, represented today by more or less 200 species, of which most are confined to the New World (Heywood 1978). The generic name, *Caesalpinia*, honours the Italian botanist Andreas Caesalpini (1519–1603) (Jackson 1990). The specific epithet, *bracteata*, is in reference to the large bracts protecting the flowers of *C. bracteata*. Most *Caesalpinia* species are attractive, scrambling shrubs, with colourful flowers and many have been taken up in ornamental horticulture.

In South Africa and Namibia, the genus *Caesalpinia* is represented by 10 species (Nkonki & Swelankomo 2003), of which four are introduced and invasive species (Henderson 2001). The remaining six species are indigenous to South Africa and Namibia. These include the widespread *C. bonduc* (L.) Roxb., *C. bracteata* Germish., *C. merxmullerana* A.Schreib., *C. pearsonii* L.Bolus, *C. rostrata* N.E.Br. and *C. rubra* (Engl.) Brenan. Four of these occur in Namibia, namely, *C. rubra* (Namibia and Botswana), *C. merxmullerana* and *C. pearsonii* (the latter two endemic to Namibia), and *C. bracteata* (Craven 1999). The alien species were introduced because of their ornamental value. These include *C. decapetala* (Roth) Alston, *C. gilliesii* (Wall. ex Hook.) Benth., *C. pulcherrima* (L.) Sw. and *C. spinosa* (Molina) Kuntze. *Caesalpinia rostrata*, another species with a fairly restricted distribution in the east of South Africa, was treated in a previous volume of *Flowering Plants of Africa* (Germishuizen & Condry 2001). The indigenous species from the semi-arid regions in the west (four species, namely *C. bracteata*, *C. merxmullerana*, *C. pearsonii* and *C. rubra*) are multi-stemmed, erect shrubs, whereas the two species from the east (*C. bonduc* and *C. rostrata*), are distinctly scrambling. The beautiful bird-of-paradise (*C. gilliesii*), a native from Argentina and Uruguay, is becoming invasive in the Northern Cape Province of South Africa.

Caesalpinia bracteata is related to *C. rostrata* from the Mpumalanga Province of South Africa in the east, but can immediately be differentiated from it by several features. *Caesalpinia rostrata* is a scrambling shrub with a distinctive rostrate beak on the lower sepal. Furthermore, *C. rostrata* has subulate stipellae on the rachis, which are absent from the leaves of *C. bracteata*. The fruits of *C. bracteata* are maroon brown and 15–22 mm long, whereas the fruits of *C. rostrata* are much larger (27–32 mm) and brownish (Germishuizen 1991).



PLATE 2330 *Caesalpinia bracteata*

Andrew Gubb (1950–), curator of the McGregor Museum, Kimberley, first discovered *Caesalpinia bracteata* on 8 July 1982, between the farms Yas and Warmbad in the Northern Cape Province in the vicinity of the Orange River (Glen & Germishuizen 2010). He collected herbarium specimens of this thorny shrub and deposited a specimen in the McGregor Museum and a duplicate was sent to the National Herbarium, Pretoria. The next collection was made on 29 September 1987 and again in 1990. Both these collections were made by Estelle van Hoepen (née Wasserfall) who found plants in the same region on the farm Skroef. Gerrit Germishuizen, botanist from the former Botanical Research Institute and specialising on the Fabaceae family at the time, investigated the specimens and realised that they represent an unnamed species. He named it *C. bracteata* in reference to the large floral bracts, separating it from *C. rostrata* (Germishuizen 1991).

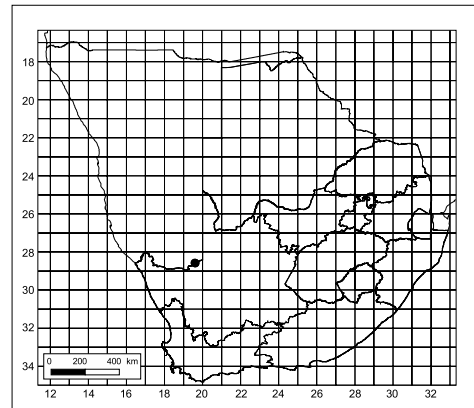


FIGURE 1.—Known distribution of *Caesalpinia bracteata* in Namibia and South Africa.

Professor Braam van Wyk of the University of Pretoria brought this species to the attention of the first author (EJvJ) who decided to visit the site to collect seed for the Botanical Society Conservatory in Kirstenbosch, where he was in charge. On an excursion to the Kaokoveld in June/July 2001, and after consulting with one of the owners, Sakkie van Staden, the farm Skroef was visited on 23 July 2001 with Tielman Haumann, a farmer from the Ghaap Plateau. *Caesalpinia bracteata* was commonly encountered and often the dominant species in some parts of the farm, and not far from the Orange River. It grew in crevices and among Naros granitoid outcrops of the Namaqua Metamorphic Complex (Miller & Schalk 1980; Visser 1984; Mendelsohn et al. 2002). Multistemmed shrubs, 1–3 m tall, grew on a gentle north-facing slope. The vegetation consists of Lower Gariep Broken Veld (Bushmanland Bioregion of the Nama-Karoo Biome) (Mucina & Rutherford 2006). Here the plants shared their habitat with species such as *Abutilon pycnodon* Hochr., *Adenolobus garipensis* (E.Mey.) Torre & Hillc., *Boscia albitrunca* (Burch.) Gilg & Gilg-Ben. and *B. foetida* Schinz, *Cadaba aphylla* (Thunb.) Wild, *Commiphora gracilifrons* Dinter ex J.J.A.van der Walt, *Diopyros acocksii* (De Winter) De Winter, *Ficus cordata* Thunb., *Maerua gilgii* Schinz, *Gymnosporia tenuispina* (Sond.) Szyszyl., *Nymanina capensis* (Thunb.) Lindb., *Parkinsonia africana* Sond., *Searsia marlothii* (Engl.) Moffett, *Senegalia mellifera* (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr., *Sisymbrium sparteum* E.Mey. ex Sond., *Tribulus terrestris* L., *Vachellia erioloba* (E.Mey.) P.J.H.Hurter and *Ziziphus mucronata* Willd. Sufficient seeds and specimens (E. van Jaarsveld 16805) were collected. This part of southern Africa is a semi-desert with the climate being hot and dry throughout most of the year. The annual rainfall has been recorded as less than 100 mm per annum and occurs mainly in spring and autumn in the form of thundershowers, although the region may occasionally experience some rain during the winter months. The average daily maximum is 29°C and the average daily minimum 13°C. During summer, extreme temperatures have been measured and can sometimes reach 44°C.

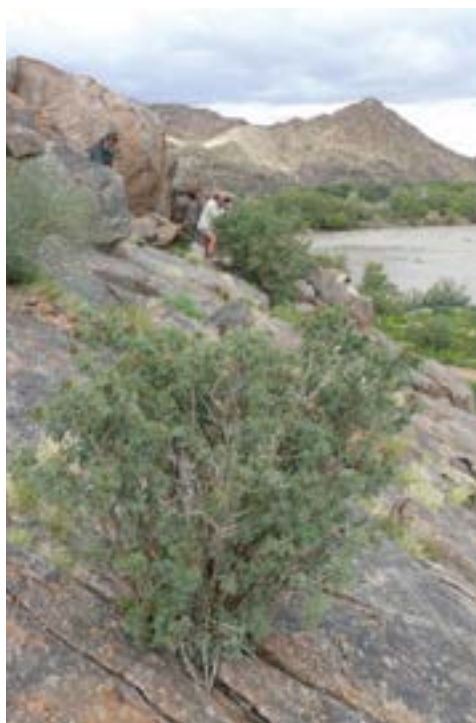


FIGURE 2.—*Caesalpinia bracteata* growing on a south-facing slope on the farm Naros, southern Namibia. Note the *Sisyndite sparteae* bush in the background. Photograph: E.J. van Jaarsveld.



FIGURE 3.—*Caesalpinia bracteata*, close-up of the flowers, growing on the farm Naros, southern Namibia. Photograph: E.J. van Jaarsveld.

The seeds that were collected were sown in sandy soil in the following spring (2001) in the succulent section of the Kirstenbosch National Botanical Garden. Germination was rapid and many plants established, some of which were transplanted into the Botanical Society Conservatory in 2002. These have a slow rate of growth, and the first plants flowered in the Conservatory only in 2008 about six years after being planted out. It was also from the plants in the Botanical Society Conservatory from which the artist was able to illustrate the plant in October 2016.

Sakkie van Staden maintained that the species' distribution extends to the Namibian side of the Orange River and one of us (EJvJ) decided to inspect this at a later stage. Subsequently an expedition was arranged to the Spelonkberge in Namibia in search of *Aloe dabenorisana* Van Jaarsv., which provided the opportunity to investigate for possible *Caesalpinia bracteata* on the farm Naros in Namibia on 25 May 2011. The party consisted of Wessel Swanepoel, Tielman Haumann, Natanya Mulholland, the farm owner (Nico Strauss) and myself (EJvJ).

We left for the farm Naros (after which the granite type was named) and headed south towards the Orange River. As we approached the farm, Naros granitoid outcrops appeared

as expected, and *Caesalpinia bracteata* was indeed commonly encountered (Figure 2). The plants were again always confined to crevices of Naros granite and growing in association with *Sisyndite sparteae* and *Cynanchum* (*Sarcostemma*) *pearsonii* N.E.Br. Here *Caesalpinia bracteata* grows mainly on south-facing slopes and are slightly smaller than the Skroef plants. *Caesalpinia bracteata* also grows here as a dense, multistemmed shrub, up to 1 m high, occasionally up to 2 m, with the plants just coming into flower (Figure 3). Young stems are initially green with spines pointing to the ground, turning reddish and blackish as they mature. Older stems die off, but are replaced by resprouting younger branches from the plant base (Figure 4). Young leaves are reddish at first, turning olive-green as they mature. Flowers are an attractive, pinkish colour.

Surprisingly, plants were also recorded by the ecologist Phillip Desmet fairly recently at Pella to the west. These plants were growing in Eastern Gariiep Rocky Desert (Desert Biome) and extending its range further west into the Desert Biome.

Caesalpinia bracteata was assessed for the *Red List of South African plants* and its status assessed as NT D2 (Not Threatened) (Victor et al. 2009).

Caesalpinia bracteata shows horticultural potential for semi-arid to arid gardens and has been introduced into cultivation. Plants given to Kevin Koen more than a decade ago, and planted in his garden at Calitzdorp, Western Cape, flower profusely and have here grown into shrubs of up to 2 m tall. It is best grown in Desert, Succulent Karoo and Nama-Karoo gardens, where frost is not too severe (Van Jaarsveld 2010).



FIGURE 4.—The lower, multistemmed portion of the plant. Note the white prickles. Photograph: E.J. van Jaarsveld.

Description (based on Germishuizen 1991).—Ascending, multistemmed and much-branched shrub, 1–2(–3) m tall. *Branches* renewed from base, at first green, turning reddish and eventually greyish black as plant matures, somewhat longitudinally fissured; young stems terete, puberulous or densely appressed pubescent, becoming glabrous with age and flaking, armed with straight to curving down, white prickles, up to 11 mm long. *Leaves* bipinnate; pinnae 2–4; leaflets 4–6 pairs per pinna, opposite to subopposite, narrowly oblong or oblong elliptic, 3–11 × 2–5 mm, rounded at apex and mucronate, asymmetric basally; young leaves reddish, soon becoming olive-green, glabrous or sparsely puberulous on both surfaces or only along midrib, densely dark gland-dotted on both surfaces; petiole sparsely puberulous, 4–16 mm long; rhachis sparsely puberulous, often prickly at intersection of pinnae pairs. *Inflorescence* a lateral, simple raceme, up to 60 mm long. *Bracts* conspicuous, purple-pink, densely adpressed pubescent, broadly suborbicular, aristate with a sharp arista, deciduous as flowers open. *Flowers* hermaphroditic, purple-pink; sepals 5, dark maroon, conspicuously veined on inside, densely grey appressed pubescent, gland-dotted outside, lower sepal larger and cucullate, forming a hood over other sepals; petals 5, free to base, obovate, up to 12 × 8 mm, glabrous or slightly puberulous on outside; stamens 10, up to 10 mm long; filaments pink, white villous for two-thirds from base, glabrous in upper third; anthers brown, dorsifixed, up to 1.5 mm long; ovary glabrous. *Pods* compressed, broadly oblong-ovoid, beaked 15–22 × 10–15 mm, maroon-brown, hard and woody glabrous. *Seed* more or less obovoid, maroon-brown. *Flowering time*: in habitat usually July–April, with good rainfall plants will flower almost throughout the year. Plate 2330.

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Eriosema distinctum

Fabaceae: Papilionoideae

Southern Africa

Eriosema distinctum N.E.Br. in Kew Bulletin 4: 103 (1906); Medley Wood: 43 (1907); Bews: 505 (1913); Bews: 113 (1921); Verdcourt: 118 (1971); Ross: 208 (1972). Stirton & Gordon-Gray: 397 (1978).

The genus *Eriosema* (DC.) G.Don belongs to the tribe Phaseoleae and it consists of about 150 species worldwide with 100 species in Africa (Leistner 2005; Candido 2016). The name *Eriosema* is derived from the Greek words *erion* in reference to wool, and *semeia* in reference to the indumentum on the back of the standard. The species epithet *distinctum* is of Latin derivation and means separate or different, here probably referring to the difference in flowers. *Eriosema* is closely related to *Rhynchosia* Lour. and differs from it in seed characteristics; mature seeds have a long, linear hilum flanked by a conspicuous, whitish, bilobed structure, which is largest near the point of funicular attachment (Gear & Dengler 1976).

In his treatment of the genus *Eriosema*, Verdcourt (1971) realised that *E. cordatum* E.Mey., *E. populifolium* Benth. ex Harv. and *E. distinctum* are very similar and he suggested that a field study should be carried out to clarify the relationships among these three species. Thus Stirton in 1975 did a field study and it revealed that the three species are morphologically different and that they may be distinguished on three main characters, namely the type of underground system, the vestiture of the plant, and the shape and the size of the flowers (see the key for more differences between the three species). *Eriosema distinctum* is morphologically similar to *E. cordatum* and *E. populifolium* of which it can be distinguished by its large flowers and exsertion of the stigma from the anthers (Stirton & Gordon-Gray 1978).

Eriosema distinctum was first collected in 1884 by W. Tyson in KwaZulu-Natal and this old specimen is housed in Compton Herbarium, Cape Town. The first person to describe *E. distinctum* was Nicholas Edward Brown in 1906. He closely associated the species to *E. oblongum* Harv. (currently known as *Eriosema pauciflorum* Klotzsch var. *pauciflorum*) and *E. kraussianum* Meisn., but separated it based on its large flowers. Later, in 1978, Stirton & Gordon-Gray stated that *E. distinctum* has commonly been confused with *E. cordatum*. It is readily distinguished from the latter by its rhizomatous underground system, the presence of persistent stipels that occur at the apex of the rachis, the general shape of the floral parts, the length of the fruits and the exserted stigma.

Eriosema distinctum is distributed through southern tropical Africa, i.e. Angola, Zambia, Zimbabwe, Malawi, Mozambique and southern Africa (Leistner 2005). In South Africa it occurs mainly in the midlands and uplands of KwaZulu-Natal, extending along the lower



PLATE 2331 *Eriosema distinctum*

Drakensberg to southern KwaZulu-Natal, Limpopo, Mpumalanga and the Eastern Cape provinces (Figure 1) (Plants of Southern Africa [POSA] 2016).

Our species grows in grassland vegetation in rocky soil, at altitudes of up to 1 980 m. It is also very common in overgrazed areas, as cattle do not like eating it (Hilliard & Burt 1987; Pooley 2003). This species produces a vast underground network of shallow acutely-angled branching rhizomes, which has probably accounted for the successful spread of it along roads after road building operations. Stirton (1975) also noted for the first time that *Eriosema distinctum* forms nodules in its roots. *Eriosema distinctum* is animal-pollinated according to Sergio (2012) and in particular bee-pollinated. It has been assessed and has a Red List status of Least Concern (Foden & Potter 2005).

The common names for *Eriosema distinctum* are scarlet eriosema and *Ubangalala olukhulu* in Zulu. The plant is used as human famine food. The Zulu people use decoctions from pounded, boiled roots for urinary ailments and for impotence (Hutchings et al. 1996; Pooley 2003). It is also used as a fish poison.

Key to species in the *Eriosema populifolium* group

(based on Stirton & Gordon-Gray 1978):

- 1a Plants solitary; rootstocks vertical without horizontal rhizomes; flowers yellow or red and yellow; keel blade 6.8–8.0 mm long, 3.0–4.6 mm wide; staminal sheath 5.0–7.2 mm long; gynoeceum 5.0–7.5 mm long, vertical height of style 2–3 mm, stigma hidden by stamens; fruits 15–17 mm long *E. cordatum*
- 1b Plants clonal; rootstocks horizontal or if vertical then with horizontal rhizomes; flowers carmine, or orange and yellow; keel blade 10.0–16.5 mm long, 5–9 mm wide; staminal sheath 9.0–13.5 mm long; gynoeceum 10–16 mm long, vertical height of style 4–7 mm, stigma exerted beyond stamens; fruit 19–22 mm long 2
- 2a Branching of rhizome acute; leaves trifoliolate, upper leaflets 30–80 mm wide, stipules present; young leaflets densely glandular and shortly yellow pubescent between the raised veins which are covered with long appressed silver hairs; stipules mostly straight, length–breadth ratio ca. 2.5; flower bract 7–9 mm long, lanceolate . . . *E. distinctum*
- 2b Branching of rhizomes right-angled; leaves unifoliolate, rarely trifoliolate (Eastern Cape), solitary leaflet or upper leaflet 110–160 mm wide, stipules absent; young leaflets silky, yellow to creamy white when closed but characteristically very shiny silvery-grey when unfolded, glands hidden; stipules falcate, length–breadth ratio ca. 1.7; flower bract 10–15 mm long, deeply boat-shaped 3 (*E. populifolium*)
- 3a Leaves unifoliolate (KwaZulu-Natal) *E. populifolium* subsp. *populifolium*
- 3b Leaves trifoliolate (Eastern Cape) *E. populifolium* subsp. *capensis*

Description (based on Stirton & Gordon-Gray 1978).—Perennial herb 0.07–0.30 m tall with 1–10 stems from vertical underground rootstock or subsurface acutely branching rhizomes, clonal. Stems shortly erect or decumbent, villous with tawny hair interspersed with short deflexed white hairs, or with scant tawny hairs only. Leaves trifoliolate, basal leaves always unifoliolate; leaflets variable, oblong, elliptic or oblanceolate, acute, mucronate, base cuneate or obtuse, 50–115(155) mm long, 30–60(95) mm wide; laterals asymmetrical with oblique bases smaller than symmetrical terminal leaflets, both surfaces green, finely pubescent with appressed hairs; young leaves densely glandular and shortly villous, pubescent between raised veins which are covered with longer appressed silver hairs. Stipules semi-connate, often splitting, 5–22 mm long, 3–10 mm wide, lanceolate, acuminate, stri-

ate, overall tawny outside with short white hairs on ridges, glabrous inside. *Rachis* 1.5–2.2(3.0) mm long with two persistent acro-rachial stipels up to 0.6 mm long. *Racemes* 7–28-flowered, peduncle long, rachis 30–110(210) mm long. *Flowers* carmine or orange or yellow, (12)16–17(20) × 6.5–8.0 mm, reflexed but hooded at apex, bract 7–9 × 1.5–2.0 mm, lanceolate. *Calyx* (5)6–7(9) mm long, either equally lobed with fine white pubescence or unequally lobed with long yellow hairs (with or without short white hairs interspersed), puberulous inside, glandular outside; tube 2.4–3.3(4.0) mm long; lobes lanceolate when unequal, triangular when equal, 5–10 mm long. *Standard* (12)14–17(19) × 9.0–14.0(17.5) mm, obovate to widely obovate, back tomentose, glandular; appendages from large up-curved flaps free of auricles. *Wings* orange, 11–17 × 4–9 mm at maximum, longer than keel blades, eglandular. *Keel blades* 11.5–16.5 × 5.5–9.0 mm at maximum, mostly eglandular. *Staminal sheath* 11–16 mm long; free stamen 9.0–13.5 mm long. *Gynoecium* (10)13–16 mm long; ovary 3.0–4.0(6.5) mm long with 0.8–2.0 mm long gynophores, clothed with long stiff hairs to end of ovary; end of style inflexed; curvature of style 5–7 mm high; stigma slightly flattened on inner face, exserted beyond stamens. *Nectary* 0.4–0.6 mm high, margin repand. *Fruit* 19–23 × 12–13 mm, oblique, softly tawny and interspersed with short white hairs and glands. *Seed* 7.6–8.0 × 4.0–4.5 mm, deep purple black with white aril. *Flowering time*: August–December. Plate 2331.

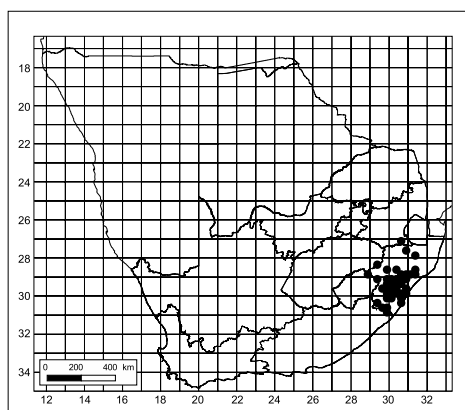


FIGURE 1.—Known distribution of *Eriosema distinctum* in South Africa.

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Adenia wilmsii

Passifloraceae

South Africa

Adenia wilmsii Harms in Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 26: 238 (1899).

Adenia wilmsii is a rare, erect, little-branched shrublet endemic to the lower foothills of the Mpumalanga and Limpopo Drakensberg from near Lydenburg in the north to Waterval Boven in the south (Figure 1). It represents one of 10 species of *Adenia* Forssk. confined to South Africa.

The Passifloraceae, to which our species belongs, have a pantropical distribution with more or less 500 species, most of which are climbers. The largest and best known is the genus *Passiflora* L. with its highest diversity of species centered in the Americas and to which the edible granadilla plant or passion fruit (*Passiflora edulis* Sims) belongs. Forsskål named the genus *Adenia* in 1775 based on *A. venenata* Forssk. (the type species), which occurs in the Yemen, and northern eastern Africa (Ethiopia, Kenya, Somalia and Tanzania). The name *Adenia* is derived from *aden*, meaning gland, and pertains to the glands found on leaves of most of the species (Jackson 1990). Currently the genus *Adenia* consists of 95 species, of which most are stem or root succulents, distributed in Africa, Madagascar and Australasia (De Wilde 2002). Most are toxic, occasionally with spines (*A. spinosa* Burt Davy, *A. pechuelii* (Engl.) Harms), while some have pachypodious caudices (*A. fruticosa* Burt Davy, *A. pechuelii*, *A. spinosa*). *Adenia* is divided into six sections (De Wilde 1971), based on the position of leaf-glands, the inflorescence architecture and flower construction. *Adenia wilmsii* together with its close allies, *A. digitata* (Harv.) Engl., *A. hastata* (Harv.) Schinz and *A. huillensis* (Welw.) A.Fernald & R.Fernald (all southern Africa), belongs to section *Blepharantes* (Wight & Arn.) Engl. This section consists of 34 species of small to large climbers with tubers, of which only two are not African. In section *Blepharantes* the glands are present on the base of the lamina (two or one, or rarely absent), the flowers are uni- or bisexual, the inflorescences axillary (leaves), and the sepals are also partially connate into a calyx tube.

From their close relatives, *Adenia wilmsii* and *A. huillensis* (Angola) are immediately separated by their stems that are without tendrils. However, there the resemblance ends, as *A. huillensis* has leaves that are entire and *A. wilmsii* has leaves that are divided with a rounded outline.

Adenia wilmsii was named in 1899 by Harms from plants collected by Friedrich Wilms (1848–1919), a German chemist from Münster, Westphalia, Germany. Wilms came to South Africa in 1883, arriving at the Cape on 4 July 1883 from where he continued his journey by sea to Durban. From here he took the train to Pietermaritzburg and then trav-



PLATE 2332 *Adenia wilmsii*

elled by ox wagon via Pretoria to Lydenburg where he remained for 13 years and continued his botanical exploration, discovering many new species. He returned to Germany in 1896 (Gunn & Codd 1980). Wilms was also commemorated in *Kirkia wilmsii* Engl., *Streptocarpus wilmsii* Engl. and *Polygala wilmsii* Chodat. He collected his *Adenia* plant near Lydenburg, growing on dolomite and shale outcrops in Lydenburg Thornveld of the Mesic Highveld Grassland Bioregion (Grassland Biome) (Mucina & Rutherford 2006). The Lydenburg Thornveld is situated mainly on the inland plateau, 1 100 to 1 600 m above sea level, in the Mpumalanga Province of South Africa. *Argyrobium wilmsii* Harms, another plant named in honour of Wilms, is prominent throughout the landscape. The vegetation consists mainly of grassland with small trees, such as *Cussonia paniculata* Eckl. & Zeyh., *C. transvaalensis* Reyneke, *Dombeya rotundifolia* (Hochst.) Planch., *Euclea crispa* (Thunb.) Gürke, *Rhamnus prinoides* L'Hér., *Senegalia ataxacantha* (DC.) Kyal. & Boatwr., *S. caffra* (Thunb.) P.J.H. Hurter & Mabb., *Vachellia karroo* (Hayne) Banfi & Gallaso and *V. robusta* (Burch.) Kyal. & Boatwr. *Adenia wilmsii* shares its habitat with other succulents, including *Aloe greatheadii* Schönland var. *davyana* (Schönland) Glen & D.S. Hardy, *A. marlothii* A. Berger, *Crassula capitella* Thunb. subsp. *nodulosa* (Schönland) Toelken, *Euphorbia clavarioides* Boiss., *Kalanchoe thyrsiflora* Harv. and *Lopholaena coriifolia* (Sond.) E. Phillips & C.A. Sm. The vegetation is subject to regular burns and well adapted to fires. *Adenia wilmsii* has a re-sprouting subterranean caudex which escapes fires during the dry winter months. It grows on rocky outcrops in grassland among shrubs. Our depicted plant was collected by one of us (GC) from the Ntsinini Private Nature Reserve, Waterval Onder, Mpumalanga. Rainfall in its habitat is about 500–800 mm per annum, mainly by thunder-showers, with hot and humid summers, but dry winters with frost frequently occurring at night. *Adenia wilmsii* is not common and has a Red List status of Endangered (Declining) with its leaves reportedly used in traditional medicine (Von Staden et al. 2009).

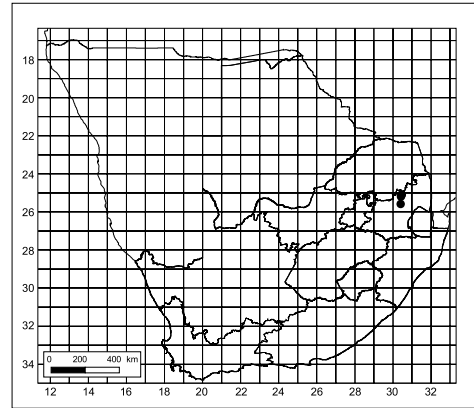


FIGURE 1.—Known distribution of *Adenia wilmsii*.

The glands at the bases of leaves act as extrafloral nectaries and secrete a type of nectar. Ants are attracted to the nectar and feed off it, in turn, protecting the plants. Additionally, *Adenia* plants are inedible to very toxic to humans, as they contain cyanogenic compounds with the possible presence of modeccine.

The genus *Adenia*, with their attractive grey to green caudices and tapering stems, is favoured among succulent plant enthusiasts. Popular southern African species with large caudices include *A. glauca* Schinz, *A. pechuelii* and *A. spinosa*. *Adenia fruticosa* has an attractive tapering green and grey caudex. *Adenia wilmsii* plants, like their close relatives, have their tubers below or partly above the ground and do not have the same appeal as most of the larger caudiciform plants; therefore they are mainly grown as a curiosity and for their rarity. One of us (EJV) was privileged to be able to grow *A. wilmsii* for a number of years in the Botanical Society Conservatory at Kirstenbosch National Botanical Garden

from plants collected and donated by Fanie Venter, formerly from the University of the North (University of Limpopo, Turfloop campus). According to Venter (1993), who collected the plants in the Lydenburg district, *A. wilmsii* grows between 1 300 and 1 500 m above sea level. He collected his plants on loam to clay loam, dolerite-derived soil and observed flowers and fruits from September to December.

Adenia wilmsii is easily grown in a well-drained soil mixture and would be best suited in bushveld and highveld gardens (Van Jaarsveld 2010). It prefers full sun but will also grow in light shade.

Description (after De Wilde 1976).—Slow-growing, long-lived, ascending shrublet, from tuberous rooted base. Leaves glaucous green, 5–7 pseudo-foliolate, outline broadly ovate to suborbicular, base cordate, 20–80(120) × 20–60(100) mm; leaflets sessile, entire to pinnately 3–7-lobed, ovate-oblong, base attenuate, apex acute, 10–60(100) mm long, middle leaflet largest; margin entire; petiole 20–80(100) mm; glands 2, at blade-base between leaflets, on auricles at transition to the petiole. *Stipules* lanceolate, 1–3 mm long. *Inflorescences* pedunculated for 5–50 mm, 1–3-flowered in male, 1(–3)-flowered in female; no tendrils. *Male flowers* tubiform to infundibuliform, 20–25 mm long including stipe of 4–6 mm long; hypanthium cup-shaped, 2–3 mm; calyx tube 7–8 × 2–5 mm, lobes elliptic or oblong, obtuse, 6.0–7.5 mm, entire; petals oblanceolate, 7–10 mm long, 3–5 nerved, subentire, inserted at same level as or up to 3 mm above corona; filaments 4.0–5.5 mm, connate for 1.5–2.5 mm, inserted on a short androgynophore; anthers 3.5–4.5 mm; septa 2–3 mm high; corona hairs 0.5–1.0 mm; disc-glands 0.5 mm long. *Female flowers* tubiform to campanulate; hypanthium ± 1 mm long; calyx tube 5 mm, 3-nerved, subentire, inserted at the same level as the corona; staminodes ± 2.5 mm long; septa ± 1 mm high; corona hairs ± 0.5 mm; disc-glands ± 0.5 mm; gynophore 1.5(2.0) mm; stigmas subglobose, papillate, each ± 1.5 mm in diameter; styles connate for 0.7 mm, style arms ± 1 mm long; ovary ovoid-ellipsoid, 4.0–4.5 mm long. *Fruit* 1 per inflorescence, ellipsoid, ± 40 × 25 mm, gynophore ± 5 mm long; pericarp thinly coriaceous; seeds unknown. *Flowering time*: October. Plate 2332.

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Esterhuysenia lucilleae

Aizoaceae

South Africa

Esterhuysenia lucilleae Van Jaarsv. sp. nov. differs from *E. grahambeckii* Van Jaarsv. by its shrubby habit and much larger, slightly laterally compressed leaves and floral petals of 35–40 × 1.5 mm, as well as its flowering time, which is during spring.

TYPE.—South Africa, Western Cape, 3319 (Worcester): Dome Kloof, Hex River Mountains, ledges on south-facing cliffs, (–AD), Van Jaarsveld & Stander 26952 (NBG, holotype).

Cliffs on rugged mountainous areas are of the least botanically explored habitats in the world for understandable reasons. I have always watched the huge cliffs of the Hex River Mountains below Matroosberg – at an altitude of 2 249 m the highest peak of the Hex River Mountains – and for many years wondered about the best way to approach these rock faces as part of a study of obligatory succulent and bulbous cliff-dwelling plants (cremno-phytes). I was then fortunate to join the snow protea (*Protea cryophila*) team, an annual event arranged by Ernst Hartwig, in January 2013 to the Cederberg where I met Retief Jordaan, grape farmer and mountaineer from the Hex River Mountains. He told me that for the past 35 years he had been leading mountaineering expeditions down the Groothoekkloof below the Matroosberg (Figure 1), and that I was welcome to join them on yet another expedition in February 2013. The Groothoekkloof represents one the most rugged and dangerous kloofs in the area (Figure 2), with a series of about 12 abseils (some directly into pools or next to wet waterfalls). The Groothoekkloof starts from near the top of Matroosberg at about 2 000 m above sea level, and can only be explored during the hot, dry season (February) due to extreme conditions at other times of the year. I joined Jordaan's team the following month and was not disappointed, as it was here that I came across an unnamed species of *Esterhuysenia* (named *E. lucilleae* here), as well as a new species of *Haemanthus* in flower.

This mesemb, an ascending soft-leaved succulent shrublet with glaucous leaves, was encountered on the middle southern slopes above 1 000 m, growing on a sheer rock wall (Figure 3). The plant was only found in fruit, and I immediately identified it as a species of *Esterhuysenia* by its vegetative growth as well as its capsules, which showed affinity with *E. grahambeckii* – a fairly recently named species from the Rooiberg (Van Jaarsveld 2011b). I realised that it possibly represented a new species. Although I collected cuttings to grow and observe the flowers, I knew that many of these alpine mesembs refuse to flower in warm terrain close to sea level and, in spite of the best possible care, these indeed did not flower at Kirstenbosch National Botanical Garden.

The genus *Esterhuysenia* (Ruschioideae) is a small mesemb genus of six species, confined to mountainous peaks along the Western Cape, South Africa. They are characterised by their

PLATE 2333.—1, seedling, much reduced; 2, mature flowering branches, × 1; 3 and 4, developing fruit, × 2 and × 2.5 respectively; 5, mature open capsule, × 2.5. Voucher specimen: Van Jaarsveld & Stander 26952, Compton Herbarium, Cape Town. Artist: Marieta Visagie.



PLATE 2333 *Esterhuysenia lucilleae*

usually firm leaves bearing a distinct mucro and capsules with low rims and with very narrow wings (Hartmann 2001). Three of these grow mainly on cliffs. The Aizoaceae, to which our species belongs, is the largest succulent plant family in South Africa (Van Jaarsveld 1988) with centres of diversity in the Western and Northern Cape, and also well represented in Fynbos regions.

During October of the same year (2013), Lucille Krige sent me photos of a mesemb found by her and Tom Jordan (from Worcester) at Dome Kloof (Hex River Mountains). I immediately realised its distinctness and an expedition was arranged to its habitat early in November 2013. We reached the original site where she and Tom had found the plant and upon investigation I realised it was the same species that I had collected earlier that year from Groothoekkloof, representing a new species, *Esterhuysenia lucilleae*.

During December 2013 I joined yet another expedition to the Hex River Mountains with Retief Jordaan and Kallie Pauw, this time to the Buffelshoekkloof where we ascended and stayed overnight at Perry Refuge (a mountain hut). Early the second morning we continued to Buffelhoek Peak, past the Shale Peaks, and descended via Milner Kloof. Our mission was to investigate the south-facing cliffs along this portion of the Hex River Mountains for any cremnophytes. Again we encountered *Esterhuysenia lucilleae* on cliffs in the Buffelshoekkloof, as well as Milner Kloof (Figure 4) and now realised that it was quite common on sheer, south-facing cliffs along the Hex River Mountains from the Buffelshoekkloof to Matroosberg in the northeast.

Another expedition was arranged in October 2016 to obtain fresh flowers for the botanical artist, and the species was once more visited at Dome Kloof together with entomologist Arne Stander. It was from this material that the description was drawn up, type material gathered and pressed, and live plants in flower presented to and drawn by Marieta Visagie (Figure 5).

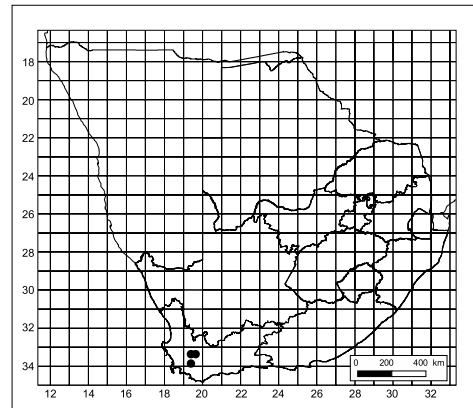


FIGURE 1.—Distribution of *Esterhuysenia lucilleae*.



FIGURE 2.—The Groothoekkloof, habitat of *Esterhuysenia lucilleae*. Photograph: E.J. van Jaarsveld.



FIGURE 3.—*Esterhuysenia lucilleae* at the Groothoekkloof below Matroosberg. Photograph: E.J. van Jaarsveld.

Anso le Roux, botanist and ecologist from Worcester, also collected a mesemb (live cuttings of a sterile plant) from a cliff face in the Stettynskloof on 6 April 2012, which she photographed and brought to me. The plant, as expected and like the other gatherings from higher altitudes along the Hex River Mountains, subsequently did not flower at Kirstenbosch due to its warmer, semi-coastal climate. This plant was sterile but reminded me of *Esterhuysenia grahambeckii*. It was only recently (October 2016) that Anso was able to show me the site in Stettynskloof where she originally found the plant, and, fortunately, it was in flower (Figure 6). To our surprise, it represented the new *E. lucilleae*, and from a new location, the first for Du Toitskloof Mountains (Figure 7). Therefore, Anso le Roux was the first person to find this species, but it took a few years before the plant was investigated in habitat.



FIGURE 4.—*Esterhuysenia lucilleae* in flowering on a cliff in Dome Kloof. Note the long calyx lobes of the young flowers. Photograph: E.J. van Jaarsveld.



FIGURE 5.—*Esterhuysenia lucilleae* in flower on a cliff at Dome Kloof. Photograph: E.J. van Jaarsveld.

Esterhuysenia lucilleae is at once distinguished from *E. grahambeckii* by its shrubby growth (not mat-forming), longer leaves and remarkably large, rose- to cerise-pink flowers during spring (October) (Van Jaarsveld 2011a) (Figure 8). It represents the species with the largest flowers in the genus and has several unique characteristics. The calyx lobes are twice as long as the young fruit in *E. lucilleae* (Figure 4), whereas they are as long as the fruit in *E. grahambeckii*. Both species have soft, glaucous leaves. The vegetation and geology also differ for the two species; for more differences see Table 1.

The floral petals, or petaloid staminodes, of *Esterhuysenia lucilleae*, like those of *E. grahambeckii*, are not carried on one plane, but are ascending-spreading (at various degrees like a cactus dahlia). This feature makes it difficult to see the inner parts, reminiscent somewhat of some species of *Erepsia*. The long, slender petals remain on



FIGURE 6.—*Esterhuysenia lucilleae* in flower at Stettynskloof where Anso le Roux originally found plants in 2011. Photograph: E.J. van Jaarsveld.

TABLE 1.—Differences in the vegetative, reproductive and habitat characters of *Esterhuysenia grahambeckii* and *E. lucilleae*

Character	<i>E. grahambeckii</i>	<i>E. lucilleae</i>
Habit	Mat-forming	Ascending shrublets
Leaves	14–17 × 3–4 mm, subterete to trigonous	22–34 × 2 mm, slightly laterally compressed
Calyx lobes and floral petals	Calyx lobes as long as fruit, floral petals 25–30 × 1 mm	Calyx lobes twice as long as fruit, floral petals 35–40 × 1.5 mm
Flowering time and floral diameter	Summer (December), 50–65 mm	Spring (October), 70–80 mm
Capsule	8–9 mm in diameter, 5 mm deep	7–8 mm in diameter, 5–7 mm deep
Seed	1.3 × 1 mm, reddish-brown	1.5 × 0.9 mm, reddish-brown
Vegetation type	Breede Quartz Fynbos	South Hex Sandstone Fynbos
Geology (Cape Supergroup)	Witteberg Group	Table Mountain Group

the plant after pollination when the inner floral parts become visible. Unlike most other mesembs from non-cliff sites, the cliff-dwelling mesembs' hygroscopic capsules remain open after initial opening, with short, erect, covering membranes and slightly flattened seeds, which are wind dispersed (Van Jaarsveld & Van Wyk 2003). This indicates that wind is the major agent used by obligatory succulent cremnophytes for dispersing their seeds. The flattish seeds are deposited in crevices or among lichens on the cliff where germination takes place. Seeds of most other mesembs are dispersed by raindrops, a mechanism known as ombrohydrochory. The kinetic energy of falling raindrops eject the seeds (Hartmann 1990).

The typical associated vegetation of *Esterhuysenia lucilleae* is sub-alpine and consists of South Hex Sandstone Fynbos (Mucina & Rutherford 2006), which is part of the Fynbos Biome – a shrubby, fire-driven vegetation type extremely rich in species and with high levels of endemism. The nutrient-poor and acidic soil is derived from the sandstones of the Table Mountain Group (Cape Supergroup). The climate is dry and windy in summer, with cool to cold winters, often with snow. Rainfall is mainly during the winter and between 1 000 and 2 000 mm per annum. During winter, the south-facing cliffs receive little to no sun, but rather open shade. The distribution of



FIGURE 7.—*Esterhuysenia lucilleae*, first discovered by Anso le Roux from Stettynskloof on 6 April 2012. Photograph: A. le Roux.

our new species thus extends along the Hex River Mountain Range as well at Stettynskloof near Rawsonville (Figure 1).

At the Groothoekkloof and other sites I have observed that *Esterhuysenia lucilleae* shares its habitat with other succulents such as *Aloe perfoliata*, *Crassula atropurpurea* var. *anomala*, *C. dentata*, *C. nudicaulis*, *C. obtusa*, *C. pellucida* subsp. *spongiosa*, *Haemanthus* sp. and *Haworthia arachnoidea*. Plants grow in shallow soil in crevices on cliffs or steep slopes, often among moss and lichens in full light, and often in areas that cannot be reached by fires.

We have pleasure in naming this species after Lucille Krige, a keen hiker in the mountains of the Western Cape, who regularly notifies me of succulents observed on her expeditions. She brought the flowering plant to my attention, which led to its description here.

Description.—Much-branched ascending shrublet, 250–300 mm high. *Roots* fibrous. *Main branch* woody, about 5 mm in diameter at the base, longitudinally fissured and with dark brown to blackish bark, younger branches about 2.5 mm in diameter, glaucous; internodes 5–20 mm apart, surface smooth. *Leaves* fleshy, subterete to somewhat laterally compressed, linear-lanceolate, falcate, 22–34 × 2 mm, lateral sides 2.5 mm high; adaxial surface flat, abaxial surface rounded, surface glaucous green, minutely papillate; apex acute, incurved, mucronate. *Flowers* solitary, at branch ends, 70–80 mm in diameter; pedicels 15–23 mm long. *Receptacle* top-shaped to globose, 8 mm high and 8 mm in diameter at top; *sepals* 5, triangular-acuminate, slightly unequal in length; inner 2 with translucent mar-



FIGURE 8.—Close-up of the rose-pink flowers of *Esterhuysenia lucilleae*. Note persistent petals of the old flower. Photograph: E.J. van Jaarsveld.

gins, 8×4 mm; outer 3 triangular-acuminate, $12\text{--}16 \times 4$ mm. *Petaloid staminodes* numerous, in 3 series, persistent after flowering, linear-lanceolate, ascending-spreading, rose- to cerise-pink, $35\text{--}40 \times 1.5$ mm, apices acute, persistent after flowering; *filamentous staminodes* absent; *filaments* in about 3–4 series, 3 mm long, base with dense translucent trichomes 0.5 mm long; *anthers* 1×0.3 mm, yellowish to cream, not completely overtopping stigmas. *Gynoecium* convex at top, 7 mm in diameter, with 5 raised obtuse sutures, green, elevated up to 1 mm; nectaries narrow, crenulated, continuous and surrounding ovary; stigmas 5, ascending, triangular subulate, 2.5 mm long, arising from sunken centre between sutures or lobes, tapering, papillate and partially concealed by stamens. *Capsule* 5-locular, hygroscopic, top-shaped, 7–8 mm in diameter, 5–7 mm deep, top rounded; open capsule up to 8–12 mm in diameter, valve wings and closing body absent, expanding keels about 2 mm long and 0.7 mm in diameter, parallel at base diverging widely, acute and incurved at apices; once opened the capsule remains open; covering membranes ascending. *Seeds* pear-shaped, 1.5×0.9 mm, reddish-brown, tuberculate, flattened. *Flowering time*: during October. Plate 2333.

SPECIMENS EXAMINED

Western Cape: 3319 (Worcester). (–AD): Dome Kloof, sheer cliffs, *Van Jaarsveld & Krige* 25141, 25563 and *Van Jaarsveld & Stander* 26952 (NBG); Buffelshoekkloof, sheer cliffs, *Van Jaarsveld, Pauw & Jordaan* 25154 (NBG); Milnerkloof, on boulders upper end of Kloof, *Van Jaarsveld & Jordaan* 25184 (NBG). (–BC): Groothoekkloof, sheer south-facing cliffs, *Van Jaarsveld & Jordaan* 24703 (NBG). (–CD): Stettynskloof, sheer south-facing cliffs, *Van Jaarsveld, Le Roux & Stander* 26964 (NBG).

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Pisonia aculeata

Nyctaginaceae

Tropical and southern Africa

***Pisonia aculeata* L.** in Species Plantarum 2: 1026 (1753). *Pisonia mitis* L.: 1026 (1753); *Pisonia villosa* Poir.: 347 (1804). *Pisonia loranthoides* Kunth: 197 (1825). *Pisonia limonella* Blume: 735 (1826). *Pisonia sieberi* Schltr.: 876 (1849). *Pisonia monotaxadenia* C.Wright.: 199 (1870). *Pisonia yagua-pinda* D.Parodi: 211 (1878).

Pisonia L. is a large genus in the Nyctaginaceae with 40 species distributed throughout the tropical and subtropical areas of the world (Whitehouse 1996; Douglas & Spellenberg 2010). The genus is probably best known for the bird-catching trees (Quattrocchi 2012), as the sticky anthocarps of some species (e.g. *Pisonia grandis* R.Br.) frequently become entangled in the feathers of seabirds, causing hundreds of bird fatalities (Burger 2005).

Pisonia is morphologically distinct from the other Nyctaginaceae genera (namely *Boerhavia* L., *Commicarpus* Standl., *Mirabilis* L. and *Phaeoptilum* Radlk.) in southern Africa. *Boerhavia*, *Commicarpus* and *Mirabilis* are unarmed, annual or perennial herbs, with white, pink, purple, or variegated flowers, while *Pisonia* has yellow or greenish flowers. *Phaeoptilum* is an armed shrub with greenish-yellow flowers, but differs from *Pisonia* in having linear leaves and winged anthocarps (*Pisonia* has ribbed anthocarps with viscid stipitate glands). A comparison of the vegetative and reproductive characters of the Nyctaginaceae genera from southern Africa is given in Table 1 of Struwig et al. (2015).

Pisonia is represented by one species in southern Africa, namely *P. aculeata* L. (Germishuizen & Meyer 2003). It is a shrub or small tree with scandent branches that creep along the forest canopy. The branches are covered in curved, axillary spines and the branchlets are characteristically at right angles to the branches. These spiny branches, together with the ellipsoid leaves (Figure 1), give this species a remarkable resemblance to that of cultivated bougainvillea, hence the common name of false bougainvillea (Palgrave & Palgrave 2002). It is also known as *valspapierblom* (Afrikaans) and as *umQopho*, *uSondesa*, or *Nsuwu* (Zulu) (Palgrave & Palgrave 2002; Boon 2010).

Pisonia aculeata has a pantropic distribution, although it is considered to have been introduced to Africa from tropical America (Stannard 1988; Spellenberg 2004). In southern Africa, *P. aculeata* is restricted to the dune forests and riverine vegetation of KwaZulu-Natal and southern Mozambique (Boon 2010) (Figure 2).

A second species of *Pisonia*, namely *P. grandis*, occurs in tropical Africa (Klopper et al. 2006). It can be distinguished from *P. aculeata* in that it is an unarmed and tall tree up to 30 m tall. The bisexual flowers are arranged in terminal cymes and the ribs on the anthocarps

PLATE 2334.—1, flowering branch, × 1; 2, male flower, × 4; 3, female flower, × 1; 4, fruiting branch, × 1; 5, pair of curved thorns, × 1. Voucher specimen: Struwig 158 in University of Zululand Herbarium. Artist: Gillian Condy.



PLATE 2334 *Pisonia aculeata*

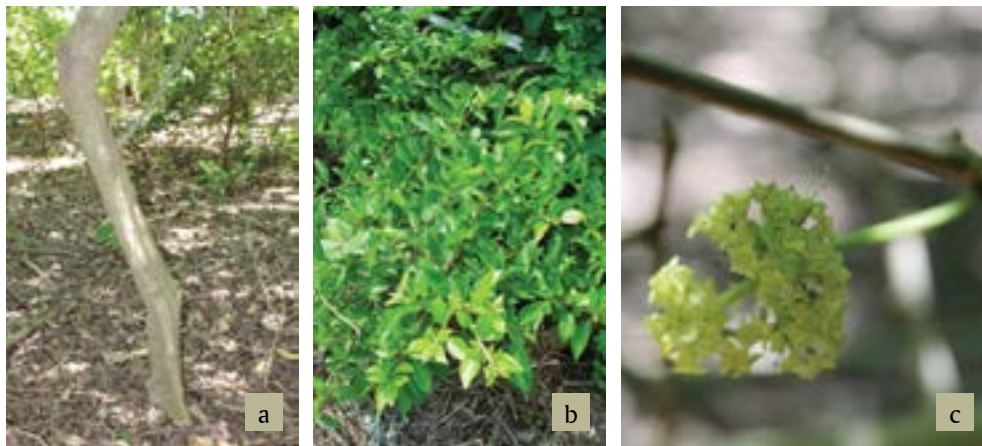


FIGURE 1.—*Pisonia aculeata*: a, stem; b, habit; c, flowers. Photographs: a, c, M. Struwig; b, G. Nichols.

are covered in a single row of viscid, stipitate glands (Stemmerik 1964; Whitehouse 1996). *Pisonia aculeata*, however, has unisexual flowers arranged in axillary cymes and the ribs on the anthocarps are covered in a double row of viscid, stipitate glands (Table 1).

The leaves of *Pisonia aculeata* are edible (Zomlefer 1994), and the stem and leaves are used in Jamaica, the Philippines and India to treat various ailments such as rheumatism, swelling, scabies, jaundice, coughing and venereal diseases (Quisumbing 1951; Ayensu 1978; Nadkarni 2005). In Africa, the juice from the leaves is used as drops against earache in Côte d'Ivoire (De Ruijter 2008), and in Ghana it is considered to be a good indication of soil that is suitable for growing cacao trees (Hutchinson & Dalziel 1937). There are no recorded uses for this plant in southern Africa.

Pisonia is named after the Dutch physician, botanist, traveller, pharmacist and pioneer of tropical medicine, Willem Piso (1611–1678) (Bogle 1974; Boon 2010). The specific epithet, *aculeata*, means 'prickly' and refers to the axillary spines on the branches (Stearn 1992). *Pisonia aculeata*, the type species of the genus *Pisonia*, was already known to the botanical community before Linnaeus published the name in his *Species Plantarum*. It was known to Charles Plumier (1646–1704), who illustrated the species during his travels in the West Indies (Plumier 1703), as well as to Georg Rumphius (1627–1702), who illustrated and described the species in his *Herbarium Amboinense* (Rumphius 1747). The classification of the species has remained unchanged thereafter.

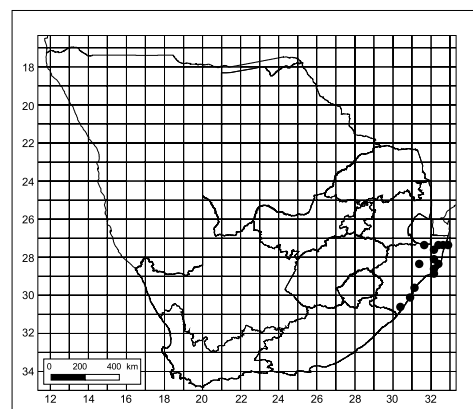


FIGURE 2.—Known distribution of *Pisonia aculeata* in the Flora of southern Africa region based on herbarium specimens housed in various herbaria. It is known from literature to occur further north in Africa.

TABLE 1.—Comparison of the vegetative and reproductive characters of the *Pisonia* species present in tropical Africa

Character	<i>Pisonia aculeata</i>	<i>Pisonia grandis</i>
Habit	Scandent shrub or small tree; armed with axillary spines	Shrub or tree up to 30 m tall; unarmed
Leaf size	20–100 × 10–65 mm	70–300 × 40–150 mm
Leaf texture	Subcoriaceous	Membranous
Inflorescence	Axillary cyme	Terminal cyme
Flowers	Unisexual	Bisexual
Flower colour	Yellow or greenish	Green
Anthocarp	Cylindrical to narrowly oblong; five ribs covered in double row of short ($\pm$ 0.5 mm long) viscid stipitate glands	Cylindrical to clavate; five ribs covered with a single row of long ($\pm$ 1 mm long) viscid stipitate glands

Pisonia aculeata flowers from November to April and produces fruits from January to May.

Description.—Scandent shrub or small tree; dioecious; stem up to 200 mm in diameter; bark whitish to pale brown; young branches smooth, older branches fissured; branchlets slender, spreading, at right angles; spines up to 100 mm long, axillary, single or paired, curved becoming straight, glabrous to pubescent. Leaves simple, opposite, sometimes alternate or whorled; petiole up to 30 mm long; lamina 20–100 × 10–65 mm, elliptic to broadly elliptic, sometimes obovate, apex acute to acuminate or obtuse, base acuminate or attenuate, margin entire, dark green above, light green below, subcoriaceous, glabrate to pubescent. Inflorescence a panicle cyme, with $\pm$ 30 flowers, axillary; peduncles up to 30 mm long, pubescent; pedicels 1–2 mm long but much elongated in fruit, pubescent; 3–4 bracteoles, ovate-oblong, pubescent. Flowers unisexual; perianth 5-lobed, yellow or greenish, scented. Male flower up to 3 mm long; perianth campanulate, urceolate to funnel-shaped; stamens 5–10, exserted; filaments 3–5 mm long, connate into a short tube at base; anthers subglobose. Female flowers up to 2 mm long; perianth similar to male flowers but with an enlarged base; ovary 1.5–1.7 mm long, sessile or stipitate, elliptic-ovate, 1-ovulate; stigma and style exserted. Anthocarp 9–15 × 3–4 mm, cylindrical to narrowly oblong, dark brown, 5-ribbed, ribs covered in double row of conspicuous viscid stipitate glands, surface between glands minutely to densely pubescent. Plate 2334.

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Schizostephanus alatus

Apocynaceae

South Africa to east tropical Africa

Schizostephanus alatus Hochst. ex K.Schum. in *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie*: 139, t.6 (figures N–Q) (1893). Goyder et al.: 466 (2012). *Cynanchum validum* N.E.Brown: 398 (1903), non *Cynanchum alatum* Wight & Arn.: 57 (1834).

Schizostephanus alatus is a twining, winter deciduous, succulent-stemmed, creeper bearing greyish, often articulated, stems that are 0.5–4.0 m long. The side branches are somewhat brittle and will root when they become detached or if they touch the substrate. *Schizostephanus alatus* grows in rocky screes in dry river valleys. The mature stems and leaves superficially resemble those of *Tinospora fragosa* (L.Verd.) I.Verd. & Troupin with which it sometimes shares the same habitat in Limpopo Province. It has a widespread distribution range in eastern Africa where it grows on screes from Somalia and Kenya in the north, to Limpopo and Mpumalanga provinces, South Africa, in the south (Figure 1).

The genus *Schizostephanus* was established by Bentham and Hooker (1876). It was sunk under the genus *Cynanchum* L. by Brown in 1903. Liede (1994) reinstated *Schizostephanus* based on the long hairs on the adaxial side of the corolla lobes, stipitate gynostegium and the attachment of the pollinia along the dorsal rims, as well as the clear sap of its only two members, *S. gossweileri* (S.Moore) Liede and *S. alatus*. A contribution on *S. gossweileri* appeared in a previous volume of this journal (Van Jaarsveld & Visagie 2015) and is only known from northern Namibia and adjacent southwestern Angola (Bruyns & Klak 2009). The genus *Schizostephanus* is related to *Cynanchum*, the latter with about 250 species and a cosmopolitan distribution of which 31 are confined to Africa (Liede 1996). *Cynanchum somaliense* N.E.Br. has, for some time, been treated as a close relative of *S. alatus*, however, the evidence is based on superficial morphological character expressions (Liede 1996). Species of *Cynanchum* differ by their usually evergreen foliage, umbellate inflorescences, distinct milky latex and with most members not distinctly succulent (Bruyns & Klak 2009). The familiar *Cynanchum viminalis* (L.) Bassi (*Sarcostemma viminalis*) is probably the best known species recently transferred to *Cynanchum*. *Schizostephanus alatus* differs from *S. gossweileri* by its smaller stature, leaves and reproductive features. The stems of *S. alatus* are 5–7 mm in diameter, with stems of *S. gossweileri* 10 mm in diameter. Leaves of *S. gossweileri* are slightly pubescent with blades 60–130 mm long, whereas they are glabrous with blades 35–80 mm long in *S. alatus*. Inflorescences are bostrychoid in *S. alatus* and elongated in *S. gossweileri*. The specific epithet, *alatus*, is in reference to the species' follicles which are distinctly winged.

Our depicted plant of *Schizostephanus alatus* (Van Jaarsveld, Haumann & Swanepoel 23008) was collected on Serra das Neves in southwestern Angola in April 2010 on an exposed northeastern scree just above Aalwynnek, where we camped at about 1 300 m

PLATE 2335.—1, plant showing mature branches (left), and younger branches with inflorescence (right), $\times 1$; 2, corolla from below, $\times 3.5$; 3, corolla from above, $\times 3.5$; 4, cross section of the young stem, $\times 1$. Voucher specimen: Van Jaarsveld, Haumann & Swanepoel 23008 in Compton Herbarium, Cape Town. Artist: Marieta Visagie.



PLATE 2335 *Schizostephanus alatus*

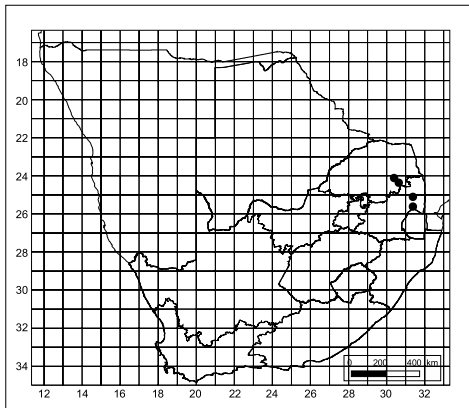


FIGURE 1.—Distribution of *Schizostephanus alatus* in the Flora of southern Africa region.

above sea level (Figure 2). Serra das Neves consists of an isolated granite inselberg. It is situated south of the town of Benguela in southwestern Angola, roughly 60 km from the Atlantic Ocean, with its highest point at 2 489 m. *Schizostephanus alatus* was observed on granite screes growing in shallow soil. The plant tends to scramble and also twine into low vegetation. The vegetation type is moist savanna with associated plants including *Ceraria carrisoana* Exell & Mendonça, *Commiphora crenatoserrata* Engl., *C. mollis* (Oliv.) Engl., *C. tenuipetiolata* Engl., *Cussonia angolensis* (Seem.) Hiern, *Ficus glumosa* Delile, *Mundulea sericea* (Willd.) A.Chev., *Obetia carruthersiana* (Hiern) Redle and *Pouzolzia mixta*

Solms. Associated succulent plants include *Aeollanthus rehmannii* Gürke, *Aloe scorpioides* L.C.Leach, *A. zebrina* Baker, *Bowiea volubilis* Harv. ex Hook.f., *Othonna huillensis* Welw. ex Hiern, *Plectranthus amboinicus* (Lour.) Spreng., *Sansevieria hyacinthoides* (L.) Druce and *S. pearsonii* N.E.Br.



FIGURE 2.—Scree habitat of *Schizostephanus alatus* on Serra das Neves in southwestern Angola at elevation of about 1 500 m. Photograph: E.J. van Jaarsveld.



FIGURE 3.—*Schizostephanus alatus* in habitat at the Strydom Tunnel, Mpumalanga. Photograph: E.J. van Jaarsveld.

Schizostephanus alatus was also collected from screes at the base of cliffs on the Leba Pass west of Lubango in southwestern Angola (Van Jaarsveld 22609). Here the plants were growing below steep cliffs on scree in association with *Adenia gummifera* (Harv.) Harms, *Dombeya rotundifolia* (Hochst.) Planch., *Euphorbia vallis* L.C. Leach, *Kalanchoe lanceolata* (Forssk.) Pers., *K. laciniata* (L.) DC., *Myrothamnus flabellifolius* Welw., *Obetia carruthersiana*, *Sansevieria hyacinthoides* and *S. pearsonii*.

In Mpumalanga plants (Van Jaarsveld 1097) were observed along the Crocodile Gorge between Mbombela and Malelane growing in granite screes below *Homalium dentatum* (Harv.) Warb. trees in Malelane Mountain Bushveld of the Lowveld Bioregion (Mucina & Rutherford 2006) at an altitude of about 450 m. During the colder winter months the plants becomes deciduous.

Schizostephanus alatus was also observed on sandstone scree adjacent to the Strydom Tunnel in Mpumalanga in April 2015 (Van Jaarsveld 25851) (Figure 3). Plants grew in association with *Cotyledon barbeyi* Schweinf. ex Baker, *Crassula ovata* (Mill.) Druce, *Dombeya autumnalis* I. Verd., *Dracaena transvaalensis* Baker, *Portulacaria afra* Jacq. and *Sclerochiton ilicifolius* A. Meeuse.

One may very well ask what characteristics give a twining shrub a competitive advantage over typical, woody, savanna plants. *Schizostephanus alatus*, with its succulent stems, is

able to survive and grow successfully in dry rocky scree where the soil dries out fast. Therefore, the species has less competition from trees and shrubs in that particular microhabitat, especially in terms of soil moisture for root growth and light. This ecological advantage enables *S. alatus* to grow in soil that remains dry throughout the winter months, where it simply resprouts new shoots and leaves during the summer rainy season.

Schizostephanus alatus flowers mainly during midsummer (January to February). Seeds are wind-dispersed in autumn. The climate in which it occurs is subtropical to tropical and frost is absent from the habitat.

Schizostephanus grows well in cultivation, both in containers and, if the climate permits, in dry, well-drained, hot gardens. It is best grown in bushveld gardens (Van Jaarsveld 2010). The plant can be propagated from stem cuttings rooted in clean sand. If it is grown outside of its natural habitat, it fares best when grown in a greenhouse under controlled conditions. If the climate permits it is best grown on steep embankments, gabions, or rockeries where frost is either absent or not too severe.

Specimens examined: Angola: Serra das Neves, middle southwestern screes, altitude 1 500 m, 22 April 2010, *Van Jaarsveld, Haumann & Swanepoel 23008* (NBC); Leba Pass, west of Lubango, on screes below cliffs, 1 600 m, 16 January 2009, *Van Jaarsveld 22609* (NBC). South Africa: 26 km from Nelspruit [Mbombela] towards Kaap Muiden–Krokodil Poort, 13 March 1976, *Van Jaarsveld 1097* (PRE); Strydom Tunnel, 1 308 m altitude, 12 April 2015, *Van Jaarsveld 25851* (NBC).

Description (partially based on Liede 2003).—Succulent shrubs 0.5–4.0 m tall. *Roots* fibrous. *Stems* twining, succulent, sparingly branched, scrambling or ascending, becoming deciduous from autumn to end of spring; branches at first green, $\pm$ 5–7(–14) mm in diameter, becoming sparsely brown and glabrescent eventually becoming pale grey to greyish-brown; main branch up to 16 mm in diameter (at base), internodes 4–35 mm apart often sub-articulated, the younger branches green. *Leaves* decussate, pendent spreading, bright green, glabrous, broadly ovate-cordate, 35–80 $\times$ 30–75 mm, apex acute, base cordate; petioles 20–40 $\times$ 2 mm. *Inflorescence* umbellate, to 50 mm long, axillary on young green side branches, 15–30-flowered (3–12 flowers open at the same time), ascending, bostrychoid, sometimes basally dichasial; peduncles 35–55 mm long; pedicels 6–8 mm long; floral buds 5–6 $\times$ 1.5–2.0 mm, elongated conical. *Corolla* lobes fused basally, 5 $\times$ 1 mm, twisted, oblong, apically obtuse, yellow, and sometimes basally purple. *Corona* white, 3.5–4.0 mm high exceeding the gynostegium; staminal and interstaminal parts fused for more than three-quarters of total corona length, free parts of staminal lobes ovate to bifid, free parts of interstaminal lobes ovate to oblong. *Gynostegium* 1.0 $\times$ 1.5 mm, on top of stipe 1.5–1.8 mm long. *Stylar head* 1.0 $\times$ 0.5 mm; apex flat. *Follicles* erect 45 mm long, apically shortly beaked, winged, glabrous. Plate 2335.

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PLATE 2336 *Gomphocarpus glaucophyllus*

Gomphocarpus glaucophyllus

Apocynaceae: Asclepiadoideae

Burundi, Malawi, Rwanda, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe

Gomphocarpus glaucophyllus Schltr. in Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 18, Beibl. 45: 19 (1894); Schlechter: 31 (1895); Wild: 63 (1965); Binns: 21 (1968); Nicholas: 170 (1999); Goyder & Nicholas: 813 (2001); Mapaura & Timberlake: 20 (2004); Baumann: 102–103 (2005); Phiri: 25 (2005). *Asclepias glaucophylla* (Schltr.) Schltr.: 455 (1896); Brown: 321 (1902); Brown: 696 (1908); Moore: 255 (1902). *Asclepias lilacina* Weim.: 374, t. 375, t. 377 (1935).

The genus *Gomphocarpus* R.Br. is a relative small genus from the Apocynaceae (subfamily Asclepiadoideae) that is naturally found in mostly arid parts of eastern and southern Africa, extending into the Arabian peninsula, Sinai and north to the Dead Sea (Victor et al. 2000; Goyder & Nicholas 2001). Due to its robust habit and (in many cases) extensive populations commonly found in disturbed roadside habitats, *Gomphocarpus* is one of the more distinct elements of the *Asclepias* L. complex in Africa, together with *Pachycarpus* E.Mey. and some *Xysmalobium* R.Br. species. Some species, like *Gomphocarpus fruticosus* (L.) Aiton f. and *G. physocarpus* E.Mey., have become weedy (Forster 1994), but some are considered to be useful plants (Hutchings et al. 1996; Sobrina et al. 2002; El-Seedi et al. 2013; Hassan-Abdallah et al. 2013; Youssef 2013) in many parts of the world. Surprisingly, only one *Gomphocarpus* species (then as *Asclepias fruticosa* L.) has thus far been covered in this series (Phillips 1926).

The genus *Gomphocarpus* was proposed by Robert Brown (1810) and formalised by Aiton (1811) as a distinct group of the family, characterised by the absence of a tooth in the corona lobe cavity, and the inflation and ornamentation of the fruit. Brown argued that the former *Asclepias arborescens* L., *A. fruticosa* and *A. setosa* Forssk. (Linnaeus 1753, 1771; Burmann 1768; Miller 1768; Forsskål 1775; Salisbury 1796) needed to be included in *Gomphocarpus*. A long-standing controversy ensued, where taxa of this entity were either attributed to *Asclepias* (Schlechter 1896; Brown 1902, 1907–1908; Weimarck 1935) or to *Gomphocarpus* (Meyer 1837; Decaisne 1838, 1844). This further coincided with an alternative view that *Asclepias* should be retained only for plants occurring in the Northern Americas, and that those known as *Asclepias* from Africa, including *Gomphocarpus*, should move to other genera (Decaisne 1838, 1844; Bullock 1952; Smith 1988; Nicholas & Goyder 1990; Goyder 1995, 1998a, 1998b, 2001a, 2001b; Fishbein et al. 2011). An alternate view is that *Asclepias* in a broad sense should be upheld and include taxa from both the Old and New Worlds (Weimarck 1935; Woodson 1941, 1954). In the most recent revision of *Gomphocarpus*, Goyder and Nicholas (2001) give a detailed overview of the complexities of the movement of taxa between *Gomphocarpus* and *Asclepias*, and the segregate genera of *Asclepias* that include *Aspidoglossum* E.Mey., *Cordylogyne* E.Mey., *Glossostelma* Schltr., *Lagarinthus* E.Mey., *Pachycarpus*, *Parapodium* E.Mey., *Trachycalymma*

PLATE 2336.—1, apical portion of stem depicting pendent umbels, × 1; 2, fruit, × 1. Voucher specimen: Condy 272 in National Herbarium, Pretoria. Artist: Gillian Condy.

Bullock (subsequently returned to *Asclepias* by Goyder in 2009), *Schizoglossum* E.Mey. and *Xysmalobium*, in an African context.

The revision by Goyder and Nicholas (2001) of *Gomphocarpus*, the synopsis of *Asclepias* for Africa (Goyder 2009), and continued work on the American species of *Asclepias* (Fishbein et al. 2011) suggests that understanding the position of *Gomphocarpus* may be key to our understanding of how the Old World and New World parts of the *Asclepias* complex evolved. This highlights the recurring problem of the circumscription of many genera of the subtribe Asclepiadinae in Africa, to which the genus *Gomphocarpus* belong. Some of the morphological features, for example, are shared between the *G. glaucophyllus* and *Calotropis procera* (Aiton) W.T.Aiton and the *Xysmalobium undulatum* (L.) Aiton f. groups (Nicholas 1999), indicating a possible common ancestor, although phylogenetic work shows different relationships.

Characters that delimit the genus *Gomphocarpus* and distinguish it from *Asclepias* (at least in Africa) are presented by Goyder and Nicholas (2001) and summarised in Table 1. Plants of *G. glaucophyllus* exhibit the following characteristic features of the genus: numerous extra-axillary inflorescences with drooping flowers (Figure 1), and the staminal corona lobes are laterally flattened (Figure 2d, 2e) with a central cavity (Figure 2c) and with teeth on the upper margins (Figure 2c–e). According to Goyder and Nicholas (2001), and supported here by one of us (SPB), the morphological structure of the corona lobe is remarkably constant within the recognised species and this remains one of the single most useful organs for species delimitation and recognition (particularly when working with herbarium material).

In the key to the species of *Gomphocarpus* by Goyder and Nicholas (2001) the genus is divided into two groups: a group with narrow leaves (the first to be described and bulk of the recognised taxa) and a group with broad leaves. The first members of the broad-leaved group were only described some eighty years after the first narrow-leaved members and are the closely related *G. semiamplectens* K.Schum. from Angola by Schumann (1893) and *G. glaucophyllus* from the mountains around Barberton in South Africa by Schlechter (1894).

TABLE 1.—Comparison of characters used to distinguish *Asclepias* from *Gomphocarpus* (adapted from Goyder & Nicholas 2001, with additional characters from Brown 1810 indicated with an asterisk[*])

Character	<i>Gomphocarpus</i>	<i>Asclepias</i>
Rootstock	Fibrous, sometimes woody, never napiform	Always napiform tuberous caudex
Habit	Short-lived perennial subshrubs with branched stems, or if pyrophytic herbs with unbranched annual stems then with broad leaf laminas	Pyrophytic herbs with annual mostly unbranched stems, leaves narrow
Inflorescences	Terminal	Extra-axillary
Tooth in the corona lobe cavity*	Absent	Present
Follicle*	Ornamented, inflated	Smooth, slender
Pedice	Contorted	Non-contorted



FIGURE 1.—*Gomphocarpus glaucophyllus*: a, pendent inflorescences axillary along the stem; b, inflorescences viewed from below; c, plant in habitat showing multiple stems (in this case approximately 35) arising from underground rhizomatous rootstock. Voucher: *Bester 11619* (PRE). Photographs: S.P. Bester.

Gomphocarpus glaucophyllus is endemic to Africa, occurring widely across the East African tropical Highlands (Burundi, Congo, Malawi, Rwanda, Tanzania and Uganda) and southern Africa (South Africa, Swaziland, Zambia and Zimbabwe) (Figure 3). In South Africa it is found in the provinces of Gauteng, Limpopo, Mpumalanga and North-West. The georeferenced occurrence data for the distribution map were obtained from the South African National Biodiversity Institute's database (including PRE herbarium records), Nicholas (1999), Goyder & Nicholas (2001) and the Global Biodiversity Information Facility (25 March 2016).

Some colloquial names under which *Gomphocarpus glaucophyllus* is known include the Shona name of *gwendere* (Kwembeya & Takawira 2002), the Afrikaans name of *melkbos* or *bloumelkbos* (Smith 1966), and in Swazi it is known as *umbohloboholo*. It is odd that so very limited specific information on the *bloumelkbos* is known, despite its wide geographical distribution range.

The only species in the genus with lanceolate or ovate leaves and rounded bases are *Gomphocarpus cancellatus* (Burm.f.) Bruyns (with a predominantly winter-rainfall regime in the southern and western Cape) and the *G. glaucophyllus* group (that consists of *G. glaucophyllus*, *G. swynnertonii* (S.Moore) Goyder & Nicholas, *G. munonquensis* (S.Moore) Goyder & Nicholas, *G. praticola* (S.Moore) Goyder & Nicholas and *G. semiamplectens*). In all of these species the base is usually cordate. *Gomphocarpus glaucophyllus* is the only species that has a distribution as far south as South Africa, while the other species in this group have a tropical and subtropical distribution. Furthermore, the follicles of *G. glaucophyllus* and allies seem particularly variable with respect to the degree of inflation present, which are invariably smooth. The fruiting pedicels are contorted in almost all species. The disc of the seed is generally verruculose, but is smooth and glabrous in *G. rivularis* Schltr. and pubescent in the *G. glaucophyllus* group. Seeds of most species have no obvious marginal rim surrounding the discoid body of the seed, but in taxa of the *G. glaucophyllus* group the margins are convoluted.

Although most species of *Gomphocarpus* are short-lived perennial subshrubs, the *G. glaucophyllus* group and some species, such as *G. purpurascens* A.Rich., are adapted to produce annual shoots from their woody rootstocks in the fire-prone habitats in which they grow (Goyder & Nicholas 2001). This is in contrast to most of the related genera where the rootstock is differentiated into a napiform tuberous caudex, which drastically limits the number of aerial stems produced annually. The adaption of producing shoots from the underground caudex is depicted in Figure 1, where at least 35 stems were produced from the rootstock of this specific plant after fire. Because of this fibrous root system and their ability to reach reproductive maturity within a year, members of this genus are able to survive as annuals, biennials or perennials, unlike their stem-tubered relatives which are long-lived but slow to mature (Nicholas 1999). Their generally shrubby habit enables them to produce numerous inflorescences. With this multitude of flowers, combined with the abundance of pollinators (primarily mellitophilous), and possible ability to self-fertilize, ensures good seed set for the taxa in general (Nicholas 1999). In observations by one of us (SPB), however, fruiting in *G. glaucophyllus* is much lower in comparison to that of *G. fruticosus* and *G. physocarpus*.

The plant illustrated here (*Condy* 272) was collected from Ezemvelo Nature Reserve, 22 km northeast of Bronkhorstspuit, straddling the border between Gauteng and Mpumalanga provinces in South Africa. Here plants are occasionally encountered growing on rocky outcrops, gentle slopes and plains. The reserve falls within the Rand Highveld and Eastern Highveld Grassland vegetation types of Mucina and Rutherford (2006).

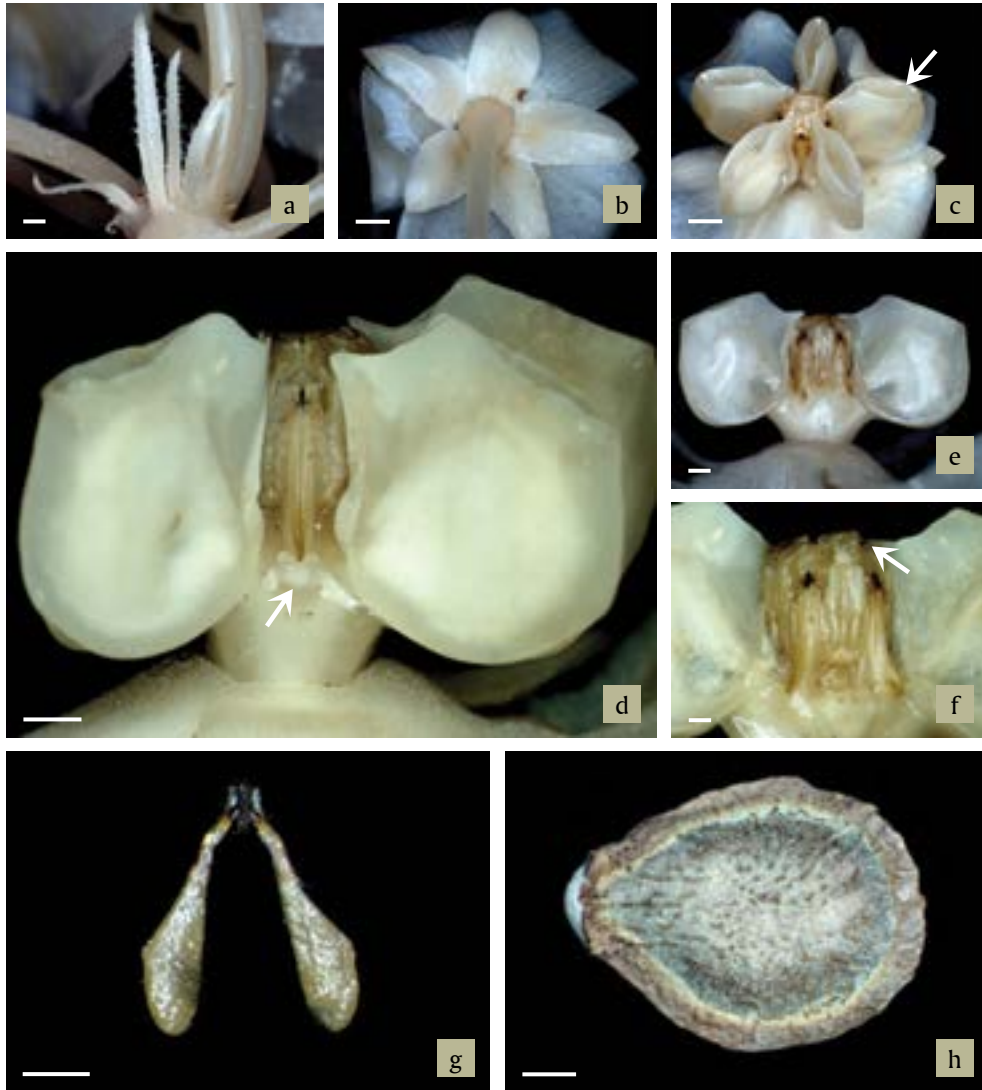


FIGURE 2.—*Gomphocarpus glaucophyllus*: a, bracts with marginal hairs; b, flower viewed from underneath showing calyx; c, flower viewed from above, note sinus (arrow) of corona lobes; d, gynostegial column showing inner corona lobe (arrow) below anther wings; e, gynostegial column in side view showing proximal sides of outer corona lobes overtopping the anthers; f, anthers with anther appendage (arrow) overtopping the style head; g, pollinarium; h, dorsal view of seed, note white scar on distal end where coma was detached. Scale bars: a, d, e, h, 1 mm; b, c, 2 mm; f, g, 0.5 mm. Vouchers: a–g, *Bester 11619* (PRE); h, *MacDonald 13* (PRE). Photographs: S.P. Bester.

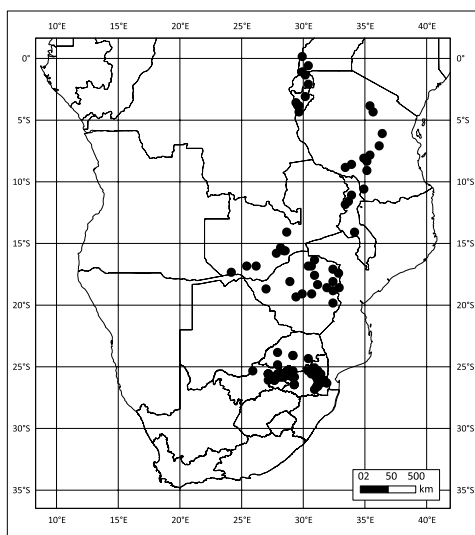


FIGURE 3.—Known distribution of *Gomphocarpus glaucophyllus*. Records were obtained from the PRE collection, SANBI database (BODATSA – Botanical Database of Southern Africa), literature (Goyder & Nicholas 2001) and GBIF occurrence data.

Plants grow in grassland, or rarely in open savanna woodlands or marshy grounds (Nicholas 1999) of south tropical Africa. Plants usually resprout and flower more abundantly when burnt. The plants flower between August and June, with peak flowering usually occurring from October to January. They occur at altitudes between 700–1 500 m and rarely to 1 900 m in South Africa (Astle 1968–1969; Nicholas 1999), and at altitudes up to 2 400 m in the East African Highlands. The *Gomphocarpus glaucophyllus* group occurs in montane grassland and in the *Brachystegia* belt that spans south central Africa; all other species have either a northern, or a southern distribution but not both. *Gomphocarpus glaucophyllus* has been found in a wide range of habitats that include mountain slopes to gentle or steep hillsides to plains, in grassland; and in a variety of soils that include red soil over limestone, red sandy loam soil, quartzite derived soils, sandy soils, dolomite, well-drained gritty red soil, compact clayey

loam soil in wetlands, and granite derived sands. They are further found in burnt grasslands and woodlands and its broad glaucous leaves are borne on annual shoots from a perennial woody rootstock. In contrast, the narrow-leaved species of *Gomphocarpus* occur in open disturbed habitats in temperate regions of southern Africa and are shrubby in habit, but are probably short-lived and generally lack thickened or tuberous roots (Goyder et al. 2007).

The species was assessed and its Red List status established as least concern (LC) for South Africa due to the species being widespread, common, and not in danger of extinction (Von Staden 2012). However, the habitat in some parts of South Africa seems to be under pressure for mining and agricultural development. Concern has been expressed in a TRAFFIC (the Wildlife Trade Monitoring Network) report by Rukangira (2001) that *Gomphocarpus glaucophyllus* is harvested and traded in Zimbabwe for its medicinal properties.

The plants have various reported uses. The roots are infused in water which is drunk for asthma or a decoction of it is made to induce vomiting in babies for the relief of various illnesses (Gelfand et al. 1985; Neuwinger 2000). On the label of a specimen it is indicated that the plants were subjected to a feeding test and that the seeds (possibly fruit) especially were eaten by cattle. In Venda, where the plant is known as *gunaperi* or *gunatela* (Fox & Norwood Young 1982; Kuiper 1555 [PRE]), people cook the young leaves and eat it as a kind of spinach. The leaves and tubers are sources of toxic cardiac glycosides, which according to Van Wyk et al. (2002), are the most important of all causes of livestock poisoning in South Africa. This is in contradiction to Schultz et al. (2005) who reason that although all *Gomphocarpus* species contain cardenolides, they are unpalatable and seldom eaten,

usually only incidentally ingested. Two species of *Gomphocarpus* have been screened for anticancer properties (Fouche et al. 2008), but due to the well-known toxicity of cardiac glycosides (Van Wyk et al. 2000), and having only moderate levels of activity, no further work was carried out. A wide range of active compounds have been isolated from *G. glaucophyllus* (Sawlewicz et al. 1967), mainly from the dried roots, of which the highest percentage were glycosides.

The two narrow-leaved species of *Gomphocarpus* (viz. *G. physocarpus* and *G. fruticosus*) are grown extensively in Kenya for the cutflower market (Saggafu et al. 2012). The introduction of *G. glaucophyllus* with its broad leaves and comparatively smooth follicles into horticulture should be considered, which may lead to interesting varieties being created.

Description (adapted from Nicholas (1999) and Goyder and Nicholas (2001) with additional measurements from specimens at PRE).—Perennial herb arising from a stout rhizomatous rootstock, 20–30 mm in diameter. *Stems* 1–32(–35), robust and somewhat fleshy, unbranched, ascending or erect, 0.3–1.0 m tall, 6–14 mm thick, glabrous and commonly glaucous. *Leaves* mostly sessile or rarely very shortly petiolate, 40–152 × 13–64 mm, apex acute, base cordate with stem-clasping lobes, glabrous, pale grey- or blue-green, generally glaucous with a waxy bloom on both surfaces, primary and secondary veins prominent, sometimes pink to reddish. *Inflorescence* in racemose, extra-axillary, one to many nodding umbels, 4–15-flowered; *peduncles* 15–60 mm long, mostly half to two-fifths the length of the subtending leaf, glabrous and generally glaucous; *bracts* 5.0–11.5 × 0.5–4.2 mm, filiform to linear, margins ciliate or not, apex acute; *pedicels* 17–35 mm long, glabrous, glaucous or not. *Calyx lobes* 5.4–10.0 × 2.1–4.0 mm, oblong to broadly ovate, apex obtuse to subacute to acute, minutely ciliate marginally, blade glabrous, reflexed, green and glaucous or not. *Flowers* 13.0–17.3 × 11–22 mm, light or apple green, yellowish green to cream, purplish. *Corolla* united at base for 1–2 mm, greenish yellow, sometimes purplish on outer face, ventrally minutely papillate particularly towards base, glabrous dorsally; lobes strongly or weakly reflexed, 9–13 × 5–8 mm, elliptic to ovate, apex acute, minutely ciliate on one margin only. *Staminal corona* lobes attached 1.1–1.8 mm above the base of the staminal column and as high, erect 4.0–6.2 × 3.0–6.2 × 0.8–1.6 mm (length × depth × width), compressed-cucullate, subquadrate, 4.2–5.3 mm broad in side view, ridge from middle of proximal side extending downwards and most pronounced at base extending horizontally towards outer margin where it fuse with distal end, truncate at top with apical angles of sides produced into short acute point ($\pm$ 0.6 mm long) over top of style-apex, rounded at base, sinus $\pm$ two-fifths of height of lobes, yellowish brown, brown with green tips or maroon; sinus 4.2–5.7 × 1.1–1.5 × 1.3–1.4 mm. *Interstaminal corona* lobes broadly deltate, 0.62–0.65 × 0.73–1.20 mm, pseudo-bifid due to base of anther wings pushing down onto middle of apex of lobe. *Staminal column* 5–6 mm tall, 3.18 mm in diam. *Androecium*: quadrate, $\pm$ 2.8 × 1.6–1.7 mm; *anther wings* 2.0–3.2 × 0.5–2.2 mm, triangular, outer margin straight or weakly concave at base of staminal column; *anther appendages* 0.6–1.1 × 0.4–1.1 mm, broadly ovate, obtuse, inflexed over and fully or partly concealing truncate and involute style-stigma head. *Corpuscle* 0.4–0.5 × 0.08–0.17 mm, narrowly ovoid to sub-cylindrical, black with translucent flanges running up sides from attachment of caudicles, these with acute apices; *caudicles* 0.47–0.56 × 0.07–0.15 mm, flattened and $\pm$ uniform in width but differentially thickened – inner margin thickened near corpuscle, outer margin thicker near pollinium, medifixed to corpuscle and fixed apically to pollinia; *pollinia* 1.18–1.27 × 0.42–

0.45 × 0.06–0.16 mm, dorsi-ventrally flattened, oblanceolate to narrowly deltoid. *Fruit* a follicle, 50–115 × 15–35 mm, fusiform with to 6 longitudinal wings with compressed linear obtuse processes 4.2–8.5 mm long, apex acute or oblong-elliptic in outline, somewhat inflated with obtuse apex, glabrous, glaucous, usually only one of the pair developing due to abortion of the other; fruiting pedicel sigmoidically contorted to hold follicle erect. *Seed* 6–7 × 4–5 mm, suborbicular to ovate in outline, slightly convoluted, dorsally convex, ventrally concave; disc pale brown, minutely pubescent, verrucose; wing 0.4–0.6 mm broad, marginal, dark brown; coma of 18–40 mm long white hairs on distal end of seed. Plate 2336.

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PLATE 2337 *Ipomoea bolusiana*

Ipomoea bolusiana

Convolvulaceae

Tropical and southern Africa

Ipomoea bolusiana Schinz, Verhandlungen des Botanischen Vereins der Provinz Brandenburg, Berlin 30: 271 (1888); Hallier f.: 147 (1893); Hallier f.: 53 (1899); Baker & Rendle: 175 (1905–1906); Meeuse: 758 (1957); Roessler: 13 (1967); Adams: t. 122 (1976); Gonçalves: 100, t. 24 (1987); Van Wyk & Malan: 200 (1988); Gonçalves: 106, t. 23 (1992); Lejoly & Lisowski: 106, t. 15 (1992); Meeuse & Welman: 48 (1996); Fabian & Germishuizen: 334, t. 159c (1997); Roodt: 63 (1998); Meeuse & Welman: 107 (2000). *I. simplex* Hook.: t. 4206 (1846) *nom illegit.* *I. angustisecta* Engl.: 245 (1888). *I. mesenteroides* Hallier f.: 544 (1898). *I. bolusiana* Schinz var. *abbreviata* Hallier f.: 54 (1899). *I. bolusiana* Schinz var. *elongata* Hallier f.: 54 (1899). *I. praetermissa* Rendle: 56 (1901). *I. simplex* Thunb. var. *obtusisepala* Rendle: 174 (1905–1906). *I. bolusiana* Schinz var. *pinnatipartita* Verdc.: 118 (1967).

The genus *Ipomoea* contains about 650 species distributed worldwide in the tropical and warm temperate countries. Fifty-seven species occur in southern Africa, five of them are introduced and naturalised. The genus is paraphyletic and can be distinguished from *Convolvulus* by its spiny pollen and its stigma which is not linearly divided. It contains annuals as well as deciduous or evergreen perennials, climbing or prostrate herbs or shrubs or even small trees; some species have tubers while a few are caudiciform succulents. Several species are ornamental, some are cultivated for their edible roots, flowers, shoots and leaves, while the seeds or roots of other species provide drugs or medicine.

Mabberley (2008) listed a number of useful species that are either indigenous to Africa or cultivated on this continent. The tuberous *Ipomoea batatas* (L.) Lam. (sweet potato), a hexaploid cultigen with many cultivars, probably originally from Central America, is one of the world's most important starch foods and a staple crop in many tropical and warm areas. Some forms of *I. aquatica* Forssk. (water spinach), an Old World species, also occurring naturally in Namibia, Botswana and KwaZulu-Natal, are cultivated for their edible shoots in China and other countries and was introduced into the New World. *Ipomoea obscura* (L.) Ker Gawl. from the Old World tropics, also southern Africa, is a pot herb in Sri Lanka. A root infusion of *I. spathulata* Hallier f. from East Africa is used against eye disease. *Ipomoea pes-caprae* (L.) R.Br. from tropical and subtropical beaches, is a sand binder; the subsp. *brasiliensis* (L.) Ooststr., grows in KwaZulu-Natal and the Eastern Cape, South Africa. Hallucinogens are obtained from the seeds of some species of *Ipomoea*; the toxin is an indole alkaloid (Van Wyk et al. 2002). Several indole alkaloids are known from *Ipomoea*, such as ergine which is present in many species; large amounts can be fatal. Mabberley (2008) listed the ornamental *I. tricolor* Cav. from Mexico and Central America, where the effective hallucinogenic agent is ergoline. Apparently no South African species have so far been investigated for these alkaloids.

PLATE 2337.—1, flowering plant, × 1; 2, fruit, × 1; 3, fruit and seed, × 1. Voucher specimens: 1, Condý 279; 2, Bremekamp & Schweickerdt 29552; 3, R. Leendertz 6620 all in National Herbarium, Pretoria. Artist: Gillian Condý.

With its usually prostrate stems and rather long and very narrow leaves or leaf lobes, *Ipomoea bolusiana*, one of the so-called ‘wild morning glories’, is almost inconspicuous in its natural environment when it is not flowering. However, its fairly large, usually bright pink, showy flowers attract immediate attention. This species is indigenous to Angola, the Democratic Republic of the Congo, Zambia, Zimbabwe, Mozambique, Namibia, Botswana, Swaziland and summer rainfall regions of South Africa (Limpopo, North-West, Gauteng, Mpumalanga, Free State and KwaZulu-Natal provinces, down to about 30 degrees south in the latter province) (Figure 1). Gonçalves (1987) noted that it is also found in Tanzania, but it was not included in the *Flora of Tropical East Africa* (Verdcourt 1963). Its occurrence in Madagascar (Meeuse 1957) could not be verified either.

Ipomoea bolusiana has a very wide ecological range and grows in grassland, various kinds of savanna, woodland or bushveld and shrub- or scrubland. The soil can be deep or shallow, poorly drained to well-drained sand of various colours, loam or clay which can be stony, rocky or gravelly. The substrate can be calcrete, dolomite, granite, ironstone, quartzite or sandstone. It can grow in rocky areas, as well as on dune ridges and in pans and depressions, also on the margins of wetlands. Because of its caudex (succulent and tuberous rootstock), *I. bolusiana* is very drought resistant; it can survive in disturbed areas like road- and railway sides, overgrazed and burned land, even on denuded, dry, hard, compacted soil. It can grow in shade, partial shade or full sun, on level to moderate slopes of all aspects. It has been recorded as solitary, rare, occasional to frequent or common. The flowering time is from August to April, mostly from October to March. The fruiting time is mostly from November to April. According to the information on specimen labels in the National Herbarium, Pretoria (PRE), this species can grow from about 45 to 1 525 m altitude in southern Africa. Gonçalves (1987) reported that in the *Flora zambesiaca* area, *I. bolusiana* grows in open woodland and savanna, grassland with scattered shrubs, in rocky and sandy soils at 0 to 1 465 m. According to Raimondo et al. (2009) the Red List status of *I. bolusiana* in South Africa is Least Concern.

Many succulent collectors include caudiciform plants in their collections. Rowley (1987) wrote of the Convolvulaceae: ‘The perennial herbs regenerate from an underground reservoir which in a few African species is a solid, smooth-skinned black or brown caudex suited to grace the glasshouse of any devotee of caudiciforms. Unlike so many caudiciforms, Ipomoeas have large, showy bisexual flowers, and because these are borne freely low down and not just at the top of metres of vine, the plants are suitable for a small glasshouse or show bench. The caudex, which is sensitive to rot, should be planted above ground on a grit base and allowed to dry off during the dormant season when the branches die away.’ Among the southern African species credited with having a caudex are *Ipomoea bolusiana*, *I. simplex* Thunb., *I. transvaalensis* A.Meeuse and *I. welwitschii* Vatke ex Hallier f. Some representatives of the closely related genus *Merremia* with white or yellow blooms may also qualify, such as the Namibian endemic *M. bipinnatifida* (Engl.) Hallier f. Rowley (1976) stated, ‘... many South African Convolvulaceae have a massive perennial caudex, and the fact that it grows underground is no deterrent to the enthusiast who happily pots it above the soil so that he can admire its distinctive bark and noble contours. And the plants seem none the worse for such unnatural treatment.’ He wrote the following notes on the cultivation of *I. bolusiana* in the northern hemisphere: ‘It offers no special problems in cultivation. I keep it in the warmest section of the greenhouse and withhold water until the first signs of growth in

early spring. It is then watered freely. ... the purple flowers appear in succession over a long period near the base of the annual branches. Each one lasts no more than a day ...'

Roodt (1998) reported that, 'In the Kalahari, this species features very prominently as a source of moisture. The flattened tuber, which is about 15 cm wide, can be scraped and the moisture squeezed directly into the mouth.' According to *De Winter* 3791 (PRE), collected in Namibia in December 1955, the tubers are 3 to 4 inches in diameter. Very young tubers are eaten and have a faintly sweet, watery taste. Elephants dig up and eat the tubers which are plentiful in some areas. *Snyman & Noailles* 247 (PRE), collected in Botswana in February 1982, noted that the c. 80 mm tuber is stamped and the liquid squeezed out for drinking. The tuber is also cut in slices and cooked in milk for drinking. These two collectors made a survey of plants used by the Bushmen; the common name for *Ipomoea bolusiana* is *n//arii* and *irixa*. In Tswana it is called *kgane-ya mothlaba*. By contrast, *Story* 6210 (PRE), collected in Namibia in January 1958, stated that the tuber is not eaten by the !khu Bushmen who call the plant *!garube*. *Mongalo* 7 (PRE), from Blouberg in Limpopo Province, gave the local names as *monna ga a apare* and *se thea motse*. *Van der Walt* 5799 (PRE), from the Kalahari Park in the Northern Cape in 1978, gave the name as *X'Horo*. *Repton* 4778 (PRE), collected near Postmasburg in the Northern Cape in 1958, gave the common name as *duikerswortel*; duikers (small antelopes) eat the stems but not the bitter tubers. *Speedy* 270 (PRE) from Vryburg in the Northern Cape in 1989, stated that it is drought resistant and readily eaten by cattle. *Burgoyne* 3396 (PRE), collected in Namibia in March 1995, reported that the crushed leaves are non-aromatic, the cut twigs exude a clear sap, the flowers have no smell and that there can be several tubers to a plant.

The species name *bolusiana* commemorates the South African botanist and businessman Harry Bolus (1834–1911) who undertook collecting expeditions to various parts of South Africa. He described many new species and also produced his own illustrations. His main interests were the Orchidaceae and Ericaceae; he co-authored the Ericaceae for *Flora capensis*. The Bolus Herbarium at the University of Cape Town was named after him after he had donated his collections and library to that university (Gunn & Codd 1981).

According to Austin & Huáman (1996), *Ipomoea bolusiana* belongs to section *Erpipomoea* Choisy (section *Leiocalyx* Hallier f. *sensu stricto*) which falls under subgenus *Eriospermum* (Hallier f.) Verdc. ex D.F.Austin. This common and variable species is closely related to and can be confused with two other species in that section, namely *I. simplex* and *I. welwitschii*. *Ipomoea bolusiana* differs from the former by its large pink to purple corolla and from the latter by its leaf morphology and glabrous vegetative parts. *Ipomoea simplex* has a white corolla and is endemic to the central and eastern parts of southern Africa,

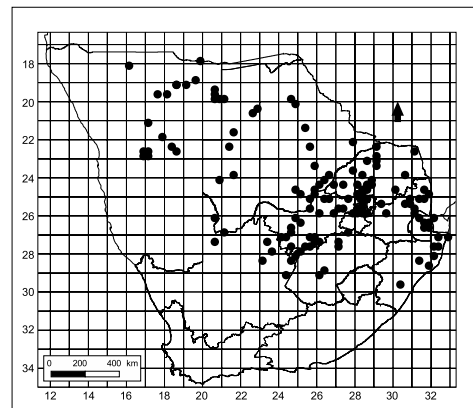


FIGURE 1.—Known distribution of *Ipomoea bolusiana* in southern Africa.

including Lesotho. The rare and variable *I. welwitschii* occurs in tropical Africa down to northern Namibia and Botswana. It is possible that these three species form one large, variable aggregate species.

The specimen used as voucher for the accompanying plate was cultivated at the Random Harvest Nursery in Muldersdrift, Gauteng, from the collection of indigenous plants built up by the late Charles Craib. It was originally collected in the Rustenburg/Brits area in the North-West Province.

Description.—Glabrous perennial geophyte. *Rootstock* tuberous, one to several light brown tubers per plant, mostly subglobose, also spindle-shaped to ovoid, up to 130 mm in diameter, frequently quite deep underground at the upper end of an up to 300 mm long taproot; $\pm$ milky inside. *Stems* annual, one or several, spreading, erect or prostrate, slender, woody at base, erect stems up to 300 mm high, prostrate ones up to 3 m or longer, pale green. *Leaves* either palmately 3–9-sect (mainly on prostrate stems) with segments $20\text{--}70 \times 0.5\text{--}3.0$ mm, or simple, linear to bilobed, $40\text{--}150 \times 2\text{--}7$ mm, sometimes pinnate, if 3 then terminal segments partly fused to form a common rhachis, keeled, dark green above, margins $\pm$ revolute, also serrated or undulate; petiole of dissected leaves up to ± 20 mm long, of simple leaves sometimes inconspicuous. *Peduncles* 1-flowered, usually very short; bracteoles often deciduous; pedicels short, thickened. *Sepals* lanceolate to elliptic or broadly ovate, acute or acuminate, equal or unequal, dark green with hyaline margins, persistent in fruit, 7–20 mm long. *Corolla* funnel-shaped, $40\text{--}70 \times 40\text{--}60$ mm, usually bright magenta-pink, lighter outside and darker in centre and on midpetaline areas, also lighter pink to reddish or purplish. *Capsule* subglobose-conical, red-brown, 10–12 mm long and in diameter, apex often depressed, apiculate by style base, splits into 4 sections. *Seeds* 4, 4.5–7.0 mm long, densely covered with 4–6 mm long, shiny, silky, fawn hairs. *Chromosome number*: unknown. Plate 2337.

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Ipomoea cairica

Convolvulaceae

Africa, eastern Mediterranean region, Asia to Taiwan

Ipomoea cairica (L.) Sweet, Hortus britannicus, 1st edn: 287 (1826); Hallier f.: 148 (1893); Hutchinson & Dalziel: 216 (1931); Brenan: 8 (1954); Meeuse: 761 (1957); Verdcourt: 125 (1963); Heine: 351 (1963); Gonçalves: 105, t. 26 (1987); Lejoly & Lisowski: 115, t. 16 (1992); Meeuse & Welman: 110 (2000). *Convolvulus cairicus* L.: 922 (1759). *Ipomoea palmata* Forssk.: 43 (1775). *Convolvulus tuberculatus* Desr.: 545 (1791). *I. senegalensis* Lam.: 464 (1793). *I. vesiculosa* Beauv.: 73, t. 106 (1819). *I. tuberculata* (Desr.) Roem. & Schultes: 208 (1819). *I. mendesii* Welw.: 584 (1859). Iconotype: illustration of *Convolvulus aegyptius* in Vesling: 75, fig. s.n. (1638).

Ipomoea L. is a very large genus in the family Convolvulaceae (morning glory family) and has about 650 species distributed worldwide; they are most common in the tropics of both hemispheres. *Ipomoea batatas* (L.) Lam., or sweet potato, a food plant with tuberous roots originally possibly from Central America, is the most important economic species in the Convolvulaceae. There are 16 genera in this family in southern Africa, with *Ipomoea* the biggest genus with 57 representatives. Of these, only five taxa were introduced, and have escaped from cultivation and became naturalised; they are *I. alba* L. (moonflower, tropical Americas), *I. carnea* Jacq. subsp. *fistulosa* (Mart. ex Choisy) D.F. Austin (morning glory bush, tropical Americas), *I. indica* (Burm.f.) Merr. (pantropical), *I. purpurea* (L.) Roth (common morning glory, New World) and the rarely collected *I. nil* (L.) Roth (Japanese morning glory, tropical Americas).

Glen (2002) listed 32 species of *Ipomoea* that are cultivated in especially the warmer parts of the southern African region and may occasionally occur as culture relicts or garden escapes. Three popular species are often cultivated: *I. arborescens* (Humb. & Bonpl.) G. Don (morning glory tree, West Indies), *I. quamoclit* L. (Cupid flower, cardinal vine, New World) and *I. tricolor* Cav. (Japanese morning glory, New World). Verdcourt (1963) listed about 10 of the more important purely ornamental species that are cultivated in East Africa of which most are also cultivated in southern Africa.

Henderson (2001) treated the three species of *Ipomoea* (*I. alba*, *I. indica* and *I. purpurea*) that are declared weeds or invaders according to the Conservation of Agricultural Resources Act (Act No. 43 of the Republic of South Africa 1983, amended in 2001) and one species (*I. carnea* subsp. *fistulosa*) that may soon be declared. *Ipomoea alba*, an annual or perennial climber or prostrate creeper that is cultivated for ornamental purposes in the warmer parts of the world, is a declared weed in KwaZulu-Natal, Mpumalanga and Limpopo provinces and a declared invader elsewhere in South Africa. Its invasive status is listed as 'transformer' and it may no longer be traded. *Ipomoea indica* (perennial) and *I. purpurea* (annual) are herbaceous twiners and are both cultivated as ornamentals. *Ipomoea indica* is a declared weed and invader in KwaZulu-Natal, Limpopo and Mpumalanga provinces, with

PLATE 2338.—1, flowering branch, × 1; 2, stamens and pistil, × 2; 3, immature fruits, × 1. Voucher specimens: 1, 2, *Herman 1594* (flowering) and 3, *Herman 1595* (fruiting), all in National Herbarium, Pretoria. Artist: Gillian Condy.

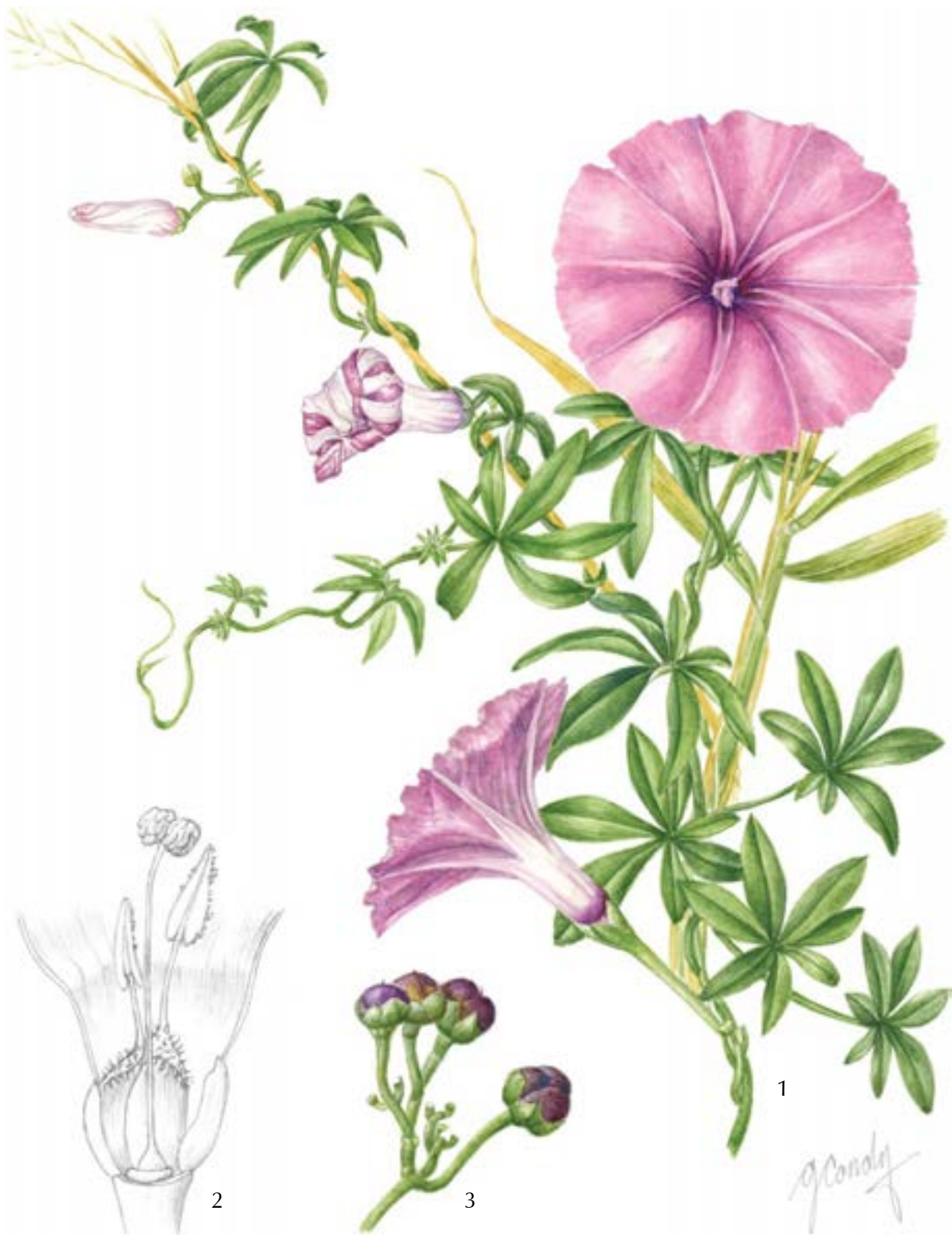


PLATE 2338 *Ipomoea cairica*

its invasive status listed as ‘transformer’. *Ipomoea purpurea* is a declared invader and is competitive throughout South Africa. Both *I. indica* and *I. purpurea* may no longer be traded. *Ipomoea carnea* subsp. *fistulosa* is a poisonous shrub which is described as an invasive weed, though not yet a declared weed. It is cultivated for ornamental purposes and as hedges and screens. It is found in Limpopo, Mpumalanga and KwaZulu-Natal provinces.

Ipomoea cairica is indigenous throughout tropical Africa, also from the eastern Mediterranean region through Asia to Taiwan. It is naturalised elsewhere as an escapee from cultivation. In southern Africa it is recorded from Botswana (Gonçalves 1987), Swaziland, and Limpopo, Mpumalanga, KwaZulu-Natal and the Eastern Cape provinces of South Africa (Figure 1). According to Raimondo et al. (2009) the Red List status of *I. cairica* is Least Concern.

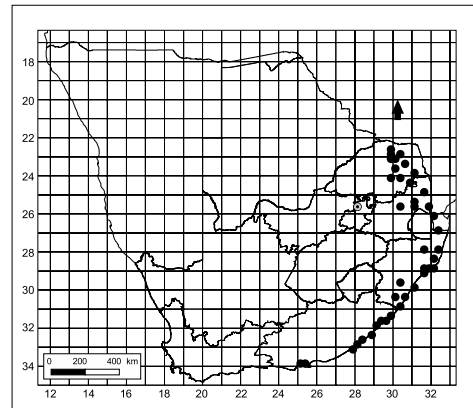


FIGURE 1.—Distribution of *Ipomoea cairica* in southern Africa.

According to the information on specimen labels in the National Herbarium, Pretoria (PRE), this species is a twining herb on trees, shrubs and grasses, and grows in swamps, on flood plains, banks of rivers, lakes and estuaries, in forests and woodland, forest edges, bush margins, on dunes and also on wasteland, in disturbed places, along roadsides, and on cultivated ground such as pine plantations. The surrounding vegetation types can be savanna, thickets, scrubland, coastal or swamp forest, or fynbos. It grows in well-drained sand, sandy loam, clay, red clay-loam and salty or brackish soil on sandstone or shale, also on granite outcrops. This species has been collected on flat ground, gentle to moderate slopes in full sun and light shade; from about sea level (15 m) to 975 m altitude in southern Africa. The specimen used as voucher for the accompanying illustration was collected in Pretoria along a canal running north–west through the suburbs of Villieria, Rietfontein and Wonderboom South – a tributary of the Apies River. It was twining over a bridge crossing Ben Swart Street, the surrounding grassland and thorn trees lining the banks of the canal. This locality is outside its normal distribution range in southern Africa and the plant was probably an escapee from cultivation. It was also seen twining along the fence of the Laerskool Constantia Park, in the east of Pretoria, where it had obviously been planted.

Verdcourt (1963) described the habitat in tropical East Africa as ‘forest clearings, lake shores, swampy grassland, hedges, waste and cultivated ground etc.’ at 750 to 1 900 m altitude. Gonçalves (1987) reported that in the *Flora zambesiaca* area, *Ipomoea cairica* grows in ‘rainforests, bushland, swampy grassland, river edges, lake shores, roadsides at 0 to 1 676 m altitude’.

According to Austin & Huáman (1996) this species belongs to section *Erpipomoea* Choisy (section *Leiocalyx* Hallier f. *sensu stricto*) which falls under subgenus *Eriosperrum*

(Hallier f.) Verdc. ex D.F.Austin. It is closely related to and can be confused with three other species in that section, namely *Ipomoea hochstetteri* House (Namibia, Botswana, Swaziland, northern South Africa and also tropical Africa), *I. tenuipes* Verdc. (northern Namibia, northern Botswana, and Limpopo and Mpumalanga provinces in South Africa, and also tropical Africa and India) and *I. tuberculata* Ker Gawl. (northern Namibia, northern Botswana, tropical Africa and also India and Sri Lanka).

These four species all have pseudostipulate and distinctly palmately or pedately 5–9-fid leaves that are usually quite glabrous. They can be distinguished as follows (see Meeuse & Welman 2000):

- 1a Calyx 8–10 mm long; outer sepals saccate at base; corolla yellow with mauve tube; leaves usually biternately pedate, often with 9 segments *I. tuberculata*
- 1b Calyx up to $\pm$ 7 mm long; outer sepals not saccate; corolla mauve, purple, red or white; leaves palmately partite, usually with 5 segments. 2
- 2a Corolla 30–60 mm long. *I. cairica*
- 2b Corolla up to $\pm$ 25 mm long 3
- 3a Peduncles very slender, filiform; corolla often shorter than 16 mm, purplish mauve *I. tenuipes*
- 3b Peduncles rather stout, not filiform; corolla 15–25 mm long, purplish mauve or white *I. hochstetteri*

The crushed leaves of *Ipomoea cairica* are non-aromatic and the cut twigs exude no sap. Pinheiro & Schlindwein (1998) found that the flowers of this species show a nectar chamber between the nectariferous disc and the insertion of the filaments at the corolla, which prevents free access of visitors to the nectar. Nectar can only be reached through five small openings between the bases of the filaments, which are covered by hairs. Due to the presence of the nectar chamber, *I. cairica* liberates nectar only for those bees that have glossae long enough to reach the nectary.

In South Africa *Ipomoea cairica* is known as Messina creeper, or sometimes mile-a-minute. It is easily cultivated from seed and cuttings in warm, more or less frost-free areas with moderate to high rainfall. Specimens collected for illustration purposes and kept in water, started producing roots within one week. It can be grown in various well-drained soils, in full sunlight or light shade. Because of its perennial tuberous root, it can survive harsh seasons. Observations on the plant collected in Pretoria for this illustration showed that the above-ground parts died off during winter but resprouted quickly in spring. Ogunwenmo (2006) found that *I. cairica* was one of the species of *Ipomoea* with seeds that observed a period of dormancy ranging from three to over six months in the soil. It can escape from gardens and become a weed. It grows quickly and vigorously and is difficult to eradicate. It is reported as invasive in Australia (Mabberley 2008). Zhang et al. (2012) stated that *I. cairica* is a notorious weed that is seriously harmful to the environment in south China. After experiments in the field, they concluded that 2,4-D Butylate could control it quite well without permanent harm to the soil and other vegetation.

Watt & Breyer-Brandwijk (1962) reported, *inter alia*, that the Zulu people drink a mixture of the crushed leaf of *Ipomoea cairica* for body rashes, especially if accompanied by fever. The leaf and root contain traces of hydrocyanic acid. The seed is purgative, an action which is due to muricatin A. The plant has considerable antibiotic action but not in every

case. *Gerstner 5112* in PRE recorded in 1944 that this 'common creeper' is planted all over Zululand and sold as a purgative, known as *ijalambu*. A.M. du Toit s.n. in PRE reported from Limpopo Province (formerly northern Transvaal) in November 1926 that this plant is 'extremely palatable and eaten by every class of stock'. However, Watt & Breyer-Brandwijk (1962) reported that in Australia this plant has been suspected of poisoning horses.

The species name *cairica* refers to Cairo in Egypt where the species was first collected. Verdcourt (1963) reported that the taxon discussed here is the rather common and widespread var. *cairica*, which also occurs in India. The var. *indica* Hallier f. [*Ipomoea palmata* Forssk. var. *indica* (Hallier f.) Rendle] occurs at about 750 m altitude in thickets near water-holes in northern Kenya, Somalia and India (Verdcourt 1963). This plant is rather intermediate between *I. cairica* var. *cairica* and *I. hochstetteri*. The corolla is 23–30 mm long. However, the present view is that *I. cairica* has no varieties. According to Mabberley (2008), *I. indica* (Burm.) Merr. from tropical South America is a different species that is cultivated worldwide in the tropics.

Description.—Glabrous perennial with tuberous root. Stems up to 1.8(5) m long, smooth or tuberculate, twining or rarely prostrate. Leaves alternate, ovate to orbicular in outline, 30–100 mm wide, deeply palmately dissected into 5–7 narrowly ovate to ovate-elliptic, mucronulate segments; basal lobes often bifid in 5-lobed leaves; petiole 20–60 mm long, usually with pseudostipules resembling leaves but smaller. Peduncles 1- to few-flowered, 5–70 mm long; bracteoles minute; pedicels (7)12–20 mm long. Flower buds sharply cone-shaped. Sepals 5, subequal, 3 broadly ovate, $\pm 6 \times 5$ –6 mm, 2 subovate, $\pm 5 \times 4$ mm, apices notched, black mucronulate, surfaces green with pellucid dots and pale scarious margins; often minutely tuberculate outside, persistent in fruit. Corolla of 5 fused petals, broadly funnel-shaped, 20–60 mm long, 40–60 mm in diameter, tube contracted near base, inside mauve with darker magenta centre, paler outside and with 5 white, inverted V-shaped markings, rarely pink or entirely white. Stamens 5, included, purple, filaments implanted in base of corolla tube, with hairy thickenings where it is fused to tube, of various lengths: 1, 2, 3 or 4, 8–11 mm long, and the other shorter, 5.5–8.0 mm long; anthers narrowly ovate, cordate, $\pm 5 \times 2$ mm. Style included, purple, 11–17 mm long, with basal thickening ± 1 mm long; stigma whitish, 1 mm long, consisting of 2 globular lobes, 1–3 mm in diameter. Immature fruit purple, subglobose, 8–12 mm in diameter, 4-lobed or 1–3-lobed by abortion. Capsule brown, 4-valved, with septum dividing it into 2 halves. Seeds 5–6 mm long, blackish, subglobose, tomentose and with white, up to 9 mm long, hairs along edges. Chromosome number: $2n = 30$, $2n = 60$ (Chiarini 2000). Plate 2338.

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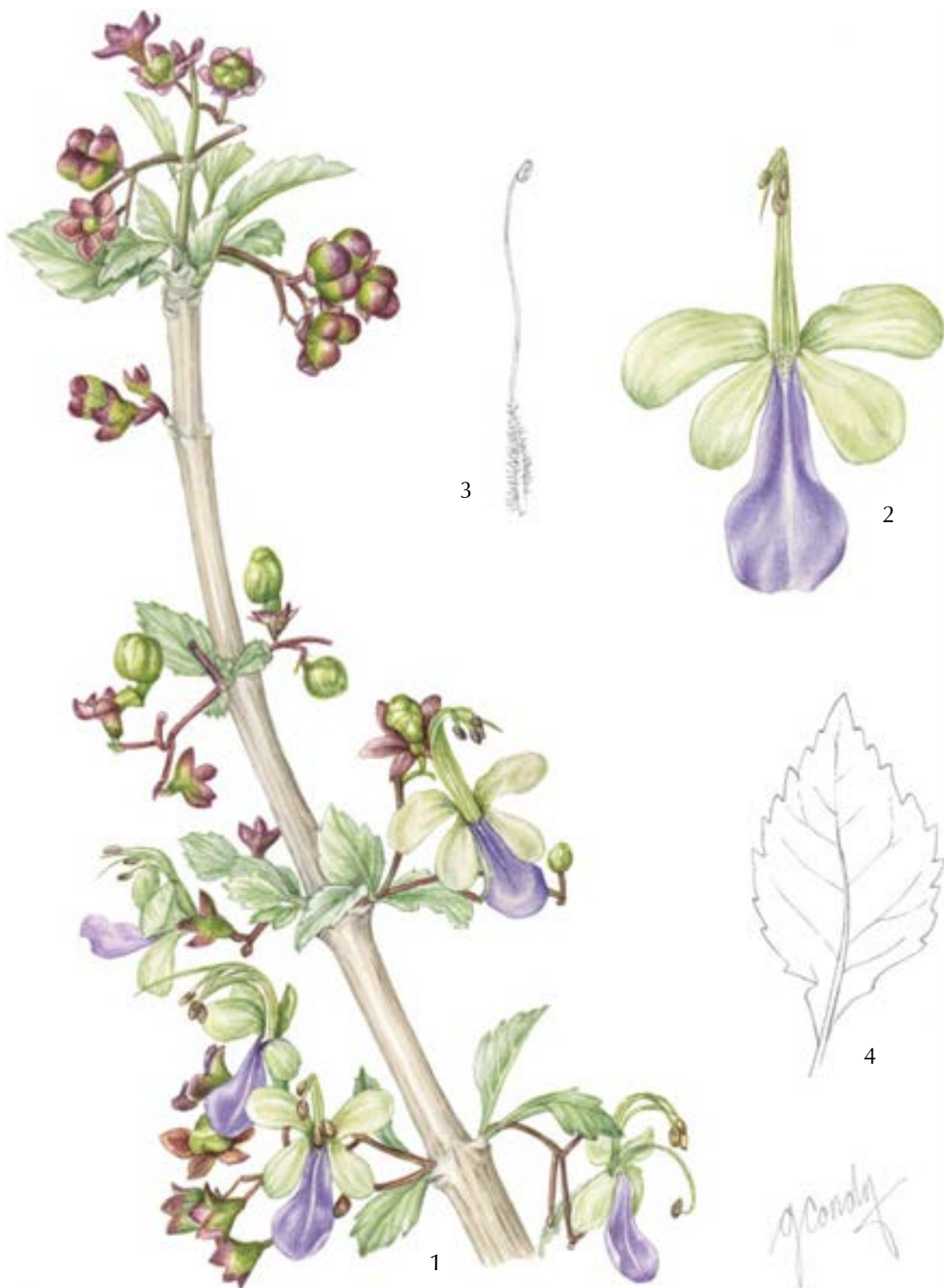


PLATE 2339 *Rothea myricoides sensu lato*

Rothea myricoides sensu lato

Lamiaceae: Ajugoideae

Throughout Africa, from Ethiopia south to South Africa

Rothea myricoides (Hochst.) Steane & Mabb. *sens. lat.*, Novon 8: 205 (1998); Fernandes & Verdcourt: 150 (2000); Fernandes: 136 (2005). *Spironema myricoides* Hochst. no. 330 (1840); Hochst. & Steud. (1838). *Cyclonema myricoides* (Hochst.) Hochst.: 226 (1842); Richard: 171 (1851); Hooker: t. 5838 (1870). *Clerodendrum myricoides* (Hochst.) Vatke: 535 (1882) [as *Clerodendron myricoides* R.Br.]; Gürke in Engler: 341 (1895) [as *Clerodendron myricoides* R.Br.]; Briquet: 176 (1895) [as *Clerodendron myricoides* (Hochst.) Gürke]; Baker: 310 (1900) [as *Clerodendron myricoides* R.Br.]; Medley Wood: t. 282 (1902) [as *Clerodendron myricoides* R.Br.]; Pearson: 223 (1912) [as *Clerodendron myricoides* R.Br.]; Thomas: 86 (1936); Moldenke: 329 (1987) [as *Clerodendrum myricoides* (Hochst.) R.Br.]; Verdcourt: 130 (1992); Retief & Herman: 641 (1997); Fernandes: 47 (1998). *Clerodendrum myricoides* R.Br. in Salt: lxx (1814), *nom. nud.*

The genus *Rothea* Raf. comprises about 30 species in sub-Saharan Africa (Fernandes 2005) with one species (*R. serrata* (L.) Steane & Mabb.) native to eastern India, Sri Lanka and Malaysia, and three species native to Madagascar (*R. microphylla* (Blume) Callm. & Phillipson, *R. mirabilis* (Baker) Callm. & Phillipson and *R. nudiflora* (Moldenke) Callm. & Phillipson) (Madagascar Catalogue 2013). About nine species are known from southern Africa (Namibia, Botswana, Swaziland, Lesotho and South Africa). Members of the genus *Rothea* were previously included under *Clerodendrum* L., subgenus *Cyclonema* (Hochst.) B.Thomas (1936). The genus name *Rothea* was reinstated by Steane & Mabberley (1998) based on differences in morphology and DNA. *Rothea* can be distinguished from *Clerodendrum* by the shape of the flower bud: in *Rothea* the flower bud is markedly asymmetrical and the corolla expands abruptly on the lower side so that it looks something like a golf club; the anterior corolla lobe is usually much larger than the other four lobes. In *Clerodendrum* the flower bud is usually symmetrical or, if asymmetrical, it expands abruptly on the upper side; the anterior corolla lobe is only slightly (if at all) larger than the other four lobes (Steane & Mabberley 1998). The genera *Clerodendrum* and *Rothea* were previously treated in the family Verbenaceae, but were transferred to the family Lamiaceae by Cantino et al. (1992). Subfamilies Ajugoideae and Viticoideae have fruits which either do not split into 4 distinct mericarps, or rarely do split late in development to produce 4 nutlets (Fernandes 2005).

The genus name *Clerodendrum* was used by Linnaeus in his *Species plantarum* (1753) and *Genera plantarum* (1754). The spelling was changed to *Clerodendron* as early as 1763 by Adanson (Moldenke 1985). Since then, there seems to have been considerable confusion about the correct spelling of the name and both names were used randomly by various authors. Moldenke (1985) pointed out that, according to the rules of botanical nomenclature, there was no reason to change the name and it should remain *Clerodendrum* L. Robert Brown (R.Br.) is often given as the author for the species name *myricoides*, but according

PLATE 2339.—1, flowering branch, × 1; 2, flower, × 2; 3, stamen with ciliate filament, × 2; 4, leaf, × 1.
Voucher specimen: Burrows 6531 in Buffelskloof Nature Reserve & Herbarium, Lydenburg. Artist: Gillian Condy.

to Verdcourt (1992), Brown only mentioned the name in one of his publications without a description or any references.

Rothea myricoides is a highly variable species. Thomas (1936), Verdcourt (1992), Fernandes & Verdcourt (2000) and Fernandes (2005) distinguished several subspecies, varieties and formas based on, *inter alia*, leaf shape, leaf margin and pubescence of the leaves. Many of the subspecies and varieties are confined to specific small areas. In her account of *Rothea* for *Flora zambesiaca*, Fernandes (2005) did not mention any occurrence of *R. myricoides* representatives in South Africa as she did for instance under *R. hirsuta*. Neither did Verdcourt (1992) in his treatment of *Clerodendrum* for *Flora of Tropical East Africa*, as he for instance did for *C. glabrum* and *C. ternatum*. The South African material could perhaps be classified as subsp. *myricoides* var. *myricoides* forma *myricoides* and subsp. *myricoides* var. *discolor* (Klotzsch) Verdc. forma *discolor* taxa, but no attempt was made to try and classify southern African material to subspecific level, as the characters tend to merge into each other. Fernandes (2005) recognised a separate species, *R. reflexa* (H. Pearson) R. Fern., which is confined to the *Flora zambesiaca* area that approaches some varieties of *R. myricoides*. Some specimens in the National Herbarium, Pretoria (PRE) fit the description of *R. reflexa* and these two species could probably prove to be conspecific.

The variation in the leaf shape of South African *Rothea myricoides* material housed in PRE is illustrated in Figure 1: the leaves are mostly ovate to rhomboid in outline with the margins dentate in the upper half to very deeply incised to almost lobed, but can also be elliptic, or in a few cases, obovate in outline and the entire margin dentate. The indumentum of the leaves varies as much: usually sparsely hairy on upper surface and sparsely to densely hairy on lower surface, sometimes almost velvety. In some cases the leaf surfaces seem to



FIGURE 1.—Line drawings to illustrate different leaf shapes and margins of *Rothea myricoides* leaves: a, ovate with dentate margin (voucher: Joffe 198, PRE); b, rhomboid with coarsely dentate margin (voucher: Smuts PRE39965, PRE); c, rhomboid with deeply lobed margin (voucher: Van Vuuren 1824, PRE); d, broadly elliptic, dentate (voucher: Galpin 601, PRE). All drawings $\times 1$. Artist: Gillian Condy.

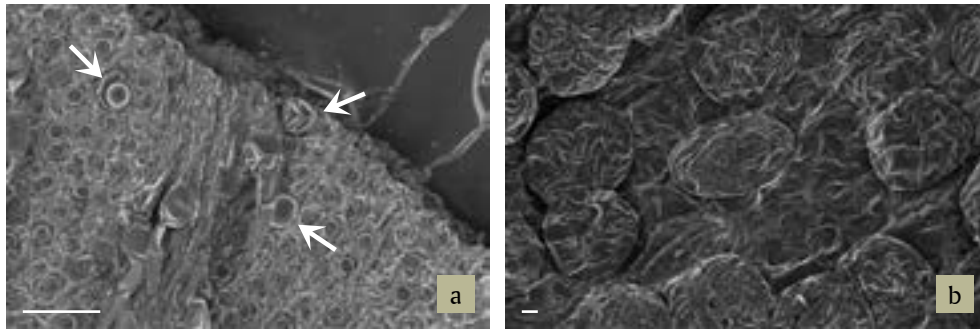


FIGURE 2.—Scanning electron microscope (SEM) images of peltate hairs: a, upper leaf surface, scale bar = 100 μm ; b, inside of calyx lobes, scale bar = 10 μm . Voucher: Van Wyk 4731, PRE. Micrographs taken with SEM at Electron Microscopy Unit, University of Pretoria, Pretoria.

be glabrous, but even then some hairs are present, especially along the margins. Most of the Namibian specimens housed in PRE have narrowly elliptic to elliptic to sometimes obovate, usually fairly small leaves with the margins entire or shallowly dentate in the upper half.

The leaves of *Rotheca myricoides* are often described as glandular punctate beneath (Verdcourt 1992; Fernandes 2005). These ‘glands’ are peltate hairs or peltate glands (Figure 2A). They are not always easy to observe when the leaf surface is densely hairy. Similar peltate hairs were described for *Clerodendrum triphyllum* (= *R. hirsuta*) and *C. louwalbertsii* (= *R. louwalbertsii*) (Herman 1998). They are possibly responsible for the unpleasant scent when the leaves are crushed. Similar peltate glands were observed on the inside of the calyx lobes of *R. myricoides* (Figure 2B) as well as on the skin of the fruit. These glands on the inside of the calyx lobes were described for *Clerodendron myricoides* by Medley Wood (1902), Pearson (1912) and Moldenke (1987), but none of the more recent publications mention them (Verdcourt 1992; Fernandes & Verdcourt 2000; Fernandes 2005). Peltate hairs or glands are often present in representatives of the family Lamiaceae (Ascensão et al. 1995; Shan-Shan Huang et al. 2008; Ping Jia et al. 2013; Rusydi et al. 2013).

There seems to be as much variation in the flower colour as in the leaf shape. The colour of the flowers, as noted on herbarium specimen labels, varies from green and blue or mauve, white and blue, or blue to mauve. The flower colours of most of the Namibian material housed in PRE are noted on the labels as whitish blue, blue or bluish, purple, four petals whitish and one blue, or green and blue. Most of the material was identified by Moldenke as *Clerodendrum dekindtii* var. *dinteri* or quoted by Friedrich-Holzhammer (1967) as *C. dekindtii*. Fernandes (2005) sank *C. dekindtii* var. *dinteri* sensu Moldenke under *R. myricoides* subsp. *myricoides* var. *moldenkei*. She sank *C. dekindtii* sensu Moldenke under *R. myricoides* subsp. *myricoides* var. *discolor* forma *discolor*. However, she recognised a separate taxon, subsp. *namibiensis*, under *R. myricoides* mainly based on the arrangement of the flowers in axillary cymes and the flowers being white or with four petals whitish green and the median petal blue, not all the petals violet.

Rotheca myricoides occurs in the South African provinces of Limpopo, Gauteng, Mpumalanga, KwaZulu-Natal (Figure 3) and possibly also North-West. In neighbouring coun-

tries it occurs in Namibia, Swaziland, possibly Botswana and further north in Africa. The species grows in a variety of vegetation types and habitats, including woodland, savanna, grassland, forest, bush, thickets, dune forest, and on mountain and hill slopes, among rocks, boulders or on rocky ridges, river or stream banks. The Red List status of *R. myricoides* in South Africa is Least Concern (LC) (Foden & Potter 2005).

According to Van Wyk et al. (2011) *Rotheca myricoides* is commonly known as: rough-leaved cat's whiskers, smelly cat's whiskers, bicoloured cat's whiskers, blue cat's whiskers, blue-flowered tinderwood, Namibian cat's whiskers; *growwe-blaarkatsnorbos*, *bloukatsnorbos*, *Namibiese katsnorbos*, *tweekleurkatsnorbos* (Afrikaans); *neigogana* (Jul'hoan); *ndimbiswilisi* (Kwangali, Manyo); *mutume* (Lozi); *bandamuchenene*, *muparamhosva*, *nyamhepo* (Manyika); *busuku* (Ndau); *bandamuchenene*, *chidzimamuriro*, *mudzimamuriro*, *nyamhepo*, *zanzi* (Shona); *umbozwa* (Swati); *mutilingwa* (Tonga); *umtyaty-ambane* (Xhosa); *umbozwa* (Zulu). The Flora of southern Africa national tree number is 667.1 and the Zimbabwe tree number is 898 (Van Wyk et al. 2011).

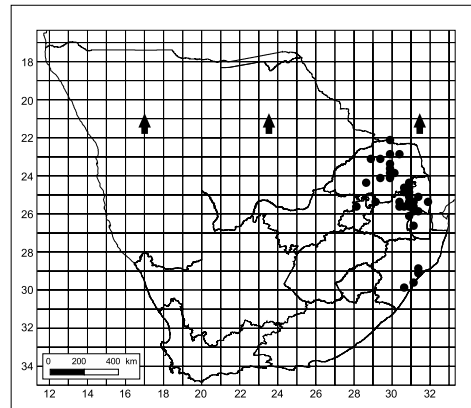


FIGURE 3.—Distribution of *Rotheca myricoides* in South Africa and Swaziland.

Rotheca myricoides has long been used in traditional medicine. According to Watt & Breyer-Brandwijk (1962) and Hutchings (1996) European and African people at Ixopo used a teaspoonful of the powdered bark for snake bite; the Masai used the root bark as a remedy for East Coast fever in cattle, and for diarrhoea in their calves; the Haya and Shambala used the plant for dysmenorrhoea, as well as a remedy for cough, furunculosis and swellings of the body associated with debility; and the root is an East African remedy for the enlargement of the spleen. The root is also used for pains in the chest, colds, bleeding of the gums, indigestion and in Zimbabwe for headaches, leaf decoctions for bathing patients with convulsions, while the leaves are used in West Africa for analgesic and antipyretic purposes (Hutchings 1996).

Description.—Shrub or small tree, up to 6 m high, sometimes scrambling or climbing. *Young branches* ± angular, pale greyish to whitish, usually with conspicuous white lenticels, glabrous or sparsely to densely whitish to rusty brown hairy, especially at growth points; side branches often opposite and rectangular to main branches, leaf scars prominent. *Leaves* opposite, decussate, rarely 3 in a whorl, almost sessile to distinctly petiolate, petiole up to 20 mm long, sometimes tinged purplish, sparsely to densely hairy; blade ovate to rhomboid, elliptic or rarely obovate, up to (100)75 × 60(75) mm, apex acute, base attenuate, margin entire in lower half, upper half dentate to coarsely dentate, sometimes almost deeply lobed, or entire margin dentate; upper and lower surfaces sparsely to densely hairy, with peltate hairs, foul smell when crushed. *Flowers* in terminal cymes, 1–3 together at a node, pedunculate, peduncle simple or branched up to 3 times, 1–3-flowered, primary peduncle up to 45 mm long, secondary peduncles up to 40 mm long, bracteate, 2 bracts

at each furcation, bracts at first furcation linear, linear-elliptic, obovate to almost leaf-like, up to 6 mm long; bracts at secondary furcations linear, up to 3 mm long, peduncles and bracts hairy; pedicels up to 8 mm long, hairy. *Calyx* with tube cup-shaped, green but sometimes purplish, up to 4 mm long, hairy; calyx lobes 5, semi-circular, up to 4×4 mm, apex roundish to obtuse, hairy on outside, peltate hairs on inside, persistent in fruit. *Corolla* zygomorph, tube 7–10 mm long, with 5 free petals, 4 lateral petals (two on each side) $5\text{--}12(15) \times 4\text{--}7$ mm, oblong-obovate, often ciliate, greenish, whitish, pale blue or purple, lower petal pyriform/ob-spathulate, $8\text{--}12 \times 3.5\text{--}10.0$ mm, dark blue or purple. *Stamens* 4, inserted in corolla throat, opposite lower corolla lip and curved towards it, long exerted, filaments 23–32 mm long, lower 5–7 mm ciliate-hairy, purple, anthers 2 mm long. *Style* long exerted, up to 36 mm long, curved towards lower corolla lip, with 2 uneven stigmatic lobes, upper lobe 1–3 mm long, lower lobe 1.5–4.0 mm long. *Ovary* superior, $\pm$ globose, $\pm 2 \times 1.5\text{--}2.5$ mm. *Fruit* 1–4-lobed drupe, $7\text{--}10 \times 8\text{--}12$ mm, purple or black at maturity, some peltate hairs present on exocarp. *Seeds* 1–4 pyrenes, reniform. *Flowering time*: August to June. Plate 2339.

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PLATE 2340 *Ruellia kaokoensis*

Ruellia kaokoensis

Acanthaceae

Angola, Namibia

Ruellia kaokoensis Van Jaarsv. sp. nov. differs from *R. bignoniiflora* S.Moore by its much smaller herbaceous habit, glaucous leaves and stems, much shorter diurnal trumpet-shaped maroon flowers of 60–70 mm long.

TYPE.—Namibia, Otjiboronbongo in Kaokoveld (Cunene District) of NW Namibia, growing on dolomite rock formation, June 2000, *Van Jaarsveld 16480* (WIND, holotype; NBG, isotype).

Acanthaceae, to which this species belongs, have a cosmopolitan distribution but are especially abundant in the tropics of Africa, Brazil, Central America and Indo-Malaysia. It consists of about 2 500 species in 250 genera (Heywood 2007), most of which are shrubs or herbaceous perennials, with some tending to scramble or climb. Many of the species have ornamental properties and several have been taken up in the horticultural industry. Well-known southern African members that are popular in gardens include *Anisotes rogersii* S.Moore, *Asystasia gangetica* (L.) T.Anderson, *Duvernoia adhatodoides* E.Mey. ex Nees, *Hypoestes aristata* (Vahl) Sol. ex Roem. & Schult., *Metarungia longistrobis* (C.B.Clarke) Baden, *Petalidium coccineum* S.Moore, *Salpinctium natalense* (C.B.Clarke) T.J.Edwards, various *Barleria* L., *Ruellia* L. and *Crossandra* Salisb. species, and the black-eyed Susan (*Thunbergia alata* Bojer ex Sims). *Brillantaisia* P.Beauv. from tropical Africa, is sometimes cultivated in suitable areas.

The leaves of *Acanthus mollis* L. (not indigenous to southern Africa) have been used as an emblem of the Corinthian capitals in Greek temples. This species is widely grown in Mediterranean type gardens.

The Acanthaceae family is distinctive and members are characterised by their simple, ex-stipulate, decussate leaves. Flowers are bisexual, irregular, or two-lipped, arranged in cymes or racemes with colourful bracts and bracteoles, often subtending the flowers. Petals and sepals amount to 4–5 each, and 2 or 4 stamens are attached to the petals. The style has two stigmas dissimilar in length. The fruit is a capsule and the seed borne on hook-like outgrowths and often released explosively, particularly after rain. Seeds are without endosperm and with large embryos. Some arid-adapted species are covered in mucous hairs which, upon wetting, aid in germination (Heywood 2007).

The Acanthaceae are divided into three subfamilies; *Ruellia* belongs to the subfamily Acanthoideae, tribe Ruellieae, subtribe Ruelliinae (Balkwill & Welman 2000). *Ruellia* is distinguished from close relatives (*Crabbea* Harv. and *Ruelliopsis* C.B.Clarke) by its muticous

PLATE 2340.—1, plant in flower, × 1; 2, internal structure of flower, × 1; 3, cross section of ovary, × 1.5; 4, gynoecium, × 1; 5, gynoecium including sepals, × 1; 6, glandular-puberulous calyx, × 1.5. Voucher specimen: *Van Jaarsveld 16480* in Windhoek Herbarium, Windhoek. Artist: Marieta Visagie.

and smaller upper stigmal lobe, each fruit locule with three seeds, and its distinctive pollen with large reticulations (Balkwill & Welman 2000). *Crabbea* has a contorted corolla in bud, with a cupular disc and a highly congested dichasial cyme surrounded by bracts. *Ruellioipis* differs from *Ruellia* by their anthers which are spurred, the upper lobe of the stigma absent, with one or two seeds in each locule, and banded pollen (Balkwill & Welman 2000). The genus name *Ruellia* was established by Linnaeus in 1753 and commemorates Jean de la Ruelle of Soissons, physician to Francis I and author of *De Natura Stirpium* in 1536 (Jackson 1990). The species name *kaokoensis* is in reference to the region where the species was first collected. There are 42 species recorded for *Ruellia* in sub-Saharan Africa (Klopper et al. 2006). Of these, 13 have been recorded for southern Africa, of which seven for Namibia (Germishuizen & Meyer 2003). These include *R. aspera* (Schinz) E. Phillips, *R. brandbergensis* Kers, *R. currorii* T. Anderson, *R. diversifolia* S. Moore, *R. kaokoensis* Van Jaarsv., *R. otaviensis* P.G. Mey. and *R. pilosa* L.f. Most are herbaceous perennials growing in various habitats such as savanna, grassland and semi-desert.

Ruellia kaokoensis is an ascending perennial with glaucous stems and leaves and beautiful maroon to pinkish, trumpet-shaped flowers, from northwestern Namibia and southwestern Angola. Where it occurs it is locally abundant in dry hot subtropical desert conditions. *Ruellia kaokoensis* is closest to *R. bignoniiflora* S. Moore, a species widespread in south tropical Africa (Vollesen 2008). *Ruellia bignoniiflora* was named by Spencer Le Marchant Moore in the *Journal of Botany* (1880) from a plant collected in the Luanda District of Angola (Welwitsch 5063). *Ruellia bignoniiflora* is a small shrub, 1.0–1.5 m high, with white nocturnal flowers that open at dusk and shed the flowers early the next day – clearly a moth-pollinated species. Its floral tube is 70–130 mm long of which the basal cylindrical part is 45–110 mm long. *Ruellia kaokoensis* differs by its much smaller stature (herbaceous perennial with glaucous leaves and stems), its maroon diurnal flowers (opening during the morning and falling shortly after dusk) and its corolla tube that is 25–30 mm long.

One of us (EJV) first came across *Ruellia kaokoensis* in the Kaokoveld on an expedition in June 2000 while studying the obligatory cliff-growing succulents in the lower Cunene valley at Otjiboronbongo. The plant was found in dry and hot semi-desert conditions, on dolomitic limestone rocks (Van Jaarsveld 16480). A year later, a specimen was recollected from the same location (Van Jaarsveld 16823). Plants were found growing scattered on rocky ridges among mopane (*Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard), *Petalidium coccineum* and species of *Commiphora* (*C. virgata* Engl., *C. multijuga* (Hiern) K.Schum.). Other species observed in the habitat include the annual *Thamnosma africana* Engl., *Aloe corallina* Verd. on the cliffs, *Ficus cordata* Thunb., *F. glumosa* Delile, *F. ilicina* (Sond.) Miq., *Adansonia digitata* L., *Tinospora fragosa* I. Verd. & Troupin and *Kalanchoe laciniata* (L.) DC. During an expedition to southwestern Angola, arranged by Brian Huntley in January 2009 (Van Jaarsveld 2010b), the plant was yet again encountered at Omauha, Iona National Park among *Acacia montis-usti* Merxm. & A.Schreib., *A. mellifera* (M.Vahl.) Benth. subsp. *detinens* (Burch.) Brenan, *Commiphora glaucescens* Engl., *C. multijuga*, *Boscia albitrunca* (Burch.) Gilg & Benedict, *Euphorbia virosa* Willd., *Salvadora persica* L., *Tamarix usneoides* E.Mey. ex Bunge and *Parkinsonia africana* Sond. In 2010 Angola was revisited with Wessel and Hannelie Swanepoel and Tielman Haumann, and *R. kaokoensis* was found as far north as Meva Strand near Benguellia along the northern Namib coast (Figure 1 & 2).

The vegetation of the northern Kaoko-veld is subjected to regular droughts. Rain-fall in this habitat is about 150–250 mm per annum (mainly thundershowers) with dry, cool winters without frost. *Ruellia kaokoensis* is common and indeed should not be given any endangered status (Raimondo et al. 2009).

Ruellia kaokoensis shows horticultural potential. It grows well from cuttings placed in sand during spring. Rooting is rapid after which plants can be transferred to individual containers. It can be grown successfully in a well-drained soil mixture and is best for dry, hot desert or arid savanna gardens. It prefers full sun but will also grow in light shade. One of us (EJv) was privileged to be able to grow *R. kaokoensis* for a number of years in the *Welwitschia* Corner Unit of the Botanical Society Conservatory at Kirstenbosch National Botanical Garden where the plant can be seen and where they flower throughout most of the year (Van Jaarsveld 2010a).

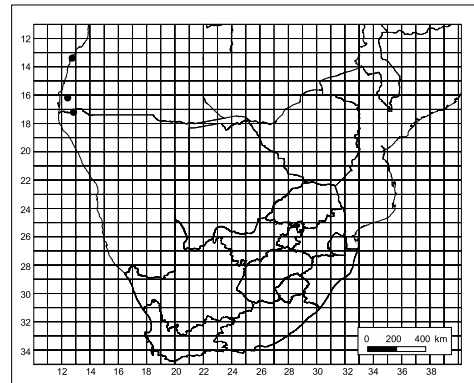


FIGURE 1.—Distribution of *Ruellia kaokoensis* in Namibia and Angola.

Description.—Ascending to decumbent, moderately branched, pale glaucous, herbaceous perennial or shrublet to 450 mm high. *Young stems* terete, faintly striate, densely puberulous, especially at the internodes with glandular and non-glandular hairs, often also with scattered, long, thin pilose hairs. *Leaves* with petioles 35–50 mm long; lamina ovate to ovate-lanceolate or cordate, 30–35 × 20–25 mm, apex acuminate, base rounded, puberulous to pubescent, especially along veins, with scattered glands. *Flowers* axillary, solitary or 2 per axil on separate pedicels, trumpet-shaped, 45 mm in diameter when fully opened; pedicels 10 mm long; bracteoles foliaceous, persistent, linear, 4–6 mm long. *Calyx* 18–20 mm long, fused at base for 1–2 mm, glandular-puberulous; lobes linear-acuminate. *Corolla* opening in the morning, falling by night, maroon; tube 55 mm long of which basal



FIGURE 2.—*Ruellia kaokoensis* in flower, growing at Meva Strand near Benguellia (northern Namib) in southwestern Angola. Photograph: E.J. van Jaarsveld.

cylindrical part is 25 mm long and throat is 27 mm long, surface glandular hairy, lobes widely spreading, 18–20 × 15 mm, broadly obovate to rounded. *Stamens* included in throat, subequal or slightly didynamous; filaments free, 20–25 mm long, glabrous; anthers 5–6 mm long. *Ovary* slender, glabrous, ± 10 mm long, 4 mm in diameter; stigma 30 mm long with two subequal lobes 2–5 mm long. *Capsule* and seed not seen. *Flowering time*: November to July. Plate 2340.

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Guide for authors and artists

INTRODUCTION

Contributions from authors and artists are most welcome. The policy of the editorial committee of *Flowering Plants of Africa (FPA)* is to obtain contributions from as wide a range of authors and artists as possible and to depict a rich and interesting mix of plants from all over Africa. SANBI reserves the right to purchase original artwork and retain copyright for *FPA*. All contributions are assessed by referees.

Plates that have already been published in colour in some other journal or magazine are generally not acceptable for *FPA*.

Authors and/or artists are advised to contact the editor (Alicia Grobler) before any work is undertaken with a view to publication in *FPA*: a.grobler@sanbi.org.za.

AUTHORS

All plates published in Volumes 1–49, are listed in the *Index* published in 1988. There are, however, several completed plates awaiting publication in *FPA*. Authors intending to have plants illustrated and written up for *FPA* are therefore advised to contact the editor to establish whether a plant has not already been figured for *FPA*.

Authors are expected to supervise the execution of plates to ensure that they are botanically correct. As detailed under the section 'Artists', a write-up and/or plate will not be acceptable **unless a voucher specimen is made** of the figured specimen and preserved in a recognised herbarium.

Before writing up a text for *FPA*, the author should ascertain whether the plate has been approved by the journal's panel of referees consisting of both botanists and botanical artists. Only after approval of the plate, should the author produce the text for submission to the editor. Approved contributions will be published when space allows. Those in which the names of new taxa are published for the first time usually receive priority.

Manuscripts should be **submitted electronically** to the editor and should conform to the general style of the most recent issue of *FPA*. From Volume 58 onwards, literature references are treated as described under headings 1, 2 and 3 further on.

The following serves as a checklist of requirements for an *FPA* text:

1. **Synopsis.** The correct name of the plant together with its author/s and relevant literature (name of publication written out in full) is cited. Put a comma after the author's name if the publication that follows is his/her own; write the word 'in' after

the author's name if the publication that follows is a journal or other work edited/compiled by someone else. Following this, are synonyms (listed chronologically) plus their author/s and relevant literature reference/s reflecting only author, page and year of publication, e.g. Boris et al.: 14 (1966). The whole synopsis is in one paragraph. If there are many synonyms and literature references, restrict yourself to the most important ones. References should be arranged in chronological sequence; where two or more references by the same author are listed in succession, the author's name is repeated with every reference. Author citations of plant names should follow Brummitt & Powell (1992, *Authors of plant names*); for other authors, give full surnames followed by a colon, page number/s and date.

2. **Literature references in the text.** Should be cited as follows: 'Jones & Smith (1999) stated ...' or '... (Jones & Smith 1999)' when giving a reference simply as authority for a statement. When more than two authors are involved, use the name of the first author followed by 'et al.' Personal communications are given only in the text, not in the list of references; please include full initials to identify the person more positively. Referencing websites are generally discouraged unless their content is based on reviewed scientific research (e.g. databases of plant names, online Floras, specimen images, Red Lists, etc.) or are otherwise trustworthy and reputable.
3. **List of references.** All publications referred to in the synopsis and the text, but no others, are listed at the end of the manuscript under the heading 'References'. The references are arranged alphabetically according to authors and chronologically under each author, with a, b, c, etc. added to the year if the author has published more than one work in a year. If an author has published both on his/her own and as senior author with others, the solo publications are listed first and after that, in strict alphabetical sequence, those published with one or more other authors. Author names are typed in capitals. Titles of books and journals are written out in full, in italics. In the case of books, the name of the publisher is followed by a comma and the place of publication. For websites, provide full website name, address and the date when it was accessed in square brackets.
4. **Text proper.** It should be written in language and style acceptable to both the scientist and informed lay person. The following features should, as far as possible, be described and discussed in the text:
 - Main diagnostic characters for a brief pen picture of the plant.
 - Affinities: how the taxon differs from its nearest allies; if necessary keys may be used to distinguish closely related taxa.
 - History of the taxon, where and when first collected and by whom.
 - Geographical distribution in Africa: a distribution map, which will be handled as a figure, is essential; authors should submit a list of Quarter Degree Grid Cells, or GPS coordinates in decimal degrees in two columns (first column for latitude, second column for its corresponding longitude), from which the editor's office will produce the distribution map.
 - Ecology: habitat preferences etc. It is highly recommended that authors submit a photograph of the plant in habitat or a general habitat image.
 - Phenology: time of flowering, fruiting, etc.

- Economic importance, edibility, medicinal use, toxicity, etc.
 - Cultivation potential and hints on cultivation.
 - Origin of the scientific names.
 - Common names in various languages.
 - Any other facts of interest to the scientist or lay person.
5. **Description.** This is a formal description of the taxon and not merely of the specimen illustrated. For measurements, use only units of the International System of Units (SI). Use only mm and/or m.
6. **Captions.** Supply a caption for the colour plate, indicating the relevant magnifications and/or reductions, and citing the voucher specimen used for the illustration, i.e. collector + number + herbarium (full name, not acronym) where the specimen is housed. The caption ends with the name of the artist. Also supply captions for the distribution map and any other figures you want to include (please use scale bars where relevant), making sure all figures are mentioned in the text.

ARTISTS

1. **Supervision.** All illustrations should be executed under the supervision of the botanist writing the text to ensure botanical accuracy and that details considered important by the botanist are adequately depicted.
2. **Dimensions.** The dimensions to work to are 160 × 210 mm (width × height of image) or slightly smaller. Illustrations are printed as is, i.e. the same size. Only in exceptional cases are illustrations reduced or enlarged.
3. **Paper.** The paper must be of good quality and as white as possible. Arches or Saunders Waterford (hot-press, 300 gsm) is recommended. The use of board should be avoided.
4. **Watercolours.** The use of good-quality watercolours, e.g. Winsor & Newton (certain pigments fade with time) or Schmincke (colourfast), is essential. The use of black paint is not recommended as it is too harsh and tends to kill colour. Similarly, white paint must be used with caution since it tends to dull adjoining colours and sometimes reproduces as a bluish colour. Its use should be limited to white hairs and certain highlights only. To reflect whiteness, endeavour to use the paper colour itself.
5. **Subject material, composition etc.** For obvious reasons, the subject material should be representative of the species being illustrated and should be in excellent condition. Drawing from photographs is not recommended: it is impossible to obtain the same detail from a photograph as from the living plant.

All parts should be measured by the artist and **magnifications indicated on the back of the plate** and the figure(s) where relevant.

The plate should not be overcrowded with too many small dissections. These should preferably be inserted as separate figures in the text. Dissections or habit sketches included on the plate should be in pencil or colour, not ink, whereas dissections or habit sketches to be used as separate text figures should be in ink.

A voucher specimen made of material from the plant(s) illustrated, must be preserved, given a collector's number and housed in a recognised herbarium as a permanent record. This is most important: **without a cited voucher specimen, the plate and write-up will not be accepted.**

Show clearly as many features as possible, for example apical buds, leaf axils, hairs, glands, bracts, stipules, upper and lower surfaces of leaves showing venation, front, side and back view of flowers, mature fruit, habit and where necessary and feasible, the underground parts. The supervising botanist will know which features require accentuation.

The artist's signature must be unobtrusive but clearly written so that it will stand reproduction. Numbering of plant parts should be done in light pencil: permanent numbering will be done by the resident artist in consultation with the editor. No other annotations should appear on the plate. Information such as species name, collector's name and number, date, locality, magnifications etc. should be written **on the back of the plate.**

- 6. Dispatch of plates.** Plates should be carefully packed, flat, using a sheet of Masonite or similar material to prevent bending, and sent by registered or insured post.

Index to Volume 65

<i>Adenia wilmsii</i> (2332)	90
<i>Aloe braamvanwykii</i> (2323)	14
<i>Caesalpinia bracteata</i> (2330)	76
<i>Cissampelos hirta</i> (2325)	34
<i>Codonorhiza azurea</i> (2321)	2
<i>Eriosema distinctum</i> (2331)	84
<i>Esterhuysenia lucilleae</i> (2333)	96
<i>Gladiolus crassifolius</i> (2322)	8
<i>Gomphocarpus glaucophyllus</i> (2336)	120
<i>Ipomoea bolusiana</i> (2337)	132
<i>Ipomoea cairica</i> (2338)	138
<i>Kalanchoe leblanciae</i> (2328)	56
<i>Pisonia aculeata</i> (2334)	106
<i>Protea foliosa</i> (2326)	42
<i>Protea namaquana</i> (2327)	50
<i>Rotheca myricoides</i> (2339)	146
<i>Ruellia kaokoensis</i> (2340)	154
<i>Schizostephanus alatus</i> (2335)	112
<i>Senna didymobotrya</i> (2329)	68
<i>Tinospora fragosa</i> subsp. <i>fragosa</i> (2324)	26

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Flowering Plants of Africa

Volume 65

June 2017

Contents

2321. <i>Codonanthus azura</i> . P. Goldblatt and John C. Manning	2
2322. <i>Gladolus crassifolius</i> . J.C. Manning, P. Goldblatt and Gillian Condly	8
2323. <i>Aloe braamvanwykii</i> . G.F. Smith, E. Figueiredo, R.R. Klopper, N.R. Crouch and Gillian Condly	14
2324. <i>Tinospora fragosa</i> subsp. <i>fragosa</i> . E.J. van Jaarsveld and Marieta Visagie	26
2325. <i>Cissampelos hirta</i> . M. Struwig, H. de Wet and Gillian Condly	34
2326. <i>Protea foliosa</i> . C.I. Peter, A.P. Dold, C. Melidonis and Susan Abraham	42
2327. <i>Protea namaquana</i> . J.P. Rourke and Ellaphie Ward-Hilhorst	50
2328. <i>Kalanchoe leblanciae</i> . G.F. Smith, E. Figueiredo, N.R. Crouch and Gillian Condly	56
2329. <i>Senna didymobotrya</i> . T.P. Jaca and Gillian Condly	68
2330. <i>Caesalpinia bracteata</i> . E.J. van Jaarsveld and Gillian Condly	76
2331. <i>Eriosema distinctum</i> . T. Nkonki, S.M. Serumula and Gillian Condly	84
2332. <i>Adenia wilmsii</i> . E.J. van Jaarsveld and Gillian Condly	90
2333. <i>Esterhuysenia lucilleae</i> . E.J. van Jaarsveld and Marieta Visagie	96
2334. <i>Pisonia aculeata</i> . M. Struwig and Gillian Condly	106
2335. <i>Schizostephanus alatus</i> . E.J. van Jaarsveld and Marieta Visagie	112
2336. <i>Gomphocarpus glaucophyllus</i> . S.P. Bester and Gillian Condly	120
2337. <i>Ipomoea bolusiana</i> . W.G. Welman and Gillian Condly	132
2338. <i>Ipomoea cairica</i> . W.G. Welman, P.P.J. Herman and Gillian Condly	138
2339. <i>Rotheca myricoides</i> . P.P.J. Herman and Gillian Condly	146
2340. <i>Ruellia kaokoensis</i> . E.J. van Jaarsveld and Marieta Visagie	154
Guide for authors and artists	159
Index to Volume 65	163

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