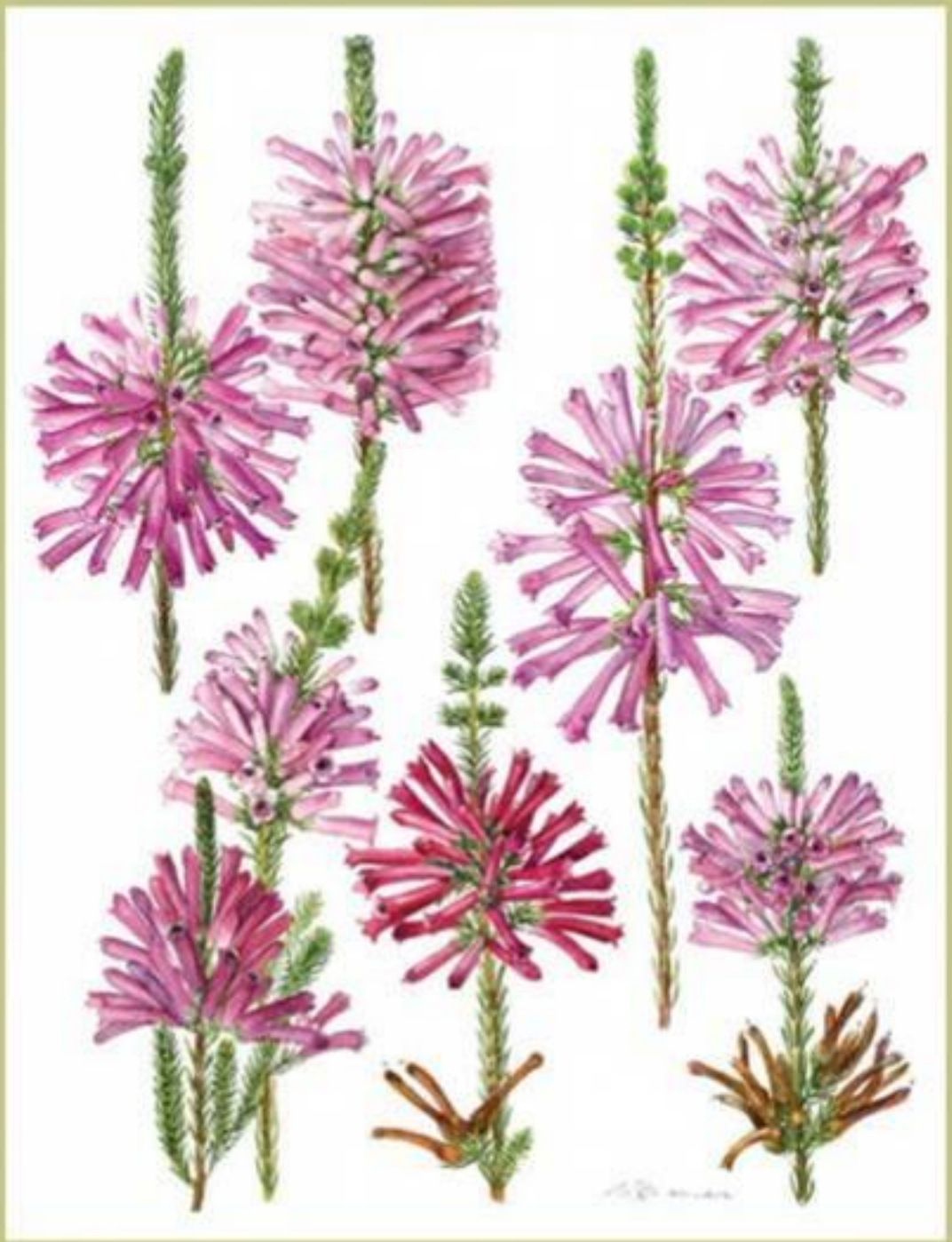
Flowering Plants of Africa

Volume 63 June 2013



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 serial 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, but we welcome other contributions of suitable artistic and scientific merit. Please see *Guide for authors and artists* on page 145.

A list of available back issues is given in the current *Publications Catalogue* of the Institute and on the website www.sanbi.org. Copies of this serial and of the *Catalogue* are obtainable from the SANBI Bookshop, South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

History of this series
(note Afrikaans translation and changes in title)

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Volume 25 (1945–1946) to Volume 26 (1947):
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Cover illustration: *Erica verticillata* (Plate 2296)

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Flowering Plants of Africa

A magazine containing colour plates with descriptions of flowering plants of Africa and neighbouring islands

Edited by

A. Grobler

with assistance of

G.S. Condy

Volume 63

SANBI
Biodiversity for Life

Pretoria
2013

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This volume is dedicated to

KIRSTENBOSCH NATIONAL BOTANICAL GARDEN
The most beautiful garden in Africa.

Celebrating its centenary in 2013, Kirstenbosch was established on the foot slopes of Table Mountain and is the largest of nine National Botanical Gardens administrated by the South African National Biodiversity Institute.

KIRSTENBOSCH
CENTENARY 1913-2013

Set in the Cape Floristic Region, this flagship garden is renowned for, amongst other attractions, the avenue of camphor trees planted by Cecil John Rhodes, fynbos-clad mountain slopes, Castle Rock, Compton Herbarium, Bird's Bath, the Botanical Society Conservatory, majestic king proteas (*Protea cynaroides*), bulbs, succulents, sunbirds, cycads and serene water features. In 2004, Kirstenbosch became the first botanical garden to be included in a world heritage site when UNESCO declared the entire Cape Floristic Region as such.

Various contributions in this volume celebrate Kirstenbosch and its biodiversity-rich setting in one way or another. Several authors are actively involved in research at Kirstenbosch. *Aloe mitriformis* subsp. *comptonii* (Plate 2282) was named in honour of R.H. Compton, director of the National Botanical Gardens of South Africa at Kirstenbosch, whereas *Begonia sonderiana* (Plate 2290) honours O.W. Sonder, co-author of *Flora capensis*. *Lachenalia pearsonii* (Plate 2285) and *Plumbago pearsonii* (Plate 2292) commemorates H.H.W. Pearson, first director who, with J.W. Mathews as curator, began planning and laying out the garden in 1913. Furthermore, several plates depict species occurring in fynbos vegetation, including the extraordinary *Erica verticillata* (Plate 2296) with its inspirational tale of extinction, rediscovery and subsequent cultivation at Kirstenbosch.

Photograph below: Kirstenbosch—the iconic Castle Rock with strelitzias in the foreground at the bottom of the main lawn. This is the first view that greets visitors as they enter through the Visitors Centre entrance gate (Photograph: Alice Notten).





PLATE 2281 *Eulophia ensata*

Eulophia ensata Orchidaceae

South Africa, Swaziland, Mozambique

Eulophia ensata Lindl. in The Botanical Register 14: t.1147 (1828); Rolfe: 44 (1912–1913); Hall: 201 (1965); Stewart *et al*.: 249 (1982); La Croix & Cribb: 505 (1998); Hall: 393 (1999).

Eulophia ensata was described in 1828 by the English botanist John Lindley [1799–1865] in *The Botanical Register*, a horticultural magazine with descriptions and hand-coloured engravings of plants and shrubs cultivated in British gardens, which later became *Edwards's Botanical Register*. The plate accompanying Lindley's text was executed by the British artist M. Hart from a plant said to have been collected in the 'Cape of Good Hope', received from the famous Sloane Street Nursery of Mr Tate in London, where rare and unusual imported plants were cultivated and introduced. Lindley was under the erroneous impression that it had originally been collected by Mr George Don, a member of the Horticultural Society of London, in Sierra Leone, and also stated it to be very difficult to grow and liable to rot (Lindley 1828). In his taxonomic revision of the South African species of *Eulophia* R.Br. ex Lindl., A.V. Hall (1965) designated Hart's colour plate as the lectotype, as no pressed material exists of the specimen upon which the plate is based. Apart from that plate, the only other published paintings of this species are those of Harry Bolus, painted in February 1893 and illustrated on plate 26 of his *Icones Orchidearum Austro-africanorum Extratropicarum* (Bolus 1911) and the present one by Gillian Condy. The specific name *ensata* is descriptive of the sword-shaped leaves, which are straight and heavily pleated.

The German botanist C.E.O. Kuntze (1891) transferred all the species referred at that time to *Eulophia* to the earlier genus *Graphorchis* Thouars (=*Graphorkis* Thouars) in the second volume of his *Revisio Generum Plantarum*, including *E. ensata*, which became *G. ensata* (Lindl.) Kuntze. *Eulophia* R.Br. ex Lindl. was later conserved against *Graphorchis* (Summerhayes & Hall 1962), but unfortunately Hall's revision (1965) omitted *Graphorchis ensata* from the synonymy of *Eulophia ensata*. According to Hall (1965) the name *E. oblonga* Rolfe (Rolfe 1910) was based on a mixed gathering, including the flower of *E. ensata* and the vegetative parts of *E. ovalis* Lindl. subsp. *ovalis*, thus it was rejected as a synonym in his revision.

The genus *Eulophia* has enjoyed fairly wide coverage in *Flowering Plants of Africa* (including the two name changes this publication has undergone since its inception in 1921) and the present contribution is the 25th species to be included in this series.

Eulophia has about 250 species distributed mainly in the tropics of central Africa. Forty-two species are found in southern Africa and it is also represented in India,

PLATE 2281.—1, plant with leaves, cauline sheaths and lower portion of peduncle, × 1; 2, inflorescence, × 1; 3, single flower, × 1; 4, unripe capsule, × 1; 5, habitat sketch. Voucher specimen: *Condy 239* in National Herbarium, Pretoria. Artist: Gillian Condy.

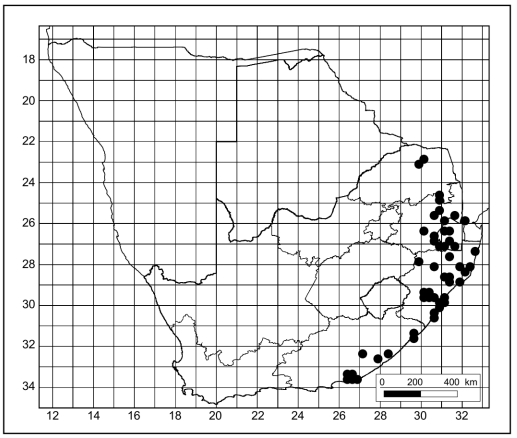


FIGURE 1.—Known distribution of *Eulophia ensata*.

Southeast Asia and Central America. Its members are mainly deciduous, summer-growing plants but the genus also has evergreen and deciduous winter-growing species. It occurs in all provinces of South Africa, with major centres of diversity in KwaZulu-Natal and Mpumalanga, and is also found in all other southern African countries, i.e. Botswana, Lesotho, Namibia and Swaziland (Hall 1965, 1999). *Eulophia ensata* occurs in the eastern and northeastern parts of the summer rainfall subregion (Figure 1). Its distribution stretches in an arc from the southern Eastern Cape to northern Limpopo in South Africa and it also occurs in western and northern Swaziland, and there is a single record (*Gomes e Sousa 139* in K) from Namaacha in southern Mozambique (La Croix & Cribb 1998). In the Eastern Cape and KwaZulu-Natal, it occurs mainly in coastal areas, extending to high rainfall mountainous areas in Mpumalanga and Limpopo; it is most frequently encountered in central and eastern KwaZulu-Natal and Mpumalanga (Hall 1999). The plant is rare to locally frequent, occurring in small populations of up to 25 plants in podzol, sandy loam and lateritic soils. Its habitat is open grassland and road reserve grassland in full sun, grassy places in coastal bushveld, often near large boulders, and in moderate shade in pure bushveld and, surprisingly, in Limpopo it also occurs in *Eucalyptus* plantations (Hall 1965). The species has a long flowering period from October to February, with a peak in January (Hall 1965). The specimen illustrated here (*Condy 239* in PRE) was collected at the Florence Guest Farm in the historic hamlet of Chrissiesmeer, also known as 'New-Scotland', in central Mpumalanga, where it was found in a clump comprising at least 15 plants in road reserve grassland (Figure 2).

The infrageneric taxonomy of *Eulophia* is problematic as many of the species are variable and comprise aggregates of forms that are difficult to subdivide and assign taxonomic status. A modern phylogeny for the genus is lacking, but in a similarity dendrogram of the South African eulophias, based on 93 morphological characters amongst 36 species, Hall (1965) found that *E. ensata* was placed adjacent to *E. leontoglossa* Rchb.f., a deciduous, summer-growing species with nodding, yellow or rarely pink flowers in short, dense, capitate racemes. *Eulophia leontoglossa* differs mainly in the side lobes of the lip that are not broadened as in *E. ensata*, and in its shorter middle lobe and much shorter peduncle. The distribution of *E. leontoglossa* overlaps that of *E. ensata* in eastern Mpumalanga and parts of KwaZulu-Natal, but the former has a more inland distribution in eastern and northeastern South Africa, extending to eastern North-West, and it has a longer flowering period from August to March, with a peak in December (Hall 1965). *Eulophia ensata* is frequently confused with *E. welwitschii* (Rchb.f.) Rolfe, another yellow-flowered species with a similar capitate

raceme which occurs mainly in the northeastern summer rainfall zone of southern Africa and into tropical Africa. The latter differs from *E. ensata* in its larger, light yellow flowers, with the crests usually absent in the upper half of the middle lobe, and with the side lobes, distal crest papillae and basal parts of the middle lobe marked with dark reddish purple, and it has a stouter gynostemium (Hall 1965).

Eulophia ensata is a tall and slender, clump-forming geophyte. The rootstock comprises a chain of up to eight persistent, subterranean pseudobulbs joined by short cylindrical stems, the roots developing from the base of the leaf shoot where it is attached to the pseudobulb (Du Plessis & Duncan 1989). The three to four sword-shaped, heavily pleated leaves are supported by two clasping, cauline sheaths, and the flower-bearing stem which develops next to the leaf shoot has three to five prominent light brown, papery sheaths. The dense flower head of 6–30 bright yellow blooms appears at more or less the same level as the leaf tips and lasts for about two weeks. The peduncle remains attached to the pseudobulb for several months after flowering and the minute, dust-like seeds are wind-dispersed from obovoid, suberect capsules. According to Pooley (1998) an infusion of the pseudobulbs is used to treat infant ailments and as a love charm.

The life cycle of *Eulophia ensata* commences with vegetative growth in October following late spring rains, and flower buds may appear shortly afterwards, or at any time up until February. The leaves remain green until late April or early May, after which they desiccate and the plant enters a winter dormant period of about five



FIGURE 2.—*Eulophia ensata* in habitat, Chrissiesmeer. Photograph: Gillian Condy.

months. Little is known of the pollination biology of *Eulophia* but it has recently been established that *E. ensata* and *E. welwitschii* are pollinated by flower chafer beetles (Cetoniinae: Scarabaeidae). None of the *Eulophia* species provide any reward to pollinators and it would appear that the basis of attraction of beetles to the unscented flowers of *E. ensata* and *E. welwitschii* relies on the similarity in general shape and colour of the inflorescence to sympatric members of the family Asteraceae, which provide rewards of food and rendezvous platforms (Peter & Johnson 2009).

Eulophia is probably the most adaptable southern African orchid genus to cultivation, particularly those members that are evergreen. For example, the evergreen *E. horsfallii* (Batem.) Summerh., a robust, southern and tropical African plant of swampy terrain, has become naturalised in several perennially moist, lower parts of Kirstenbosch National Botanical Garden, from seeds originally wind-dispersed from mature plants in the bulb nursery (Duncan 2000). Similarly, seedlings of the xerophytic, evergreen *E. petersii* (Rchb.f.) Rchb.f. have appeared in a seasonally dry and exposed part of the nursery bulb collection, from seeds dispersed from mature plants in the succulent nursery. Many deciduous eulophias are also of easy culture, provided the appropriate dry dormant period is strictly enforced. Members of the latter group are generally best grown as container subjects that can be moved to the most appropriate position during the active growth and dormancy periods. The deciduous, summer-growing *E. ensata* has been in continuous cultivation at Kirstenbosch for almost 30 years. It performs well in 250 mm and 300 mm plastic pots, in a well drained medium recommended for eulophias which comprises equal parts of coarse river sand, silica sand and well-rotted acid compost (Du Plessis & Duncan 1989). The pseudobulbs are planted in spring at a depth of 20–30 mm, and given an initial drench of water. Once the leaf shoots appear, a weekly drench is applied throughout the summer months until late autumn when the leaves turn brown, and the plants are kept completely dry in winter. *Eulophia ensata* needs a sunny aspect and it is advisable to place a stake into the pot when planting takes place, as the inflorescences tend to flop over in strong wind. Ideally, the rootstocks of *E. ensata* need to be lifted and replanted into new soil approximately every three years to stimulate flowering, and they require protection from winter frosts and frozen ground.

The reason that most orchids cannot easily be raised from seed sown under non-sterile conditions is that the seedlings are dependent for survival on a symbiotic association with a specific fungus. In addition, further requirements for germination of viable seeds such as sufficient moisture, optimum temperature and light levels have to be met. The fungus penetrates the roots of the orchid seedling and through the exchange of nutrients, nutritional benefit is obtained by the seedling, and in some instances, by the fungus as well. It is especially during seed germination and subsequent growth of the seedling that the orchid's dependence on its associated fungus is greatest. Growing and propagating these species from seed requires knowledge of the mycorrhizal associations, which these orchids form, and is dependent on laboratory research at the institutional level. Generally, two methods are used for germinating seeds of the deciduous terrestrials, the symbiotic and asymbiotic methods, both of which are complicated procedures beyond the capabil-

ity of the home gardener, and take place *in vitro*, under sterile conditions (Du Plessis & Duncan 1989; Crous & Duncan 2006). Fortunately, the rootstock of *E. ensata* sometimes forms branches, and these can be separated during the winter dormant period and should be replanted immediately into dry medium. Each branch has to be separated with a growing point, i.e. with the youngest pseudobulb attached. As far as is known, old, persistent pseudobulbs are not viable if separated and replanted (Du Plessis & Duncan 1989).

In the Kirstenbosch Bulb Nursery, two major pests affect *E. ensata*, western flower thrips and red spider mites. Thrips infest the developing flower buds in early summer, causing severe deformation, and red spider mites infest upper and lower leaf surfaces in late summer, causing them to desiccate and turn brown, and the plants to enter dormancy prematurely.

Description.—Deciduous, summer-growing terrestrial geophyte 0.30–1.04 m high. *Rootstock* subterranean, persistent, moniliform, sometimes branch-forming, consisting of up to 8 pseudobulbs; pseudobulbs more or less oblongoid, 45–70 × 30–50 mm, horizontally elongate. *Leaves* 3–4, ensiform, 0.3–1.0 × 0.07–0.15 m, acuminate, erect to suberect, light green, heavily plicate, partially to fully developed at flowering; cauline sheaths 2, 130–225 mm long, clasping. *Inflorescence* a dense, capitate raceme; peduncle erect, 0.3–1.0 m high, slender to stout with 3–5 internodes, light green, arising laterally to leaf-bearing axis; sheaths 3–5, prominent, 90–110 mm long, erect, light brown, papery, clasping, uppermost sheath slightly exceeding internode; bracts linear to narrowly lanceolate, 10–15 × 1–2 mm, light brown; pedicels suberect, 2–3 mm long, light green. *Flowers* narrowly campanulate, 6–30, suberect to erect, unscented; sepals, petals and lip bright yellow; median and lateral sepals narrowly oblong to narrowly elliptic, 13.2–25.2 mm long, apices acute; petals narrowly oblong to narrowly elliptic-oblong, 12–20 mm long, apices obtuse to acute; lip 3-lobed, apex obtuse, crests consisting of 2 broad ridges in basal half, passing into dense filiform yellow or orange papillae on midlobe, extending to near apex, side lobes of lip sub-oblong, broadening near base, with a rounded, slightly spreading free distal portion 3–4 × 3–4 mm; mentum 2–3 mm long; spur cylindrical, slender, 4–7 mm long. *Gynostemium* slender, 6–8 mm long; anther cap shortly rostrate. *Capsule* obovoid, 25 × 12 mm, suberect. Chromosome number: n=27 (Hall 1965). Plate 2281.

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PLATE 2282 *Aloe mitriformis* subsp. *comptonii*

Aloe mitriformis subsp. *comptonii* Asphodelaceae

South Africa

Aloe mitriformis subsp. **comptonii** *(Reynolds) Zonneveld* in *Bradleya* 20: 10 (2002).

Aloe comptonii Reynolds was first named in *The Aloes of South Africa* (1950), with the description based on plants collected by Dr. G.W. Reynolds at Uniondale (Western Cape). However, this taxon was recently subsumed under *A. mitriformis* following genome studies by Zonneveld (2002). *Aloe mitriformis* subsp. *comptonii* belongs to *Aloe* (Section *Aloe*) Series *Aloe* (Glen & Hardy 2000 [following Reynolds 1950, Series *Mitriformes* (Salm-Dyck) Reynolds]), which is centred mainly in the southern and south-western parts of South Africa, an area that receives most of its rainfall during winter. Members of Section *Aloe* Series *Aloe* are easily recognised by their characteristic persistent firm ovate-acute green to glaucous, succulent leaves with white or yellowish marginal teeth and distinct capitate racemes. The plants are usually branched with short to long leafy, procumbent, decumbent, erect or pendent stems. Eight taxa are classified under Section *Aloe* Series *Aloe*, namely *Aloe arenicola* Reynolds, *A. mitriformis* subsp. *comptonii* (Reynolds) Zonneveld, *A. mitriformis* subsp. *distans* (Haw.) Zonneveld, *A. mitriformis* Mill. subsp. *mitriformis*, *A. dabenorisana* Van Jaarsv., *A. meyeri* Van Jaarsv., *A. pavelkae* Van Jaarsv., Swanepoel, Van Wyk & Lavranos, and *Aloe pearsonii* Schönland. Of all these taxa, *A. mitriformis* is the most variable and widespread in South Africa's winter rainfall region. Plants vary in habit (procumbent to decumbent), leaf size, leaf colour, as well as leaf margin prickle colour (yellow to white). These variations, however discrete, prompted Zonneveld to reduce both *A. comptonii* Reynolds and *A. distans* Haw. to subspecific level (Zonneveld 2002; Carter *et al.* 2011).

Glen & Hardy (2000) treated *Aloe comptonii* as a synonym of *A. perfoliata* without justifying this action. In spite of a floral specimen by Linnaeus, Reynolds (1950) was unable to determine the identity of *A. perfoliata*. This specimen (with short pedicels) does not match the distinct capitate raceme and long pedicels, which is characteristic of *A. mitriformis*, with Reynolds concluding and treating *A. perfoliata* as an imperfectly known taxon. Therefore the name *A. mitriformis* Miller takes priority based on the figure (iconotype) in Dillenius's *Hortus Elthamensis* 21, tab. 17, fig. 19 in 1732 (Carter *et al*. 2011).

Aloe mitriformis subsp. *comptonii* is characterised by its short decumbent stems, bearing ascending to erect rosettes and paniculate inflorescences consisting of up to eight distinctly rounded to pointed, capitate racemes. Flowering time is during spring and early summer (September–December). Its closest relative (subsp. *mitriformis*) has long procumbent stems (sometimes pendent from cliffs), leaves somewhat less glaucous and flowering during summer.

PLATE 2282.—1, flowering raceme, × 1; 2, decumbent stem with erect rosette, much reduced. Voucher specimen: *Van Jaarsveld 19527* in Compton Herbarium, Kirstenbosch. Artist: Gillian Condy.

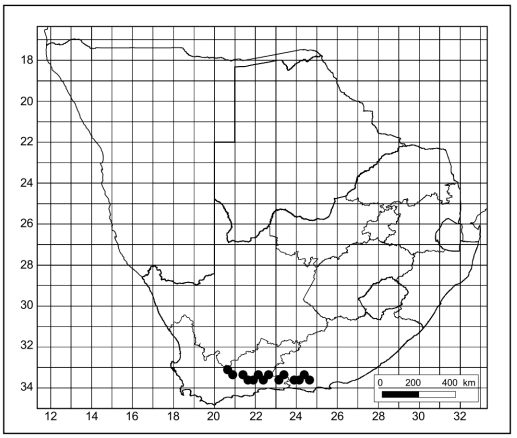


FIGURE 1.—Known distribution of *Aloe mitriformis* subsp. *comptonii*.

Apart from *Aloe pearsonii*, which is an erect branched shrub, all the other aloe members in Section *Aloe* Series *Aloe* have a procumbent, decumbent or pendent growth. These species are also more or less confined to the Succulent Karoo and Fynbos biomes. This includes mainly the Western Cape and the northwestern parts of the Northern Cape. *Aloe pearsonii* is the most distinct of the group. It is an erect, branched shrub occurring in dense stands in the lower Gariep River Valley (Central Richtersveld Mountain Shrubveld, and the adjacent northern Hunsberg in Namibia; Mucina & Rutherford 2006). *Aloe arenicola* occupies the sandy regions of the Namaqualand Coastal Duneveld (Mucina & Rutherford 2006). In terms of habitat preference, both *A. pearsonii* and *A. arenicola* occur in the Succulent Karoo and are geographically limited to the Northern Cape and adjacent Namibian territory. Three species (*A. dabenorisana*, *A. meyeri* and *A. pavelkae*) are confined to sheer cliffs of the hard metamorphic quartzitic or sandstone formations in the lower Gariep River Valley in the Desert Biome. The remaining three clearly form a related group where they occur in both the Succulent Karoo and Fynbos Biomes in the Western Cape (*Aloe perfoliata*, sensu Glen & Hardy 2000). *Aloe mitriformis* subsp. *distans* occurs in the Western Strandveld (Fynbos Biome), usually confined to sandy flats or granite outcrops of the Saldanha Bay to St Helana Bay coastal region. *Aloe mitriformis* subsp. *mitriformis* is the most widespread of the group. It occurs in the Western Cape, where it is usually confined to the Cape Fold Mountains, from the Bokkeveld Escarpment in the north to the Riviersonderend Mountains in the east, as well as the coastal region from Blaauberg (Cape Town), north to Lambertsbaai (north of Saldanha) and reaching as far north as Spoegriviermond (southern Namaqualand). Plants can be found growing on steep rugged quartzitic sandstone mountains in acidic soils, sometimes pendent from rock faces.

Aloe mitriformis subsp. *comptonii* grows further east than any other taxon in Section *Aloe* Series *Aloe* and is known from Whitehill, Laingsburg in the west to the Swartberg, east of Oudtshoorn, Uniondale, Western Cape, to the Baviaanskloof, Kouga River, Grootrivierspoort to about 60 km southeast of Steytlerville in the Eastern Cape. It grows both in mountainous terrains and the intermontane valleys, in soils derived from sandstone, Witteberg Quartzites or Enon Conglomerates, and to a lesser extent shale derived soil (usually confined to Succulent Karoo and smaller areas of Fynbos and Thicket biomes). Although the plants grow on gentle hills they are also found on sheer cliffs (Meiringspoort to Grootrivierspoort) at altitudes of 500–1 000 m. Their Succulent Karoo habitat consists mainly of Eastern Little Karoo, Willowmore Gwarrieveld and Steytlerville Karoo of the Rainshadow Valley

Karoo Bioregion (Mucina & Rutherford 2006). Rainfall in the region is during winter (mainly cyclonic) and summer (thundershowers) and ranges between 150–400 mm per annum. The substrate varies from rocky to sandy and slightly acidic soils. Various habitat observations were made at several sites throughout the species' distribution range. At Vanwykskraal, plants were found growing in flat to hilly terrain in weathered, reddish Enon Conglomerate soils. The plants grow scattered and sympatric with *Aloe striata*, *A. humilis* and *A. variegata*. Other prominent succulents observed in the immediate vicinity include *Cotyledon orbiculata* var. *spuria*, *Cotyledon papillaris*, *Gasteria brachyphylla* var. *brachyphylla*, *Haworthia truncata*, *Malephora lutea*, *Lampranthus haworthii*, *Senecio radicans*, *Tylecodon cacalioides* and *T. tuberosus*. At Rooinekpass (near Laingsburg), plants were growing among Witteberg quartz rocks on north-facing, gentle to steep mountain slopes among succulents such as *Crassula orbicularis*, *C. perforata*, *C. rupestris*, *Haworthia wittebergensis*, *Drosanthemum anemophilum* and *Tylecodon tuberosus*. The Kouga populations in the southeast (Eastern Cape) grow on Witteberg quartz formation in Groot Thicket. Associated succulent plants include *Bulbine retinens*, *Crassula rupestris* subsp. *rupestris* and *Dioscorea elephantipes*. The accompanying plate was illustrated from plants grown in the Botanical Society Conservatory, Kirstenbosch National Botanical Garden. These plants were collected from steep Enon Conglomerate slopes and cliffs on the farm Skuinsklip, east of Oudtshoorn. Associated plants include *Adromischus triflorus*, *Crassula cotyledonis*, *C. orbicularis*, *C. muscosa* var. *muscosa*, *C. perforata*, *Senecio crassulaefolius*, *Conophytum truncatum*, *Machairophyllum brevifolium* and *Lampranthus haworthii*.

Aloe mitriformis subsp. *comptonii* grows in groups with the heads mostly erect. The rounded capitate dull scarlet racemes (150 × 100 mm), in ascending panicles, grow up to a metre high and are very striking when in flower. These racemes attract sunbirds—the main pollinators of taxa in Section *Aloe* Series *Aloe*. On two occasions, yellow to orange-yellow flowering forms were observed. The first was found just north of Uniondale and the other in the Baviaanskloof, in both cases solitary clones, growing among the red-flowering forms. After flowering, the fruiting capsules, held in an erect position, ripen during summer and the seed is released during autumn. Dispersal mechanisms of semi-desert plants are generally well known and complex (Gutterman 1994). As in most aloes, the seed of *Aloe mitriformis* subsp. *comptonii* is dispersed by wind, and the erect position of the capsules enables the seed to become airborne in strong winds. Seeds germinate readily in crevices or other suitable sites, usually among other karoo shrublets. Growth is slow with plants in habitat reaching flowering size within seven years.

Reynolds named this species in honour of Professor Robert Harold Compton [1886–1979], longest serving director of the National Botanical Gardens (presently part of the South African National Biodiversity Institute). He was appointed in March 1919 and stationed at the Kirstenbosch National Botanical Garden where he remained for 34 years until 1953. Professor Compton, a graduate of Cambridge University, succeeded Professor Pearson, founder and first director of the National Botanical Gardens of South Africa (Gunn & Codd 1981).

Aloe mitriformis subsp. *comptonii* thrives in cultivation but is best grown in Succulent Karoo or dry Fynbos gardens (Van Jaarsveld 2010). Plants can be propa-

gated from seed sown during late autumn in sandy, slightly acidic soil. Cover the seed with a thin layer of sand (1–2 mm thick) and keep moist in a warm area with ample shade. Seeds germinate within three weeks. The seedlings, which are slow growing, should be transferred to individual small containers after about 12 months. These should flower about four years after sowing. Finally, plant in a sunny well drained position

Key to the species of Section *Aloe* Series *Aloe*

1a Leaves reflexed:
  2a Erect shrubs; leaves 70–90 mm ..... *Aloe pearsonii*
  2b Pendent from cliffs; leaves 350–400 mm ..... *Aloe dabenorisana*
1b Leaves not reflexed:
  3a Leaves blueish green, distinctly spotted ..... *Aloe arenicola*
  3b Leaves not spotted:
    4a Plants pendent from cliffs:
      5a Leaves green ..... *A. pavelkae*
      5b Leaves glaucous:
        6a Perianth longer than 25 mm ..... *A. mitriformis* subsp. *mitriformis*
        6b Perianth shorter than 25 mm ..... *A. meyeri*
    4b Plants not pendent:
      7a Plants procumbent:
        8a Leaves 180–200 mm long ..... *Aloe mitriformis* subsp. *mitriformis*
        8b Leaves 150 mm or shorter ..... *Aloe mitriformis* subsp. *distans*
      7b Plants decumbent rosettes ascending or erect ..... *Aloe mitriformis* subsp. *comptonii*

Description (after Reynolds 1950).—Plants solitary or branching, forming groups of 3 to 5 plants, with decumbent stems bearing erect rosettes up to 600 mm in diameter and 500 mm high. *Leaves* lanceolate-attenuate in a dense rosette of up to 300 × 90 mm; upper face flat but becoming slightly channelled during the dry season; lower surface convex, keeled in upper half; surface smooth, glaucous-green becoming reddish tinged during dry conditions; margin with white to yellowish teeth 2–3 mm long and 10–15 mm apart, becoming pale brown in older leaves. *Leaf sap* bitter, drying yellow. *Inflorescence* an ascending panicle bearing up to 8 racemes; bracts absent on main peduncle, few, scattered, ovate-acuminate, sub-amplexicaul, dry, white, 15 × 7 mm; racemes capitate and densely flowered, up to 150 × 90–100 mm, rounded to pointed at apex; pedicels up to 35 mm long, becoming shorter upwards; floral bracts ovate-lanceolate, 3-nerved, acuminate, white, scarious, 7 × 3 mm. *Perianth* 35–40 mm, dull scarlet, cylindric-trigonous, slightly curved and slightly enlarging in upper third; outer segments free to base, the apices sub-acute, slightly spreading; inner segments free, broader than outer segments and with obtuse apices; anthers and stigma exserted to 5 mm. *Ovary* 8.0 × 2.5 mm, green. Plate 2282.

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Aloe pavelkae Asphodelaceae

Namibia

Aloe pavelkae *Van Jaarsv., Swanepoel, Van Wyk & Lavranos* in Aloe 44: 75–79 (2007).

Aloe pavelkae is a rare cliff-dwelling endemic from the southern outlier of the Hunsberg in the |Ai-|Ais/Richtersveld Transfrontier Park, southern Namibia. It is a cliff-dweller, confined to southern and southeast facing cliffs with long, pendent stems of up to 3 m that carry of 5–8 heads.

The depicted species is closely related to *Aloe meyeri* Van Jaarsv. and *A. dabenorisana* Van Jaarsv. from the Northern Cape, South Africa. In fact, the trio are all cliff-dwelling and range-restricted species confined to the lower Gariep River (Orange River), the largest river system in South Africa. *Aloe meyeri* occurs nearby (about 60 km southeast) and is endemic to south-facing quartzite cliffs of the Rosyntjiesberg in the Richtersveld, Northern Cape Province of South Africa, and southern Namibia. *Aloe dabenorisana* is confined to the quartzites and metaschists of the Dabenorisberg and Pellaberg of the Northern Cape, South Africa—about 180 km east of the Hunsberg. *Aloe pavelkae* is immediately distinguished from *A. meyeri* by its longer stems and larger rosettes (350–450 mm in diameter) of dark green leaves that are more densely arranged (i.e. with shorter internodes) and flowering during autumn or early winter (May to July). The leaves of *A. pavelkae* tend to wither below the rosettes. *Aloe meyeri* is a smaller species with smaller rosettes (± 260 mm in diameter) of grey-green leaves and flowering during midsummer (December to February). Leaves often remain functional for most of the stem length. *Aloe dabenorisana* differs from these two species by its more clustered growth with distinctly recurved leaves and shorter stems. Its leaf surface colour is similar to *A. pavelkae*. *Aloe dabenorisana* flowers during summer (November to February). *Aloe pearsonii* is another related species of the lower Gariep River Valley, growing in both Namibia and South Africa. It is an erect shrub with very different, reflexed leaves and is not associated with cliffs.

Aloe pavelkae is only known from the Sonnenberg and Kuamsibberg, growing at altitudes of 700–900 m (Figure 1). The habitat is frequently covered in fog from the nearby Atlantic Ocean. Rainfall is during the winter months and range from 75–100 mm per annum. The vegetation is clearly sub-desert and the plants grow in association with other succulent and bulbous plants such as *Conophytum ricardianum*, *Crassula macowaniana*, *C. pseudohemisphaerica*, *C. sericea* var. *velutina*, *C. sladenii*, *Cyrtanthus herrei*, *Gasteria pillansii* var. *ernesti-ruschii*, *Tylecodon bruynsii*, *T. buchholzianus*, *T. racemosus*, *T. rubrovenosus*, *T. singularis* and *Kleinia cephalophora*.

Aloe pavelkae belongs to Section *Aloe*, (Glen & Hardy 2000 [following Reynolds 1950, Series *Mitriformes* (Salm-Dyck) Reynolds]) to which eight aloe taxa belong.

PLATE 2283.—Plant in flower, × 1. Voucher specimen: *Van Jaarsveld 21081* in Compton Herbarium, Cape Town. Artist: Gillian Condy.



PLATE 2283 *Aloe pavelkae*

These include *Aloe arenicola* Reynolds, *A. dabenorisana* Van Jaarsv., *A. meyeri* Van Jaarsv., *A. mitriformis* subsp. *comptonii* (Reynolds) Zonneveld, *A. mitriformis* subsp. *distans* Haw., *A. mitriformis* Mill. subsp. *mitriformis*, *A. pavelkae* Van Jaarsv. and *A. pearsonii* Schönland. These eight taxa form a closely related group immediately recognisable by their distinctive capitate racemes, and leafy stems. They are mainly confined to parts of the Northern, Western and Eastern Cape provinces which experience most of their rainfall during winter. Of these, four are confined to the lower Gariep River Valley.

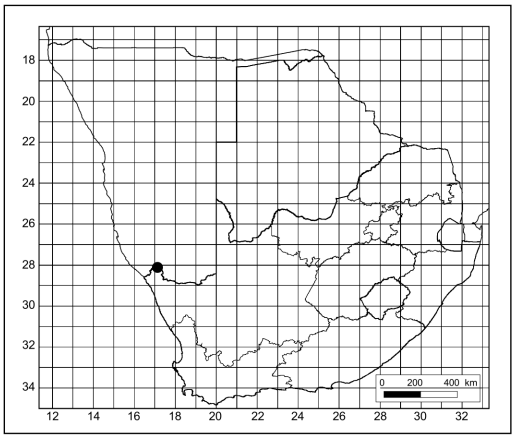


FIGURE 1.—Known distribution of *Aloe pavelkae*.

Aloe pavelkae was discovered by Mr Petr Pavelka, intrepid plant explorer from the Czech Republic. He has undertaken several expeditions to South Africa and Namibia and discovered a number of new taxa. Mr Petr Pavelka first encountered this species on the Sonnenberg in southern Namibia and brought it to the attention of one of us (EJvJ). Subsequently a photograph of the plant appeared under the name *A. meyeri* in Craven & Loots (2002), which Dr Peter Bruyns had taken on the Kuamsibberg in southern Namibia. The author (EJvJ) decided to investigate, and an expedition was arranged to the Hunsberg in November 2006. The party consisted of six individuals and we approached from the eastern side and proceeded up the southern ridge. Many interesting species were encountered along the way such as *Aloe pillansii*, *Euphorbia hottentotta*, *E. virosa* and *Stoeberia arborea*. On the upper south ridge we also encountered a stand of *Aloe pearsonii*, as well as a solitary specimen of *Gasteria pillansii* var. *ernesti-ruschii* growing on a dolomite ridge. The summit of the Kuamsibberg is 1 160 m above sea level and consists of sandstone and succulent karoo vegetation. Once the summit was reached, we walked towards the highest peak. It was here that Werner Voigt (now curator of the Karoo Desert National Botanical Garden) first spotted the aloes, with his binoculars, growing on south facing cliffs in a southwest facing kloof. The summit had a great stand of *Aloe pillansii* and we reached the new aloe, along the way walking through a dense stand of *Dioscorea montana*. *Aloe pavelkae* grows on sheer sandstone cliffs, which we could just reach on horizontal accessible ledges. Other succulents noticed, growing at the type location, include *Tylecodon racemosus* (*T. chloroleuca*), *Conophytum ricardianum*, *Crassula sericea* var. *velutina* and *C. pseudohemisphaerica*. *Aloe pavelkae*, a clear obligatory cliff-dweller, consists of large pendent shrubs with stems frequently longer than 2 m, usually with many heads. It grows in sub-desert vegetation, not unlike the Noms Mountain Desert (Gariep Desert Bioregion) (Mucina & Rutherford 2006) found in the Richtersveld just south of the Gariep River.

Aloe pavelkae thrives in cultivation, but is best grown in Succulent Karoo or dry Succulent Karoo gardens (Van Jaarsveld 2010). Plants can be propagated from seed

sown during the late autumn in sandy slightly acidic soil. Cover the seed with a thin layer of sand (1–2 mm thick) and keep moist in a warm situation providing ample shade. Seeds germinate within three weeks, are slow growing and the young plants are best transferred to individual small containers after about 12 months. These should flower about four years after sowing. Plant in a sunny, well drained position, providing a place where it can become pendent, such as a windowsill, sheer embankment, dry stone wall or terraces.

Key to the members of Section *Aloe* Series *Aloe*

1a Plants erect shrubs . . . . . *A. pearsonii*
1b Plants decumbent, procumbent or pendent:
  2a Leaves reflexed . . . . . *A. dabenorisana*
  2b Leaves not reflexed:
    3a Leaves distinctly spotted . . . . . *A. arenicola*
    3b Leaves not spotted:
      4a Plants pendent from cliffs:
        5a Leaves green . . . . . *A. pavelkae*
        5b Leaves glaucous . . . . . *A. meyeri*
      4b Plants procumbent or decumbent, not pendent:
        6a Plants procumbent:
          7a Leaves 180–200 mm long . . . . . *Aloe mitriformis* subsp. *mitriformis*
          7b Leaves 150 mm or shorter . . . . . *Aloe mitriformis* subsp. *distans*
        6b Plants decumbent rosettes erect . . . . . *Aloe mitriformis* subsp. *comptonii*

Description—Plants slow growing and long-lived, forming loose pendulous clusters of up to eight heads (rarely up to 25 heads), branched from the base and with elongated stems to 1.5(–3) m long, occasionally stemless. *Roots* slightly fleshy. *Branches* with dry leaves and leaf bases persistent, becoming deciduous towards base of stem. *Leaves in mature plants* fleshy, coriaceous, in an apical rosette up to 350–400 mm in diameter, spreading during the rainy season, incurved and becoming drawn together with a reddish colour on the abaxial surface during the dry season or prolonged droughts, 180–280 × 25–70 mm, linear lanceolate, dark green, faintly striated; adaxial surface flat, channelled towards the apex; abaxial surface convex; margins cartilaginous, white (often reddish towards apex), serrate; teeth 1.5 × 1.5 mm, projected towards apex and 4–8 mm apart; apex acute; leaf sap drying orange-yellow. *Leaves in juvenile plants* distichous at first, their abaxial surface beset with white tubercles, becoming smooth at maturity. *Inflorescence* simple (rarely branched), up to 240–320 mm long, pendulous for 150–200 mm then recurved to an erect position; peduncle biconvex and green towards base, becoming dark purplish brown in the upper half, 6–8 mm in diameter, up to 180–220 mm long; raceme capitate (not pointed), 45–90 mm long; sterile bracts triangular-acuminate, grey-brown, the lower ones triangular, scarious, 5 × 5 mm; floral bracts smaller, 3.0 × 1.5 mm. *Flowers* subpendent, borne in dense capitate raceme; pedicels ascending and then spreading, reddish, 20–28 mm long. *Perianth* orange-red, yellow at apex, buds green-tipped, subclavate and cylindric-trigonous, 20 mm long, 4 mm wide at base, 6 mm wide at apex; segments free for 15 mm but fused at base, the outer linear-oblanceolate, 19 × 3 mm, the inner broader, 20 × 5 mm, apices subacute. *Stamens* with filaments filiform, flattened, 15–17 mm long, the three inner ones slightly longer, slightly exserted; with anthers 1.5 mm long; pollen yellowish orange. *Ovary* cylin-

drical, 4 × 2 mm, yellowish; style 14 mm long, lengthening to 16 mm, becoming slightly exserted. *Fruit* a capsule, 15–18 × 6–7 mm, ascending spreading, young fruit ovoid, maroon. *Seed* 3.5 × 2 mm, blackish grey. *Flowering time*: May–July. Plate 2283.

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Gasteria croucheri subsp. *pondoensis* Asphodelaceae

South Africa

Gasteria croucheri subsp. **pondoensis** *N.R.Crouch, Gideon F.Sm. & D.G.A.Styles* in Bothalia 41: 183–185 (2011).

Remarkably apt and implicitly predictive words were documented by Van Wyk & Smith (2001). In their chapter on the Pondoland Centre of Plant Endemism, they captioned their image of the Lukabeni stream in the Mkambati Nature Reserve '... spectacular waterfall at the head of a deep side-gorge of the Mtentu River ... most of the forested gorges of the Mtentu River remain botanically unexplored'. It is from the banks of this very tributary—about 4.5 km upstream of the Mtentu mouth, which opens into the Indian Ocean—that the type of a new member of *Gasteria* was subsequently gathered in 2009. Indeed, various other new species and interesting records have emerged from northern Pondoland since 2001—including the Mtentu River system itself (Edwards 2005; Crouch & Edwards 2007; Crouch & Klopper 2010).

Gasteria croucheri subsp. *pondoensis* is a large and splendid leaf succulent, an obligate cremnophyte that grows on cliffs both fully exposed on southern aspects, as well as within the shaded margins of riverine forest. It is a clumping subspecies that bears long, angular leaves, most of which hang pendulously, sickle-like in form (Figure 1). Gasterias are well known as masters of the art of camouflage, for the leaves of most species are usually highly mottled, rendering plants difficult to detect in the shady spots they seem to naturally prefer. *Gasteria croucheri* subsp. *pondoensis* is no exception, as its dark green leaves are spotted with paler green blotches, making the rosettes blend in well with their surroundings. From mid- to late-summer, sparsely branched panicles bear attractive pink-green flowers, which, at up to 50 mm, are the longest yet recorded for *Gasteria*. The enormous leaves too are extraordinarily long for the genus, for at 1.5 m they are more than twice the length of any other documented species! One might reasonably question why this, the largest of all gasterias, has been overlooked until so recently.

Botanical exploration of the Pondoland coastline has certainly proven a challenge, for while its riches have been enticing to many, access has been limited largely to those with a penchant for adventure. The topography so characteristic of this region is that of rugged plateaux of between 100 and 500 m altitude, dissected deeply by narrow river gorges (Van Wyk & Smith 2001). Accordingly, to access plants of this new subspecies from the northern bank of the Mtentu River, one has to travel over rugged terrain in a suitably equipped vehicle for two hours before canoeing at least 1.5 km upstream of the mouth, ultimately to scramble about narrow, waterside cliff ledges. With Zambesi sharks frequenting the estuary, great care is duly taken when disembarking from one's wobbly craft! Given the logistical challenges involved,

PLATE 2284.—1, basal portion of rosette, × 0.5; 2, branches of flowering raceme, × 1. Voucher specimen: *Crouch & Styles 1149* in KwaZulu-Natal Herbarium, Durban. Artist: Gillian Condy.



PLATE 2284 *Gasteria croucheri* subsp. *pondoensis*

it is small wonder that the early explorers Johann Drége and his brother Carl missed this taxon in the course of their botanising of Pondoland—it is documented that for ease of passage, they crossed at the very mouths of both the Msikaba and Mtentu Rivers in late February 1832 (Glen & Germishuizen 2010).

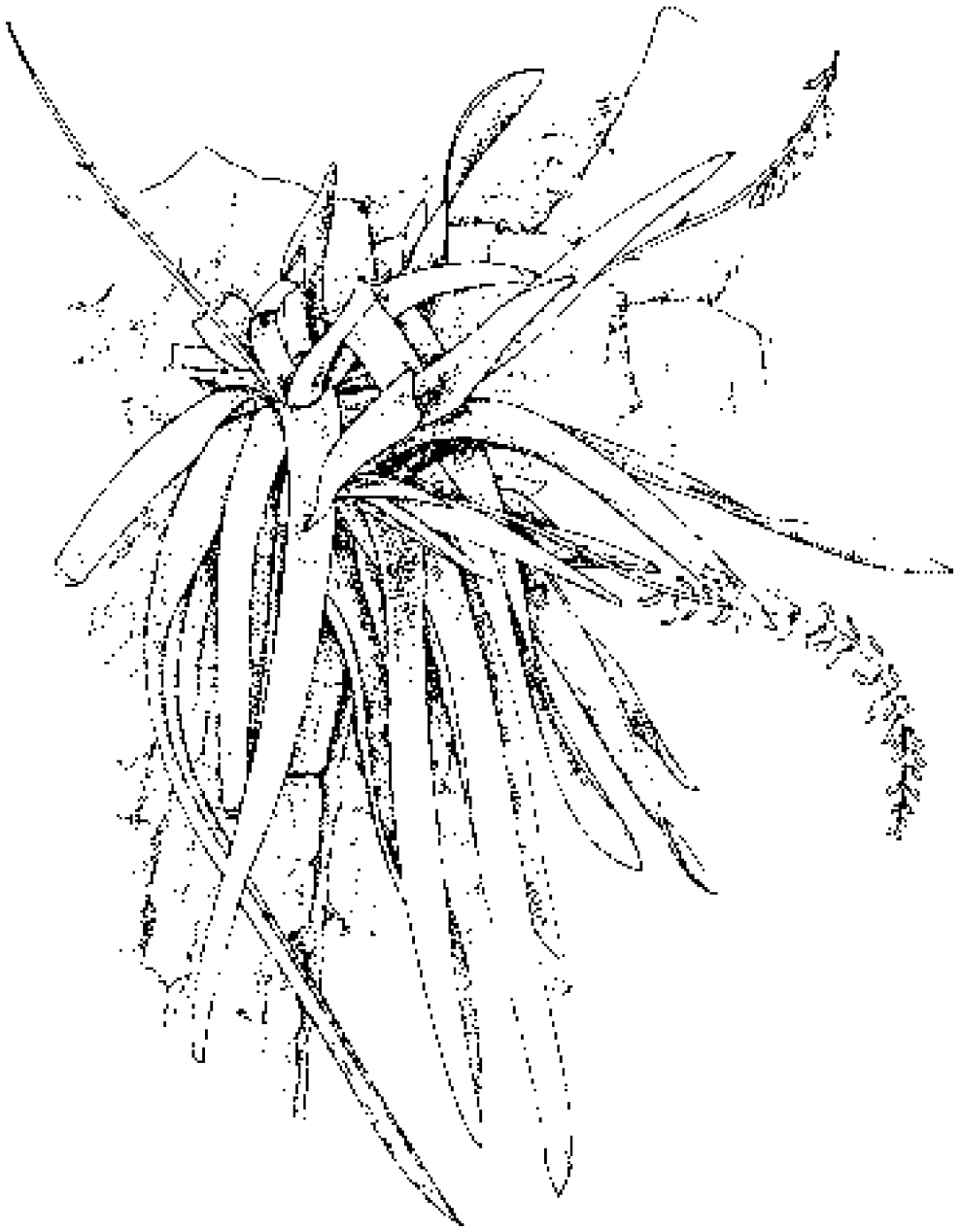


FIGURE 1.—Pendulous habit of *Gasteria croucheri* subsp. *pondoensis*. Artist: Gillian Condy.

Gasteria is essentially South African, with a single species, *G. pillansii*, entering the Richtersveld in the extreme south of Namibia. Perhaps somewhat surprisingly, none of the *Gasteria* species that occur naturally in the northeastern, subtropical parts of South Africa have yet been reported for Mozambique (Da Silva *et al*. 2004), whereas at least *Haworthia limifolia* var. *limifolia*, a representative of a related alooid genus, does enter this neighbouring country (Smith *et al*. 1997a).

Although *Gasteria* is readily recognisable on the basis of both vegetative and floral characters, its infrageneric classification nonetheless remained elusive for nearly two centuries following its establishment by Duval (1809). By the late 1980s, over 100 taxa had been described, a figure reduced substantially with the publication of a major revision of the genus (Van Jaarsveld 1994). The consolidation by this author resulted in the enumeration of only 16 species with a total of 22 taxa. Since then, considerable further work has been undertaken that has resulted in the recognition of an additional seven species, bringing the total number of taxa to 35 (Van Jaarsveld 2007; Crouch *et al*. 2011).

On the basis of genome size, those taxa found furthermost from the centre of *Gasteria*'s present-day distribution in the southeastern Cape are argued to be the evolutionarily most advanced (Zonneveld & Van Jaarsveld 2005). They include the northernmost species *G. batesiana* and the newly described *G. tukhelensis* from the lower Tukhela River near Kranskop, both of which Van Jaarsveld & Van Wyk (2005) placed in *G*. Section *Longiflorae* Series *Longifoliae* along with *G. acinacifolia*, *G. croucheri* subsp. *croucheri* and *G. croucheri* subsp. *pendulifolia* (as *G. pendulifolia*). All members of this series are characterised by narrow, elliptical flowers in which the swelling in the upper half approximates the rather unpronounced basal gasteriform portion (Van Jaarsveld *et al.* 1994). Although the artificial nature of the sections and series of Van Jaarsveld *et al.* (1994) was illumined by the total nuclear DNA work of Zonneveld & Van Jaarsveld (2005), these subgeneric groupings were nonetheless deemed clear-cut by Van Jaarsveld (2007) and so maintained for practical reasons.

Gasteria croucheri is one of five species confined largely to the coast of the summer-rainfall region of South Africa and is a taxon which in its broadest sense has earlier been depicted in *Flowering Plants of Africa* (Smith *et al.* 1997b). From cliff faces of the greater Durban area, forms previously referred to as cultivars 'Shongweni' and 'Umgeni' of *G. croucheri* (Van Jaarsveld 1994) have collectively been provided with specific rank, as *G. pendulifolia* (Van Jaarsveld & Van Wyk 2001; Van Jaarsveld 2007). These authors considered the distribution range of *G. pendulifolia* to extend along the subtropical coast, from Durban northwards to just south of Mkuze in Zululand. However, following measurement of the nuclear DNA content of this and other genus members, the rank of *G. pendulifolia* was subsequently lowered to that of a subspecies of *G. croucheri* (Zonneveld & Van Jaarsveld 2005). These authors distinguished *G. croucheri* subsp. *pendulifolia* from the typical subspecies on account of its smaller size, prolific clustering habit, and pendulous leaves that are narrow, glaucous and with an entire margin. The flowers are also predominantly white infused with pink basally while those of subsp. *croucheri*—and subsp. *pondoensis* for that matter—are pinker throughout, with more prominent green striations above.

The typical subspecies has been reported as larger, with leaves ascending to spreading, and a lower propensity for cluster-forming (Van Jaarsveld & Van Wyk 2001; Van Jaarsveld 2007). Based on their somewhat broader concept of *G. croucheri* subsp. *croucheri*, Van Jaarsveld & Van Wyk (2001) reported the typical subspecies to occur from Durban southwards to the Msikaba River in the Eastern Cape. Subspecies *croucheri* is currently not known from the Msikaba and Mtentu River gorges, but has been observed beyond the range of subsp. *pondoensis* to as far south as the Mzimvubu River where plants were found on shale cliffs about 15 km inland of the coast (Van Jaarsveld & Van Wyk 2003).

Populations of *Gasteria croucheri* subsp. *pondoensis* occur towards the southern end of the range of subsp. *croucheri*, and are geographically separated from the similarly pendulous-leaved subsp. *pendulifolia* by a distance of approximately 150 km. The three subspecies of *Gasteria croucheri* are thus allopatric. As related above, the leaves of subsp. *pondoensis* are often significantly longer than those of any other subspecies, for they may attain lengths of up to 1.5 m. By comparison, those of subsp. *croucheri* reach only 0.36 m and those of subsp. *pendulifolia* little more than 0.45 m (Van Jaarsveld & Van Wyk 2001). The perianth size of the subject of this account is longer too than that of both its closest relatives, attaining a length of 50 mm compared to 40 mm.

In terms of size, gasterias can be clustered into three distinct groups: miniatures such as *Gasteria baylissiana*, small plants the likes of *G. bicolor*, and large ones that develop impressive rosettes. Our species most certainly falls into this latter group, for an able-bodied man will struggle to lift a single mature specimen! In contrast to the closely related genus *Aloe*, gasterias do not include amongst their ranks any tree-like species, and those with a distinct, even thin stem are very poorly represented. To date, a caulescent habit is known only in the most primitive species, the pendulous cliff-dwelling *G. rawlinsonii* from the Eastern Cape.

Gasteria croucheri subsp. *pondoensis* is associated with Scarp Forest, a vegetation unit which today exists as an archipelago of scattered patches ranging in altitude from near sea level to an altitude of 600 m (Rutherford *et al*. 2006). This *Gasteria* has, however, not yet been found at altitudes higher than 200 m or beyond the Msikaba and Mtentu River systems (Figure 2). Particularly fine specimens can be seen on cliffs at the Superbowl on the Msikaba, and along the Mtentu fringe about 3.5 km upstream of the mouth. Both these two deep gorge systems have probably provided stable forest refugia for this and other endemic taxa that have been unable to escape their enclave as a result of susceptibility to, *inter alia*, hot seasonal fires in the surrounding sourveld grasslands (Edwards 2005).

In habitat, *Gasteria croucheri* subsp. *pondoensis* grows on cliff faces and on rock ledges in dense subtropical vegetation that includes the following shrub and tree species: *Commiphora harveyi*, *Dracaena aletriformis*, *Encephalartos altensteinii*, *Grewia pondoensis*, *Helichrysum populifolium*, *Jubaeopsis caffra*, *Strelitzia nicolai* and *Tarchonanthus trilobus*. Associated cremnophytic succulents include *Aeollanthus parvi-*

folius, *Aloe arborescens*, *Bulbine* sp. nov., *Crassula multicava* subsp. *multicava*, *C. orbicularis*, *C. pellucida*, *C. streyi*, *Delosperma* sp., *Ischnolepis natalensis*, *Plectranthus saccatus* subsp. *pondoensis*, *Rhipsalis baccifera* subsp. *mauritiana*, *Senecio medley-woodii* and *S. oxydontus*.

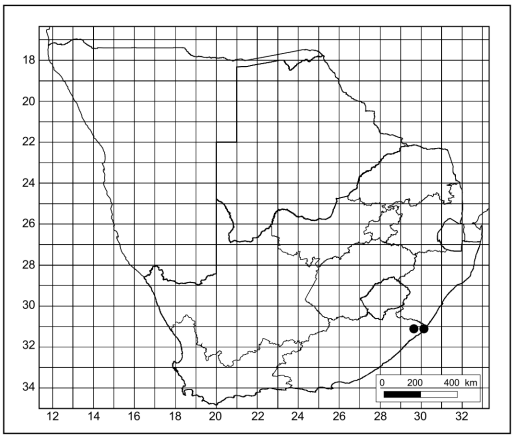


FIGURE 2.—Known distribution of *Gasteria croucheri* subsp. *pondoensis*.

At a species level, the Red List status of *Gasteria croucheri* has recently been evaluated as Vulnerable (A2d) (Van Jaarsveld & Raimondo 2009) based on extensive and unsustainable harvesting for the trade in traditional medicine (Crouch *et al.* 2000). For this purpose, subsp. *pondoensis* will undoubtedly be as sought after as its sister taxa. As far as cultivation is concerned, *G. croucheri* subsp. *pondoensis* offers few challenges. It grows very easily in virtually any soil type, including clay, even though it prefers a friable, rich, well-drained mixture. This is not surprising as it is a cliff-dweller that often grows in thin, but humus-rich soils in rock crevices.

The genus name *Gasteria* derives from the Greek for belly, *gaster*, in allusion to the swollen base of the perianth tube. The specific epithet *croucheri* commemorates Mr Croucher, Curator of the succulent plant collection at Kew around 1870, 'to whose zeal and especial love for this class of plants the [Kew] collection owes much of its value and interest' (Hooker 1869). The subspecific epithet *pondoensis* is a geographic indicator of the presently known distribution of this Pondoland endemic.

The plant figured here was gathered from the Mtentu River system (Lukabeni Stream) in northern Pondoland, and grown on to flowering in Kloof, Durban.

Description.—Plants acaulescent, decumbent to rarely erect, 250–400 mm tall, up to 600 mm in diameter, solitary, dividing or proliferating from base to form dense groups. *Roots* succulent, up to 6 mm in diameter. *Leaves* rosulate, triangular, linear-lanceolate to falcate, rarely lorate, 0.2–1.5 m long, 30–100 mm broad at base, erectly spreading, rarely patent or recurved; apex obtuse or acute, mucronate; adaxial surface broadly canaliculate, plane towards apex, abaxial surface somewhat convex with a distinctly tuberculate-serrulate excentric keel, both surfaces dark green, often glaucous, with dense white to concolourous spots arranged haphazardly or in transverse bands; surface smooth, rarely slightly asperulous; margin tuberculate-serrulate, rarely denticulate. *Juvenile leaves* distichous, lorate, patent to erectly spreading, smooth; apex acute, rarely obtuse, mucronate. *Inflorescence* racemose, up to 900 mm tall, ascending, at first drooping, with or without a pair of side branches; scape 10–14 mm broad at base, flattened; floral bracts 6–11 mm long, piliferous; pedicels 10–11 mm long, pink. *Perianth* 42–50 mm long, stipitate for up to 9 mm, gasteriform

proximally (narrow-elliptic) for half its length; proximal gasteriform portion pink, 7 mm wide (often triangular in cross section), distally light pink with green striations, inflated to nearly the same diameter as proximal portion (with slight constriction in middle); apex erect becoming erectly spreading, obtuse; margins of inner segments free and channelled at base for 8–12 mm, diverging gradually towards apex. *Stamens* 33 mm long; anthers 2.5–4.0 mm long, shortly exserted at anthesis. *Ovary* 9–10 mm long, 3 mm in diameter; style 17–19 mm long, lengthening considerably during female phase of flower; stigma capitate, included or slightly exserted, curved upwards, minute. *Capsule* 20–22 mm long, obtuse at apex. *Seed* 3–4 × 2–3 mm. *Flowering time*: December to February. Plate 2284.

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PLATE 2285 *Lachenalia pearsonii*

Lachenalia pearsonii Hyacinthaceae

Namibia

Lachenalia pearsonii *(R.Glover) W.F.Barker* in The Journal of South African Botany 35: 321 (1969); Sölch & Roessler: 54 (1970); Duncan: 50 (1988); Duncan: 366 (2012). *Scilla pearsonii* R.Glover: 105 (1915).

Lachenalia J.Jacq. ex Murray is a horticulturally important genus of 133 species endemic to South Africa and Namibia (Duncan 2012). Confined mainly to the winter rainfall zone, it is centred in the Worcester grid (3319) in the southwestern Western Cape. It is also well represented in the western part of Western Cape and in the northwestern Northern Cape, but diversity decreases towards the Eastern Cape and an outlier (*L. karooica* W.F.Barker ex G.D.Duncan) occurs in the central Northern Cape and southwestern Free State. In Namibia the genus is confined to the western, southwestern and southern parts. *Lachenalia* is phenotypically and genotypically diverse, and the two most important modes of speciation appear to have been allopatry, due mainly to increasing aridity, and ploidy changes (Duncan 2005; Duncan *et al*. 2005).

Professor Henry Harold Welch Pearson [1870–1916], first Director of the National Botanical Gardens of South Africa at Kirstenbosch, discovered *Lachenalia pearsonii* during the course of a Percy Sladen Memorial Expedition to Great Namaqualand, which he led to the Groot Karasberge in southern Namibia (Bolus *et al*. 1915). Endowed by Sladen's wife and administered by the Linnean Society of London, the Percy Sladen Memorial Trust was established in 1904 to fund fieldwork in the earth and life sciences following the death of the British marine biologist and echinoderm specialist, Percy Sladen [1849–1900] (Nichols 2003). The Expedition, which commenced on 8 December 1912 and ended on 26 January 1913, crossed the mountains from northwest to southeast, then crossed them again by a different route (Pearson 1914).

Pearson found this lachenalia in flower on 17 January 1913, growing in sandstone on the middle slopes of Lord Hill, also known as Scharfenstein or Schroffenstein. *Lachenalia pearsonii* was originally mistaken for a species of *Scilla* L. and described as *S. pearsonii* R.Glover by Miss Ruth Glover (later Mrs Wordsworth), a botanist on the staff of the Bolus Herbarium. It was one of numerous new species of flowering plants and ferns discovered during this Expedition, many of which were published in the first volume of *The Annals of the Bolus Herbarium* (Bolus *et al*. 1915). In 1963 the holotype of *S. pearsonii* was examined by Louisa Bolus who suggested the species would be more appropriately placed in *Lachenalia*. This was confirmed upon dissection of a flower, in which W.F. Barker found it to have a short perianth tube, with the filaments attached

PLATE 2285.—Two mature plants showing bulbs, leaves from previous and current summer seasons, peduncles and open flowers, × 1. Voucher specimen: *Bruyns 3554* in Compton Herbarium, Kirstenbosch; Kirstenbosch National Botanical Garden reference no.: 3/2000. Artist: Gillian Condy.

at different levels on the tube, and two tepal whorls in which the tepals differed in width and shape.

Consequently, Barker transferred the species to *Lachenalia* and the new combination, *L. pearsonii* (Glover) Barker, was published in *The Journal of South African Botany* (Barker 1969). In the list of *Lachenalia* taxa included under the family Liliaceae *s.l.* in the *List of species of southern African plants* (Reid 1984), 'P.E.Glover' was mistakenly given as the original author of this species, and the error has been perpetuated in every subsequent version of the latter publication. The correct author is R. Glover, who is the third author, with F. Bolus and L. Bolus, of the paper in which the species was originally published (Bolus *et al*. 1915). The holotype (*Pearson 7989*) is preserved in the Bolus Herbarium, University of Cape Town, and isotype sheets are in the Botanical Museum of Berlin-Dahlem and Kew Herbarium.

In *The Lachenalia handbook* (Duncan 1988), the author reported the species to be unknown in cultivation, but in the interim it has been recollected twice, on both occasions by Dr Peter Bruyns, near the type locality, but at higher altitude. The first collection was made on 16 January 1989 in flower (*Bruyns 3554* in NBG) and more recently, vegetative specimens were collected just below the summit on 8 January 2000 (Duncan 2012). Plants of the latter collection have flowered every subsequent year in the bulb nursery at Kirstenbosch and it is from these plants that the accompanying plate by Gillian Condy was executed in February 2011. The plate depicts two flowering specimens, the right-hand bulb of which is an offset that matured after seven years.

Lachenalia pearsonii falls within a small alliance of dwarf species with widely campanulate, white flowers borne on white pedicels held more or less perpendicular to the rachis. This alliance includes *L. giessii* W.F.Barker, which extends from western Namibia to the southern Richtersveld, *L. multifolia* W.F.Barker from the Tanqua Karoo and western Great Karoo, and *L. namibiensis* W.F.Barker from southwestern Namibia. *Lachenalia pearsonii* has a distinctive conical flower head with almost perpendicular white pedicels, narrowly ovate outer tepals, linear inner tepals and exserted, narrowly spreading stamens (Figure 1). Duncan *et al*. (2005) consider *L. pearsonii* to be sister to *L. namibiensis*, sharing narrowly spreading stamens, similar bifacial leaves with a distinct midrib on the lower surface, and ciliolate margins. The latter species differs in its longer perianth tube (3 mm), much longer inner tepals (7–9 mm), included stamens, smaller, ovoid bulb (up to 15 mm in diameter) and shorter, lanceolate leaves (30–60 mm long). Floral symmetry is nearly actinomorphic in *L. pearsonii* but less so in *L. namibiensis*. The globose seeds of *L. pearsonii* are large (2.1 × 2.0 mm) compared with those of *L. namibiensis* (1.2–1.3 × 1.3–1.4 mm), and one of the largest in the genus (Duncan 2005, 2012).

Lachenalia pearsonii is currently known only from Lord Hill in the Groot Karasberge of southern Namibia (Figure 2). Situated in the northwestern corner of these mountains, Lord Hill rises to 2 200 m and has the highest altitude within these mountains. In this part of the Karasberge, the granites, gneisses and schists have penetrated right through the sandstone layers that cover most of the rest of these mountains

(P.V. Bruyns, pers. comm.). Occurring in Dwarf Shrub Savanna vegetation (Loots 2005) in arid terrain with erratic summer rainfall, *L. pearsonii* is the only summer-growing member of the genus, occurring in large colonies at high altitude, and is found from the middle slopes to just below the summit peak, between 1 800–2 200 m (Duncan 1998). It is also the earliest-flowering species of the genus, its blooms first appearing between mid-January and early February, depending on sufficient summer rains (Duncan 2005). The type material was recorded growing on sandstone of the middle slopes at 1 800 m, whereas the recent collections made by Bruyns were found on vertical schist layers from 2 000–2 200 m, amongst grasses and *Lithops karasmontana* (Dinter & Schwantes) N.E.Br. (Mesembryanthemaceae) (*Bruyns 3554* in NBG).



FIGURE 1.—The conical flower head of *Lachenalia pearsonii*. Photograph: Graham Duncan.

Lachenalia pearsonii was Red Listed as Data Deficient in the *Southern African Red Data List for Namibia* (Craven & Loots 2002), and omitted from the *Red Data Book of Namibian Plants* (Loots 2005). Although restricted to a single mountain within the Groot Karasberge, the plant occurs in large numbers and is isolated to high altitude slopes; there appears to be no immediate threat to its integrity and consequently it has no conservation status.

Little is known of its ecology, but in common with other members of the alliance, the widely campanulate, slightly spice-scented (during the hottest part of the day) white flowers are probably bee-pollinated. The scape remains attached to the bulb after the capsules have dehisced, and the seeds are dispersed by the shaking action of wind.

The main horticultural attribute of *Lachenalia pearsonii* is its beautiful conical flower head of white star-like flowers with exserted stamens. The species flourishes in deep 150 mm diameter plastic containers in a very sandy, slightly acid medium of equal parts coarse river sand and silica sand, with a 20–30 mm layer of well-rotted compost placed over the drainage chips at the bottom of the container. The bulbs are long-lived and are best planted with the top of the neck resting at, or just below, soil level. In the bulb nursery at Kirstenbosch, the plants flower consistently every year in late January and early February. Although summer-growing, watering should

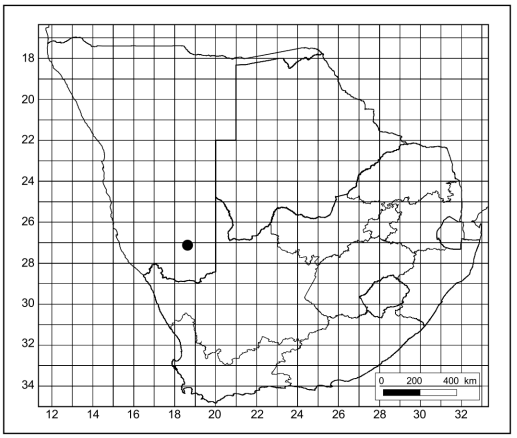


FIGURE 2.—Known geographical distribution of *Lachenalia pearsonii*.

only commence in midsummer (early January in the southern hemisphere). A heavy drench applied at this time stimulates the almost immediate emergence of the inflorescence and new leaves. Despite flowering at the hottest time of year, the inflorescence is remarkably long-lived, the lowermost flowers remaining attractive for about 10 days until most of the upper ones have opened. Seed production has been poor in the bulb nursery despite frequent, careful hand pollination between different clones, with only one to three seeds obtained from infructescences that had borne up to 50 flowers or more. Leaf growth continues from midsummer to midwinter (late June in the southern hemisphere) at which time watering should cease and the containers be stored completely dry in a cool, well-aerated place. The bulbs are extremely slow in vegetative reproduction; at Kirstenbosch only one offset has been produced by one mature bulb, which matured after seven years.

An orange-flowered lachenalia with red-tipped, tubular pendent blooms, said to be a cross between *Lachenalia bulbifera* and *L.* x *nelsonii*, was briefly and inadequately described as 'Lachenalia Pearsonii' in *The New Zealand Gardener* in 1949, having been raised by a Mr Aldridge in 1924, a previous Curator of Parks and Reserves in Auckland, and named for a Mr Pearson. The name is invalid as it was not accompanied by a Latin description. The plant most closely resembles a form of *L. aloides* and it is doubtful that *L. bulbifera* was one of the parents as it exhibits no traits from that species whatsoever; a more appropriate name for the plant is *L. aloides* 'Pearsonii'.

Description.—Dwarf geophyte, summer-growing, 50–180 mm high. *Bulb* globose, 10–20 mm in diameter, rarely offset-forming, neck distinct, 10–30 mm long; tunic multilayered, outer layers cartilaginous, dark brown or black, apex uppermost portion produced into a thick layer of long, flat, papery bristles; inner cataphyll tightly adhering to leaf bases, aerial portion bright green, subterranean portion translucent white, apex obtuse. *Leaves* 2, narrowly lanceolate, 55–100 × 5–9 mm; suberect, glaucous, canaliculate, abaxial midrib distinct; margins ciliolate; leaf bases clasping, 20–35 mm long, subterranean portion white, aerial portion glaucous; primary seedling leaf terete, erect. *Inflorescence* racemose, flower head conical, few- to many-flowered, sterile apex short; scape erect, 30–70 mm long, slender, yellowish green; rachis white or light green, extremely slender; pedicels suberect in bud, perpendicular at anthesis, 4–7 mm long; light green; bracts cup-shaped throughout, 2 × 1 mm, white, bases swollen. *Perianth* slightly zygomorphic, widely campanulate, white, slightly spice-scented; tube cup-shaped, 1 mm long; outer tepals narrowly ovate, 4 × 2 mm, apices recurved, apical gibbosities dull maroon; inner tepals linear,

4.5 × 1.0 mm, keels dull maroon, apices slightly recurved. *Stamens* shortly exserted, narrowly spreading; filaments white, 4 mm long, anthers introrse. *Ovary* obovoid, 1.0 × 1.3 mm, light green; style shortly exserted, straight, 4 mm long, stigma capitate, minute. *Capsule* obovoid, 4.0 × 4.0–5.0 mm. *Seed* globose, 2.1 × 2.0 mm, glossy, black; strophiole rudimentary, 0.1–0.2 mm long, ridged. Plate 2285.

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Crassula smithii Crassulaceae

South Africa

Crassula smithii *Van Jaarsv., D.G.A.Styles & G.J.McDonald* in Aloe 45: 90–92 (2008); Smith & Crouch: 68 (2009).

As part of the Plant Systematics Stimulation Programme (PSSP) funded by the former Foundation for Research Development (FRD), forerunner of the National Research Foundation (NRF) (Smith *et al*. 1996), 25 national and regional activities were arranged and attended by dozens of taxonomists. The courses were mostly aimed at developing human capital in, and rejuvenating, this critically important area of scientific endeavour. One of the initial activities, the first field trip that took place under the auspices of the PSSP, was a joint collecting expedition led by Professor A.E. (Braam) van Wyk of the University of Pretoria. The trip took participants to the vicinity of the Noodsberg in the KwaZulu-Natal Midlands, and took place between 8 and 15 October 1989. The subject of the current account, *Crassula smithii*, was collected during that trip in this highland range, in a location situated ± 50–60 km northwest of Durban, alongside the lower Thugela River and west of Stanger.

During that trip, one of us (GFS), who has a longstanding interest in the taxonomy of succulents, focussed his collecting activities on representatives of this growth form. One of the specimens collected as both preserved and living material was of a thick-leaved, rosulate species of *Crassula*. Two characters of the specimens immediately set it apart from other, similar, aloe-like *plakkies*: the leaves were much thicker than those of any similar species in the genus, and the nonflowering plants were a pleasant, faintly red-spotted, bright greenish yellow colour. Although efforts to identify the material using existing keys failed, there was initially a reticence to describe the material as new, for species of *Crassula* can be notoriously variable—few more so than some members of the heterogeneous Section *Rosulares* (Toelken 1977a), to which our subject belongs. All members of the section bear carnose stems that elongate substantially when flowering but are otherwise short in young or resting plants (Toelken 1985), thus appearing rosulate.

Crassula was comprehensively treated by Hellmut Toelken while based at the Bolus Herbarium, and in correspondence with him on the identity of the material, he responded as follows: "...I would like to inform you that this plant probably belongs to a form of *Crassula alba* var. *alba* … which was illustrated in *Flow. Pl. Afr*. plate 1520." (quoted from a letter dated 29 April 1994 to one of us, GFS). This correspondence was supported by live material sent to him, but which sadly arrived at the State Herbarium, Adelaide, South Australia—where he was by then based—in a completely desiccated condition. Although Toelken's suggestion for the identity

PLATE 2286.—1, basal rosette and peduncle with leaf-like bracts, × 1; 2, round-topped thyrse inflorescence, × 1; 3, terminal inflorescence portion × 1. Voucher specimen: *Condy 237* in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2286 *Crassula smithii*

of the Noodsberg plant was carefully considered, our plant seemed distinct, for the material illustrated in *Flowering Plants* (Dyer 1967) lacked a conspicuously succulent leaf consistency, had whitish flowers, presented much redder leaves and bore prominent leaf marginal cilia (see description for a more detailed discussion). However, a close relationship between these species seemed very likely. It is noteworthy that a few years earlier, in a letter dated 17 August 1990, Toelken had suggested that the material could well represent *Crassula vaginata*, another member of Section *Rosulares* and one historically confused with *C. alba*. This point of view expressed by Toelken was also reflected on a determinavit slip attached to a G.F. Smith specimen (no. 96, PUC # 24 154, collected on 11 October 1989), which was donated by the Goossens Herbarium (PUC) of the Potchefstroom campus of the North-West University to the Bews Herbarium (NU) of the University of KwaZulu-Natal in Pietermaritzburg.

Living material of the Noodsberg collection was at first cultivated at the present-day Potchefstroom campus of the North-West University and in the early 1990s taken to Pretoria and later to Ernst van Jaarsveld, horticulturist at the Kirstenbosch National Botanical Garden in Cape Town. Doctor Van Jaarsveld, one of South Africa's leading succulent experts grew material in the nursery at Kirstenbosch for a few years and was eventually contacted by Mr David Styles, who in September 2005 had collected similar material atop the Ozwatini Plateau in the Noodsberg, at an altitude of ± 950 m.

The plant figured here was originally gathered by David Styles from this site, before being grown on in Kloof by one of us (NC). In cultivation, the plant has proven easy to grow in a very well-drained medium on a northwestern aspect and in the partial shade of other potted succulents. Although under such conditions it retains its characteristic bright colouration and degree of succulence, plants receiving a greater amount of direct sunshine produce marginally more plantlets at the stem base. Individual sterile specimens look superficially like short-stemmed variants of *Crassula perfoliata* var. *heterotricha*, most especially the Zululand-centred form with yellow-green rather than glaucous leaves. In bloom, though, these two cannot be confused as *C. perfoliata* var. *heterotricha* bears white and *C. smithii* red flowers.

As mentioned above, the taxon considered the closest relative of *Crassula smithii* is the widespread and highly variable *C. alba* var. *alba* (see Plate 1520, Dyer 1967), which—despite its specific epithet—most usually bears red flowers (Toelken 1977b). However, it can be easily separated: *C. alba* usually grows solitary and is a far less succulent-leaved species, with obvious, persistent cilia on the leaf margins; in *C. smithii*, plants of which usually form small clusters, cilia are only occasionally present on the youngest leaves. Further, the individual flowers of *C. alba* are tubular while those of *C. smithii* are slightly urn-shaped. Both species occur in the Noodsberg, with *C. alba* prevalent in rocky grasslands rather than on cliff edges. Van Jaarsveld *et al.* (2008) have detailed further species differences based largely on characters of the inflorescence.

To date this species is known only from the Noodsberg (Figure 1), which falls within the Savanna Biome and more specifically the KwaZulu-Natal Sandstone

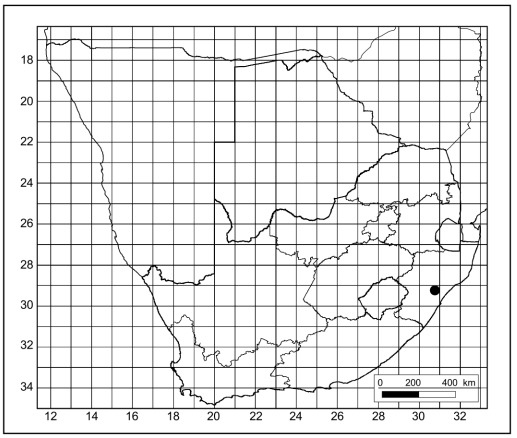


FIGURE 1.—Known distribution of *Crassula smithii*.

Sourveld of Rutherford *et al*. (2006) with its underlying geology of Ordovician Natal Group sandstones. These authors have described this unit as short, species-rich grassland with scattered low shrubs and geoxylic suffrutices. This vegetation unit—notably a borderline candidate also for the Grassland Biome—is Endangered, with over 68% already transformed, and only 0.2% statutorily conserved. Van Jaarsveld *et al*. (2008) related how human settlements were then affecting the Ozwatini Plateau grasslands, requiring the last few hundred remaining plants to seek refuge on the cliff edges and amongst rocks in grassland. Several species of interesting and often imperfectly known crassulas occur in this sourveld type, including *Crassula multicava* subsp. *floribunda*, *C. inandensis* and *C. foveata*. Indeed, further regional novelties in this genus appear to await description.

The Noodsberg landscape is dominated by a series of rolling plateau tops with steep slopes, forming characteristic table mountains up to ± 1 000 m in elevation. The Ozwatini Plateau, the type locality of *Crassula smithii*, presents a good example of such a feature, especially when viewed from the southwest. Sharing its habitat are a number of other succulent cremnophytes such as *C. perfoliata* var. *heterotricha*, *Aloe arborescens*, *Plectranthus purpuratus* subsp. *purpuratus* and *Aeollanthus parvifolius* (Van Jaarsveld *et al*. 2008), species quite commonly encountered on the precipitous margins of such regional table mountains.

One of the first to have extensively explored the Noodsberg botanically was John Medley Wood, first Curator of the then Natal (now KwaZulu-Natal) Herbarium, who delved into its floral treasures during the second half of the 19th century. A number of Wood types derive from there (e.g. *Orbea woodii* [= *Stapelia woodii*], Walker & Downs 2000), with the flora of this region featuring prominently in the *Natal Plants* series, six volumes of which appeared between 1898 and 1912. That no Wood gatherings of *Crassula smithii* have yet been located in any herbaria is testament to the highly localised distribution of this species within that escarpment range.

Description.—Perennial up to 0.30 m high when flowering, usually with compact, rosulate clusters 200(–300) mm in diameter, leaf pairs spirally arranged, old leaves remaining attached to the stem. *Roots* fibrous. *Stems* erect to decumbent, succulent, up to 11 mm in diameter, glabrous, yellowish becoming red-brown. *Leaves* sessile, succulent, firm, subulate, linear-triangular, 40–100(–180) × 8–14 mm, up to 11 mm thick, upper surface flat to channelled, lower surface rounded, yellowish to reddish green, older leaves faintly purplish mottled below; apex acute, mucro-

nate, margins entire and purple-red on basal half on older leaves. *Inflorescence* a terminal round-topped thyrse with numerous pedicellate 5-merous flowers in 1–many dichasia, lower inflorescence parts glabrous, upper parts covered in many recurved, scabrid hairs; bracts 3–5 pairs, leaf-like, triangular-subulate, gradually decreasing upwards, upper bracts 10 × 4 mm, floral bracts 5.0 × 1.5 mm; pedicels 1–3 mm long. *Calyx* lobes subulate, 2.5–3.0 × 1.5 mm, subglabrous, with scattered recurved translucent scabrid hairs and distinct marginal cilia, apex acute. *Corolla* urceolate; petals red, fused basally into tube for 1.5 mm, triangular-lanceolate, 5.0 × 1.8 mm, spreading and recurved at apex which is reddish with distinct subulate dorsal appendage 0.5 mm long. *Stamens* with filaments 5.0 × 0.8 mm, tapering towards apex; anthers 0.8 × 0.5 mm, brown; pollen yellow. *Squamae* 0.3 × 0.5 mm, slightly emarginate, orange. *Carpels* 4.0 × 0.7–0.8 mm, abruptly tapering in upper half to erect reddish styles. *Fruit* a head of free follicles. *Seeds* small, ellipsoid. *Flowering time*: January to March. Plate 2286.

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Crotalaria agatiflora subsp. *agatiflora* Leguminosae

East and northeast Africa

Crotalaria agatiflora *Schweinf.* subsp. **agatiflora**, Schweinfurth: 13 (1892); Taubert: 206 (1895); Baker: 315 (1914); Brenan: 414 (1949); Polhill: 205 (1968). Polhill: 72-74 (1982).

Crotalaria L. is a large genus in the Leguminosae family with approximately 690 species (Lewis *et. al.* 2005; Le Roux & Van Wyk 2012). The genus is distributed in the tropical and subtropical areas of the world with the majority of species found in Africa and Madagascar (Polhill 1968; Polhill 1982; Lewis *et al.* 2005). Polhill (1968) studied the genus extensively after Milne-Redhead (1961) and recognised 432 species for the African continent. About 54 indigenous species are found in southern Africa (Nkonki & Swelankomo 2003) of which four are exotic species and declared invasive alien species or weeds (Germishuizen *et al.* 2006). Other species in the genus are also known to occur in India, America and China (Lewis *et al.* 2005; Le Roux *et al*. 2011). The genus shows a remarkable diversity in its mophology, which greatly facilitates the differentiation of individual species, but variation between the species is of a markedly reticulate nature precluding any simple division of the genus into sections (Polhill 1968). *Crotalaria agatiflora* has five subspecies and subsp. *agatiflora* differs from the other four by its bracteoles which are less than 2.0(–3.5) mm long and its ovate-elliptic leaflets that are less than twice as long as broad, usually glabrous beneath. There are various common names for *C. agatiflora* subsp. *agatiflora* including bird flower, canary bird bush, rattlebox, Queensland bird flower and *voëltjiebos*. The common name, rattlebox, is derived from the fact that the seeds become loose in the pod as they mature and rattle when the pod is shaken.

The plant illustrated here is indigenous to tropical East Africa and northeast Africa (Tanzania and Kenya). In southern Africa it occurs in Namibia, South Africa (Gauteng, North West, Limpopo, Mpumalanga, KwaZulu-Natal and the Western and Eastern Cape) and has become naturalised in Australia (Queensland), New Zealand and South America. Distribution of *Crotalaria agatiflora* subsp. *agatiflora* in Africa, based on the PRE Computerised Information System (PRECIS), Southern African Plant Invaders Atlas (SAPIA 2011) and Global Biodiversity Information Facility (GBIF 2013) databases, is presented in Figure 1. Canary bird bush was first introduced into South Africa as an ornamental plant. The earliest known record in the Pretoria National Herbarium is from the Johannesburg Railway Horticulture Garden dated 1921 in the Johannesburg area. According to SAPIA, the earliest record of its establishment in the wild is from the Rustenburg and Brits area in North West. It has escaped from cultivation into natural areas and has been recorded in conservation areas and reserves in Pretoria such as the Colbyn conservancy area, and Faerie Glen, Groenkloof and Wonderboom Nature Reserves (Henderson & Musil 1987; SAPIA 2011).

PLATE 2287.—1, flowering stem × 1. Voucher specimen: *Condy 251* in National Herbarium, Pretoria. 2, fruiting branch × 1. Voucher specimen: *Condy 253* in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2287 *Crotalaria agatiflora* subsp. *agatiflora*

Crotalaria species are widely used in Chinese traditional medicine to treat several types of internal cancers. In the United States of America some species, such as *C. pumila*, are used to treat yellow fever and skin rashes. In the Siaya area, Kenya, the roots are used as a remedy for gastrointestinal discomfort (Kokwaro & Johns 1998). *Crotalaria agatiflora* subsp. *agatiflora* is used as a medicinal plant in several African countries for the treatment of bacterial infections and cancer (Le Roux *et al.* 2011). In Ecuador *C. agatiflora* subsp. *agatiflora* is also traditionally used as a decoction to treat cancer. The above ground parts of *C. agatiflora* subsp. *agatiflora* are used in its native range to treat otitis media, a bacterial infection of ears, as well as for treatment of sexually transmitted diseases (Le Roux *et al.* 2011). In India other species of *Crotalaria* has similar uses, where it is used to treat eczema and the leaves are placed on cuts or wounds to aid the healing process. Sharma *et al.* (1967) found that *C. agatiflora* subsp. *agatiflora* relieves spasms in dogs, found to be a good relaxant, and lowered blood pressure during treatment.

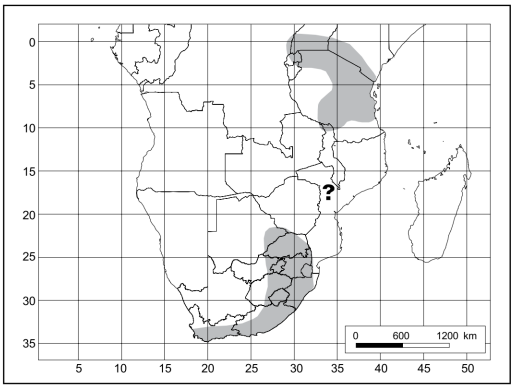


FIGURE 1.—Distribution range of *Crotalaria agatiflora* subsp. *agatiflora* based on herbarium records in the National Herbarium, Pretoria, and SAPIA and GBIF databases. The question mark (?) indicates regions of possible occurrence where records were not found.

A few *Crotalaria* species are consumed by humans in some parts of the world, however, many species are known to be toxic to humans and livestock. Examples include (but are not limited to) *C. oridicola*, *C. barkae*, *C. berteroana* and *C. retusa*. Toxicity has been proven in the genus *Crotalaria* to be due to the presence of pyrrolizidine alkaloids in plants and seeds (Pilbeam & Bell 1979). All plant parts of *C. agatiflora* subsp. *agatiflora* have been reported not to be toxic or poisonous.

In South Africa *Crotalaria agatiflora* subsp. *agatiflora*, is a declared category 1a species according to the National Environmental Management: Biodiversity Act (2004) and listed as a proposed invader in the Conservation of Agricultural Resources Act (1983). This species was previously misidentified as *C. agatiflora* subsp. *imperialis* (Macdonald *et al.* 2003). It grows in watercourses in Grassland and Savanna biomes; potentially invasive in forest margins and also occupies cleared grassy areas in South Africa. In some parts of the world where it has been introduced, it is regarded as an agricultural, environmental and garden weed. For example in Australia it is regarded as a minor environmental weed that has escaped cultivation and invading grasslands and areas with sandy soils (Cooperative Research Center for Australian Weed Management 2013). This is also the case in South Africa where the species has escaped cultivation and has established itself in the wild. According to herbarium material in the National Herbarium, Pretoria, *C. agatiflora subsp. agatiflora* is frequently collected along roads and railways, near rivers, gardens and natural habitats. Ecological data was compiled from herbarium specimens (collected from

1921–2011) and SAPIA records. Sixty-five percent were recorded near road sides, five percent along rivers, 10 percent in natural areas (including nature reserves) and 18 percent in urban areas including gardens.

Crotalaria agatiflora subsp. *agatiflora* reproduces and spreads exclusively by seeds. The average number of pods produced per plant is 50 and number of seeds per pod is 28. Seeds germinate in early summer.

Although no studies have focused on its effects on natural ecosystems, canary bird bush may affect the ecology of invaded areas in several ways for example through the enhancement of nitrogen levels in the soil. The species threatens watercourses in Grassland and Savanna biomes where it has been introduced. Furthermore, it has the potential to invade forest margins and often occupies cleared grassy areas and disturbed sites.

Description—Perennial woody herb, 0.3–2 m high, usually much branched, glabrous. *Leaves* 3-foliolate; leaflets ovate-elliptic, 25–90 × 10–35 mm, glabrous to densely hairy; petioles 30–120 mm long, mostly longer than leaflets. *Stipules* linear and caducous or absent, 4–12 mm long. *Racemes* stoutly pedunculate, many-flowered; flowers 40–50 mm long; bracts linear to attenuate-lanceolate, up to 16–20(–24) × 1–6(–9) mm; bracteoles filiform, 0.5–3.5 mm long. *Calyx* 18–30 mm long, with upper and lateral lobes joined almost to tips on either side, ± twice as long as tube; pedicels about 15 mm long, glabrous-glaucous or villose. *Standard* ovate, lemon-yellow to greenish yellow, sometimes medially pubescent outside; wings half to two-thirds as long as keel; keel broadly rounded, with a relatively short, projecting, often greenish or purplish beak, 11–55 mm long. *Pod* oblong-clavate, narrowed to a 15–25 mm long stipe, ± 75–100 mm long, glabrous. *Seeds* tumid, 6–7(–9) mm long, ± smooth. *Flowering time*: January–December in South Africa. Plate 2287.

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Abrus precatorius subsp. *africanus* Leguminosae

Africa, Australia, Americas, Asia

Abrus precatorius *L.* subsp. **africanus** *Verdc.* in Kew Bull. 24: 235 (1970); Gillett et al.: 11 (1971). *A. minor* Desv.: 418 (1826). *A. squamulosus* E.Mey.: 126 (1836). *A. tunguensis* Lima: 127 (1921). *A. cyaneus* Viguier: 172 (1952), *pro parte.*

The genus *Abrus* Adans. is a small group of about 18 species in the Leguminosae (subfamily Papilionoideae) that is native to Africa, Madagascar, India and Indo-China and is the only member of the tribe Abreae (Leistner 2000; Lewis *et al*. 2005; Kolberg & Swanepoel 2011). Two of the species are widespread across the world where they have seemingly been introduced (Lewis *et al.* 2005). *Abrus* was first described by Linnaeus in 1767 as *Glycine abrus* L. after which Adanson described the genus *Abrus* in 1763. The generic name is derived from the Greek word *habro*, which means delicate, elegant, pretty or soft in reference to the leaflets (Lewis *et al.* 2005). The specific epithet, *precatorius*, is a Latin word meaning petitioning or praying because of its use in rosaries (Masupa 2009).

The English common names for *Abrus precatorius* subsp. *africanus* are numerous and include jequirity, rosary bean, bead vine, coral bead plant, coral bean, crab's eye, licorice vine, love bean, minnie-minnies, prayer beads, prayer bean, precatory pea, red bead vine, weather plant, weather vine and lucky bean (Smith 1966; http://en.wikipedia.org/wiki/Abrus_precatorius 2012). In Afrikaans it is known as *paternostertjie*; other vernacular names include *amabope* (Ndebele), *nsimani* (Tsonga), *umuthi wenhlanhla* (Zulu) and *umkhokha* (Zulu) (Smith 1966; http://redlist.sanbi.org/species 2012). According to the Pretoria National Herbarium's database, *A. precatorius* subsp. *africanus* occurs in Namibia, Botswana, Swaziland, South Africa (Limpopo, Mpumalanga, KwaZulu-Natal and Eastern Cape provinces) (Figure 1), it is also found in Kenya, Mozambique, Madagascar, Mauritius and Seychelles. *Abrus precatorius* subsp. *africanus* occurs in orchard savanna, shrub savanna, gallery forest and also in plantations.

Abrus precatorius subsp. *africanus* has been widely cultivated as a garden ornamental, mainly because of its eye-catching and decorative bright red and black coloured seeds. It has a tendency to become weedy and invasive where it has been introduced, for example on Fraser Island, Australia, where the species grows readily in coastal environments and shows an enormous capacity to alter habitats (Hosking *et al.* 2007). It is naturalised in Hawaii, invading dry disturbed sites, while in Florida it has invaded undisturbed pine forests (Environmental Weeds of Australia 2008) and other open woodlands (Hosking *et al.* 2003). The species has also been reported to be opportunistic, growing very fast after disturbances such as fire and often outcompetes native species in the critical period after burn (www.bmrg.org.au/infor-

PLATE 2288.—Fruiting branch of *Abrus precatorius* subsp. *africanus* × 1, showing habit, fruit and seeds. Voucher specimen: *Condy 251* in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2288 *Abrus precatorius* subsp. *africanus*

mation.php/2/106/379 2012). It was introduced into Australia and the New World (Foden & Potter 2005).

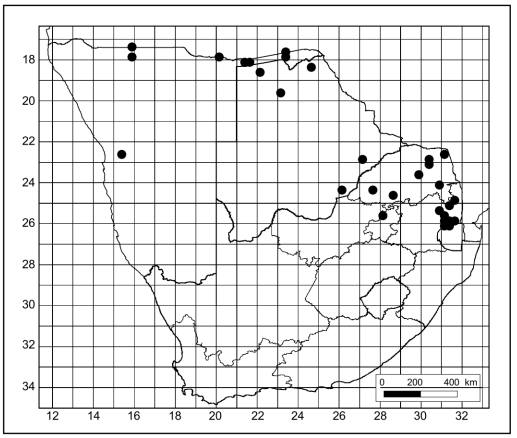


FIGURE 1.—Known distribution of *Abrus precatorius* subsp. *africanus* in southern Africa.

In southern Africa, it is found at altitudes of 15–1 500 m. The seeds are spherical, smooth, of a bright, shining red or white colour, with a black mark at the eye, or more rarely, black with a white eye. In India three forms of *Abrus precatorius* are recognised: with rose-coloured flowers, red seed with black eye; with lavender flowers, black seed with white eye; and with white flowers, white seed with black eye (http://wildlifeofhawaii.com 2012). The seeds are used as ornaments, decorations for costumes and lucky charms. Indian people used the seeds to weigh gold using a measure called a Ratti (Major *et al*. 1932). In China *A. precatorius* is used as a symbol of love and its Chinese name is *xiang si dou* or 'mutual love bean'. In Trinidad in the West Indies, the brightly coloured seeds are used to ward off evil spirits and the evil eye (http://en.wikipedia.org/wiki/*Abrus_precatorius* 2012).

The seeds of *A. precatorius* subsp. *africanus* are highly poisonous and are often encountered in cases of criminal poisoning (Subramanian *et al.* 1973). According to Ghosal & Dutta (1971) the major alkaloid constituents of lucky bean seeds are N-methyltryptophan (abrine), precatorine and hypaphorine. These toxins are so dangerous that even half a seed, chewed and swallowed, can be fatal to an adult person. The seed coat is quite hard, so there is presumably no danger if the seed is swallowed whole. The digestive fluids cannot break down the seed coat, therefore the toxins are not released and the seed passes through the whole alimentary canal without being scathed. When consumed in large doses, they are an acrid poison, giving rise to symptoms similar to those of cholera. Nadkarni (1910) stated that the lethal dose of powdered seeds for human beings is 1 to 3 grams. From experiments done in horses, it was clear that *A. precatorius* seeds given orally in small and gradually increasing doses to horses, cause the animal to develop somewhat of a tolerance to relatively large doses, whereas a large dose administered either by feeding or as a bolus will kill the horse within 18 hours (Major *et al.* 1932).

Indigenous African tribes have traditionally used the seeds, roots, leaves and flowers for various ailments such as the treatment of eye infections, stomach disorders, snakebite and also as a contraceptive (Watt & Breyer-Brandwijk 1962). Crushed leaves are placed in boiling water, to prepare a steam bath for inflamed eyes. If administered uncooked, the seed acts as a strong purgative and emetic (Hutchings 1996). In Zulu culture root or leaf decoctions are used for pleuritic chest complaints and also as love charms (Hutchings 1996). Tamil Siddha people have used *Abrus pre-*

catorius for many years and as a result, they are familiar with its toxicity. Based on this knowledge they suggested a purification method where seeds are boiled in milk and subsequently dried. In this way, the Tamil Siddhars made tea from the leaves for the treatment of fevers, coughs and colds (http://en.wikipedia.org/wiki/*Abrus_precatorius* 2012). When sorcerers plot to kill a person, they make an effigy of their intended victim and put the beans in the place of ears (Nadkarni 1910).

Description.—Perennial twining climber, 2.4–4.5 m high, with glabrescent mostly yellowish green young branches. *Leaves* 50–100 mm long; petiole 5–18 mm long, 11–15-jugate, leaflets ovate, obovate, or oblong, 6–25 mm long, 3–9 mm wide; base rounded or subcordate; apex obtuse or acuminate; upper surface glabrous or glabrescent, lower surface sparsely appressed-pubescent. *Inflorescence* mostly stout, rigid and strongly falcate; bracts are up to 1 mm long, bracteoles very small. *Flowers* densely arranged on the inflorescence, up to 10 mm long, subsessile. *Calyx* ±3 mm long, pubescent. *Corolla* 3–5 times as long as the calyx, pale purple to yellowish. *Pods* almost rectangular, swelling or covered with low tubercles, 20–35 mm long, 10–15 mm wide, densely warty, tomentose, 3–7-seeded; beak reflexed, hook-shaped; mostly truncate at both ends. *Seeds* ovoid, 5–7 mm long, 4–5 mm broad, scarlet with a black spot around the hilum or rarely, black with a white eye, glossy. *Flowering time*: November–March. Plate 2288.

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Cucumis metuliferus Cucurbitaceae

Sub-Saharan Africa and Yemen

Cucumis metuliferus *E.Mey. ex Naudin* in Annales des Sciences Naturelles, Botanique ser. 4, 11: 10 (1859); Meyer: 406 (1838); Sonder: 495 (1862); Hooker: 543 (1871); Cogniaux: 499 (1881); Hiern: 397 (1898); Stuhlmann: 137 (1909); Bews: 202 (1921); Landsell: 144 (1923); Cogniaux & Harms: 146, t. 15 (1924); Burtt Davy: 228 (1926); Broun & Massey: 102 (1929); Exell et al.: 195 (1929); Exell: 186 (1944); Andrews: 172 (1950); Hutchinson & Dalziel: 213 (1954); Meeuse: 68 (1962); Berhaut: 262 (1967); Jeffrey: 98 (1967); Keraudren: 142 (1967); Launert & Roessler: 12, 14 (1968); Renew: 6, t. 5 (1968); Fernandes & Fernandes: 259 (1970); Ross: 341 (1972); Jeffrey & Mann: 463, 464 (1978); Onderstall: 190 (1984); Halliday et al.: 71, t. 7 (1986); Kirkbride: 70 (1993); Germishuizen & Fabian: 414 (1997); Lebrun & Stork: 132 (1997); Retief & Herman: 395 (1997); Welman: 415 (2003); Braun et al.: 83 (2004); Da Silva et al.: 51 (2004); Mapaura & Timberlake: 38 (2004); Phiri: 45 (2005); Pooley: 80 (2005); Setshogo: 53 (2005); Klopper et al.: 253 (2006); Welman: 371 (2006); Figueiredo & Smith: 65 (2008); Welman: 1 (2009). *Cucumis tinneanus* Kotschy & Peyritsch: 17, t. 8 (1867).

Cucumis is the Latin name for the cucumbers, which had already been in cultivation in ancient Egypt, and consists of 55 species (Telford *et al*. 2010). Molecular studies showed the affinities of the genera *Cucumella*, *Dicoelospermum*, *Mukia*, *Myrmecosicyos* and *Oreosyce* which are, based on this data, now included in *Cucumis* (Ghebretinsae *et al*. 2007a, 2007b; Schaefer 2007). The genus is largely indigenous to Africa, but also found in Asia, Australia and some of the islands in the Pacific. The genus includes two major commercial vegetable crops namely cucumbers (*C. sativus*, mainly from Asia) and melons (*C. melo*, from Africa and Australasia) and two minor crops namely the West Indian gherkin (*C. anguria*) and the kiwano (*C. metuliferus*) (Kirkbride 1993). Despite Africa being the proposed centre of origin for the genus, the type species (*C. sativus*) comes from southern Asia (Garcia-Mas *et al*. 2004).

This species is found naturally throughout sub-Saharan Africa: from northern tropical Africa from Nigeria eastwards to Sudan and Ethiopia, south to the Congo, Okavango and Namibia and south from Kenya to the Eastern Cape in South Africa. It has also been reported from Yemen (Wood 1997). The natural distribution is given in Figure 1. Surprisingly, this is the first member of this genus to feature in this series. The other six members of the Cucurbitaceae family from previous volumes of *Flowering Plants of Africa* are *Citrullus ecirrhosus* (Chadwick & De Winter 1990), *Coccinia palmata* (Welman & Condy 2007a), *Gerrardanthus tomentosus* (Crouch *et al.* 2003), *Momordica clematidea* (Meeuse 1959) [= *M. cardiospermoides*], *M. foetida* (Welman & Condy 2007b) and *Trochomeria macrocarpa* (Meeuse 1954).

This plant usually grows in shallow or deep, well-drained sand or loam soils, mostly in alluvial soil on riverbanks, in river beds or on flood plains. It is also recorded from clay soil and rocky slopes. It climbs on trees, shrubs and even grasses

PLATE 2289.—1, flowering stem, × 1; 2, leaf, × 1; 3, fruiting branch, × 1. Voucher specimens: *Bester 11104* (1, 2); *Bester & Condy 10672* (3) in National Herbarium, Pretoria (PRE). Artist: Gillian Condy.



PLATE 2289 *Cucumis metuliferus*

through attaching itself by means of tendrils. The variety of habitats further includes forest edges, deciduous woodland, savanna or grassland in natural or disturbed areas and abandoned lands and dry thickets. Herbarium specimens of this species have been collected from a wide altitudinal range, from 210–1 800 m above sea level. Plants flower from January to May and fruit from February to July (based on records from the National Herbarium in Pretoria [PRE]).

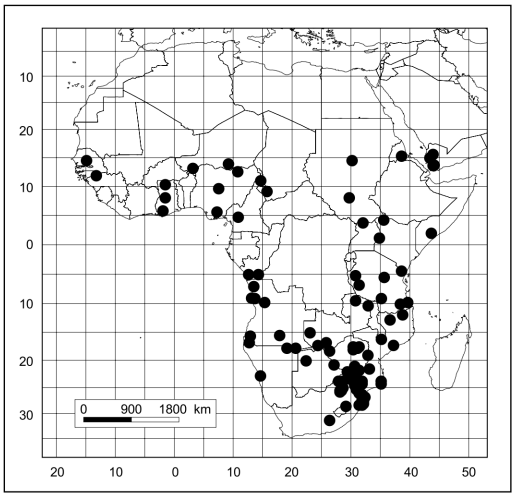


FIGURE 1.—Known distribution of *Cucumis metuliferus* based on specimens in the National Herbarium, Pretoria; Lebrun & Stork (2003); and Wood (1997).

The fruiting specimen depicted here was collected in the Pretoria National Botanical Garden towards the end of May 2011, where it was twining amongst trees and surrounding vegetation on the northern (and warmer) side of the Silverton Ridge. The flowering stem was collected from a plant further east on the same ridge towards the end of March 2012. After pollination, the fruits develop slowly over a couple of months.

Despite numerous literature references and labels on herbarium sheets that indicate that the species is rare, it possibly only indicates local rarity as the African horned cucumber is very widespread in its natural distribution. By the time that the fruit ripens, most of the rest of the plant has already died away, which may explain why so many labels indicate that it is rare. The threat status of this species was assessed and Red Listed as least concern (LC) in the most recent assessment for South Africa (Foden & Potter 2005).

The African horned cucumber is edible and Meeuse (1962) states that two types of 'jelly-melon' can be distinguished: a bitter (and unpalatable) and non-bitter form. He further reports this plant to be an excellent vegetable, like cucumber. Fruits can be stored for up to six months without cold storage. The bitterness of plants does not seem to be geographically correlated and it is not possible to tell whether a fruit is bitter or not without tasting it first. Elatrase activity in the plant is mainly responsible for its bitterness (Watt & Breyer-Brandwijk 1962). One of us (GC) has personally eaten the fruit sliced up in salad, but it had an uninteresting and bland taste. Parsley (1981) suggests that the flesh be scooped out and added to other salad ingredients to make a refreshing fruit salad, as it has a slight pineapple-banana flavour. Morton (1987) is of the opinion that the desirability of these fruits are over-emphasised by previous authors who reported on the use of this plant as a vegetable. Nevertheless, it is not only cultivated for its edible fruits but also because the fruits are so decorative.

The leaves (like those of most Cucurbitaceae) may be cooked and eaten as spinach (Onderstall 1984; Roodt 1998; Pooley 2005). The foliage, however, contains saponin, an oily glycoside, which is a strong foaming extract when mixed with water. This compound can be toxic, but also has many medicinal uses. According to Roodt (1998), the bitter compounds in the leaves can be neutralised when it is cooked. The root is used for birth pains. It is also cooked and applied externally to the genitalia for treatment of gonorrhoea. The Bushmen roast the fruit and then strain the flesh before eating it (Renew 1968; Roodt 1998)—the strained liquid is retained as a water source.

Fruits are eaten by a variety of birds when they ripen on the stems; birds are therefore largely responsible for the dispersal of seeds. They eat the juicy ripe fruit easily due to the absence of a tough or hard outer skin. Fruit that fall to the ground may further be consumed by rodents, primates and small antelope. It has proportionally much more moisture than commercial cucumbers and is thus a useful source of water for humans and animals in arid areas (Van Wyk & Gericke 2000). The flesh may further be used for making a jelly (Welman 2009). Some indigenous tribes pound the roots, mix it with fat and smear it on their bodies in order to ward off evil spirits (Watt & Breyer-Brandwijk 1962).

Plants produce many seeds per fruit and these seeds germinate and grow quite easily. As this species is a fast-grower, it can quickly cover a frame, trellis or unsightly compost heap in the garden. It is, however, prone to mildew and white fly, which also cause the plant to die back quickly.

In the early 1970s, *Cucumis metuliferus* was used in hopeful trials to incorporate its nematode and disease-resistance into muskmelons and the common cucumber (Fassuliotis 1970, 1977; Provvidenti & Robinson 1974). Success in producing fertile F_1-generations to incorporate the disease resistant genes of *C. metuliferus* into other economically important Cucurbitaceae has still to be realised. Norton (1969) was able to incorporate into *C. melo* the resistance to the root-knot nematode found in *C. metuliferus* (Fassuliotis 1967) by successfully crossing the latter with the feral type of the former. However, this claimed cross between *C. metuliferus* and *C. melo* is highly unlikely due to the long phylogenetic distance between the two taxa (one is in section *Metuliferi*, the other in section *Cucumis*, which split several million years ago) (pers. comm., H. Schaefer).

The African horned cucumber has been grown in Queensland (Australia) and has become naturalised (Morton 1987) and even been listed on the Australian weed list (Randall 2007). It was first grown commercially in New Zealand in the 1980s and registered under the name 'Kiwano'. More recently, it has also been grown in Kenya (Van Wyk & Gericke 2000). This species is also listed as a noxious weed in the US (Holm *et al*. 1979; Thomas 2007). Only a few natural species of *Cucumis* are cultivated, and then usually as garden novelties (Whitaker & Davies 1962).

The description that follows is partly adapted from Kirkbride (1993) and from specimens housed at PRE.

Description.—Annual mostly climbing herb, sometimes a creeper with trailing stems. Vegetative parts covered with spreading stiff white or brown hairs resulting in a rough feel (Figure 2a). *Stems* to 5 m long, radiating from a woody rootstock, hispid with spreading hairs (Figure 2a). *Tendrils* slender, simple, in axils of leaves. *Leaves* ovate-cordate in outline with a large basal sinus, sometimes heart-shaped, to 32–125 × 35–135 mm, sometimes unlobed but usually palmately 3–5-lobed,



FIGURE 2.—*Cucumis metuliferus*: a, multi-cellular hairs on stem; b, hairs on petiole; c, hairs on main veins of leaves (abaxial side); d, toothed leaf-margin with sinus; e, toothed projection on epicarp with bristle of immature fruit; f, toothed projection on epicarp with bristle of mature fruit. Voucher specimens: *Bester 8459* (a, b); *Retief 1252* (c, d); *Bester 11104* (e); *Bester & Condy 10672* (f); all in National Herbarium, Pretoria. Scale: a–f, 1 mm. Photographs: S.P. Bester.

lobes triangular to rounded, rarely ovate, obtuse to rounded and apiculate, veins below roughly hairy (Figure 2c), margins minutely toothed (Figure 2d); petioles to 20–110 mm long, hirsute (Figure 2b). *Flowers* monoecious, funnel-shaped, axillary. *Male flowers* in clusters of 1–4, sessile or shortly pedicillate, peduncle to 10 mm long, corolla green to pale yellow, 5–13 × 2–8 mm, united in lower third, pedicels 2–20 mm long. *Female flowers* solitary on 20–60 mm long pedicels, corolla yellow, 8–15 × 4–12 mm. *Ovary* to 20 mm long, green with numerous dark green fleshy spines ending in stiff bristles. *Fruit* ellipsoid-cylindrical, obscurely trigonous, 60–130 × 28–94 mm when ripe, the scattered spines rather stout, broad-based, fleshy, ±6–14 × 2–5 mm and white to brown bristle-tipped; deep green, ripening yellow to orange-red with longitudinal bands of pale markings, rather soft and fleshy; carried on a 20–70 mm long peduncle (Figure 2e & f). *Seeds* ellipsoid, flattened, hundreds per fruit 6.0–9.0 × 2.0–4.0 × 1.0–1.5 mm embedded in a light green, emerald-green or translucent, jelly-like flesh. Plate 2289.

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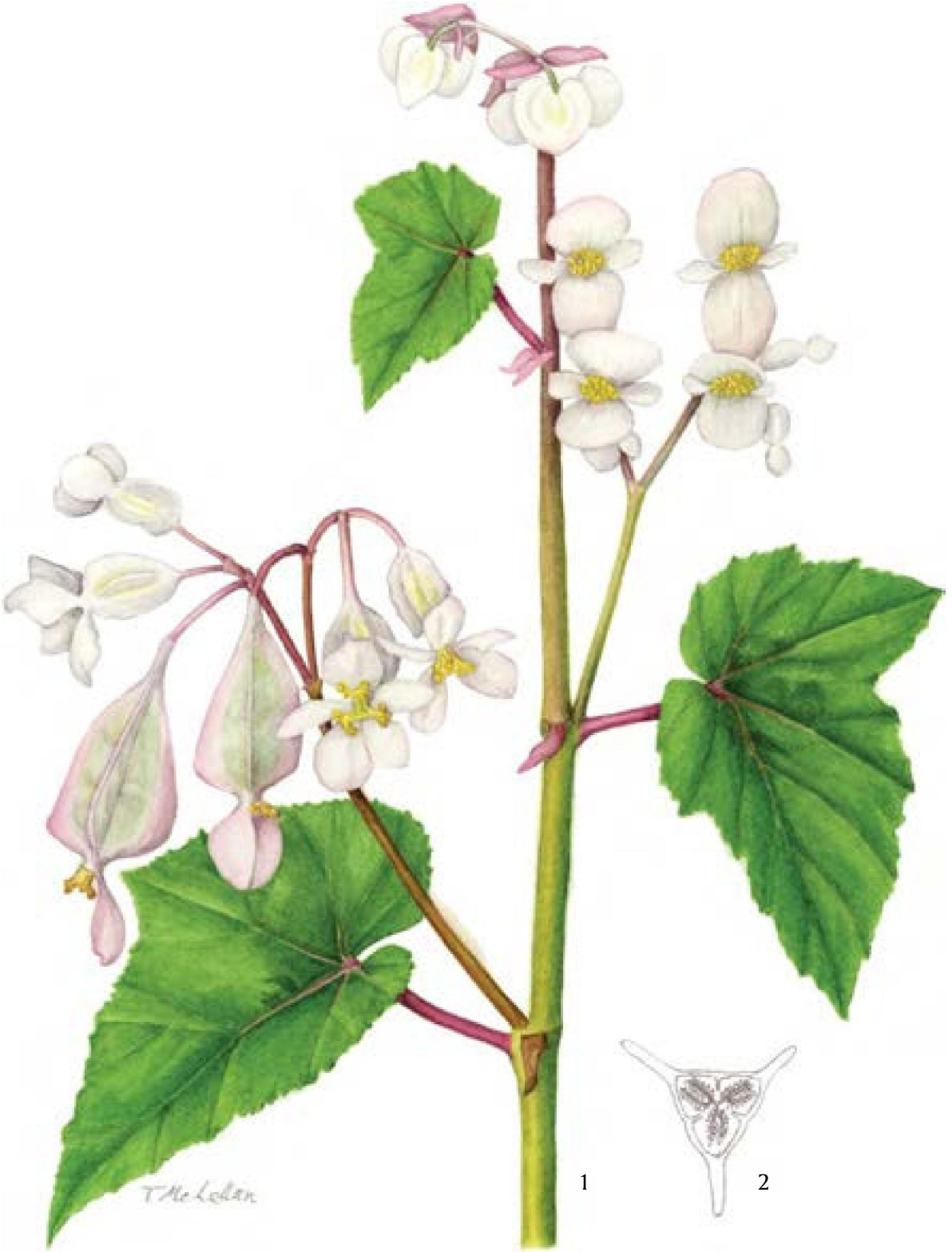


PLATE 2290 *Begonia sonderiana*

Begonia sonderiana Begoniaceae

Southern and central Africa

Begonia sonderiana *Irmsch*. Botanische Jahrbücher 81: 156–160 (1961); Hilliard: 137, figs 44 & 45 (1976) (as *B. sonderana*); Tebbitt: 280 (1997) (as *B. sonderana*). *B. sonderiana* var. *transgrediens* Irmsch.: 160 (1961). *B. caffra* Meisn., Burtt Davy: 232 (1926). *B. dregei* Otto & A.Dietr., Burtt Davy: 232 (1926). *B. natalensis* Hook., Burtt Davy: 232 (1926). *B.* sp., Letty: 204, t.101 (1962).

Begonia is comprised of succulent herbs or subshrubs, and sometimes even climbers, with five representatives indigenous to the *Flora of southern Africa* region. The series *Flowering Plants of Africa* has previously treated four of the five, most recently *B. homonyma* (McLellan *et al.* 2009). The current account is of *B. sonderiana*, one of the largest local species, found in eastern South Africa, Swaziland, Mozambique and Zimbabwe (Figure 1). Plants bloom in mid- to late-summer, with flowers bright shell-pink, rarely white or white tinged with pink. Separate male and female flowers, each up to 30 mm across, are produced on the dichotomously branched cymes, with several male flowers presented before the first female flower matures. The first leaves of the season, as they emerge from the overwintering tuber, are distinctly spotted above, particularly towards their margins. This characteristic is absent in those leaves produced later on in the season. Mature leaves have pink petioles, are ovate-acuminate in outline, 5–7-lobed and have toothed margins. *Begonia sonderiana* is a rarely encountered mesophyte, which is largely restricted to the Archipelago-like Afromontane Centre of Endemism (Van Wyk & Smith 2001). For most of its range in southern Africa, it occurs within Northern Mistbelt Forest (Rutherford *et al*. 2006b) where it is an uncommon component of the understory, a cremnophyte on broken cliff faces, or found amongst rock falls within forest or along its margins. It may also be encountered in shady rock outcrops on steep grass slopes. The specimen figured here was collected from the upper reaches of Mariepskop where it was found locally common in partial shade along a moist forest roadside. Plant associates of this geophyte typically include *Clivia caulescens*, *Solenostemon* cf. *latifolius*, *Plectranthus laxiflorus*, *Impatiens sylvicola*, *Aloe arborescens*, *Psychotria zombamontana* and the ferns *Asplenium friesiorum* and *A. aethiopicum* subsp. *tripinnatum*.

When in bloom the plants are obvious, their fleshy pink stems rising to about 1 m in height, and their delightful flowers presented terminally in bright, slightly nodding inflorescences. In southern Africa, the altitude range for *Begonia sonderiana* has been given as 1 000–1 850 m (Hilliard 1976), whereas in the *Flora zambesiaca* region plants have been found at expectedly higher elevations of between 1 650 and 2 000 m (Kupicha 1978). Very rarely, at the far south of its range on the Lebombo Mountains, Sonder's begonia may be encountered at low altitudes (ca. 700 m) in

PLATE 2290.—1, flowering and fruiting shoot with separate male and female flowers, × 1; 2, transverse section through ovary showing bifid placentae, × 2. Voucher specimen: *Crouch 1193* in KwaZulu-Natal Herbarium, Durban. Artist: Tracy McLellan.

xeric habitats, growing exposed in humic pockets overlying rhyolite. This is within the Maputaland-Pondoland Region of plant endemism (Van Wyk & Smith 2001) in drought tolerant vegetation corresponding to Southern Lebombo Bushveld (Rutherford *et al*. 2006a). Differences in flower size are evident between plants from one end of the range to the other: the tepals of the southern xeric form are larger in males and smaller in females (Crouch & McLellan 2008). It is highly likely that little gene flow occurs between isolated populations, similar to what has been found for other species of *Begonia* from the region. Accordingly, for conservation purposes, each subpopulation should be seen as genetically distinct because of the low dispersal ability of Begoniaceae generally (Matolweni *et al*. 2000; Hughes & Hollingsworth 2008).

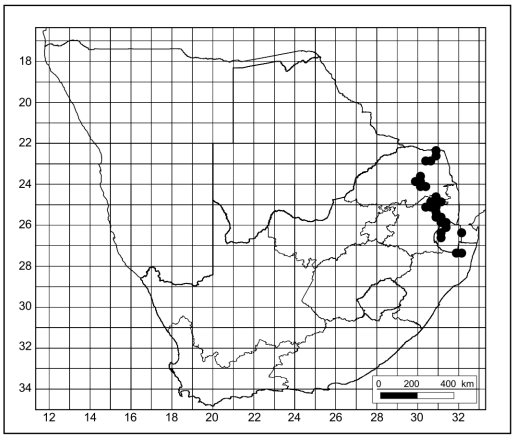


FIGURE 1.—Known distribution of *Begonia sonderiana* in southern Africa.

Although *Begonia sonderiana* has often been confused in herbaria with other South African species, including *B. homonyma*, *B. dregei* and *B. sutherlandii*, several traits can be used to distinguish between them. Sonder's begonia typically has bright pink flowers with the males having four tepals rather than two. Both *B. homonyma* and *B. dregei* usually have white or pale pink flowers and two male tepals, whilst flowers of *B. sutherlandii* are orange. In *B. sonderiana* the placentae are bilamellate, appearing bifurcate in transverse section, while in the other three taxa the placentae are entire. Without flowers, the large leaves of both *B. sonderiana* and *B. homonyma* could cause confusion in identification. However, they do not occur sympatrically except in the southern Lebombo Mountains, in Gwalaweni Forest, KwaZulu-Natal. The range of *B. homonyma* extends to the south from there, and that of *B. sonderiana* to the north. The morphology of the stem bases of these two species differ greatly: Sonder's begonia has a spheroidal tuber usually growing under the soil whereas *B. homonyma* has a largely epigeal caudex. Since plants of both species can reach over 1 m in height, the bases of stems are rarely represented in herbarium specimens and this trait has received little attention in the taxonomic literature. In the southern Lebombo Mountains *B. sonderiana* might also be confused with the naturalised *B. hirtella*, an annual species which is not only atuberous and shorter, but distinctly hirsute, with thinly villous leaves (Crouch 2011). Both species possess ovaries with divided placentae. Notably, leaf size alone should not be used to identify *B. sonderiana*, for even larger-leaved forms of *B. sutherlandii* exist, most especially in the Qudeni Forest. In the absence of its orange flowers, Sutherland's begonia can be distinguished from *B. sonderiana* by its much more elongated leaves with regularly dentate margins.

The difference in placentation referred to above forms the basis for sectional arrangements in *Begonia*, with *B. sonderiana* placed in sect. *Rostrobegonia* and the

other four indigenous species in closely related sect. *Augustia* (Doorenbos *et al.* 1998). Irmscher (1961) further cited the lower number of short brown bristles on the end of the petioles as evidence that *B. sonderiana* belonged to sect. *Rostrobegonia*. Despite its distinction at sectional rank, unpublished sequences (Genbank Acc No AF485216; Matolweni 2001) and analyses have shown a close relationship of Sonder's begonia with the other southern African species. Accordingly, *B. sonderiana* likely has greater affinities to both South American (Plana *et al.* 2004) and Asian clades (Forrest *et al.* 2005) than to tropical African species. In this regard, molecular studies have shown that African begonias are not monophyletic (Plana *et al.* 2004).

Irmscher described *Begonia sonderiana* as a distinct species in 1961. Although it had been collected previously, it was misidentified as *B. homonyma* or *B. dregei*. He simultaneously described var. *transgrediens*, distinguished from the typical form by presenting two or three tepals in the male flowers rather than four, and narrower leaves with less pronounced lobes and teeth. This name, based on a single specimen from Sabie in Mpumalanga, has since not been upheld (Hilliard 1976).

Begonia sonderiana is not widely cultivated, though it is available commercially from a few speciality growers, and has been recommended as a good container or shade plant (Pooley 1998). It has entered the European garden flora (Tebbitt 1997), likely first under one of its misapplied names. It has though not been used much, if at all, in the hybridisation of cultivated begonias—unlike its regional cousin *B. dregei* (Plate 673) which has been used to generate the Hiemalis group of north-temperate houseplants so favoured for their winter flowering habit (Tebbitt 1997). Globally, a wide range of begonia hybrids has become an important, and at times weedy, series of horticultural subjects. Amongst these are the immensely popular Semperflorens or wax begonias, used primarily as half hardy bedding plants for landscaping. Altogether, well over 200 of the 1 400–1 600 species of *Begonia* are known to have been introduced to horticulture where they are variously employed as bedding, conservatory and window-garden subjects. Many are grown for their attractively marked foliage and others for their showy blooms, with a large proportion of the latter treated as single pot subjects, although a few are used for bedding. More than ten thousand cultivars and hybrids have been developed, including a range of tuberous pot plant forms (*B.* ×*tuberhybrida* cultivars) with double and triple blooms that display an enormous spectrum of bright colours (Tebbitt 1997). Cultivation of Sonder's begonia is best undertaken in a manner that emulates the natural growing conditions, in which plants are well watered but extremely well drained. Accordingly, this species is best suited to pot or shaded rockery culture, and will not readily tolerate planting out in open beds. Sonder's begonia goes dormant at the end of summer, its brittle succulent stems being fully deciduous. Watering over the winter period (from April to September in the southern hemisphere) should accordingly be minimal. Propagation may be achieved from seeds or cuttings, both preferably started early in the growing season, so that perennating organs can form to allow survival beyond the following winter. This species is highly susceptible to powdery mildew such that prophylactic treatment with fungicide is recommended, particularly in hot weather and towards the end of the growing season.

The name *Begonia* was first published in 1700 by Joseph Pitton de Tournefort, having been named by Charles Plumier in honour of Michel Bégon [1638–1710], Intendant of the French Antilles when not Governor of French Canada, and a patron of botany. The specific epithet *sonderiana* honours Dr Otto W. Sonder [1812–1881], co-author of the first three volumes of *Flora capensis* who, *inter alia*, worked on South African begonias (Sonder 1862). At the time he collaborated with Harvey on their treatise of Cape plants, Sonder was employed as an apothecary in Hamburg, Germany (Gunn & Codd 1981).

Description.—More or less erect, perennial, glabrous, monoecious herb bearing spheroidal subterranean tubers (to 75 × 29 mm) with spaced swellings. *Stems* 1 to several, 0.4–1.0 m tall, erect, stout, fleshy, simple or sparsely branched, usually red, nodes swollen, leafy throughout. *Stipules* 2, lanceolate, brown, membranous, persistent. *Leaves* alternate; lamina obliquely ovate-acuminate, up to 180 × 140 mm, asymmetric base cordate, with 5–7 more or less distinct triangular lobes, margins irregularly and shallowly dentate, occasionally crenate, light green and waxy above, paler below; veins digitate, often reddish; petioles up to 150 mm long, often reddish, decreasing in length upwards. *Inflorescences* protandrous, presented mainly in upper leaf axils, bracteate, cymose, dichotomous, flowers zygomorphic, usually bright pink, occasionally white or white flushed pink. *Bracts* 2–5 mm long, ovate, brownish, membranous. *Male flowers* caducous, tepals 4, occasionally 2–3; outer pair 8–13(–16) × 11–17(–21) mm, suborbicular to transversely elliptic, often cordate at base; inner pair 5–8(–11) × 3–4(–5) mm, obovate; stamens yellow, numerous, filaments free, 2–3 mm, anthers 2-thecous, dehiscing by lateral slits. *Female flowers* tepals petaloid, unequal, 5; outer ones 6–17 mm long, elliptic to suborbicular, inner ones shorter and narrower; styles 3, divided to about half their length, the branches stigmatic and spirally twisted, connate at base, papillose; ovary inferior, 14 × 5 mm, ellipsoid, subequally 3-winged; placentae bifid. *Fruit* loculicidal capsule, deep reddish pink with 3 subequal, more or less fleshy wings, wings elliptic, oblong or triangular in outline, 20–30 mm across the expanded wings. *Seeds* numerous, minute, without endosperm, testa reticulate. Plate 2290.

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Turnera oculata var. *oculata* Turneraceae

Namibia, Angola

Turnera oculata *Story* var. **oculata** in *Bothalia* 7: 493 (1961).

Turnera oculata Story var. *oculata* is a rare, sparingly to much branched rather slender shrub bearing densely hairy leaves and striking yellow flowers. The flowers have dark shiny circular parts with light centres, resembling an eye. The Latin specific epithet (*oculata* = eye) alludes to this distinct feature. It grows in dry sandy streambeds and on mountain plateaus in the desert and arid savanna regions of the lower Kunene River (Kaokoveld in Namibia and adjacent southern Angola). Plateaus include those of Okahukumune and the southern margin of the Otjihipa Mountains in arid savanna near Orukatuwo, Namibia. The var. *paucipilosa* usually grows on the western escarpment mountains.

During a visit to the Kaokoveld in July 2004, investigating the cliffs of the high twin-peaked Okahukumune Mountian (just below 2 000 m), a tall shrub was encountered resembling a species of *Hibiscus*. The plant was later identified as *Turnera oculata* var. *oculata* by Braam van Wyk of the H.G.W.J. Schweickerdt Herbarium, University of Pretoria. Plants were found growing in a dry sandy gravel stream bed just south of Okahukumune, together with *Colophospermum mopane*, *Acacia reficiens*, *Sesamothamnus benguellensis* and *Tamarix usneoides*. Upon further investigation it was found that this attractive species grow widespread in the Namib Desert along both sides of the lower Kunene River valley, from the western end of the Baynes Mountains towards the coast. The vegetation in the western part of its distribution consists of hot desert and most trees and shrubs are confined to dry river beds or rocky outcrops. Apart from the aforementioned companion species, the mustard tree (*Salvadora persica*) and *Commiphora virgata* shrubs are relatively common in this area. Rainfall is mainly during summer and autumn, ranging from 75–100 mm per annum.

An interesting feature of *Turnera oculata* is the pair of extrafloral nectaries just below the leaf blade and at the top of the petiole (abaxial surface). The nectaries secrete a sweet clear nectar droplet utilised by local ants, which in turn protect the plant. This mutualism benefits both plant and insect. Deserts hold little moisture and food resources, and competition is intense among insects and other herbivores. The protection from ants is vital for the plant's survival. At Iona Peak (north of the Kunene River in Angola) one of us (EJvJ) deliberately placed his hand on *T. oculata* var. *paucipilosa*. Within seconds ants were crawling all over his hand, biting viciously. A notable exception is *Acraea brainei* of which both butterflies and larvae feed from

PLATE 2291.—1, flowering branch, × 1. Voucher specimen: *Van Jaarsveld 19527* in Compton Herbarium, Kirstenbosch. 2, capsule, × 2. Voucher specimen: *De Winter & Leistner 3770* in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2291 *Turnera oculata* var. *oculata*

T. oculata, seemingly unmolested by ants. Extrafloral nectaries are well known in some other local plants groups such as *Rogeria* (Pedaliaceae) and *Adenia* (Passifloraceae).

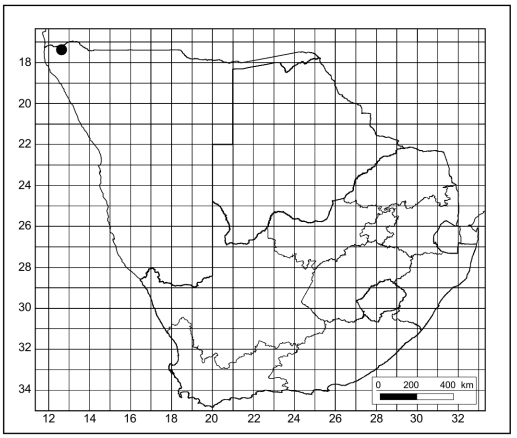


FIGURE 1.—Distribution of *Turnera oculata* var. *oculata* based on specimens in the National Herbarium, Pretoria.

Turnera oculata var. *oculata* belongs to the family Turneraceae (which in modern classification systems is usually placed in the Passifloraceae) which is not well represented in southern Africa. Turneraceae *s.str.* is a small family consisting of 10 genera and about 120 species of which most occur in South America (Willis 2005). Of these, most (about 60) belongs to the genus *Turnera*. Therefore, it is somewhat surprising to find *T. oculata* with its two subspecies occurring in Namibia and Angola. In southern Africa only four genera and 11 species of the Turneraceae have been recorded (Bredenkamp 2003; Thulin *et al.* 2012). The genus is also represented in northeast Africa by a closely related species, *T. thomasii*, presenting a rare case of both trans-Atlantic, as well as African arid corridor disjunction in the genus (Thulin *et al.* 2012). *Tricliceras* Thonn. ex DC. (previously known as *Wormskioldia* Thonn.) is the best represented with six known species mainly confined to the northern savanna regions of South Africa and into Namibia. The other genera locally recorded, includes a newly described monotypic genus *Afroqueta* Thulin & Razafim., and *Streptopetalum* Hochst. with one species in southern Africa.

Turnera oculata var. *oculata* was discovered by Dr Bernard de Winter and Dr Otto Leistner at Otjinungua during their expedition to Koakoveld in 1957 (Gunn & Codd 1981). Two varieties have been recorded; the other variety, var. *paucipilosa* grows on regions of the Baynes Mountains, usually above 1 000 m, in arid savanna. This is a much smaller and sparingly hairy shrublet with distinctly longer floral bracts. This variety was named by Amelia Obermeyer (Mrs Mauve) in 1974 from plants collected by Wilhelm Giess [1910–2000], a botanist from Windhoek, Namibia and the specific epithet alludes to its sparse indumentum in comparison to the var. *oculata*. Subsequently, populations of *T. oculata* var. *paucipilosa* have also been found on the northern side of the Kunene River on the Iona Mountain in Angola.

Turnera oculata var. *oculata* is an attractive shrub with horticultural potential. The plant is easily grown and flowers freely. Flowering specimens in the Botanical Society Conservatory at the Kirstenbosch National Botanical Garden always attract a lot of attention from visitors. The plant is best grown in desert gardens (Van Jaarsveld 2010). Semi-hardwood cuttings can be prepared during the warmer summer months in a mixture of peat and polystyrene or sand. Rooting is rapid and the plant will flower after the third year.

Like most plants grown from specimens collected in the wild, cultivation of *Turnera oculata* var. *oculata* is a rather complex procedure. Furthermore, non-succulent plants, such as *T. oculata* var. *oculata*, are generally more difficult to grow than succulent plants. Vegetative material was gathered in the field using a sharp pair of secateurs or knife. When non-succulent cuttings are prepared, plants require 'frail care' for at least the first month, from the time of collecting until the roots appear. The cuttings of *T. oculata* var. *oculata* were first stored in moist cloth or newspaper (to prevent desiccation in hot and dry weather) and placed in a cool box. Time is crucial and the collected material must ideally reach a nursery mist bed within a week, as the foliage may drop. Foliage is vital in sequestering energy from the sun through photosynthesis for root production. Upon arrival at Kirstenbosch, the cuttings were prepared. Each branch was cut just below a node, the lower leaves removed and the basal portion of the cutting prepared with hormonal rooting powder Seradix (indolebutyric acid) to stimulate root formation. This in not essential, as plants should root without the hormone, however, it could take twice as long and is often less effective. The cuttings were then placed in a container in rooting medium, which can be pure sand or a mixture of sand, peat and polystyrene. The latter provides aeration and good drainage, which is essential for root formation. Sufficient light is very important. Rooting under controlled conditions (controlled heat and occasional misting) is usually rapid, after which the plants are transplanted and transferred to individual containers and placed in a warm but shady position to harden off. The hardening process is a crucial part of the procedure, as a sudden change to full sun will damage the leaves and can lead to death. Once well-rooted the plants were planted out in the Botanical Society Conservatory. The plant used for figuring the accompanying plate reached maturity and first flowered during 2007. Presently it stands 2 m high. Plants flower almost throughout the year and their striking flowers attracting much attention. It is also interesting to note that the pair of extrafloral nectaries quickly attracted local ants.

Little is known about the dispersal of its seeds. At this stage without evidence, one can only speculate. The seeds are relatively small and have arils, which suggest dispersal by ants (Van der Pijl 1982). Availability of water could also play a role as these dry streambeds are sometimes subject to flash floods.

Key to the varieties of *Turnera oculata*

1a Plants erect, slender shrubs, 1 m and taller; pubescence velvety; bracts 8–10 mm long ..... var. *oculata*
1b Plants small, shrublets less than 1 m tall; pubescence sparse; bracts 11 mm or longer ..... var. *paucipilosa*

Description.—Plants slender, fairly fast growing, erect and sparingly branched shrubs to 2 m tall, the vegetative young stems and leaves are densely velvet pubescent. *Surface indumentum* consists of stellate and simple silvery hairs. *Leaves* ovate to obovate, up to 25–35 × 12–20 mm; apex acute; base cuneate; petiole 7 mm; leaf margin dentate, the lower margin interrupted at the junction of petiole and leaf margin by two oblong circular, reddish-rimmed extrafloral, nectar-secreting glands about 1.5 mm across; stipules minute. *Petiole* and veins on lower surface pale whit-

ish green. *Flowers* solitary, axillary; pedicles fused to the petioles; bracts 2, filiform 8–9(–10) mm long. *Calyx* tubular, 12 × 9 mm, 10-nerved, lobes linear lanceolate 20–25 × 8 mm. *Petals* convolute, inserted on calyx throat, spreading, broadly obovate, 45 × 25 mm; apex obtuse to subacute, base cuneate, bright yellow, the inner portion purplish-black, shiny with a whitish centre. *Stamens* 5, exserted, filaments 30 mm long, arcuate, margins shortly winged, adhering to calyx tube below; anthers basifixed, introrse. *Ovary* cylindrical, obtuse, pubescent, ovules pluriseriate, numerous. *Styles* 3, 35 mm long; stigmas fimbriate. *Capsule* 3-valved, ovoid, about 9 mm long, pubescent and pustulate. *Seed* cylindrical curved, 4 mm long, cream, reticulate with membranous aril. Plate 2291.

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Plumbago pearsonii Plumbaginaceae

Namibia

Plumbago pearsonii *L.Bolus* in Annals of the Bolus Herbarium 3: 7 (1920).

Plumbago pearsonii is a little-known, spreading shrub from the foothills and valleys of the Great Escarpment mountains in the Rehoboth and Maltahöhe districts of Namibia (Figure 1). It is at once distinguished by its grey-green to silvery, lepidote leaves and pink to violet-purple flowers borne in summer. *Plumbago pearsonii* is related to both *P. hunsbergensis* from the Hunsberg further south and *P. wissii* from the Brandberg further north, but its broad grey-green leaves are distinctive. For a comparison of the three species, the reader is referred to Plate 2273 (Van Jaarsveld *et al*. 2011) in the previous volume of *Flowering Plants of Africa*.

Our plant is up to about 0.6 m tall and 1 m in diameter, and although the illustration does not show, it has ribbed stems. At the foot of the Naukluft Mountains on the farm Buellsport near Rehoboth, it was observed in a valley of arid savanna with *Acacia karroo*, *A. mellifera* subsp. *detinens* and *Boscia albitrunca*. It is locally scattered on stony, dry stream banks. The mainly summer and autumn rain in the region amounts to about 250–350 mm per annum. The illustrated plant was drawn from material collected at Buellsport by one of us (EJvJ) and cultivated at Kirstenbosch National Botanical Garden. The flowers are yellow with a pinkish tinge at first and are carried in an ascending to horizontal position. After pollination, they bend down, with the calyx then adpressed against the stem in an almost vertical position, the corolla becoming pink to violet-purple with age.

Plumbago pearsonii is variable in leaf colour. Photographs sent to EJvJ by Pikkie Hoffman (Windhoek), which she took in the Namib-Naukluft Park, show the leaves being very silvery in colour. Often observed in desert species, this grey-green to silvery colour is possibly an adaptation to reflect sun radiation typically experienced in hot, dry desert conditions. However, when grown under nursery conditions and ample shade is provided, the leaves become greener. The plant illustrated was grown under light shade and consequently is not as grey-green as in its native habitat. In its native habitat and cultivation, plants are able to adjust leaf colour according to ambient environmental conditions. Theoretically, in nature trees can sprout and grow causing *P. pearsonii* to become shaded. When grown in shade, the plants become less grey as evident in our illustrated plant.

The name *Plumbago pearsonii* honours Professor H.H.W. Pearson [1870–1916]. Born and educated in England, he was a Cambridge student and in 1903 was

PLATE 2292.—1, flowering branch, × 1; 2, basal part of leafy branch (leaves more grey-green to silvery in its native habitat), × 1; Voucher specimens: *Van Jaarsveld 19885* in Windhoek Herbarium, Windhoek; live specimen *328/06* in Kirstenbosch National Botanical Garden. Artist: Marieta Visagie.



PLATE 2292 *Plumbago pearsonii*

appointed in the Harry Bolus professorship of botany at the South African College (now University of Cape Town) (Glen & Germishuizen 2010). In 1913, he became the first director of the then National Botanic Gardens with its headquarters at Kirstenbosch. He collected *Plumbago pearsonii* during an excursion to present-day Namibia in 1907 and Louisa Bolus named it in his honour in 1920.

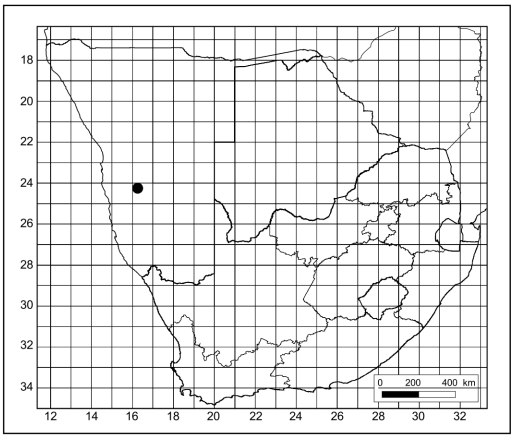


FIGURE 1.—Known distribution of *Plumbago pearsonii*.

With its silvery to grey-green leaves, *Plumbago pearsonii* is an attractive shrub with ornamental value, especially for arid semidesert and desert gardens (Van Jaarsveld 2010). It is drought tolerant and does well in cultivation, growing very easily from soft-tip to semihardwood cuttings, rooted in summer, as well as from seed. It can also be grown from stolons or side shoots, rooted in a container. The plants adapt well to cultivation under glass at Kirstenbosch where it flowers throughout spring and summer. Its close relative, *P. hunsbergensis*, also flowers in spring and summer and *P. wissii*, the other related species, mainly in summer. The plants can be pruned back hard when they become untidy and will then re-sprout.

We are grateful to Holger Kolberg of the Ministry of Environment and Tourism in Namibia for plant collecting permits. We are also indebted to our colleagues Werner Voigt, Freddie van Wyk and the late Kobus Kritzinger who assisted us at Buellsport, habitat of *Plumbago pearsonii*.

Description.—Ascending, spreading, multistemmed, stoloniferous shrub usually ± 0.6 m tall and up to 1 m in diameter; vegetative parts with white resinous exudate. *Stolons* horizontal, with erect aerial branches. *Branches* woody at base, 4–5 mm in diameter, tinged reddish; younger branches distinctly ribbed (up to 7–9 ribs), ± 2.5–3.0 mm in diameter, greyish green; nodes 15–20 mm apart. *Leaves* ascending, alternate, petiolate; lamina decurrent, spathulate, (17–)25–38 × 8–18 mm, subcoriaceous, apex obtuse to subacute, base attenuate and decurrent on petiole and partially amplexicaul, auriculate, surface grey-green to silvery grey-green, beset with glandular hairs, becoming glabrescent, veins parallel, somewhat translucent; margin entire, wavy in upper half; petiole 8–20 mm long, but often indistinct. *Inflorescence* a terminal raceme, 170–250 mm long; all parts densely glandular hairy and with one pair of bracts below inflorescence. *Flowers* heterostylic, alternately arranged, 20–30 mm apart at base becoming denser towards apex; pedicel 1–2 mm long. *Bracts* linear-spathulate, 11.0 × 3.5 mm, auriculate at base; floral bracts 3, at base of each flower, the one larger, linear-triangular to triangular, 4.5–5.0 × 2.5 mm, the other 3.0 × 1.5 mm; base sagitate, glandular-hispid. *Calyx* 5-lobed, tubular, 8.0 × 2.5 mm, dark to blackish green, densely glandular hairy; lobes linear-lanceo-

late, hyaline between ribs but free for up to 2.5 mm. *Corolla* yellowish (yellow group 2d, Royal Horticultural Society Colour Chart), becoming violet-purple (red group 55d), opening during the day, 15–17 mm in diameter when fully opened, with slender pale rose-pink tube 25.0 × 1.3 mm, gradually widening to 2.5 mm at throat, midribs whitish; lobes obovate, 8 × 6 mm, apex obtuse. *Stamens* 32 mm long in thrum flowers, 26–27 mm long in pin flowers; filaments white; anthers oblong, 1.50 × 0.35 mm, blackish, pollen cream-coloured. *Ovary* tapering, linear-ovate, 1.5–2.0 × 0.5 mm, green; style 20 mm long in thrum flowers, 23 mm long and exserted for 4 mm in pin flowers, 5-lobed, lobes 1 mm long, papillose. *Capsule* membranaceous, circumscissile, 7.0 × 1.5 mm. Plate 2292.

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PLATE 2293 *Plumbago wissii*

Plumbago wissii Plumbaginaceae

Namibia

Plumbago wissii *Friedrich*, Senckenbergiana Biologica 38: 417–419 (1957).

The genus *Plumbago* L. consists of about 24 species and has a worldwide distribution, occurring from warm-temperate to subtropical and tropical regions of the world (Kubitzki 1993). It is the largest of the four genera comprising subfamily Plumbaginoideae (Lledó 1998, 2001). *Plumbago wissii* Friedrich is endemic to the upper slopes of the Brandberg Mountain massif in northwestern Namibia. One of the rarest members of the genus, it has attractive pale to dark violet-purple or maroon (rarely cream) flowers that are heterostylous.

Plumbago wissii is one of six species of *Plumbago* indigenous to southern Africa. It is a rare and poorly-known species. It grows very easily from soft tip cuttings as well as from seed. The plants adapt well to the dry Mediterranean-type climate in summer at Kirstenbosch and prove to be extremely hardy without showing signs of stress during periods of drought. *Plumbago wissii* plants are rather floriferous and flowers throughout summer. The plants can be pruned back hard when they become untidy, as they simply re-sprout.

Plumbago wissii thrives surprisingly well in Fynbos gardens (Van Jaarsveld 2010). A number of other southern African *Plumbago* species have been taken up in ornamental horticulture. One of them, *P. auriculata* (= *P. capenses*), is a dense, scandent shrub 2–3 m tall from mainly the Eastern Cape in South Africa and is extensively cultivated for its attractive blue or white flowers. *Plumbago auriculata* seems to be a worthwhile horticultural introduction with a number of cultivars. The white-flowered *P. zeylanica* (closely related to *P. auriculata*) is a smaller scrambling shrub from savanna regions in the northern regions of southern Africa (Kaokoveld in Namibia, and Limpopo and other northern provinces in South Africa). The remaining three *Plumbago* species occurring in southern Africa are from the arid southern and western parts of the subcontinent forming a related group based on their floral features. *Plumbago tristis* is a dwarf shrublet in Succulent Karoo vegetation of the Western Cape in South Africa. *Plumbago hunsbergensis*, only known from the Hunsberg and recently named (Van Jaarsveld & Thomas 2011), is the closest related to *P. wissii*. *Plumbago pearsonii* is an erect shrub up to 1 m tall, with much broader, obovate, silvery-green leaves and occurs in arid savanna in central Namibia.

Plumbago wissii is a rare endemic of the upper slopes of the Brandberg (northwestern Namibia; Figure 1) where it forms part of a type of sclerophyllous vegetation

PLATE 2293.—1, mature branch showing short side branches, × 1; 2, flowering branch, × 1; 3, cross section of leaf, × 2; 4, leaf viewed from below, × 2; 5, cross section through young stem, × 1; 6, side view of calyx, × 3; 7, side view of corolla showing the tube, lobes, gynoecium and androecium × 2.5. Voucher specimen: *Van Jaarsveld 17973* in Compton Herbarium, Cape Town. Artist: Marieta Visagie.

(related to the Renosterveld of the Western and Northern Cape provinces of South Africa). The species occurs among granite boulders on rocky ground in full sun and is quite common in this habitat (Figure 2). It is an untidy, spreading shrub, up to about 1 m tall (rarely up to 1.5 m) with distinctly ribbed stems, linear leaves and a raceme containing the tubular, violet-purple flowers.

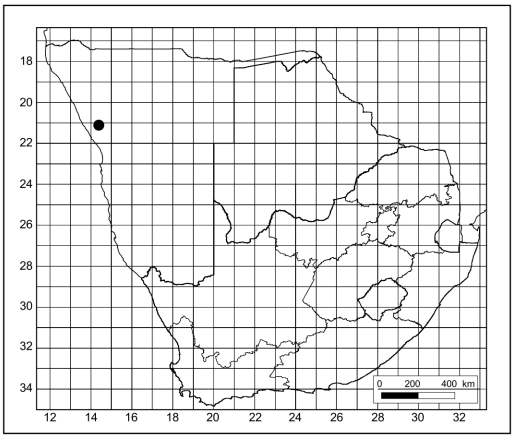


FIGURE 1.—Known distribution of *Plumbago wissii* in Namibia.

At 2 579 m the Brandberg is the highest mountain in Namibia. An isolated, more or less circular, granite inselberg (ancient volcano) of about 23 × 25 km, it lies more or less 70 km from the Namibian coast. Biologically the Brandberg is probably the best studied mountain in Namibia (Craven & Craven 2000). The mountain massif is surrounded by the Namib Desert with an average rainfall of about 100 mm per annum. Floristically the arid lower slopes is typical of the northern Namib, with among the taller woody plants species such as *Acacia montis-usti*, *Sterculia africana* and various members of the genus *Commiphora*. Also present in this zone is *Aloe dichotoma*, a tree aloe with its main centre of abundance further south towards the Northern Cape. The upper slopes of the mountain, however, receive considerably more rain (more than 200 mm per annum) and carry a unique vegetation studied by, amongst others, Nordenstam (1974) and Craven & Craven (2000). The floristic checklist by Craven & Craven (2000) records 480 taxa of which nine are strictly endemic to the mountain, including *Plumbago wissii*. Phytogeographically the mountain is considered part of the Kaokoveld Centre of Endemism (Van Wyk & Smith 2001).

The specific epithet of *Plumbago wissii* honours Mr Hans-Joachim Wiss [1903–1991], Windhoek farmer and naturalist. He was a member of the South West Africa Scientific Society from 1955–1974 and served as president of the Society from 1960–1961. Wiss was the first person to collect specimens of the species during an archaeological expedition to the upper Brandberg in 1955 (Gunn & Codd 1981). Wiss found his plants on the highest peak, Königstein (above 2 000 m), where it was growing together with *Eriocephalus pinnatus*, *Olea europaea* subsp. *africana*, *Euryops multifidus* and *Euphorbia monteiroi*.

In April 2003 *Plumbago wissii* was collected by one of us (EJvJ) on Königstein while searching for cliff-dwelling succulents on the Brandberg. Plants were recorded at Lion's Cave and several other sites, from north of Orabes Wand to Königstein. They were growing among *Codon schenkii*, *Dianthus namaensis*, *Antizoma miersiana* and *Tetradenia riparia*. The kobasboom (*Cyphostemma currorii*), with its striking shape resembling a dwarf baobab, is a prominent feature in the area.



FIGURE 2.—*Plumbago wissii* in habitat on the Brandberg.

Semi-hardwood cuttings from several individuals were rooted at Kirstenbosch. Seeds sown in spring germinated within three weeks. The plants grew rapidly, already flowering in January 2004. They produced strong lateral branches, which soon became spreading—featured in the accompanying plate. The fruits are typical of the genus *Plumbago*. They are retained in the glandular-hairy calyx becoming detached and adhering to roaming animals, which seem to be the main dispersal agents. The thin, long-tubed flowers suggest a bee pollinator with a long proboscis. The flower colour varies from pale violet-purple (Red Group 55D, Royal Horticultural Society Colour Chart) to dark violet-purple and maroon (Red Group 55B) but cream-coloured flowers were also observed. The flowers become darker with age. During the course of examining flowering individuals, it was noted that in most plants the stigma was shorter than the stamens (thrum flowers). However, the stigmas of a few individuals protruded at the mouth, overtopping the stamens (pin flowers). Known as heterostyly, this is the first record of its occurrence in *P. wissii*. Heterostyly of the distylous type (Ganders 1979) has previously been reported in some of the other species of *Plumbago* and is widespread in subfamily Plumbaginoideae (Dahlgren 1918; Kubitzki 1993; Lledó 1998).

We are grateful to Holger Kolberg of the Ministry of Environment and Tourism in Namibia for plant collecting permits.

Description.—Spreading multi-stemmed stoloniferous shrub usually about 1 m tall, occasionally up to 1.5 m; vegetative parts sub-glabrescent. *Stolons* horizontal with erect aerial branches. *Branches* woody at the base, distinctly ribbed (up to seven ribs), purplish; young branches green, up to 3 mm in diameter; internodes 10–25 mm apart. *Leaves* ascending, spreading and curving upwards, alternate, sessile, linear-oblanceolate to linear, (40–)50–80(–95) × 1–4 mm, slightly fleshy; apex acute, apiculate, base attenuate; surface with slightly raised reticulate veins, sparsely beset with glandular hairs at first, becoming glabrescent; margin entire to obscurely sinuate, partially amplexicaul at the base. *Inflorescence* a terminal raceme (80–)150–330 mm long, sometimes with 2 shorter side branches from the base forming a loose panicle; all parts glandular-hairy. *Flowers* heterostylic and alternately arranged, 40 mm apart at base but becoming denser towards apex (8–12 mm apart);

pedicels 1 mm long. *Bracts* leaf-like and gradually becoming smaller; floral bracts triangular acuminate, 7–10 × 2 mm, glandular-pilose, amplexicaul at base. *Calyx* green, 5-lobed, tubular, 6.0–7.0 × 2.5 mm, densely glandular-hairy; lobes linear-lanceolate, hyaline between ribs but free for up to 2.5 mm. *Corolla* violet to rarely cream, open during the day, 13–14 mm in diameter when fully opened, with slender pale maroon-coloured tube (17–)23–25 × 1 mm, midribs whitish; lobes obovate, (5–)8 × 3(–5) mm, apices obtuse, apiculate. *Stamens* 22–24 mm long in thrum flowers, 22 mm long in pin flowers; filaments white; anthers black, oblong, 1.5 mm long, pollen cream-coloured. *Ovary* greenish, ovate, 2 × 1 mm; style 15 mm long in thrum flowers, 24 mm long in pin flowers, 5-lobed, lobes 1 mm long, papillose. *Fruit* membranaceous, circumscissile capsule. *Flowering time*: January to July. Plate 2293.

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PLATE 2294 *Delosperma scabripes*

Delosperma scabripes Mesembryanthemaceae (Aizoaceae)

South Africa

Delosperma scabripes *H.M.L.Bolus* in Notes on Mesembrianthemum and allied genera 2: 388 (1933); Jacobsen: 460 (1974).

Prior to the establishment of *Delosperma* N.E.Br. by Brown (1925), with just 35 species assigned to it, *Mesembryanthemum* L. was one of the few genera recognised in the Mesembryanthemaceae (Aizoaceae) or *vygie* family. This generic concept for *Delosperma* held for over 40 years, before Mary O'Connor-Fenton (née Lavis) emended it (Lavis 1966). After working on mesembs at the Bolus Herbarium between 1924 and 1935, Lavis married and moved away, returning to Cape Town and herbarium life only in the mid-1960s. She then engaged in active research on *Delosperma* and *Conophytum* (Gunn & Codd 1981). Within *Delosperma,* three sections (sections Delosperma, Planifolia and Angustifolia) were subsequently validly described by her (Lavis 1966, 1967, 1969), the other 26 sections being invalid (naked names) (Koutnik & O'Connor-Fenton 1985). The genus currently comprises approximately 158 species and has not been fully revised since its inception, a task requiring urgent attention. As an octogenarian, Lavis attempted just such a revision, but her death in 1992—at the grand age of 89—unfortunately precluded her substantial insights from being broadly communicated. In view of a continuing need, one of us (PMB) is currently revising the southern African species.

Delosperma scabripes was first collected by Neville S. Pillans 'on a rocky ridge' near Maclear in the Transkei during May of 1932, (*Pillans 6687*, BOL!). The plants were grown in Pillans' Rosebank garden—one renowned internationally for its remarkable succulent collection, most especially of stapeliads (Gunn & Codd 1981). Upon flowering, a colour plate depicting the new taxon was completed by Beatrice Carter, the resident artist at the Bolus Herbarium, who illustrated many mesembs for Louisa Bolus. Following its painting, the plant was pressed as the holotype. Cultivation before description was a standard practice at the time and has often resulted in mesemb types being somewhat non-representative of wild-growing plants. This is due to cultivated mesembs often etiolating in lower light conditions than found in habitat. In the case of *D. scabripes*, type material from the 'rockery' was only marginally etiolated.

The Mesembryanthemaceae is a very large family of 126 genera and about 1 800 taxa centred in the southwestern tip of Africa, from Angola south towards the Cape provinces of South Africa. Few genera extend beyond this region. *Carpobrotus* is a notable exception and is globally the most widely distributed of all mesemb genera. *Disphyma* is also widespread, particularly in Australasia (Smith *et al*. 1998). *Delosperma*, in the subfamily Ruschioideae, is unique amongst the larger South

PLATE 2294.—*Delosperma scabripes*: whole plant habit with flowers open, × 2. Voucher specimen: *Crouch 1275* at KwaZulu-Natal Herbarium, Durban. Artist: Wilna Eloff.

African *vygie* genera because its centre of diversity is in the summer-rainfall region, in the Eastern Cape Province. The vast majority of other mesemb genera occur within the winter-rainfall region. Although several other genera are found predominantly in the summer-rainfall region (e.g. *Frithia*, *Khadia*, *Mossia* and *Aptenia*), they are uncommon and far less diverse. Indeed, when mesembs are encountered in the northeastern provinces of South Africa, Lesotho and Swaziland, they are usually delospermas. Beyond southern Africa, continental Africa has no unique mesemb genera and a diversity of species minuscule by comparison. Of the *vygies*, *Delosperma* is the only genus to have dispersed and diversified through central and East Africa, the Arabian Peninsula, Madagascar and Réunion (Hartmann 2001, 2008).

There are three taxa closely resembling *Delosperma scabripes* that occur broadly in the same geographic region: *D. repens*, *D. imbricatum* and *D. vinaceum*. These have decumbent branches, ascending to spreading leaves and blooms of a not-dissimilar deep-pink colour. Presently, it is uncertain which of these, if any, is the closest relative of *D. scabripes*. However, *D. scabripes* can vegetatively be distinguished from the others by a suite of characters: lanceolate leaves to 16 mm long, which are acute to acutely acuminate when viewed from the side, apetiolate and connate at the base. Plants bear rough, evenly-spaced (bladder) cells that cover the stems and leaves, and which in habitat turn hard and waxy with age. Although this coarse feature may be markedly reduced when *D. scabripes* is cultivated, if one runs one's hand over the plants, a sense of roughness is still evident. *Delosperma repens* has slightly shorter leaves (to 14 mm long) that are more obtuse with a blunt tip and with the base narrowing abruptly to form a petiole. The upper surface of the leaves is grooved slightly and the lower surface rounded or obscurely keeled towards the apex. Both *D. imbricatum* and *D. vinaceum* have leaves that are erect and imbricate, apetiolate, connate at the base and up to 20 mm in length. Internode lengths similarly assist with distinctions in the field: those of *D. scabripes* are 30–40 mm, whilst *D. repens*, *D. imbricatum* and *D. vinaceum* are 10–20 mm, 10–15 mm, and 10–20 mm respectively.

Whereas the flowers of *Delosperma scabripes* and *D. vinaceum* are both 1–2-nate, those of *D. repens* are always solitary and *D. imbricatum* blooms are borne in compact cymes. The petals of *D. scabripes* and *D. vinaceum* are 2–3-seriate, obtuse and are slightly narrowed at the base, whereas those of *D. imbricatum* are 1–2-seriate, obtuse and not narrowed below. However, the aforementioned Carter painting of the *D. scabripes* holotype shows petals that are narrowly ovate-lanceolate, a feature presumed to have resulted from drying out of her specimen. In this regard, it has been observed that flowers of field-collected plants—if not kept moist enough—tend to dry out such that petals appear narrower than in fresh material (Figure 1). One of us (PMB) has further observed characters, such as petal width, to vary between years of high and low rainfall. Glands positioned at the base of the filaments of all species mentioned above are deep-green, distant, crenulate and inconspicuous, especially so in *D. scabripes*.

This dwarf plant with its highly succulent leaves forms trailing branches up to 1 m long, and bears its deep-pink flowers from spring through to late summer (September–March, depending on rainfall). Each bloom can be up to 22 mm in diam-

eter. Flowers open during the middle of the day, when light levels and temperatures are at their peak, and close at night. In common with most members of the Mesembryanthemaceae, this species targets generalist pollinators. Accordingly, visits by various bees, flies and other insects have been observed. Following successful pollination, seeds are soon dispersed from the shallow capsules as without covering membranes, these propagules are readily splashed out when it rains. The 5-locular fruit capsules of *Delosperma scabripes* are pale brown and shallow with the covering membranes expressed as a narrow ledge, with valve wings twice as broad as the expanding keels, and with closing bodies absent (Figure 2). Thus when capsules are open, the seeds are readily visible as the membranes that cover those of most mesembs are absent. A postulated reason for shallow capsules within the genus *Delosperma* is that—as most members occur within the summer-rainfall region where precipitation events are fairly sure—there is less need to strategically retain seeds until favourable conditions (e.g. high soil moisture content) can ensure survival post-germination. Such capsule features are rarely observed in mesembs from the winter-rainfall region, the genus *Conophytum* being a notable exception.

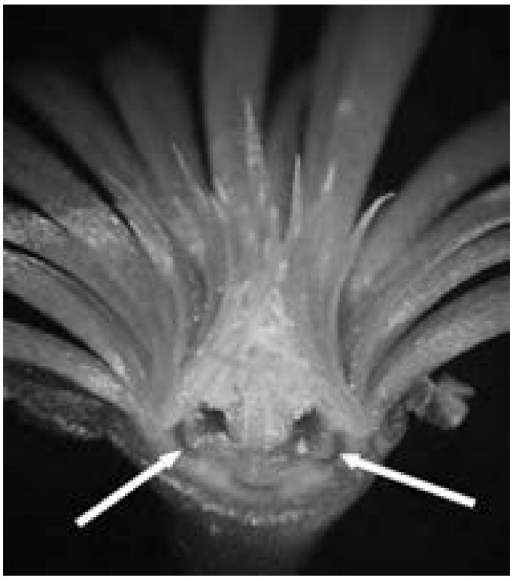


FIGURE 1.—Flower of *Delosperma scabripes*, arrows indicate glands. Voucher specimen: *Crouch 1275*.

Delosperma scabripes is endemic to the vicinity of Maclear in the Eastern Cape Province (Figure 3) (Burgoyne in prep.), where it is confined to well-drained soils in rocky spots of East Griqualand Grassland and Southern Drakensberg Highland Grassland. Both of these vegetation units are geologically dominated by mudstones and sandstones (Mucina *et al.* 2006). The former vegetation unit is characterised by hilly grassveld with bush clumps at altitudes of 920–1 740 m, and the latter by more mountainous terrain (altitudes of 1 460–2 060 m; mostly 1 780–1 840 m). Here, steep-sloped broad valleys are populated by sour grasslands and scattered trees, mostly proteas. In habitat, plants experience annual average rainfall in the range of 780 to 1 000 mm, severe frosts and even snowfalls. Accordingly, under severe environmental stress, *D. scabripes* may necessarily abort its aerial stems to later resprout from its slightly tuberous and persistent rootstock.

Neither *Delosperma scabripes* nor the other species under discussion have been Red Listed as, or considered threatened (Burgoyne & Victor 2003; Burgoyne 2009). As the subject of this account is present mainly on private land, its future conservation hinges upon protection by individuals.

The generic name *Delosperma* is derived from the Greek words *delos* (visible), and *sperma* (seed) and refers to the absence of covering membranes in the fruit capsules; the specific epithet *scabripes* is derived from the Latin *scaber*, meaning rough and *pes* for foot or base. This refers to the pedicel and receptacle at the flower base, both of which become rough with age.

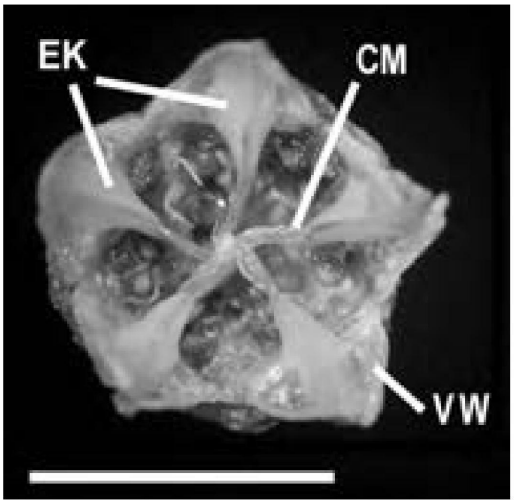


FIGURE 2.—Open capsule; VW = valve wings, EK = expanding keels, CM = covering membranes. Scale bar: 5 mm. Voucher specimen: *Crouch 1275*.

The plant figured was gathered by one of us (NC) about 1 km northeast of Maclear in January 1996, from a colony observed cascading down the rock face of a roadside cutting. This delicate and attractive mesemb was in full bloom on a sunny western aspect at an altitude of 1 300 m; a return visit to the site during 2009 revealed that the colony has since been destroyed through widening of the road. Following its collection in the mid-1990s, material has remained in cultivation, during which period it has been disseminated into the Durban indigenous-gardening community. The delicate pendant virtues of *Delosperma scabripes* are best employed in cascades to liven up hanging baskets, large planters or retaining walls situated in bright sunny areas of the garden. When grown thus, the long branches with their widely spaced leaf pairs can reach a length of over 1 m. Older less-attractive branches can simply be cut away annually from behind the current season's overtopping growth, so keeping the arrangement light and fresh. Growing *D. scabripes* is relatively easy and even small shoot sections usually strike. However, cuttings should never be left to dry out as the stems are thin and inherently non-succulent. They typically die following such treatment. In the well-drained soils that are recommended for this species, water should not be supplied too sparingly (except over winter) as this is, after all, a high-rainfall species. Insufficient bright light may change their natural appearance, making them somewhat etiolated with longer nodes than found in natural populations. About 15 other delospermas—known as rock mesembs or *klipvygies*—have been introduced to horticulture and selected for colour, ground-covering and soil-retaining qualities (Smith & Van Wyk 2008). Additional horticultural attributes include ease of cultivation and their unusual summer-flowering character—one that extends the traditional winter–spring 'mesemb season' (Eliovson 1973). Probably the best known of these *klipvygie* introductions is *D. herbeum* (white mountian vygie; *witbergvygie*) (Joffe 2001), which fortunately is not as rampant as *Aptenia cordifolia* or the various *Carpobrotus* species, employed in similar bank-stabilising and ground-cover roles. Some delospermas such as *D. tradescantoides* and *D. lebomboense* have also entered the horticultural trade, but tend to form dense untidy mats and are best avoided, unless a retaining wall requires complete exclusion and a particularly wild and scruffy look!

Description.—Trailing leaf succulent about 20–100 mm tall, glabrous. *Main stem* shortened, thickened with age, branches procumbent, up to 300 mm long. *Roots* fleshy becoming thickened to slightly tuberous with age. *Leaves* 15–25 mm long, borne upright, not connate at the base but slightly narrowed below, dull green, tinged red when water-stressed, margins rounded, leaf surface slightly concave above, rounded below, covered in bladder cells that are higher than broad and become rough and waxy with age. *Flowers* single to 2-nate, borne upright on a pedicel 8–15 mm long, deep bright pink, sometimes with paler centre. *Sepals* shorter than petals, two rounded, fleshy, resembling leaves, the other three with membranous margins. *Petals* in series of one or two, obovate to ovate-lanceolate. *Staminodes* to 5.5 mm long, broadly recurved, yellow, filaments, cream or white, papillate above the middle. *Pollen* yellow. *Nectary* comprising five, small, thin, dark-green, crenulate, distant, glands. *Ovary* inferior, concave at top, with five cells, stigmas much shorter than stamens, subulate, slender, recurved with fimbriate inner margins. *Fruit* a pale brown hygrochastic capsule, open when wet and closed when dry, 5-locular, 9–12 mm in diameter, closing bodies absent, covering membranes reduced to a narrow ledge and valve wings broader than the expanding keels. *Seeds* light-brown, subobovate, up to 0.70 mm long. Plate 2294.

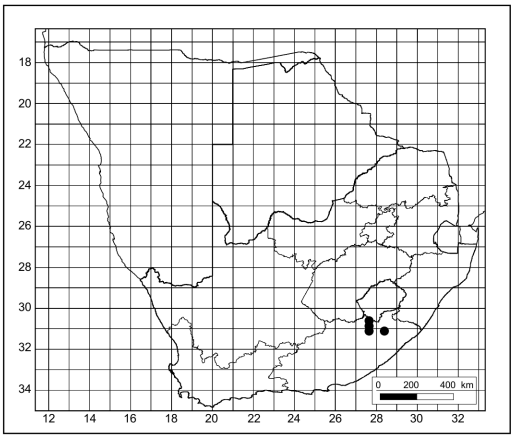


FIGURE 3.—Known geographical distribution of *Delosperma scabripes*.

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PLATE 2295 *Commicarpus pentandrus*

Commicarpus pentandrus Nyctaginaceae

Tropical and southern Africa

Commicarpus pentandrus *(Burch.) Heimerl* in Die Natürlichen Pflanzenfamilien: 16C: 117 (1934); *Boerhavia pentandra* Burch.: 432 (1822); *B. grandiflora* sensu Oliv.: 142 (1875), *non* A. Rich.; *B. plumbaginea* var. *pentandra* (Burch.) Heimerl: (1897); *B. transvaalensis* Gand.: 221 (1919); *B. burchellii* Choisy: 455 (1949), *nom. superfl.* based on *B. pentandra* Burch.

This is the first species of the Nyctaginaceae to be illustrated in *Flowering Plants of Africa*. It is commonly known as the four o'clock family, as most members have flowers that open in the late afternoon to early evening (Levin *et al*. 2001). The family is renowned for its genera *Mirabilis* (commonly known as four o'clocks) and *Bougainvillea* (commonly known as Bougainvilla) for their brightly coloured and profuse flowering. These and most other genera are mainly distributed in the Neotropics and western North America, and globally the family consists of 30 genera with 300–400 species (Douglas & Spellenberg 2010). In southern Africa, the family is represented by five genera with 20 species. *Commicarpus* Standl. is the genus in southern Africa with the largest and most spectacular flowers.

Commicarpus was originally regarded as a section of *Boerhavia* L. (*Boerhavia* sect. *Adenophorae* Heimerl) (Heimerl 1889), but was segregated based on morphological differences (Standley 1909). *Boerhavia* species have an upright or diffuse habit, the inflorescence is a compound cyme and the flowers are campanulate. The anthocarps (defined as a fruit enclosed by a persistent perianth [Hickey & King 2000]) are clavate, fusiform or oblong with five ribs or 3–5 wings, and the surface is smooth or covered with multicellular hairs. In contrast, *Commicarpus* species are subshrub-like, spreading or scrambling herbs, the inflorescence is an umbel and the flowers are infundibiliform. The anthocarps are cylindrical, fusiform, clavate or elliptic-clavate with ten ribs and sessile or stalked mucilaginous glands (Stannard 1988). Molecular studies support this segregation and indicate that *Boerhavia* and *Commicarpus* form monophyletic groups (Douglas & Manos 2007).

The genus *Commicarpus* consists of about 30–35 species distributed worldwide in the tropical and subtropical regions, mainly in Africa and western Asia (Bittrich & Kühn 1993; Douglas & Spellenberg 2010). Northeastern tropical Africa and southern Arabia are considered to be the centres of diversity for this genus (Thulin 1990). In Africa, the genus is distributed throughout the continent, except for the extreme north and south and the wet forested areas of the west (Meikle 1978). The species have a preference for arid environments with 12 species occurring in Somalia, Ethiopia and adjacent regions of tropical Arabia, seven species in Namibia, and five in South Africa (Meikle 1978).

Germishuizen & Meyer (2003) list eight species of *Commicarpus* for southern Africa; of these *C. pentandrus* is the most common and widespread species, occurring

PLATE 2295.—1, habit, × 1; 2, flower, × 3; 3, anthocarp, × 6. Voucher specimen: *Struwig 140* in A.P. Goossens Herbarium, Potchefstroom. Artist: Gillian Condy.

in Namibia, Botswana and South Africa (Figure 1). *Commicarpus pentandrus* also occurs throughout tropical Africa (Klopper *et al*. 2006).

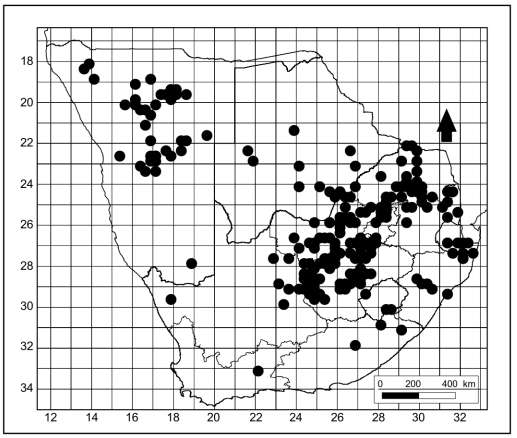


FIGURE 1.—Known distribution of *Commicarpus pentandrus* in the FSA region based on specimens in the National Herbarium, Pretoria.

Commicarpus pentandrus was first collected by William J. Burchell [1781–1863] along the Vaal River in Griqualand West, South Africa. He described it as *Boerhavia pentandra* Burch. in his book, *Travels in the interior of southern Africa* (1822), but the taxon was later transferred to *Commicarpus* by Heimerl (1934). It is a forb with trailing stems of up to 1 m with striking bright pink or purple flowers carried in umbels on tall, upright peduncles. It is commonly known as cerise stars, referring to the flower colour, or *veldpatat* (Afrikaans), in reference to the rootstock, which can be up to 30 mm thick and 300 mm long, resembling a sweet potato (Figure 2). *Commicarpus pentandrus* flowers and produces fruits from October to May, but flowers and fruits can appear as early as August (late winter) and as late as July (mid winter).

Commicarpus pentandrus is common in bare patches in grassland, savanna and bushveld. It occurs on floodplains, plains, depressions, valleys, hill slopes or outcrops in well-drained to moist, stony or gritty soil.

The flowers of *Commicarpus* species are divided into an upper petaloid part and a lower coriaceous part. The shape and sculpturing of the lower, coriaceous part of the flowers, as well as the shape and sculpturing of the anthocarps, differ among the *Commicarpus* species of southern Africa (Struwig 2012). *Commicarpus pentandrus* differs from the rest of the species in that the apex of the lower part of the flower has one or two rows of five prominent sessile glands with smaller, less prominent glands scattered over the surface below the apex. The anthocarps have five thickly stalked glands alternating with five smaller, less prominent glands around the apex and sessile glands are scattered over the surface below the apex.

Commicarpus chinensis subsp. *natalensis* and *C. pilosus* are often confused with *C. pentandrus*. The former easily, as both species are forbs with trailing stems and pink or purple flowers in umbels on long, upright peduncles. *Commicarpus pilosus* is often mistaken as *C. pentandrus*, as their distribution ranges overlap and both species have purple flowers. However, these three species differ significantly in the shape and sculpturing of the lower part of the flower and the anthocarp (Table 1).

Commicarpus chinensis subsp. *natalensis* and *C. pentandrus* are allopatric, as the former is habitat specific, occurring on coastal dunes and forest edges along the north

TABLE 1.—Shape and sculpturing of the lower part of the flower and the anthocarp of *Commicarpus chinensis* subsp. *natalensis*, *C. pentandrus* and *C. pilosus*

Species	Lower floral part		Anthocarp	
	Shape	Indumentum	Shape	Indumentum
C. chinensis subsp. *natalensis*	Cylindrical	Sessile glands scattered over the surface	Cylindrical	Sessile glands around the apex and wart-like glands scattered over the surface below the apex
C. pentandrus	Clavate	One or two rows of five prominent sessile glands around the apex with smaller, less prominent glands scattered over the surface below the apex	Clavate	Five thickly stalked glands alternating with five smaller, less prominent glands around the apex; sessile glands scattered over the surface below the apex
C. pilosus	Elliptic	Five prominent sessile glands around apex with smaller, less prominent glands scattered over the surface below the apex	Elliptic-clavate, tapering to both ends	Five shortly stalked glands around the apex and sessile glands are scattered over surface below the apex

coast of KwaZulu-Natal. *Commicarpus pilosus* differs in habit from *C. pentandrus* in that it is not trailing, but subshrub-like and up to 1 m tall.

Plants of *C. pentandrus* from Sekhukhuneland, differ morphologically to plants occurring elsewhere in that the branches are shorter, the leaves are smaller and arranged less densely. Molecular studies are currently in progress to ascertain different phenotypes.

A root decoction of *C. pentandrus* is used in Namibia and elsewhere in Africa to treat gonorrhea (Neuwinger 2000; Von Koenen 2001) and the whole plant is used as fodder in South Africa (Cooke 1912; Burtt Davy 1926; Stannard 1988). The plant is also used in Tswana traditional culture for magical purposes (Hedberg & Staugard 1989).

The generic name, *Commicarpus* (Greek for *Commi*, meaning gum, and *carpus*, meaning fruit), refers to the sticky anthocarp (Meikle 1978). The specific epithet, *pentandrus*, means with five stamens (Glen 2007).



FIGURE 2.—Rootstock of *Commicarpus pentandrus* which can be up to 30 mm thick and 300 mm long. Photograph: S.J. Siebert.

Commicarpus pentandrus germinates easily from seed and in cold climates is cultivated in a greenhouse at 25°C in a mixture of river sand, soil and compost. The addition of Multifeed® K will ensure optimum growth.

Description.—Perennial herbs, prostrate or procumbent up to 1 m long, from a woody rootstock up to 30 mm thick and 300 mm long. *Stems* sometimes tinged purple; pubescent. *Leaves* petiolate, petiole (4–)8(–12) mm long; ovate, elliptic, orbicular, deltoid, (13–)27(–39) × (13–)20(–29) mm, apex apiculate, rounded to acute, base cordate, truncate, cuneate, rounded, obtuse, subcordate or shortly attenuate, upper sides darker than undersides; margin entire; sparsely pubescent; slightly fleshy. *Inflorescence* pedunculate, peduncles (30–)79(–150) mm long; umbellate, sometimes up to three whorls of umbels and up to six flowers per umbel; pubescent; bracteate. *Flowers* pedicellate, pedicels (2–)7(–18) mm, flowers (12–)15(–23) mm long, bisexual. *Perianth* divided into a lower and upper part; lower part (2–)4(–6) mm long, clavate, greenish, coriaceous, constricted above ovary, with ten narrow, longitudinal grooves, one or two rows of five prominent sessile glands around the apex with smaller, less prominent glands scattered over the surface below, persistent; upper part (9–)11(–17) mm long, infundibuliform, petaloid, purple or pink, lobed, with a distinct greenish, basal tube, caducous after anthesis. *Stamens* 4–6, long exserted, filaments 11–17 mm long, anthers 0.7–0.8 × 1.2–1.5 mm long, transversely elliptic. *Ovary* 0.75–1.00 mm long, ellipsoid, stipitate; style 14–20 mm long, long exserted. *Anthocarp* (7.0–)8.4(–9.0) × (2.0–)2.1(–3.0) mm, 10-ribbed; clavate, five thickly stalked glands alternating with five smaller, less prominent glands around the apex, sessile glands scattered over surface below the apex; glabrous. Plate 2295.

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Erica verticillata Ericaceae

South Africa

Erica verticillata *P.J.Bergius*, Descriptiones plantarum ex Capite bonae spei: 99 (1767); Guthrie & Bolus: 81 (1905); E.G.H.Oliv. & I.M.Oliv.: 135 (2005). *Erica concinna* Sol.: 23 (1789); Benth.: 636 (1839); Dulfer: 51 (1965).

Originally inhabiting the sandy flats near the early Cape settlement, *Erica verticillata* was collected by some of the region's first plant collectors. Bergius (1767) in his protologue made only one citation—'HERM *Afr*. 8', presumably a specimen collected by the German, Paul Hermann, when he made the first herbarium collections at the Cape in 1672 (Gunn & Codd 1981). This specimen has not been found. Until it is found, a new type was chosen to replace the Hermann type. A good specimen from Bergius' own herbarium was selected which was given to him by Michael Grubb, director of the Swedish East India Company who bought his collections from the resident German gardener, Johann Auge, upon calling at the Cape from the Far East in 1764 (Gunn & Codd, 1981).

Bergius's name was overlooked by Solander (1789) when he described *Erica concinna* based on a collection made by Francis Masson. This name persisted in English literature until Guthrie & Bolus (1905) realised that it was the same species as Bergius's *E. verticillata*.

Erica verticillata var. *roxburghii* (Benth.) Bolus has contributed to some speculation within the taxonomic literature of this species. Of this variety, Bentham (1839) writes, "Leaves subincurved-patent, finely linear-trigonous, almost glabrous; Sepals linear-acuminate from ovate base; corolla oblong, 8 mm long, tubular-campanulate, almost glabrous, limb mostly shorter than the tube". He notes that this could be a hybrid between *E. concinna* (=*E. verticillata*) and *E. pyramidalis* as the material was growing with these two species. Bentham further writes, "in damp places, Stellenbosch, growing together with *E. concinna* and *E. pyramidalis*, legit Roxburgh & Niven, and this shows strongly it is a hybrid arising naturally between them, in fact it is also intermediate. Corolla 8 mm; capsule 4-valved with intruding margins of the valves sub 8-locular! Seeds seemed in fact perfect." This is known only from the type collection.

Erica verticillata is a handsome, strong growing and tough species. On average plants are between 1.5–2 m in height, but old specimens have been recorded to grow up to 3 m tall. It produces beautiful mauve-pink, tubular flowers arranged in neat whorls organised in distinct groups up the principal stems and near the tips of sturdy branches. Peak flowering is from January to March, but plants produce some

PLATE 2296.—Flowering specimens and registered cultivar names of *Erica verticillata*. 1, 'Adonis' and 'Louisa Bolus', × 1; 2, 'Cherise', × 1; 3, 'Belvedere', × 1; 4, 'Doctor Violet Gray', × 1; 5, 'Tresco Abbey', × 1; 6, 'Harry Wood', × 1; 7, 'African Phoenix', × 1. Voucher specimens: 1, *Adonis 1*; 2, *Adonis 2*; 3, *Hitchcock 2280*; 4, *Hitchcock 2270*; 5, *Hitchcock 2268*; 6, *Hitchcock 2307*; 7, *Von Well 1*, all in Compton Herbarium, Cape Town. Artist: Vicki Thomas.



PLATE 2296 *Erica verticillata*

flowers intermittently throughout the year. It has been observed that inflorescences produced outside of the main flowering season are not as floriferous as those produced during peak flowering—they tend to be arranged in a less orderly manner. The flowers attract sunbirds, bumblebees, hawk moths, bees and beetles that come to sip the nectar the flowers provide as reward to pollinators. The specific epithet, from the word *verticillatus*, is descriptive of the whorled (verticillate) arrangement of the flowers.

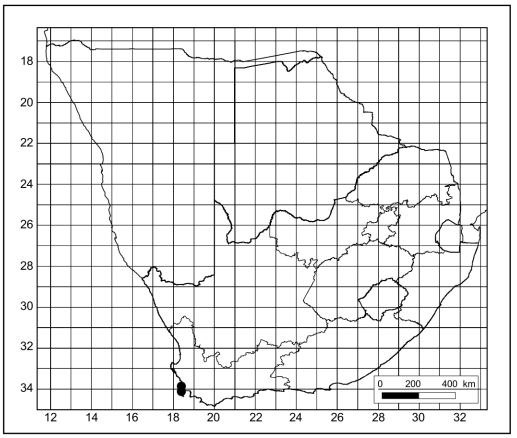


FIGURE 1.—Historical distribution of *Erica verticillata*.

The story of *Erica verticillata* is unique in the annals of plant conservation in South Africa (Hitchcock 2003). It was regarded as extinct in the wild, possibly extinct, by the second half of the 20th century (Adamson & Salter 1950). It was rediscovered in a park in Pretoria in 1984 and since then in various botanical gardens around the world and brought back into cultivation at Kirstenbosch National Botanical Garden. The species has become Kirstenbosch's flagship conservation species and has been re-introduced to three Sand Plain Fynbos reserves within the urban sprawl of Cape Town, namely the Rondevlei Nature Reserve, Kenilworth Racecourse Conservation Area and at the Tokai Park.

The most recent herbarium specimen collected from a naturally occurring population dates back to 1908 (*Dümmer 210* in NBG). The most recent records of this species in South Africa are herbarium specimens of a plant that was growing in Kirstenbosch National Botanical Garden in 1943 (*Henderson 1669* in NBG) and a specimen submitted by J. E. Repton in 1961 from a cultivated plant growing in the Pretoria district. (*Repton 5698* in PRE). *Erica verticillata* used to grow in Sand Plain Fynbos on the Cape flats of the Cape Peninsula from the Black River to Zeekoevlei (Oliver & Oliver 2000). Herbarium records indicate that it grew in a narrow band between Main Road and the M5 freeway. It is further recorded from the Black River cottages near Mowbray in the north, at Rondebosch, Newlands, Claremont, Kenilworth, Wynberg and as far south as Zeekoevlei (Figure 1). The rather vague information on herbarium sheets and in the literature suggests that this species prefers seasonally damp, acid, sandy soils near rivers and wetlands. Agricultural and urban development that occurred as colonial Cape Town expanded resulted in the destruction of its natural habitat. It was further reduced by picking for the flower markets.

It is interesting to note that *Erica verticillata* has featured on the Bergvliet Primary School badge since the school's founding in 1950 and is referred to as the marsh erica (Figure 2). The school is situated near the Diep River in the suburb of Bergvliet, which is between Wynberg and Zeekoevlei and therefore falls within its original distribution range.



FIGURE 2.—Artist's impression of the marsh erica, *Erica verticillata*, which was designed as the emblem for Bergvliet Primary School in 1950.

Erica verticillata is one of the relatively few South African *Erica* species that is comparatively tough, disease resistant and recommended for planting in both gardens and containers. It is one of the easiest ericas to grow from cuttings. Heel cuttings are selected from fresh side shoots usually taken in autumn, but at Kirstenbosch they have been rooted throughout the year. They should preferably be rooted in multi-trays in a medium consisting of equal parts of 6 mm milled pine bark and polystyrene or perlite chips under mist and on heated propagation benches. Rooting is enhanced by using a powder based rooting hormone for semi-hardwood cuttings or by dipping the base of the cutting for five seconds in 2 000 ppm indole-3-butyric acid (IBA) solution. Roots appear after three to six weeks. Once the cuttings are well rooted, they are removed from the propagation benches and placed on hardening off benches away from bottom heat or mist. At this stage, they should be fed with diluted (50%) liquid, organic seaweed based fertilisers. Rooted cuttings are planted and established in a well-drained potting mix consisting of equal parts composted pine bark or pine needles and acidic river sand. Well-decomposed compost will be suitable so long as it has been naturally composted and does not contain additives such as manure.

Erica verticillata does not readily produce seed unless two or more different clones of this species are in relatively close proximity, for intraspecific cross-pollination to take place. Seed production is low when compared with most other wild ericas. Of the collections of cultivars at Kirstenbosch, 'African Phoenix', 'Louisa Bolus' and 'Adonis' produce the most seed.

The seed, three years or younger, should preferably be sown in late summer or autumn, as most erica seed appear to gradually lose viability. Seed is sown in seed trays on top of the fynbos potting mixture, lightly covered with sand, and then subjected to smoke treatment before the trays are watered. This allows for maximum smoke penetration into the medium containing the seed. Smoke is generated in a drum using dry and semi-dry fynbos plant material and pumped into a sealed plastic tent stretched over a frame containing the trays of *Erica* seed. The smoke is allowed to settle onto the medium leaving a brownish film after which trays are removed from the tent. The seed trays may then be lightly watered taking care not to dis-

turb the seed. *Erica* seed germinates approximately three to four weeks after sowing and produce very small cotyledons at the first growth stage. The secondary, ericoid leaves, begin to appear from the eighth to the twelfth week. Seedlings may be planted out into multi-trays or grow plugs after they have reached 5 mm in height. They should not be planted into too large a container where the soil to seedling root ratio is not in balance because the medium remains wet too long and the root zone may become anaerobic. Once the seedling has filled the plug with roots, it may be potted into a larger container. The same rationale should be followed when potting erica cuttings. Both seedlings and cuttings should be grown under 40% shade until they have become established in their containers and only then moved into full sunlight. Plants are grown to about 100 mm before planting out into the garden. Plants propagated from cuttings taken from mature plants will flower in the first season whereas plants grown from seed usually only flower in their third year.

Erica verticillata performs best when planted in a well-ventilated, warm, sunny position. It will grow well in average Mediterranean or warm-temperate garden conditions provided the soils are acidic and the plants are not subject to frost. The best time to plant them in the winter rainfall areas of South Africa is in autumn or during the winter although they may be planted at other times of the year if regularly watered. The general rule is to plant at the beginning of the rainy season.

Place plants in a prepared hole with as little disturbance to the root zone as possible. Fill the hole in with the surrounding soil and add pine compost if available. Make a catch basin from the soil around the plant to help collect water. Mulching is strongly recommended as it keeps the soil surface cool and damp and reduces weed growth. Plants should be well watered after planting and then every two to three days unless good rainfall occurs. Deep watering encourages the roots to penetrate deeper into the soil, which helps the plant survive the hot dry conditions in summer.

Container grown plants may be kept in a warm, bright and well-ventilated position, but will not tolerate indoor conditions. They grow and flower well under conditions of up to 40% shading, but heavier shading will result in the plant etiolating and the flower colours becoming washed out.

Pruning is very important and may be done from early in the development of the plant. Pruning will increase branching and the number of flower bearing stems and will prolong the life of the plant. Plants pruned regularly from an early age will produce a lovely full shape. Only prune more mature plants after flowering in order not to cut away new buds. Ericas should be regularly fed with organic liquid fertilisers or control release fertilisers low in phosphorus. Control release fertilisers should be applied sparingly, about 10 granules per plant, to balance growth of foliage versus flower production.

Erica verticillata has been known to survive for more than 20 years at Kirstenbosch and at Rondevlei Nature Reserve, but becomes increasingly woody and senescent after 10 to 15 years. Plants grown in their natural habitat appear to keep their

form and condition better, probably because their rate of growth is more measured under natural conditions.

Erica verticillata has very few pest problems. Seedlings may suffer from damping off fungal disease if the seed is sown too thickly, subject to poor ventilation and the soil medium is kept too wet. New growth tips may occasionally be damaged by thrips. Thrips, from the Order Thysanoptera, are tiny, slender insects with fringed wings that puncture and suck on the softer new growth causing growth distortion and browning of the growth tips. Thrip infestations are easily controlled by applying a pesticide and by pruning and destroying the infected parts of the plant.

There has been much debate and some scepticism within botanical gardens, academic, conservation and botanical research organisations over the value of *ex situ* conservation (the keeping of collections of wild species in botanical gardens or in private collections). *Erica verticillata* is testimony that keeping such collections can play an important role in preserving a species and may in some cases contribute to conservation programs. *Erica verticillata* has, with the help of a few botanical gardens and some dedicated collectors and growers, managed to claw its way back from extinction to become one of the most important flagship conservation species in South Africa. So-called flagship species are high profile species that draw attention to important conservation issues and the plight of threatened species. An example of a flagship species in the animal kingdom is the Panda bear.

Adamson and Salter (1950) stated that *Erica verticillata* had not been seen in remnant natural vegetation within its distribution range for many decades and was thought to be extinct in the wild by 1950. In the early 1980s, Deon Kotze, horticulturist specialising in ericas at Kirstenbosch (at the time), began a concerted search amongst the remnants of lowland fynbos on and near the Peninsula for lost and rare *Erica* species. He was very keen to find *E. verticillata*, which presented particularly fine, showy specimens on some herbarium sheets. A fortuitous conversation with Kirstenbosch horticultural scholar, David von Well, in 1984, led to a significant discovery. Von Well mentioned to Kotze that there was a large pink-flowered *Erica* matching the description of *E. verticillata* growing at Protea Park in Pretoria. Von Well confirmed the similarity when he saw herbarium specimens. He brought back cuttings for Kotze and flowering specimens for Dr E.G.H. Oliver (EGHO) at the Compton Herbarium, who confirmed it as *E. verticillata*.

Protea Park was one of two parks in the Pretoria area that displayed collections of fynbos plants. Also known as Jan Celliers Park, it was established in 1962 by Mr Bruins-Lich and Mr Repton who decided the park should be completely indigenous. No records could be traced of how these plants came to be in this park, but they are thought to have been introduced during the early1960s. Three very old plants were growing in the park of which two had died by the 1980s. Cuttings were collected from the last remaining plant and added to the Kirstenbosch collections in 1984. It has been named *Erica verticillata* 'African Phoenix' to distinguish it from other forms that have since been discovered.

In 1984 David Cooke, Temperate House Manager and erica enthusiast at the Royal Botanic Gardens, Kew, heard about the rediscovery of *Erica verticillata* in Pretoria from Kirstenbosch horticulturists at the Chelsea Flower Show. He reported that Kew also had living specimens of this species and kindly sent cuttings to Kirstenbosch. Unfortunately, this clone was found to be a sterile hybrid that is probably the registered *E. verticillata* 'African Fanfare'.

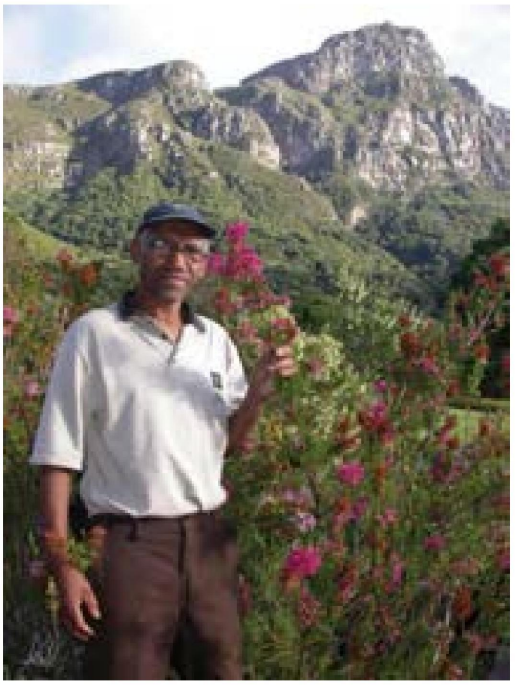


FIGURE 3.—Mr Adonis Adonis with the form of *Erica verticillata* that he discovered at Kirstenbosch National Botanical Garden. Photograph: Anthony Hitchcock.

A few years later in 1990, a large mature plant was discovered by Kirstenbosch National Botanical Garden's head foreman, Mr Adonis Adonis, growing in a clearing in the forest behind the Braille Trail in the garden (Figure 3). It is surmised that this plant was a remnant seedling from the old erica collections that were grown on terraces nearby. The Kirstenbosch plant records were consulted back to the creation of the garden in 1913 and the only collection of this species prior to 1943, and indeed the only one from the wild, was made by Mrs Louisa Bolus, first Curator of the Bolus Herbarium (Gunn & Codd 1981). She is recorded as having collected seeds from plants growing in swampy areas on the Wynberg flats on 1 May 1917. A specimen of *Erica verticillata* from the garden collection was lodged in the Compton Herbarium in 1943. It is most probable therefore, that the plant found growing at Kirstenbosch in 1990 originates from the original collection made by Mrs Bolus. The original plant has since died, but cuttings were made and the plants cultivated from these in the Kirstenbosch collections nursery display two shades, dark pink and light pink. It is assumed that there was more than one plant growing together in the forest clearing. The dark pink flowered form has been given the cultivar name *E. verticillata* 'Adonis' in recognition of its discoverer and the light pink form has been named *E. verticillata* 'Louisa Bolus' the original collector of the material.

One might have thought that this was the end of a happy tale of rediscovery, but it was not to be. Horticulturists at Kirstenbosch and other botanical gardens in the South African National Biodiversity Institute regularly contribute 'plant of the week' articles on South African plants for the Institute's website (http://www.plantzafrica.com). One of us, (ANH) wrote an article on *Erica verticillata* and asked *Erica* systematist, EGHO, to check the article before it was posted on the web page. He responded that there was actually a further clone, and that he had seen plants in cultivation

in a nursery attached to the Belvedere Palace Gardens in Vienna back in 1967. He recalled that there was quite a good collection of southern hemisphere plants, which were meticulously cared for.

EGHO made contact with a fellow researcher, Dr Michael Kiehn, at the nearby University of Vienna and through their efforts managed to get a fourth clone of this lovely species. As a bonus, it was found that they also had plants of *Erica turgida*, another Cape lowlands species, which become extinct in the wild in the early 1970s due to a housing development adjacent to Kenilworth Race Course.

The process of retrieving these species proved most difficult with bureaucratic restrictions on importing the plant material back into South Africa being the biggest challenge. The back and forth communications between ANH, Dr. Kiehn, and the Belvedere Garden attracted the attention of the Austrian Ministry of Agriculture and the South African Embassy in Vienna. An official handing over ceremony was arranged in 2001 where the Austrian Minister of Agriculture and the Environment, Dr Wilhelm Molterer, ceremonially handed the plants over to the South African ambassador, Prof. Alfred T. Moleah.

Surprisingly, when the cutting material arrived there were two separate packs labelled red and pink. Upon further investigation, Mr Michael Knaack, horticulturist at the Belvedere Palace Garden, confirmed that they have two forms of *Erica verticillata* in their collections. The Belvedere Palace Garden has no written records on the origin of the plants and could only provide verbal information that had been handed down from generation to generation. One of the clones appeared to be another cultivar of the species whereas the other is much like the 'African Fanfare' cultivar. The new cultivar has since been verified and named after the place of origin, namely *E. verticillata* 'Belvedere'.

The story of the plants grown at the Belvedere Palace Garden goes back a long way. The Belvedere Palace Gardens is part of a group of botanical gardens and parks in Vienna that collectively fall under the Schönbrunn Palace Botanical Garden management. Two gardeners, Francis Boos and George Scholl, were responsible for many plant collections made in the Cape between 1786 and 1799 for Emperor Joseph II of Austria (Gunn & Codd 1981). Francis Boos was evidently the leader of the expedition. He was a botanist as well as a gardener whereas Scholl was a working gardener with little scientific knowledge. The Emperor Joseph II sent them to make collections of tropical plants from Mauritius, but bad weather forced their ship to shelter at the Cape of Good Hope and their stay turned out to be longer than planned (Nelson & Oliver 2004). They made numerous collections of South African plants and even went on a brief collecting trip with Francis Masson (Gunn & Codd, 1981). Boos stayed at the Cape for a year and then went on to Mauritius leaving Scholl behind to continue collecting. Boos returned to the Cape in 1788 and stayed for only a few months before returning to Vienna in July 1788 with a large collection of specimens and living plants. Scholl stayed at the Cape for twelve years mainly because he could not get passage on a ship that would transport his plant collections. Scholl was aided in the Cape by Colonel Robert Jacob Gordon, Commandant of the Dutch Garrison at the

Cape. Gordon gave him protection, assisted him with his field excursions and allowed him to grow his plants in his garden, often referred to in literature as 'the Gordon's Garden', which was situated on what is now Prince Street in the suburb known as Gardens (Garside 1942; Gunn & Codd 1981). Many plants were established here and Scholl collected seed from them. From time to time Scholl sent shipments of dried bulbs and seeds to Vienna of which four shipments are recorded in the Cape Archives from 1790 to 1792. They were first shipped to the Austrian Consul in Holland who had them transported up the Rhine and then overland to Vienna. Scholl was finally able to return to Vienna in 1799 taking with him a large collection of living plants and seed including species of *Erica*. Scholl was rewarded for his efforts by being promoted to the post of Superintendent to the Gardens of the Belvedere Palace (Garside 1942). Staff at Schönbrunn Botanical Gardens believe that the ericas at the Belvedere Palace Garden date back to the Boos and Scholl collections, as there is no evidence of other collections being made. The Belvedere collections has representatives of various Cape Proteaceae and at least 20 ericas, including *E. patersonii*, *E. cerinthoides*, *E. turgida*, *E. abietina*, *E. mollis*, *E. ventricosa*, *E. heliophila*, *E. canaliculata*, *E. diaphana* and *E. baueri*. Upon further enquiries about the South African erica collection at Belvedere Palace Garden, the senior gardener, who had been working in the gardens since the 1930s, remembered his predecessor noting that the collection had always been there. Therefore, the erica collection date at least as far back as the nineteenth century and therefore quite conceivably originate from the Boos and Scholl collections.

These original collections at Belvedere Palace Gardens may have been nurtured for over 200 years through all the political turmoil of wars and conquest. Indeed some knowledgeable members of the Heather Society of Great Britain doubt that these collections could have survived the ravages of war and particularly the bombing at the end of the Second World War. Indeed, most of the collections at Belvedere were destroyed at the end of the war when the glasshouses were damaged by a bomb falling in the centre of the Reservegarten. Many plant collections survived however, because they were purposely duplicated and kept in other gardens and glasshouses so it was possible to reduce the risk and to save most of the species. The erica collection was evidentially moved to the Alpengarten (Alpine Garden) where there is an Erdhaus, which is a glasshouse built below the surface of the earth, so it is free from frost even when the artificial heating systems are not functioning. This is apparently how the erica collection survived the last winter of the Second World War.

The search for lost collections of *Erica verticillata* continued, becoming an exercise in detective work. The existence of additional collections of *E. verticillata* was revealed with assistance from members of the British and North American Heather Societies, botanical gardens, erica growers in Europe and by searching the internet. Through this process we were able to add a collection from Tresco Abbey Gardens on the Scilly Isles, one originally from the erica collection of Dr Violet Gray via the British Heather Society, a trademarked selection from Monrovia Nursery in California called *E. verticillata* RUBY LACE®, two from a nurseryman in Germany and another collection from Kew.

Trying to determine the origin, uniqueness and genetic integrity of these collections is a difficult if not impossible process because plants are frequently exchanged between organisations without good records having been kept. It is therefore possible that duplicate collections from different sources were sent to Kirstenbosch. Kew records show that they had a number of different forms of *Erica verticillata*, but unfortunately some were discarded some years ago. Their records showed that one of their collections originated from seed sent them by Mr Harry Wood—curator of Fernkloof Botanical Garden in Hermanus in 1961. Cuttings taken from this collection were brought back to Kirstenbosch by Ernst van Jaarsveld in 2006.

Attempts thus far to use molecular means to establish which collections are pure species, different clones or duplicate collections have not been conclusive. Molecular studies, however, would be useful to help establish the size and integrity of the genetic pool and will be important for selecting clones for restoration programmes.

One of us (EGHO) undertook a comparative study of the clones in the Kirstenbosch collections in 2008. Fresh material was examined and all were attributed to *Erica verticillata*. Six clones were recorded as producing fertile seed and determined to be true *E. verticillata*, corroborating their taxonomic status. These were from the plants sourced from Protea Park, Pretoria; Kirstenbosch Braille Trail; Belvedere Palace; Tresco Abbey Garden; Dr Violet Gray *ex* David Small of the British Heather Society; Kew Gardens *ex* Harry Wood. The collection *E. verticillata* 'Cherise' (previously sold under the trademark RUBY LACE®) was not assessed as it had not produced flowers at Kirstenbosch at the time of the study. It does however superficially appear to be a true species and does produce viable seed that flowers true to the type. 'Cherise' (Plate 2296.2) was assessed in May 2012 and confirmed as a true species, bringing the total number of living collections of *E. verticillata* held at Kirstenbosch National Botanical Garden to seven.

Three collections were noted not to match any of the currently known and accepted 840 species of *Erica*, but with a superficial 'look' of *Erica verticillata*. These collections are more or less identical to those determined to be hybrids between *E. verticillata* and other species, most probably having originated in some European garden collection. These include collections from Kew Gardens, Belvedere Palace and Rhineland Nursery. There is no possibility of knowing what the other parent species could be. Some flowering branches of these plants look like *E. doliiformis* which has similarly shaped and sized flowers and are umbellate on the ends of main branches with long crowded leaves, but its flowers have very long glandular pedicels. All three clones are recorded as being infertile thus corroborating their hybrid status.

The rediscovery of *Erica verticillata* generated interest amongst conservationists to attempt to re-establish it in its natural habitat. All suitable natural habitats save three, Rondevlei Nature Reserve, an area of sand plain fynbos within the Table Mountain Park at Tokai, and the centre of the Kenilworth Race Course, have been destroyed by development.

Mr Dalton Gibbs, Conservation Manager for the Cape Metropolitan Council, was the first to attempt to reintroduce the Pretoria clone (*Erica verticillata* 'African Phoenix') to Rondevlei Nature Reserve in 1994 with plants supplied by Kirstenbosch. He planted ten plants, in a transect, from the drier sandy areas across a range of habitats ending in the wetland. However, only one plant survived, and this indicated to him that this species prefers the margin between the dry and wet soils. More plants were planted in the identified suitable niche habitats at Rondevlei (Figure 4) in 1995, 1997 and 1998. The ericas established well reaching maturity and attracting pollinators such as the southern double-collared sunbirds, hawk moths and bumblebees. The plants were however self-sterile and were not producing seed, so it was decided to add a second clone, *E. verticillata* 'Adonis', in 2001. The plants at Rondevlei have produced viable seed since the introduction of this second clone and seedlings have been germinated from this seed and planted at a community development project at Bottom Road Sanctuary on the shores of Zeekoevlei. These two clones of *E. verticillata* were also planted at Kenilworth Race Course in 2005 and have survived and flower profusely every year. Seedlings have been observed to be recruiting near the parent plants.

In 2004 Dr A. Rebelo from the South African National Biodiversity Institute and one of us (ANH) began planning the restoration of Red Listed species to the sand plain fynbos areas of Tokai that had recently been handed over to be managed by the South African National Parks. Restoration focussed on Red Listed species from



FIGURE 4.—Julia September and Anthony Hitchcock inspecting *Erica verticillata* plants restored at Rondevlei in February 2011. Photograph: Alice Notten.

the area that had not naturally re-emerged after the removal of the pine plantations and after the area was burnt. This area was considered ideal for re-establishing *Erica verticillata*. Three clones have been planted at Tokai including those originating from Protea Park, Kirstenbosch Braille Trail and Belvedere Palace. They have established splendidly at Soetvlei and Prinskasteel wetlands at Tokai.

The restoration of this species is a long process and it has to survive through natural recruitment through three generations, i.e. three burn cycles in the wild without further restocking, replanting or reseeding before it will be re-assessed according to IUCN Red List categories. The reclassification will be determined by the numbers of plants that exist after three generations on their own, whether the population are stable, declining or increasing, and how fragmented the populations are in the area that plants have been re-introduced to.

Conservation of our rich Cape flora is a great challenge, especially given the increased demand for land and resources, and the effects of climate change. This is particularly true on the lowlands from where *Erica verticillata* originates. Many other species will not be so lucky and will be lost forever. An example is *E. pyramidalis*, which grew together with *E. verticillata*, but is now extinct in the wild with no *ex situ* cultivated plants in existence. Furthermore, large numbers of plants are on the brink of extinction on the Cape flats. We will lose these species, and many more, unless their endangered habitats are not conserved as a matter of urgency. *Erica verticillata* therefore plays a crucial role in this process as it is a flagship species that helps to create awareness and represents the general plight of our vanishing flora.

The external features of the various *Erica verticillata* collections housed at Kirstenbosch National Botanical Garden are highlighted below. For a full account of the species' diagnostic features, refer to the description. Each collection is recorded in the Kirstenbosch Garden Plant Records database with a unique accession number. The various forms have also been endorsed with cultivar names and numbers by the international registrar of *Erica* cultivar names, Dr Charles Nelson. All plant collections at Kirstenbosch Botanical Garden are recorded in its Garden's Database. Plant collections are provided with a sequential number for the year of collection. Therefore, *Erica verticillata* collected from Protea Park, Pretoria was the 536th collection made in 1984. The accession number is used on plant labels and to access records for the collection in the garden database.

Erica verticillata 'African Phoenix'

This specimen comes from Protea Park in Pretoria (Plate 2296.7). It is recorded at Kirstenbosch National Botanical Garden with accession number 536/1984 and registered as cultivar E. 2012-05 'African Phoenix'. It is a tall, erect cultivar growing to an average height of 1.8 m, but old specimens may reach up to 2.5 m. The flowers are medium pink, tubular (18 mm) and arranged in small terminal umbels (3–5-flowered) on very short lateral branches arranged in whorls. The lateral flowering branches are aggregated into neat, spike-like synflorescences (groups) on strong, erect main branches, up to six verticils per synflorescence, with terminal apex of the stem con-

tinuing growth. The non-flowering lateral branches on the main flowering stems are arranged in whorls of five.

Erica verticillata 'Adonis'

This dark pink form (Plate 2296.1) is recorded at Kirstenbosch National Botanical Garden with accession number 273/12 and registered as cultivar E. 2012-06 'Adonis'. It is believed to be a remnant seedling from an early collection, possibly the one made for Kirstenbosch by Mrs Louisa Bolus in 1917. This collection was originally recorded in the Kirstenbosch Garden database with the accession number 294/1990, but we have separated the two colour forms allocating them different numbers. It is a medium sized shrub, smaller and bushier than 'African Phoenix' growing to an average height of 1.4–1.6 m, but old specimens may reach up to 2.0 m. Flowers of the two surviving forms (pale and dark pink) are tubular (20 mm) and arranged in small terminal umbels (3–6-flowered) on very short lateral branches arranged in whorls. The lateral flowering branches are aggregated into less orderly verticils than 'African Phoenix'; spike-like synflorescences on strong, erect main branches, up to six verticils per synflorescence, with terminal apex of the stem continuing growth. The non-flowering lateral branches on the main flowering stems are arranged in whorls of six, shorter in length (30 mm) and the leaves appear more crowded. This gives this form an overall thicker, heavier, bushier appearance.

Erica verticillata 'Louisa Bolus'

This form (Plate 2296.1) is recorded at Kirstenbosch National Botanical Garden with accession number 272/2012 and registered as the cultivar E. 2012:12 'Louisa Bolus'. The description is the same as for the cultivar *E. verticillata* 'Adonis' except for the flower colour, which is light pink.

Erica verticillata 'Belvedere'

This form (Plate 2296.3) is recorded at Kirstenbosch Botanical Garden with accession number 109/2001 and registered as the cultivar E. 2012-07 'Belvedere'. It is a medium, erect species growing to an average height of 1.7 m by 1.0 m wide, but old specimens may reach up to 2.0 m. The flowers are light pink and appear translucent in sunlight, tubular (20 mm) and arranged in small terminal umbels (3–6-flowered) on very short lateral branches arranged in whorls. The lateral flowering branches are aggregated into neat, spike-like synflorescences on strong, erect main branches, up to six verticils per synflorescence, with terminal apex of the stem continuing growth. The non-flowering lateral branches on the main flowering stems are arranged in whorls of five.

Erica verticillata 'Tresco Abbey'

This form (Plate 2296.5) is recorded at Kirstenbosch National Botanical Garden with accession number 543/2006 and registered as cultivar E. 2012-08 'Tresco

Abbey'. It is a smaller rounded species growing to an average height of 0.6 m by 0.5 m wide. The flowers are smaller, medium pink, tubular (15 mm) and arranged in small terminal umbels (2–4-flowered) on very short lateral branches arranged in whorls. The lateral flowering branches are aggregated into neat, spike-like synflorescences on thin, erect main and side branches, 3–4 verticils per synflorescence, with terminal apex of the stem generally, but not always, continuing growth and then much less pronounced. Verticils arranged at terminal apex in about 20% of cases. The external morphology of the Tresco Abbey form is noticeably different from all the other *Erica-verticillata* forms as there are no conspicuous flower bearing stems, flowers are smaller, verticils fewer, side branching is elongated, erect, reaching almost up to the apex of the shrub.

Erica verticillata 'Doctor Violet Gray'

This form (Plate 2296.4) is recorded at Kirstenbosch National Botanical Garden with accession number 548/2006 and registered as cultivar E. 2012-09 'Doctor Violet Gray'. This specimen originates from the erica collection of the late Dr Violet Gray in the United Kingdom. It is a medium sized, erect species growing to an average height of between 1.0 × 0.5 m wide. The flowers are light pink, tubular (20 mm) and arranged in small terminal umbels (3–4-flowered) on very short lateral branches arranged in whorls. The lateral flowering branches are aggregated into neat, spike-like synflorescences on strong, erect main branches, up to six verticils per synflorescence, with terminal apex of the stem continuing growth. The non-flowering lateral branches on the main flowering stems are arranged in whorls of five.

Erica verticillata 'Harry Wood'

This form (Plate 2296.6) is recorded at Kirstenbosch National Botanical Garden with accession number 657/2006 and registered as cultivar E. 2012-10 'Harry Wood'. It is a medium sized, erect species growing to an average height of 1.0–1.2 m by 0.6 m wide. The flowers are light pink, tubular (20 mm) and arranged in small terminal umbels (4–5-flowered) on very short lateral branches arranged in whorls. The lateral flowering branches are aggregated into neat, spike-like synflorescences on strong, erect main branches, up to six verticils per synflorescence, with terminal apex of the stem continuing growth. The non-flowering lateral branches on the main flowering stems are arranged in whorls of five. This form is very similar to *Erica verticillata* 'Doctor Violet Gray' 548/06 and the two may be identical.

Erica verticillata 'Cherise'

This form (Plate 2296.2) is recorded at Kirstenbosch National Botanical Garden with accession number 549/2006 and registered as cultivar E. 2012-11 'Cherise'. It was obtained from Nurserymen's Exchange, a wholesale nursery in Monterey, California, where it was sold under the trademark RUBY LACE®. No further information is available on the history of this form. It is a medium sized, erect species growing to an average height of 1.0–1.3 m by 0.5–1.0 m wide. The flowers are dark reddish-pink,

tubular (17 mm) and arranged in small terminal umbels (3–5-flowered) on very short lateral branches arranged in whorls. The lateral flowering branches are aggregated into neat, spike-like synflorescences on strong, erect main branches, up to six verticils per synflorescence, with terminal apex of the stem continuing growth. The non-flowering lateral branches on the main flowering stems are arranged in whorls of five.

Description.—Evergreen, erect, woody, shrub,1.2–1.5(2.0) m tall with branches spreading or erect. *Leaves* ericoid 4–6-nate, densely imbricate, erect or spreading, 4–8 mm long, linear, convex and sulcate, glabrous, younger leaves ciliate. *Inflorescence* mostly 4-flowered in 1 whorl on short lateral branchlets, whorls often crowded in dense oblong pseudo-racemes below ends of branches, flowers erect or spreading; pedicel 2 mm long; bract and 2 bracteoles approximately linear, foliaceous. *Sepals* 4–5 mm long, linear from ovate scarious base, foliaceous, ciliate. *Corolla* 4-lobed, tubular, mostly straight, 14–20 mm long, pubescent, dry, rosy; limb erect or spreading. *Stamens* 8, free; filament inserted about middle of cell to the thick dorsally-projecting connective; anthers included, about 1 mm long, oblong, curved, muticous. *Ovary* completely 8-celled, conical, with apical callous-like processes, glabrous; capsule at length splitting into 8 valves. Plate 2296.

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Pavetta edentula Rubiaceae

Mozambique, South Africa, Swaziland

Pavetta edentula *Sond*., Flora capensis 3: 20 (1865); Bremekamp: 209 (1929); Bremekamp: 169 (1934); Kok & Grobbelaar: 186 (1984); Retief & Herman: 587 (1997); Bridson: 579 (2003). *Ixora edentula* (Sond.) Kuntze: 286 (1891). *Pavetta disarticulata* Galpin: 145 (1895); Bremekamp: 209 (1929).

The genus *Pavetta* L. belongs to the family Rubiaceae, the gardenia or coffee family and comprises ± 400 species occurring in the Old World tropics (Bridson 2003). About 24 species occur in the summer rainfall areas of southern Africa (Palmer & Pitman 1972; Bridson 2001; Retief 2003; Herman 2005). Nine endemic taxa are currently recognised in South Africa (Retief 2006) and 13 near endemics (occurring also in Swaziland and Lesotho, or just crossing the border into southern Botswana or Mozambique). Only five of the species occurring in southern Africa are also recorded in tropical and north Africa (Bridson 2003). They are either trees, shrubs or dwarf shrubs and are commonly known as bride's bushes or Christmas bushes, certainly referring to the masses of fragrant white flowers usually produced during December. Their leaves are opposite, entire and with interpetiolar stipules, characteristics common to all representatives of the family Rubiaceae. Bacterial nodules are a diagnostic character for *Pavetta* leaves and domatia are sometimes found on the lower leaf surfaces (see Herman & Hyde-Johnson 2011 and references therein for a discussion on bacterial nodules). Another interesting feature of the genus *Pavetta* is the pollen presenter, which is the upper, club-shaped part of the style with eight shallow, hairy ribs. When the flower is still in bud, the anthers fit into these ribs and pollen is released before anthesis. As the flower opens, the style elongates and the pollen is carried out to be collected by insects for cross-pollination (Figure 1). The stigmatic area is confined to the small, two-lobed apex (Bremekamp 1929, 1934; Bridson 2003).

The most important characters used in the classification of the different *Pavetta* species are the calyx, the arrangement of the inflorescences, the branching of the peduncles, the shape and hairiness of the leaves, the shape and distribution of the bacterial nodules and the presence or absence of domatia on the leaves. Sonder (1865) used the calyx as the foremost character in his key to distinguish three groups of species. In his revision of the genus *Pavetta*, Bremekamp (1929) classified *P. edentula* with two other species, *P. disarticulata* and *P. eylesii*, in his Group Edentatae, on the grounds of the 'calyx teeth inconspicuous or absent' and the large leaves. In his monograph of the genus, Bremekamp (1934) placed them in his Section Brachypus on grounds of 'calyx dentate or shortly lobed'. Bridson (2003) also used the peduncle/inflorescence supporting branches and the calyx features in her key to the different species.

PLATE 2297.—1, flowering branch, × 1; 2, fruiting branch, × 1. Voucher specimen: *Condy 238* in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2297 *Pavetta edentula*

Pavetta edentula and *P. eylesii* are related only on the grounds of their similar calyx and the fact that they both have quite large leaves. Morphologically, the two species are quite dissimilar. *P. edentula* has stiff, glabrous leaves, while the leaves of *P. eylesii* are soft and hairy on the lower surfaces. *Pavetta eylesii* is distributed further west, occurring in Botswana, Limpopo, North-West, Gauteng, with a few isolated spots in Mpumalanga and Swaziland, and also in Tropical Africa (Zimbabwe, Zambia and Malawi). The closest relative of *P. edentula* is *P. crassipes* K.Schum. from West and Tropical Africa. These two species are almost indistinguishable except for the much narrower leaves with fewer lateral veins and shorter petioles of *P. crassipes* (Bremekamp 1934; Bridson 2003).

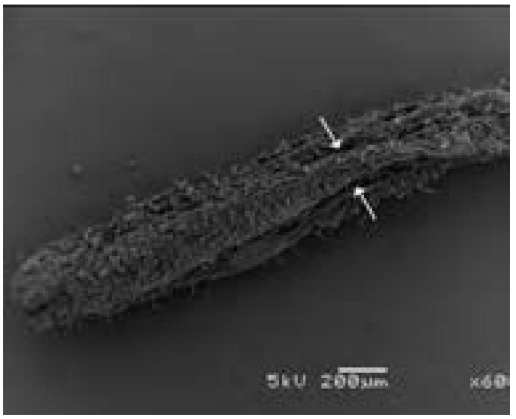


FIGURE 1.—The pollen presenter as seen under scanning electron microscope. The ribs in which the pollen is released are indicated by the arrows. Voucher specimen: *J.N. Pienaar 1195* in National Herbarium, Pretoria. Use of the scanning electron microscope at the Electron Microscopy Unit of the University of Pretoria is greatly acknowledged.

Pavetta edentula is a shrub or small tree characteristic of the sandstone cliffs and steep rocky hillsides in the bushveld of Mpumalanga, KwaZulu-Natal (South Africa), Swaziland and southern Mozambique (Figure 2). The stems and branches are covered by thick, corky bark with very few, short, side branches on which the inflorescences are borne. The leaves are clustered near the apices of the branches, directed upwards, thick and glabrous, and the veins appear almost yellowish. Numerous small, round bacterial nodules are found scattered all over the leaf surface but domatia are absent from the lower leaf surfaces. The flowers are borne on thick branches below the leaves. The wood is fine-textured, easy to work and produces a smooth surface. It would be suitable for ornamental woodwork (Van Wyk 1974; Boon 2010). According to Fox & Young (1982), the leaves are used as a vegetable by the Zulu people and are generally consumed raw. The species name *edentula* means without teeth, referring to the lack of calyx lobes or teeth. According to Raimondo *et al*. (2009), the Red List Status of *P. edentula* is LC (least concern). It is commonly known as gland-leaved bride's bush, braille bride's bush, glandleaf-tree, large-leaved bride's bush (English); *kliertjiesboom* (Afrikaans); *sawoti*, *simunyane* (Swati, siSwati); and *isimuncwane*, *umafayindlala* (Zulu, isiZulu) (Van Wyk *et al*. 2011). The national tree number for this species in South Africa is 717 (Von Breitenbach 1990; Boon 2010).

Description.—Shrub or small tree, up to 5 m high, usually single-stemmed. *Branches* knobbly, covered with thick, corky bark; internodes suppressed, only visible on elongated branches in new growth. *Interpetiolar stipules* hardly distinguishable, only visible on elongated branchlets, sheathing, with blunt mucro or broadly triangular tips, up to 7 mm long, soon becoming corky and contributing to knobbly appear-

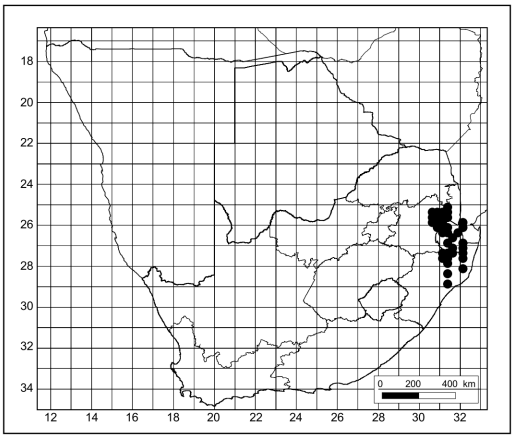


FIGURE 2.—Known distribution of *Pavetta edentula* in southern Africa.

ance of branches. *Leaves* simple, clustered near apices of branches, decussate on elongated branchlets, stiff, held erect, up to 210 × 65(–70) mm, narrowly elliptic, elliptic or rarely obovate, apex acute to acuminate, base cuneate, margin entire, glabrous; bacterial nodules numerous, small, ± rounded, scattered over leaf surface; domatia absent. *Petiole* up to 30 mm long. *Inflorescences* below leaves, terminal on short, thick, side branches (inflorescence supporting branches), corymbose, up to 110 mm in diameter, in opposite pairs, many flowered, sweetly scented. *Peduncle* branched 3 or 4 times, various parts from 5–25(–30) mm long, glabrous, with bracts and bracteoles at bases of ramifications, those at first ramification broadly and shallowly triangular, at upper ramifications triangular to narrowly triangular, 1–3 mm long. *Pedicel* 4–10 mm long, glabrous, with 0–3 linear bracteoles, ± 1 mm long. *Calyx tube* ± 1 mm long, widening towards mouth, rim undulate or very shortly and shallowly dentate, with 4 rudimentary teeth, ± 0.5 mm long, glabrous. *Corolla* white to cream, glabrous, tubular below, tube 10–15 mm long, 4-lobed, lobes narrowly ovate, narrowly oblong or rarely narrowly obovate, acute, 5.0–10.0 × 2.5–3.5 mm, slightly asymmetrical, perpendicular to tube. *Anthers* 4, inserted in sinuses between corolla lobes, exserted, twisted when dehydrated, 6–7 mm long, filaments very short. *Style* and *pollen presenter* long-exserted, up to 40 mm long, upper part club-shaped, glabrous but hairy on club-shaped part. *Ovary* inferior, ± 1 mm long. *Fruit* a drupe, black, smooth, shiny, spherical, 7–9 mm in diameter, crowned with persistent calyx rim. *Seed* 2, (1 by abortion), ± 4 mm in diameter. *Flowering time*: (October) November–February (March). Plate 2297.

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Cephalanthus natalensis Rubiaceae

South Africa, Swaziland, Zimbabwe, Malawi, Mozambique, Tanzania

Cephalanthus natalensis *Oliv.* in Hooker's Icones Plantarum 14: 22, t. 1331 (1881); Haviland: 41 (1897); Ross: 332 (1972); Ridsdale: 183 (1976); Burrows: 622 (2002); Coates Palgrave: 1039 (2002); Verdcourt: 420 (2003); Boon: 546 (2010).

Oliver (1881) was the first to describe and illustrate *Cephalanthus natalensis* and he placed it in Rubiaceae subfamily Cinchonoideae tribe Naucleeae (DC.) Hook., a concept also followed by Schumann (1891), Haviland (1897) and Verdcourt (1976). Ridsdale (1976) disagreed, considered the tribe as heterogenous, and placed *Cephalanthus* in a monotypic tribe, Cephalantheae. Members of the family Rubiaceae can be recognised in the vegetative state by their opposite, sometimes whorled, entire leaves and interpetiolar stipules that have axillary colleters and an inferior ovary. The tribe Naucleeae can be subdivided into six highly supported and morphologically distinct subtribes, where *Cephalantus* belongs to subtribe Cephalanthinae that is characterised by their stipules, which are entire, lobes mostly valvate, corolla is 5-lobed and lobes are imbricate, with flowers and fruit in dense globose heads. APG III (2009) divided Rubiaceae into four groups and *Cephalanthus* belongs to the Cinchonoideae group. The genus *Cephalanthus* comprises of six species. Three species are from the Americas, two from Asia and *C. natalensis* the only member of this genus in Africa and, considering their distribution, is a relict group.

Cephalanthus natalensis occurs in the eastern parts of South Africa, in the provinces of Limpopo, Mpumalanga, KwaZulu-Natal and Swaziland, and further northwards into Mozambique, eastern Zimbabwe, Malawi and as far north as southern Tanzania (Figure 1). It grows in montane forest as the understorey constituent, forest margins, open montane grassland and scrub on rocky outcrops at a high to medium altitude.

Although Bridson & Verdcourt (1988: 415) state that *Cephalanthus* does not extend into the *Flora of tropical East Africa* region, and is therefore not included in their flora treatment, it has since been collected in southern Tanzania in the Rungwe District, on the Livingstone Mountains by *Gereau & Kayombo 4174* (MO, PRE). Verdcourt (2003) has since acknowledged that this species does occur in southern Tanzania.

The name *Cephalanthus* is derived from the Greek words *kephalos* = head, and *anthos* = flower, referring to the flowers which are arranged in a globose head (Glen 2004). The specific epithet, *natalensis*, refers to KwaZulu-Natal where the type specimen was collected. The fruits range from whitish to reddish pink and look very much like a strawberry. This small tree is called the strawberrybush or quinineberry, witaar-

PLATE 2298.—1, flowering branch, × 1; 2, fruiting branch × 1; 3, fruiting branch × 1. Voucher specimens: 1, *Condy 221* and 2 & 3, *K. Grieve s.n.*



PLATE 2298 *Cephalanthus natalensis*

beibos (Afrikaans), umfomfo (Zulu and Swazi) and murondo (Venda) (Van Wyk *et al*. 2011).

It is grown for its attractive white flower heads appearing in summer and fruits, which become succulent and edible when ripe. *Cephalanthus occidentalis* L. from northern America, called the buttonbush, is often used as an ornamental plant in gardens in the tropics. It is an evergreen or deciduous tree, growing in damp places near streams or lakes. *Cephalanthus natalensis* can be used in indigenous gardens in South Africa in inland areas and can be grown from seed (Boon 2010). It thrives in moist well-drained soil in full or somewhat shaded places in the garden (Johnson *et al*. 2002).

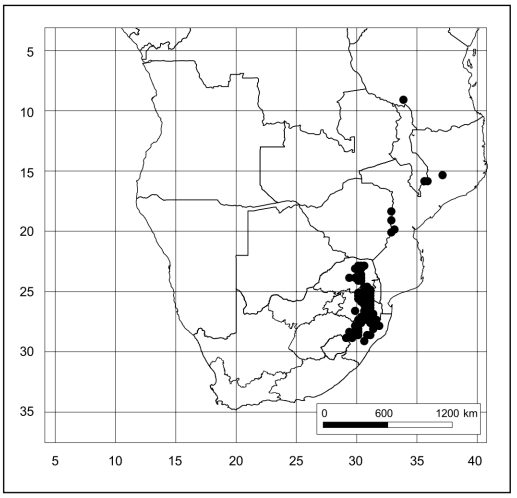


FIGURE 1.—Known distribution of *Cephalanthus natalensis* based on specimens housed in the National Herbarium, Pretoria, and literature (Verdcourt 2003).

According to Watt & Breyer-Brandwijk (1962) and Verdcourt (2003), the fruits have a bittersweet taste like lemon peel and also make a good preserve. The fruits were used as a malaria remedy by early settlers but do not seem to be very effective. The foliage is browsed by stock, birds and baboons and monkeys love the flowers. The fruits are dry, soft compounds that are white, variously tinged with pink colour. Dlamini *et al.* (2009) conducted a study in Swaziland of using indigenous fruits like *Cephalanthus natalensis* (locally known as umfomfo) to flavour yoghurts. It was concluded that indigenous fruits can be successfully used to flavour yoghurt, and in addition may improve the texture of the yoghurt and most probably lower its consumer price.

Description.—Scrambling shrub, shrub or rarely small tree up to 3 m, occasionally up to 4 m tall, many-branched, branching low down, branches trailing, arching; young branchlets finely hairy, with lenticels. *Bark* smooth, brown, vertically striated. *Stipules* 3–5 mm long, broadly ovate at base, apex threadlike, deciduous. *Leaves* simple, opposite, dark glossy green above, paler below, hairless; lamina ovate, elliptic-oblong (20–)30–50(–80) × (10–)16–30 mm, apex acute to acuminate, base cuneate to rounded or truncate, margin entire, domatia in axils of veins below, lateral veins in 4–6 pairs, looping near margin; petiole 1–7 mm long, with few hairs. *Inflorescences* of dense globose heads (pompom-like), 1–3 together, axillary or terminal on short branches; peduncle 20–25(–30) mm long. *Flower* heads up to 30 mm in diameter, bisexual, yellowish green or reddish, scented. *Calyx* 5-lobed, shorter than corolla; tube 2–3 mm long, hairy; lobes elliptic, ± 1 mm long, hairy. *Corolla* 5-lobed; tube funnel-shape, 6–10 mm long, widened at throat, glabrous outside, densely hairy inside; lobes triangular, ovate or oblong, ± 1 mm long, hairy inside. *Stamens* 5, arising deep in corolla throat, included. *Ovary* 2-locular, with 1 ovule per locule; style

± 7 mm long, including narrowly clavate pollen presenter, exserted. *Fruit* a globose cluster of fleshy fruits, consisting of tightly packed but separate succulent fruit, heads up to 30 mm in diameter, each fruit 2–3 mm long, oblong, white variously tinged with pink or reddish when ripe, breaking into 1-seeded cocci; calyx lobes persistent and folding inwards. *Seeds* ± 2.5 mm long, brown, capped by a small brown aril. Plate 2298.

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PLATE 2299 *Chlorocyathus lobulata*

Chlorocyathus lobulata Apocynaceae

South Africa

Chlorocyathus lobulata *(Venter & R.L.Verh.) Venter* in South African Journal of Botany 74: 289 (2008). *Raphionacme lobulata* Venter & R.L Verh.: 603 (1988). *Kappia lobulata* (Venter & R.L.Verh.) Venter *et al*.: 529 (2006).

The first herbarium specimen of *Chlorocyathus lobulata* was collected by R.A. Dyer in 1936, growing 6.4 km from the Fish River mouth (Figure 1), 'near the confluence of the Kap and Fish rivers' (Venter & Verhoeven 1988; Venter *et al*. 2006). The type specimen, *Dyer 3381*, cites the locality as '4 miles from Fish River mouth, near Kap River in low forest'. The plant was found growing in Euphorbiaceous thicket (Venter & Verhoeven 1988), now called Kowie Thicket (Hoare *et al*. 2006), and was reportedly rare as Dyer stated that it was not seen more than the once and was rather inconspicuous, so it would need luck to rediscover it (R.A. Dyer pers. comm. 1987: Venter & Verhoeven 1988). Venter revisited the type locality but was unable to find the plant and postulated that the cryptic nature of this species, coupled with large scale agricultural transformation of the habitat had probably resulted in its disappearance (Venter & Verhoeven 1988). The suggestion by Dyer that luck would be required to find this species again proved accurate and it was only by chance that one of us (APD) found a single individual in the crown of a fallen tree after many weeks of searching the Kap River Reserve. In this way, *C. lobulata* was rediscovered in 2003, nearly 70 years after it was first collected.

Naming the plant turned out to be as challenging as rediscovering it given its unusual characters. Professor Johan Venter immediately recognised Dyer's specimen lodged in PRE as a new taxon in the Periplocoideae (Apocynaceae) but features such as its forest habitat, climbing habit, leaf morphology, crown-like interpetiolar stipules and the presence of hairs on the inner surface of the petal excluded it from most genera within this subfamily (Venter *et al.* 2006). It was however, sufficiently similar to *Raphionacme* to warrant its initial inclusion in this genus and was named *Raphionacme lobulata* (Venter & Verhoeven 1988). The original classification was based on the incomplete type specimen and its re-discovery in 2003 enabled fruit and tuber to be collected for the first time. It became apparent that this species was not a *Raphionacme* but rather related to genera such as *Batesanthus*, *Baseonema*, *Mondia* and *Stomatostemma* (Venter *et al*. 2006). Based on this new information it was transferred to the monotypic genus *Kappia*, named after the type locality, the Kap River Reserve (Venter *et al.* 2006). The specific epithet, *lobulata*, refers to the distinctive hemispherical coronal lobes that distinguish this species from *Raphionacme* (Venter & Verhoeven 1988). When the first specimens of the underground tubers became available, Venter finally assigned

PLATE 2299.—1, fleshy root tuber, × 1; 2, young stem showing interpetiolar stipules and inflorescence, × 1; 3, fruit with paired follicles, × 1; 4, flower showing distinctive coronal lobes, × 3.3; 5, longitudinal section through flower showing funnel shaped corolla, × 2.7. Voucher specimen: *Dold 4461* in Selmar Schonland Herbarium, Grahamstown. Artist: Susan Abraham.

the species to the genus *Chlorocyathus* which has similar fleshy root tubers and *Raphionacme*-like flowers (Venter 2008). The genus *Chlorocyathus* was originally described by Oliver in 1887, but was later included in *Raphionacme* by N.E. Brown (1907). The genus was resurrected by Venter (2008) to accommodate *C. lobulata* and *C. monteiroae*.

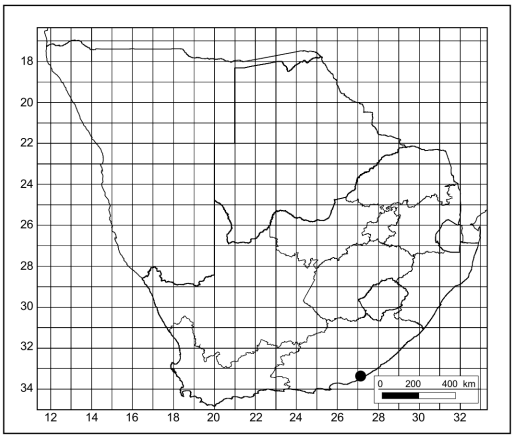


FIGURE 1.—Known geographical distribution of *Chlorocyathus lobulata*.

Chlorocyathus lobulata is a rare endemic liana that to date has only been found growing in the riparian forest restricted to the eastern bank of the lower reaches of the Kap River near its confluence with the Fish River (Venter *et al*. 2006). This is the only known population of this highly localised Albany Centre endemic (Van Wyk & Smith 2001). As the species occurs in an area of less than 5 km^2 it was assessed and Red Listed as Vulnerable (Victor & Dold 2003). In the forest, *C. lobulata* grows into trees such as *Trichocladus ellipticus*, *Euphorbia triangularis*, *Harpephyllum caffrum*, *Celtis africana* and *Mimusops obovata*. The maximum height of mature individuals varies between 12–15 m but this depends on the size of the supporting tree. The thickened stems of large individuals are sometimes seen hanging from trees and climbing for several metres into the forest canopy where plants typically flower. Individuals growing on smaller trees may also flower at lower heights under the forest canopy. Stems may be identified by the characteristic interpetiolar stipules that form a crown of tooth-like projections surrounding the stem (Venter *et al*. 2006). Interpetiolar stipules are more obvious in younger parts of the stem. The fleshy tubers are usually hidden below ground, but may become exposed on steeper slopes or where the underlying substrate is rocky.

Flowering begins in January and continues until late April. Pollen is aggregated as tetrads and is contained in five cup-like translators that are arranged radially within the flower and surround the gynostegium (Verhoeven & Venter 2001; Venter *et al*. 2006). Translators overlay the stigmatic surface and contain approximately 300 pollen tetrads per translator. Observations of pollinators indicate that this species is pollinated by flies that visit the small, bright green flowers. Flowers attract flies by emitting a pleasant fruity scent similar to that of watermelon. While probing the cavities between the coronal lobes in search of the small nectar reward, one or more translators may become attached to the proboscides of pollinating flies by means of a white, sticky pad similar to the viscidium found in orchid pollinaria (Johnson & Edwards 2000; Endress 2001; Verhoeven & Venter 2001). The removal of translators from the flower exposes the stigmatic surface onto which pollen tetrads are subsequently deposited when a fly carrying one or more translators probes the flower. Flies that have been collected carrying translators include one individual of a species of *Degenea* (Tachinidae), one *Ceratitis* species (Tephritidae) and an unidentified species of Tachinidae.

Most inflorescences are infested by larvae of the moth *Bocchoris onychinalis* (Pyralidae—Pyraustinae). Initial signs of infestation are the blackening of the corona lobes after which the entire flower is either consumed or becomes a dark brown-black colour. Small, light-green larvae are sometimes seen on infested flowers and buds, spinning loosely woven silk strands between the flowers and buds. Data collected by Coombs (2010) indicates that approximately 80% of inflorescences are infested with these larvae that consume a large proportion of buds.

Description (after Venter *et al.* 2006).—Perennial liana. *Roots* slender, with succulent sub-spherical tubers (50–200 mm in diameter) strung along the roots. *Stems* up to 12 m long, up to 15 mm in diameter, twining. *Leaves* simple, opposite, glabrous, petiolate; petiole deep maroon, 8–12 mm long, grooved, with reddish prickles in the groove; interpetiolar stipules fleshy, sub-spherical, dentate; blade ovate to elliptic, coriaceous, 60–70 × 20–35 mm, adaxial surface glossy, dark green, abaxial surface pale green, margin entire, undulate, revolute, apex acute to acuminate and recurved, base obtuse to rounded, sometimes with reddish prickles. *Inflorescence* cymose, monochasial branches up to 10-flowered, glabrous; peduncles 5–15 mm long, pedicels 4–5 mm long; bracts triangular, margins membranous, often ciliate. *Flowers* actinomorphic, bisexual, pentamerous. *Sepals* free, broadly triangular, 2–3 × 2 mm, margins membranous to ciliate, apex acute. *Corolla* funnel-shaped, 6–10 mm long, semi-succulent; tube 2–3 mm long, glabrous; lobes ovate, 4–7 × 3–5 mm, apex acute, outside glabrous, apple green flushed pale maroon towards the base, inside apple green, hirsute, hairs white. *Coronal columns* 5, at corolla mouth, laterally fused to the inner base of adjacent corolla lobes, yellow, fleshy; lobes from apices of coronal columns, broadly obcordate, 0.5–1.0 × 2.0 mm, yellow-green, tinged pale maroon, minutely hirsute on distal surface. *Stamens* directly below corona lobes; filaments fused to inner base of coronal columns, linear, ±0.5 mm long; anthers fused to style-head, angular-ovate, ±1 mm long, lower half infertile with basal callosities, upper half fertile, apical connectives triangular, fused into a dome-shaped cover over style-head; pollen in decussate tetrads, average 49.3 × 45.6 μm; single grains 4–8-porate. *Nectaries* inserted below and alternate to stamens, strap-shaped and erect around style, ±1 mm long, nectar pouches below nectaries vertically fused with bases of adjacent coronal columns. *Pistil*: ovaries 2, semi-inferior, ±0.5 mm long; style terete, dilating towards apex, ±1.5 mm long; style-head broadly angular ovate, ±0.5 × 1.0–1.5 mm; pollen translators embedded in the upper surface of the style-head, spatulate with broad ovate receptacle, stipe short, viscidium ovate, 795–830 × 414–440 μm. *Fruit* paired, 45° divergent follicles, occasionally single and erect; follicles narrowly ellipsoid with rounded and retuse apices, 65–80 × 23–25 mm, smooth, glossy green becoming pale straw coloured when ripe. *Seeds* oblong-obovate, flattened, concavo-convex, 10–13 × 3–5 mm, yellow-brown becoming dark brown, comose; coma white, spreading, 20–30 mm long. Plate 2299.

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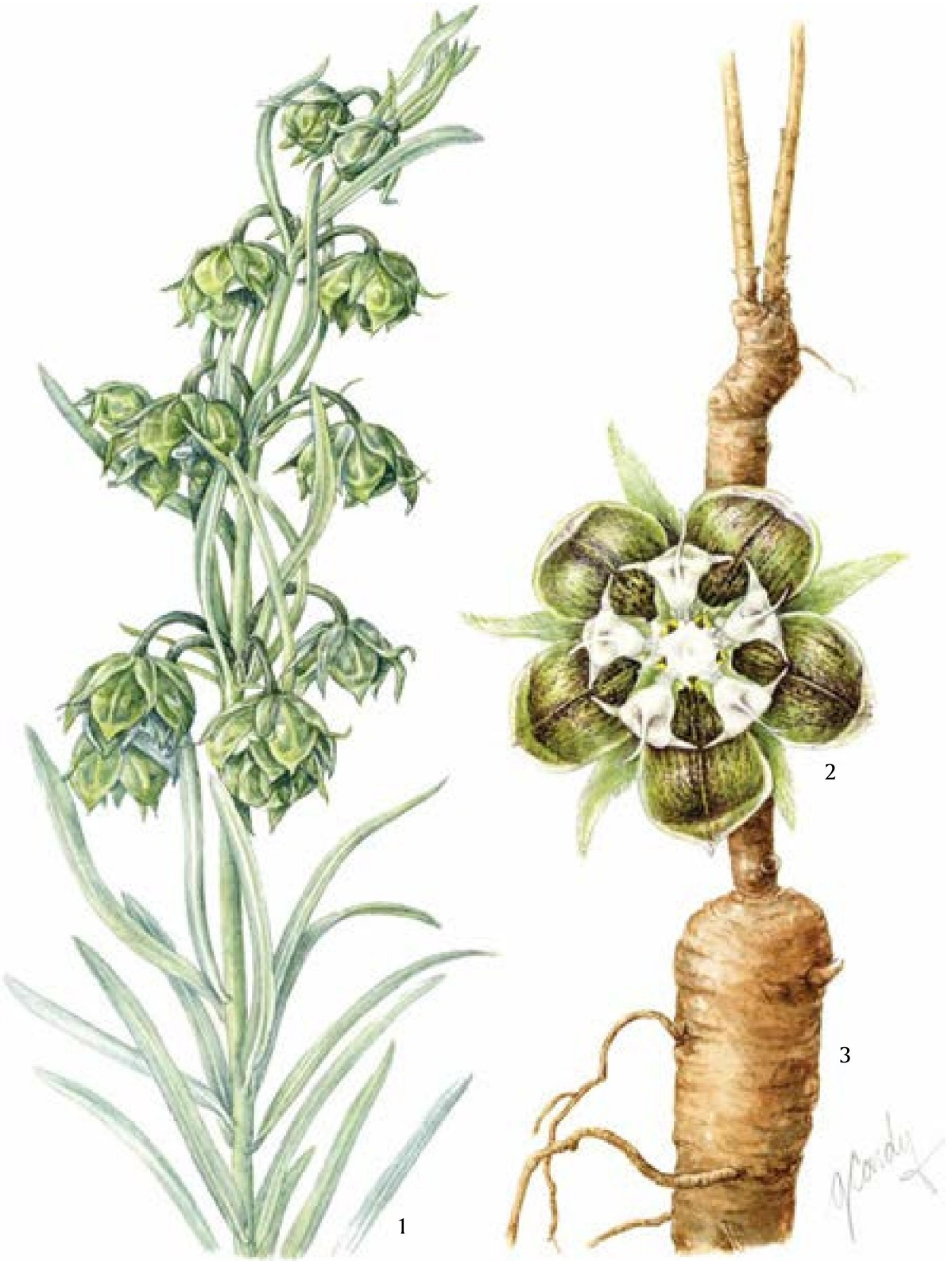


PLATE 2300 *Miraglossum davyi*

Miraglossum davyi Apocynaceae

South Africa

Miraglossum davyi *(N.E. Br.) Kupicha* in Kew Bulletin 38: 632–633, t. 634 (1984); Retief & Herman: 272 (1997); Nicholas: 678 (1999); Müller et al.: 184 (2002); Bester et al.: 135 (2006); Klopper et al.: 71 (2006). *Schizoglossum davyi* N.E.Br.: 635 (1907).

The genus *Miraglossum* currently consists of seven species (Kupicha 1984; Victor *et al*. 2000). The genus was established by Kupicha (1984) when she moved five species from *Schizoglossum* to this new genus and described two additional new species. Of the known *Miraglossum* species, *M. davyi* is the most robust and discernible. To see this species for the first time in its natural environment was quite a 'wonderful' and 'astonishing' experience—these words allude exactly to the meaning of the generic name. The Latin words *mirus/mirari* (to wonder or be astonished at) and *glossa* (tongue) were combined to form the generic name, which aptly describes the astonishing corona lobes of most of the species in this genus.

The genus is closely related to *Schizoglossum* from which it was split off due to the absence of a distinct germination crest on the pollinia and the presence of sessile, clustered inflorescences (Kupicha 1984, Müller *et al*. 2002). The genera *Aspidoglossum*, *Schizoglossum*, *Miraglossum* and *Aspidonepsis* (Nicholas 1999, Bester & Condy 2009) are closely related, with most species analysed appearing in a well-supported clade in a molecular analysis by Goyder *et al.* (2007). Distinguishing characters of these four genera are tabled in Bester & Condy (2009).

Miraglossum davyi is the most distinct and largest-flowered member in the genus. Brown (1907) describes the corona of the syntype *Bolus 12116* (BOL, in spirit, not seen) as having "outspread arms, touching at the tips, are strongly suggestive of five children with their hands joined in a ring and dancing around a table". The corona lobe of this species closely resembles that of *M. laeve* (Kupicha 1984) which, in her words, "resembles the head of an African elephant, the apex being prolonged into a slender upturned 'trunk' and the lateral concavities deepened and widened into 'ears'". These descriptions indicate the truly remarkable structure of the corona lobes.

The only other *Miraglossum* species that occur in the same habitat with *M. davyi* is *M. pulchellum*, which is the widest distributed species of the genus. The rare *M. laeve*, closest related to our species (at least in terms of the shape of the corona lobes), grows in the Potchefstroom district, North-West Province, some 300 km southwest from the *M. davyi* populations.

Brown (1907) listed two syntypes for this taxon namely *Burtt Davy 964* (K, NH, PRE) and *Bolus 12116* (BOL) when the species was decribed for the first time. The

PLATE 2300.—1, flowering branch, × 1; 2, flower, × 3; 3, apical portion of tuber and neck, × 1. Voucher specimen: *Bester 10626* in National Herbarium, Pretoria. Artist: Gillian Condy.

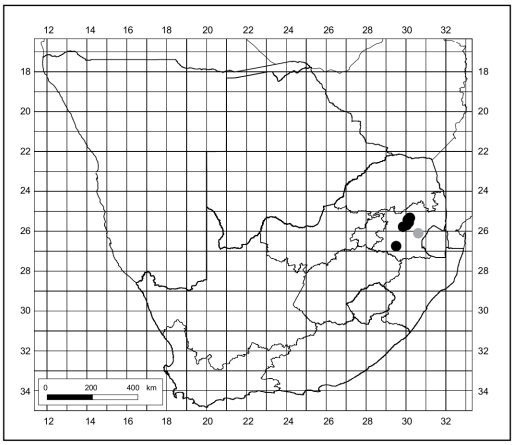


FIGURE 1.—Known distribution of *Miraglossum davyi*; ●, georeferenced localities based on herbarium specimens; ● locality of uncertain location.

lectotype specimen designated by Kupicha (*J. Burtt Davy 964*, K) was collected on 9 January 1904 by Joseph Burtt Davy on the road between Standerton and Ermelo north of a small stream, the Blesbokspruit, in heavy black loam soil. Brown (1907) honoured Burtt Davy in the specific epithet he used for the name. Burtt Davy was a prolific plant collector in South Africa in the early 1900s and first curator of the National Herbarium in Pretoria (PRE) which today houses about 6 000 of the more than 14 000 specimens he collected during his career (Glen & Germishuizen 2010). A digital image of the lectotype specimen is housed at Kew (Kew Catalogue 2012). The accompanying letter mounted with this specimen that Burtt Davy wrote to Brown reads as follows: "This appears to be an extremely local species; I have met with it but once, and then it was barely in flower—only two or three flowers were out, and as I was walking hurriedly up hill to catch a waiting wagon, I had no time to examine it closely, and just thrust it into my press. The exact locality is near Morgenzon on the coach road from Ermelo to Standerton, in heavy black clay-loam ('turf') in the Ermelo District. I am sending you a better specimen—the only one in flower. Thank you very much for the honour you give me by associating my name with this species; I am particularly pleased in this instance, for the finding of this plant was a particularly happy incident, cheering me up on a most trying trek. With kind regards, sincerely yours, Agrostologist and Botanist J. Burtt Davy".

The entire genus *Miraglossum* is restricted to southern Africa and particularly to the eastern part of the *Flora of southern Africa* (*FSA*) region. The species depicted here is endemic to Mpumalanga Province in South Africa (Figure 1). In its last assessment (2005) this taxon was listed as vulnerable (VU) on the Red List of South African plants (Lötter *et al*. 2012). This threat status is based on the small number of known populations and declining nature of the species as a result of habitat loss to coal mining, urban expansion and agriculture. *Miraglossum davyi* is a very rare plant—at PRE there are only seven specimens lodged and in other herbaria less than half a dozen specimens could be traced. It seems that populations have a low rate of producing fruit. Fruit are prone to infection of especially woolly aphids. This, coupled with the possible absence of successful pollinators, may have led to the decline in population size and is in need of further investigation.

One of us (SPB) has attempted on several occasions to re-locate plants from the lectotype locality without success. The natural area is heavily impacted by agriculture and cattle farming. Since the collection of this specimen in 1904, no other

material has come to light from either this locality or from between Carolina and Swaziland where the other syntype originated from.

In mid-January 2010 (which was a very dry season), a fruiting stem with a dry follicle and deflexed pedicel were collected on the farm Lunesklip 105JT, about 13 km northeast from Dullstroom on the main road to Lydenburg [Mashishing] in Mpumalanga Province. The same locality was revisited, earlier in the season, in January 2011 and the flowering plant, illustrated in the accompanying plate, was collected. The plants grew in reasonably gently sloping grassland with scattered quartzite outcrops. Flowering time is from November to January (mainly in December and January). The habitat on various herbarium sheets seen, indicate that the plants have a preference for open, rocky, reasonably high-altitude montane grassland. Plants grow in well-drained to moist or damp gravelly to humic or black clayey soils with a high organic content. Most specimens variously came from gentle to moderate hill slopes or plains, usually in annually burnt grassland and growing in full sun at altitudes of 1 700–1 840 m.

The description that follows is partly adapted from Kupicha (1984) and Müller *et al*. (2002), and from specimens housed at LYD, MO, PRE, and PRU.

Description.—Perennial geophytic herb. *Tuber* deep-seated, dry-fibrous, brown outside, white inside, cylindrical and elongated, 65–110 × 16–20 mm, neck ±60 mm long, unbranched (only a single specimen with 2 stems from the crown of a single tuber seen), aboveground parts deciduous, all parts with milky latex. *Stems* 320–610 mm tall, lanate. *Leaves* crowded and irregularly inserted on the non-flowering part of the stem becoming verticillate at the flowering nodes, internodes on fertile section of stem 27–42 mm long, 0.2–0.3 mm thick; leaves at flowering nodes only slightly reduced in size, usually only narrower; lamina 24–52 × 3–6 mm, linear to ensiform, acute at apex, base obtuse, margins strongly revolute, midvein 0.7–0.8 mm broad with revolute margin 0.5–1.0 mm broad; petiole to 2.0 mm long; both surfaces lanate, the indumentum adaxially and especially on lower midrib more dense, indumentum adaxial 0.1–0.2 mm and abaxial 0.2–0.4 mm thick (indumentum on adaxial side ± half as thick as on abaxial)(Figure 2a–c); midvein slightly sunk on adaxial and strongly expressed on abaxial side, base to 2 mm broad becoming less distinct towards apex, 0.5–0.6 mm thick. *Flowers* in sessile fascicles of 3–4 at the distal 2–7 nodes; pedicels 12–27 mm long and pendulous at anthesis; green, paler on outside, inside darker with brown to maroon blotches in longitudinal stripes sometimes alternating with some white stripes; calyx lobes 11.0–16.0 × 2.9–4.4 mm, bottom 2.2–2.7 mm fused, dorsally and ventrally densely lanate to pilose mixed with fine patent hyaline and brown adpressed hairs; pale blueish green; bracts 8.0–18.0 mm long, linear, pilose, pale brown. *Corolla lobes* 12.2–16.7 × 5.0–8.7 mm, ovate-lanceolate, membranous margin of corolla 0.4–0.5 mm thick spreading at anthesis; dorsal surface pilose with a mixture of patent hyaline and brown adpressed hairs, pale green outside and darker green inside with maroon to brown blotches or longitudinal striations or sometimes homogeneously green. *Corona* arising from base of staminal column, lobes 4.0–9.2 × 5.0–9.6 × 3.8–5.8 mm (wings included, excluding wings: body 2.0–4.4 mm broad), resemble the head of an African elephant, slightly compressed-ovoid



FIGURE 2.—*Miraglossum davyi*. Leaf: a, adaxial side; b, abaxial side; c, cross section through blade. Seed: d, ventral surface (left), dorsal surface (right). Follicle: e, surface showing lanate bristles; f, mature follicles (note the recurving pedicels). Voucher specimens: a–c, *Bester 10626*, National Herbarium, Pretoria; d, e, *Meyer 3*, H.G.W.J. Schweickerdt Herbarium, University of Pretoria, Pretoria; f, *Bester 11462*, National Herbarium, Pretoria. Scale: a–e, 0.5 mm; f, 10 mm. Photographs: S.P. Bester.

or square, fleshy, spreading into lateral wings, the wing and apical portion ± triangular in outline, basal concavity on the ventral face just above connection with staminal column; inner appendage triangular at base, with broadened base, 4.0–5.8 mm long, 0.3–0.8 mm in diameter, pointing towards the centre of the flower, apically fili-

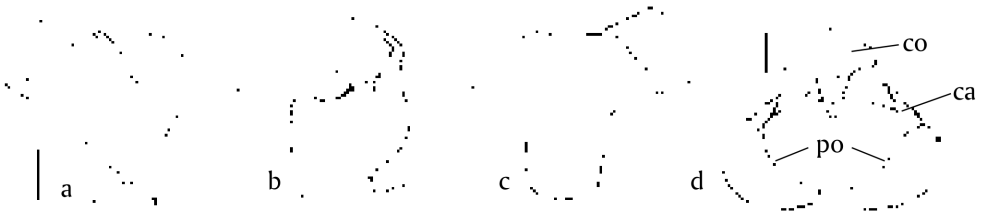


FIGURE 3.—*Miraglossum davyi* corona: a, ventral view; b, side view; c, dorsal view; d, pollinarium: ca = caudicle, co = corpusculum, po = pollinia. Voucher specimen: *Bester 10626*; in National Herbarium (PRE), Pretoria. Scale: a–c, 3 mm (at a); d, 0.5 mm. Artist: Gillian Condy.

form, bent outwards in a horizontal position on top of the lobe, free ends of the process tend to be dextrorse; cream sometimes finely blotched in pale purple (Figure 3a–c). *Gynostegium* 4.1–5.4 × 4.0–5.0 mm, style head 3.8–4.7 mm diameter. *Anthers*: wings 0.6–0.8 × 1.8–2.0 mm long, notched at base; appendages 0.8–1.5 × 1.3–2.0 mm long, flat; fused with style-head into a gynostegium. *Pollinarium*: corpusculum 0.4–1.4 × 0.2–1.3 mm, strongly winged, wings 0.2–0.3 mm long; pollinium 0.5–2.0 × 0.3–0.8 mm; caudicle 0.2–1.0 × 0.1–0.4 mm (Figure 3d); pollinia pendent. *Fruit* 63–80 × 8–10 mm, covered with bristles 2.5–8.0 mm long, bristles and fruit covered with dense white lanate indumentum; fruiting pedicel 20–32 mm long, elongated s-shaped retrorsely from attachment at node (Figure 2e–f). *Seed* 2.0–2.6 × 1.5–1.8 mm, ventral side concave and somewhat longitudinally rugose, dorsal side convex and irregularly rugose; coma white, 10–22 mm long (Figure 2d). Plate 2300.

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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 before any work is undertaken with a view to publication in *FPA*: The Editor, *Flowering Plants of Africa*, South African National Biodiversity Institute, Private Bag X101, 0001 Pretoria [Tel. 012 843 5000; Fax 012 804 3211]. E-mail: a.grobler@sanbi.org.za

AUTHORS

All plates published in Volumes 1–49, are listed in the *Index* published in 1988. There are, however, many 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** 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 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.

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.

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 are welcome to submit a list of quarter degree grid references from which the Editor's Office will produce the distribution map.
   - Ecology: habitat preferences etc. It is essential to submit a photograph of the plant in habitat.
   - 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.
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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 to ensure 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 far 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 plants(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.

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5. **Palaeoflora of southern Africa**: Molteno Formation (Triassic) Vol. 1, Introduction, *Dicroidium*; Prodromus of South African megafloras, Devonian to Cretaceous. Obtainable: A.A. Balkema Publishers, PO Box 1675, NL-3000 BR Rotterdam, The Netherlands. Molteno Formation (Triassic) Vol. 2. Gymnosperms (excluding *Dicroidium*). Three books published in the *Strelitzia* series (15, 20, 21).

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