

Flowering Plants of Africa

Volume 62

June 2011



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 147.

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History of this series

(note Afrikaans translation and changes in title)

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Flowering Plants of Africa

Cover illustration: *Ficus sur* (Plate 2268)

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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

G. Germishuizen

with assistance of

E. du Plessis and G.S. Condry

Volume 62



Pretoria
2011

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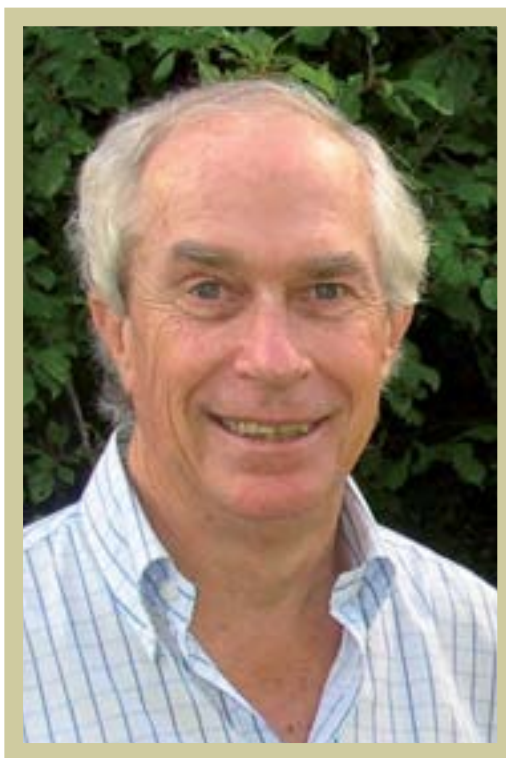
New taxa published in this volume

Plumbago hunsbergensis Van Jaarsv., W.Swanepoel & A.E.van Wyk, sp. nov., p. 89
Xysmalobium pedifoetidum Bester & Nicholas, sp. nov., p. 100

This volume is dedicated to

BRIAN JOHN HUNTLEY

First Chief Executive Officer of the National Botanical Institute, and later Acting Chief Executive Officer of the South African National Biodiversity Institute. Before that he was employed by the Foundation for Research Development, from which base in the late 1980s he played a pivotal role in establishing the Plant Systematics Stimulation Programme. As part of the Programme, 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, and the first field trip that took place under the auspices of the Stimulation Programme, was a joint collecting expedition to the vicinity of the Noodsberg highland range in the KwaZulu-Natal Midlands. One of the species treated and illustrated in this volume (*Aloe neilcrouchii*) was new to science and first collected and recorded during that historic expedition.



Later, while Brian headed the National Botanical Institute, the vision for the Systematics Stimulation Programme expanded significantly into the SABONET Project, which more broadly benefited conservation, taxonomy and horticulture throughout the subcontinent, and beyond. During a career spanning over 40 years Professor Huntley made numerous visionary contributions to biodiversity conservation, the development of botany, horticulture, and botanical art in southern Africa, and influenced the careers of scores of biodiversity specialists.



PLATE 2261 *Baeometra uniflora*

Baeometra uniflora

Colchicaceae: Anguillarieae

South Africa

Baeometra uniflora (Jacq.) G.J.Lewis in South African Journal of Botany 7: 59 (1941). *Melanthium uniflorum* Jacq.: 100 (1791). *Kolbea uniflora* (Jacq.) Harv.: 354 (1838). *M. aethiopicum* Desr. in Lam.: 29 (1797). *B. columellaris* Salisb.: 330 (1812), nom. illegit. superfl. pro *M. uniflorum* Jacq. *M. flavum* Smith in Rees (1819), nom. illegit. superfl. pro *M. uniflorum* Jacq. *Kolbea breyniana* Schltldl.: 82 (1826), nom. illegit. superfl. pro *M. uniflorum* Jacq. *Jania breyniana* (Schltldl.) Schult.f.: 1528 (1830), nom. illegit. *Baeometra breyniana* (Schltldl.) Voigt: 647 (1845), nom. illegit. *B. breyniana* (Schltldl.) Baill.: 588 (1894), nom. illegit.

Brilliant orange or sulphur-yellow flowers with a dark eye make the beetle lily, *Baeometra uniflora*, instantly recognisable among all other Colchicaceae. Endemic to the extreme southwestern Cape, this little geophyte is relatively commonly encountered on clay or loamy soils in spring, from Tulbagh southwards through the Swartland and Boland to the Cape Peninsula and thence eastwards through the Overberg as far as Swellendam and Riversdale (Figure 1). Plants favour open, seasonally damp or waterlogged situations and are often found in lightly disturbed areas on road verges, along paths and in meadows, typically at lower altitudes in moist-temperate situations. Flowering is from August to October. Its readiness to colonise road verges and lawns makes the species an attractive subject for cultivation in suitable climates but does suggest a propensity for naturalisation unless carefully controlled, as it has indeed already done in Western Australia (Hewson 1987).

Baeometra uniflora, like all related cormous members of Colchicaceae tribe Anguillarieae, is adapted to seasonal drought. In nature, the plants sprout in winter with the onset of the rainy season, coming into flower in spring. The flowers are sensitive to temperature, opening fully only on warm, sunny days, when their bright colour and contrasting dark eye are especially striking. Each flower lasts several days, after which the tepals drop off to expose the rapidly enlarging ovary. The capsules mature slowly and are ready to shed seeds only in late summer (December). Like most mem-

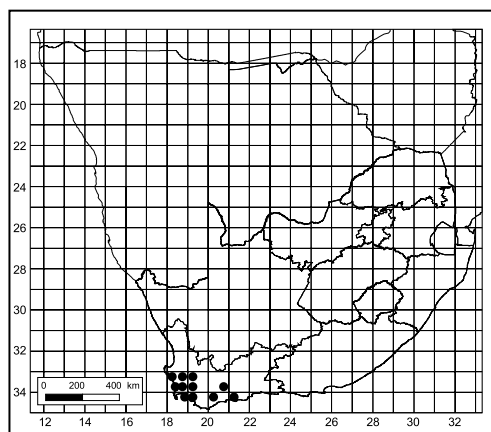


FIGURE 1.—Known distribution of *Baeometra uniflora*, based on specimens in the Compton Herbarium, Kirstenbosch, and on additional material cited by Baker (1897).

PLATE 2261.—1, flowering stem, $\times 1$; 2, whole plant with corm, $\times 1$; 3, top view of flattened flower, $\times 1$; 4, capsules and seeds, $\times 1$. Voucher specimen: Manning 3190 in Compton Herbarium, Kirstenbosch. Artist: Gillian Condry.

bers of the family, the woody fruits are septicidally dehiscent, splitting open along the joints between the locules. They dehisce only in the upper quarter, and the seeds are thus shed slowly over a long period of time as the dry stalks are shaken by the summer winds.

The flowers resemble those of several other geophytes in the southwestern Cape in their colour and markings, especially *Ixia curta* and *I. maculata* (Iridaceae) and *Ornithogalum dubium* (Hyacinthaceae). These species are among several in the Cape that are adapted to pollination by monkey-beetles (Scarabaeidae: Hopliini), which are drawn to the dark markings on the perianth, presumably by their resemblance to a potential mate (Goldblatt *et al.* 1998). The relatively large size of the flowers of *Baeometra*, their firm-textured, yellow or orange perianth with maroon centre, and their lack of fragrance or nectar are all consistent with pollination by flower-visiting monkey beetles. Pollination of the species by these insects was first suggested by Manning *et al.* (2002) and has now

been confirmed by observations made in September 2009 (Manning unpublished) of plants at Elandsberg Nature Reserve near Tulbagh, which were well visited by the beetle *Peritrichia abdominalis* (Figure 2). The species appears, however, to be self-fertile as all capsules invariably develop fully, with a full complement of fertile seeds. It is thus evidently only a facultative outcrosser.

Although not specifically identified as such, *Baeometra uniflora*, like other members of Colchicaceae, is almost certainly poisonous to humans. We can find no evidence that it has been used medicinally.

Originally treated in a broadly circumscribed Liliaceae, it was soon evident that the relationships of *Baeometra uniflora* lay with *Wurmbea* and allied genera, and it was accordingly included in the family Colchicaceae (Nordenstam 1998) following the splitting of Liliaceae *sensu lato* (Dahlgren *et al.* 1985). Although its affinity to *Wurmbea* and allied cormous genera from the southwestern Cape was clear, *Baeometra* was until recently treated in its own tribe Baeometreae on account of its racemose inflorescence with pedicellate lower flowers associated with a narrow bract. This inflorescence structure appeared to be intermediate between the bractless spikes of *Wurmbea* and allied genera, and the leafy racemes characteristic of the rest of the

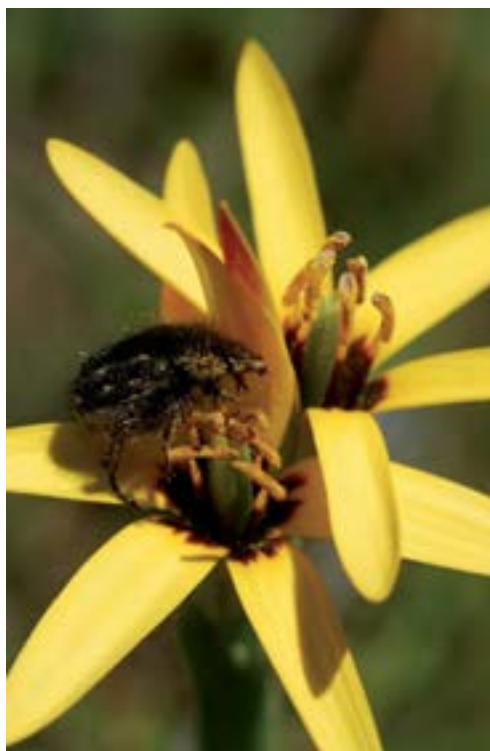


FIGURE 2.—*Peritrichia abdominalis* covered with pollen on flower of *Baeometra uniflora*. Voucher specimen: Manning 3190 in Compton Herbarium, Kirstenbosch. Photographer: John Manning.

family (Buxbaum 1936). Recent phylogenetic analysis of DNA sequence data places *Baeometra* as sister to the spicate genera of tribe Anguillarieae (*Wurmbea*, *Neodregea* and *Onixotis*). The spiciform inflorescences in these genera are morphologically condensed scorpioid cymes (Nordenstam 1998). The foliar organs associated with the lower one or two flowers in *Baeometra*, traditionally regarded as floral bracts, were reinterpreted by Garside (1935) as representing reduced stem leaves, which approach the lower flowers and thus appear as bracts. If this is indeed the situation, then the flowers of *Baeometra*, like those of *Wurmbea*, are strictly ebracteate.

Following the consolidation of *Neodregea* and *Onixotis* into the single genus *Wurmbea* (Vinnersten & Manning 2007), it seemed redundant to retain two monogeneric tribes, especially as the supposed difference in inflorescence structure between the two tribes was in doubt, and *Baeometra* was accordingly included with *Wurmbea* in an expanded circumscription of Anguillarieae (Vinnersten & Manning 2007). *Baeometra* differs from *Wurmbea sensu lato* (= *Neodregea*, *Onixotis*) in its several (> 3) leaves, pedicellate lower flowers, orange perianth lacking perigonal nectaries, and in its elongate, columnar ovary and capsule. Outgroup comparison suggests that the lack of nectaries is a specialised condition, and the unusual perianth colour and the absence of nectar are best interpreted as linked character states that facilitate beetle-pollination.

The nomenclatural confusion that bedevilled the early history of *Baeometra uniflora* was unravelled by Lewis (1941). Until then it had been generally known under the invalid name *Baeometra columellaris*. The first definite reference to the species comes in the second edition of Linnaeus's *Species plantarum* (1762) under the name *Tulipa breyniana* L. This name, which dates from the first (1753) edition, was based solely on an inadequate illustration in Breyne (1678), which is now understood to represent an unidentifiable species of *Moraea* in the *Homeria* group of species (Goldblatt 1981). Linnaeus evidently saw a specimen of *Baeometra* for the first time after the publication of the first edition of the *Species plantarum* and confused this plant with his *T. breyniana* since by the second edition he had emended his brief diagnosis with appropriate details of the foliage and flowers that are unequivocally at odds with Breyne's plate. Following this revised description, and possibly with recourse to a clearly labelled herbarium specimen (LINN425.3), subsequent authors accepted the application of the name *T. breyniana* to the present *Baeometra*, with the signal exception of Nicolaas Jacquin, who illustrated the species under the name *Melanthium uniflorum*. Jacquin subsequently observed that his choice of epithet was singularly unfortunate since the species seldom has only one flower (Ker Gawler 1804), provoking Smith (Rees 1819) to formalise Ker Gawler's common name, yellow melanthium, as the nomenclaturally superfluous *Melanthium luteum*. Jacquin's *uniflorum* is, however, undisputedly the earliest available name for the species in question, although European botanists (Schlechtendal 1826; Voigt 1845; Baillon 1894; Durand & Schinz 1895) persisted in misapplying Linnaeus's epithet to it. British botanists, in contrast, adopted Jacquin's name (Ker Gawler 1804) until Salisbury (1812) provided the new name *Baeometra columellaris* for the taxon.

After its initial placement in the genus *Tulipa* by Linnaeus (1762), *Baeometra uniflora* was treated in the genus *Melanthium* (Melanthiaceae) [along with the species

of *Wurmbea* then known] until Salisbury (1812), and later Schlechtendal (1826), realised that it was misplaced here. They respectively proposed the monospecific genera *Baeometra* and *Kolbea* to accommodate it. Schlechtendal was the first author to apply the epithet *breyneana* in its modern context (i.e. excluding the Breyne type) outside *Tulipa* when he used it in his new genus *Kolbea*. He was thus in effect applying the epithet to a new taxon and is to be credited with sole authorship of the name in this sense. Although Harvey (1838) first treated the species in *Kolbea*, providing the combination *K. uniflora*, he subsequently (Harvey 1868) reverted to Salisbury's *B. columellaris*. Mabberley (1980) has correctly pointed out that at the time of its appearance *Baeometra* was technically unpublished in lacking a description (McNeill *et al.* 2006: Art. 32.1), and was thus only validated much later (Endlicher 1836). Both *Kolbea* Schltld. (1826) and *Jania* Schult. & Schult.f. (1830) are thus nomenclaturally earlier than *Baeometra* but the former is orthographically too close to *Kolbia* Adans. (1763) and must be treated as a later homonym and the latter is a direct later homonym of *Jania* J.V.Lamour. (1812) (McNeill *et al.* 2006: Art. 53.3). *Baeometra* thus remains the earliest legitimate generic name for the taxon. The nomenclatural issues are summarised below.

Baeometra Salisb. ex Endl.: 136 (1836) [*Baeometra* Salisb.: 330 (1812), nom. nud.] [*Baeomitra* sphalm. Harv. (1868)]. Type species: *Baeometra columellaris* Salisb. (= *Baeometra uniflora* (Jacq.) G.J.Lewis). *Kolbea* Schltld.: 80 (1826), hom. illegit. non *Kolbia* Adans. (1763) [Ericaceae]. *Jania* Schult.f.: 1528 (1830), hom. illegit. non *Jania* J.V.Lamour. (1812) [Rhodophyceae].

Despite its attractive appearance, ease of cultivation and availability in the trade (Bryan & Griffiths 1995), *Baeometra uniflora* is poorly known in horticulture. This is despite an early introduction into cultivation in both continental Europe (Jacquin 1791) and in England (Ker Gawler 1804), where it was introduced by the nurseryman William Salisbury. The species also numbered among several South African plants introduced into cultivation in the Calcutta gardens of the British East India Company in 1841 (Voigt 1845). A plant from Salisbury's nursery at Queen's Elm, Brompton, which he held in partnership with William Curtis (Desmond 1994), was illustrated in *Curtis's Botanical Magazine* (Ker Gawler 1804) under the common name yellow melanthium, but this name was not taken up into general use and the name beetle lily, which was recently coined for the species (Goldblatt & Manning 2000; Manning *et al.* 2002), is gaining popularity.

Horticulturally, *Baeometra uniflora* should be treated like other Mediterranean bulbs, and cultivated in a bright situation in well-draining sandy loam. In its native habitat the species seldom or never experiences frost during the growing season and Bryan & Griffiths (1995) report that it is frost-tender. Salisbury (1812), however, found it not to be so in his London nursery, although flowering in the species was more luxuriant '...with a little artificial heat'. The species should be grown under cool temperate conditions, with a moist winter growing season and pronounced summer dormancy. It is amenable to pot culture but in cooler climates may be grown in summer in a border, to be lifted in autumn. Water the plants plentifully during growth but withhold water after flowering to allow them to enter summer dormancy. Plants set plentiful seed, which should be sown in autumn (March in the southern hemisphere).

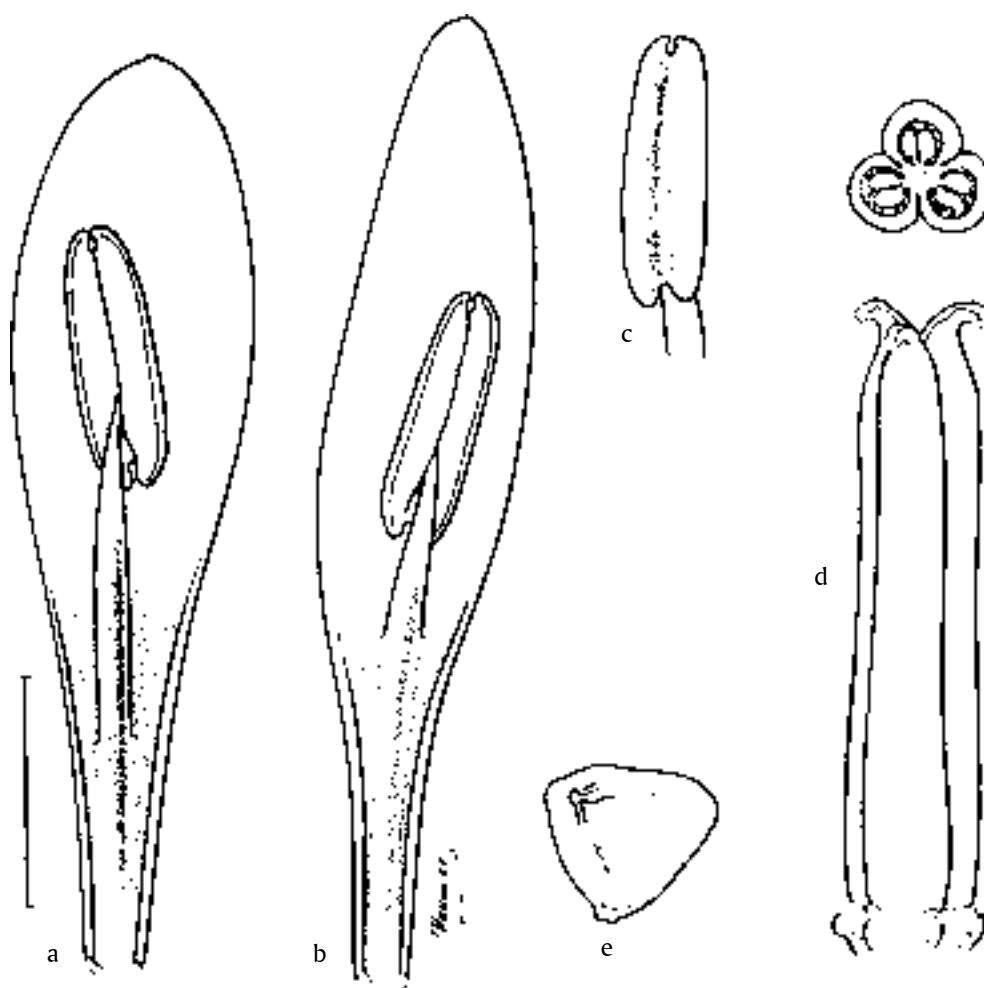


FIGURE 3.—a, outer tepal; b, inner tepal; c, adaxial surface of anther; d, ovary, and in transverse section; e, seed. Scale bar: a–d, 1 mm; e, 2 mm. Voucher specimen: *Manning 3190* in Compton Herbarium, Kirstenbosch. Artist: John Manning.

In the southwestern Cape, the species should naturalise well in wild places in the garden. We know of yards where it has colonised unkempt grassy areas away from intensive cultivation and watering, and cannot see why it should not thrive in similar situations elsewhere where suitable climates or conditions exist, especially in rockeries where drainage is good.

Description.—Deciduous geophyte, (50–)100–300 mm. *Corm* obliquely ovoid with small, crescent-shaped basal ridge, 5–10 mm diam.; tunics dark brown, leathery. *Leaves* 5–8, mostly congested in a basal fan but only lowermost truly basal, narrowly lanceolate-attenuate, canaliculate, largest with blade 100–300 × 5–10 mm, stem-clasping at base, uppermost almost entirely sheathing. *Inflorescence* racemose or subspicate, 1–5-flowered, lower flowers shortly pedicellate on stout pedicels 2–10 mm

long, upper flowers successively more sessile, lowermost 1 or 2 flowers only with associated bract, remainder ebracteate; bracts thread-like or awl-shaped, lowermost largest, up to 25×1 mm. *Flowers* suberect, unscented, yellow to orange flushed red on reverse with tepal claws dark maroon adaxially; tepals free, $\pm$ erect below and flaring above, oblanceolate, $15\text{--}28 \times 3\text{--}5$ mm, narrowed below into channelled claw $3\text{--}12$ mm long, abscising after flowering. *Stamens* adnate to tepal claw; filaments filiform, free parts ± 3 mm long, dark maroon; anthers $2\text{--}4$ mm long, dorsifixed, latrorse, yellow. *Ovary* cylindrical and 3-lobed, $7\text{--}10$ mm long, with 3 short, hooked styles ± 0.5 mm long, green. *Capsule* septicidal, cylindrical and 3-lobed, $30\text{--}50$ mm long, woody, dehiscing only in distal quarter. *Seeds* subglobose but angled by pressure, $1.0\text{--}1.5$ mm diam., reddish brown, testa finely reticulate. Plate 2261. Figure 3.

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Aloe neilcrouchii

Asphodelaceae: Alooiidae

*KwaZulu-Natal, South Africa**Aloe neilcrouchii* Klopper & Gideon F.Sm. in *Bothalia* 40: 117–120 (2010).

Plant systematics in South Africa has been fortunate in having benefited from a Plant Systematics Stimulation Programme designed by members of that community in collaboration with the former Foundation for Research Development (FRD), forerunner of the National Research Foundation (NRF) (Smith *et al.* 1996). Professor Brian J. Huntley, who was to become the first Chief Executive Officer of the National Botanical Institute, was employed by the FRD at the time; he played a pivotal role in establishing the stimulation programme. This paper, and this volume, are respectfully dedicated to him.

Following the in-depth taxonomic works of Reynolds on South African (1950) and tropical African and Madagascan (1966) species of *Aloe*, it was widely thought that nearly all representatives of this predominantly African group had been described. However, new species are constantly being discovered and described from throughout the range of this spectacular genus. Even South Africa—the country in which Reynolds spent his entire working life—and one comparatively well botanised in comparison to other more remote and inaccessible *Aloe*-rich regions, has yielded much since Reynolds' landmark works.

Recently, renewed interest in *Aloe* has been sparked partly by the broadly supported *Aloes of the World* project. One of its aims is to build a comprehensive web-based electronic facility on the genus (Smith *et al.* 2008a, b, c), in essence a scholarly resource for aloecologists working across the globe. While various books and taxonomic treatments on South African aloes have appeared in print subsequent to Reynolds's works, one particular group, the broadly conceived grass aloes, has benefitted additionally. This has been through Charles Craib's 2005 volume which focussed on the South African representatives of this previously neglected subset of the genus (Smith 2005).

When first encountered in its most pristine form in its natural habitat, one would be forgiven for mistaking *Aloe neilcrouchii* (Plate 2262) for a hybrid between a grass aloe and *Aloe marlothii*. The reason is simple: it usually grows as a large, erect, multibranched plant with large rosettes consisting of erect to recurved or rarely even drooping leaves. In habitat at the type locality the plants are often shrouded in low clouds and mist, under which conditions they appear almost ghost-like, with their erect, leaf-tipped branches somewhat resembling outstretched arms.

PLATE 2262. —1, habit, much reduced; 2, raceme, $\times 1$; 3, fruits, $\times 1$. Voucher specimen: Smith, Crouch & Johnson 1 in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2262 *Aloe neilcrouchii*

One of us (GFS) first observed material of *Aloe neilcrouchii* between 8 and 15 October 1989 during the first collecting trip arranged under the auspices of, and partly sponsored by, the then FRD as part of the Plant Systematics Stimulation Programme. This excursion, led by Professor Abraham E. (Braam) van Wyk of the University of Pretoria, centred on the Noodsberg of the KwaZulu-Natal Midlands, a range situated alongside the lower Thugela River and west of Stanger, $\pm$ 50–60 km northwest of Durban. On that occasion these plants were mistaken for robust forms of *Aloe boylei*. These two taxa certainly appear to be most closely related, but differ in that *A. boylei* (including *A. boylei* subsp. *major*) remains virtually stemless (with stems at most $\pm$ 100 mm long) and does not take on the morphological dimensions generally attained by *A. neilcrouchii*. The latter differs from *A. boylei* by its long, sprawling, leafless stems that branch from the base or as offshoots along its length, in bearing shorter but broader, elongate-deltoid leaves that are copiously covered with white tuberculate spots on both surfaces, and taller inflorescences that bear slightly longer flowers.

Many years were to pass before the species resurfaced as part of material collected on heights near Karkloof in KwaZulu-Natal by Prof. Neil R. Crouch and Ms Isabel Johnson, both of the South African National Biodiversity Institute. Plants were initially found in a near-leafless, singed state following an early spring veld fire. This exposed their branched stems, revealing a length ($\pm$ 1 m) and robustness hitherto unknown amongst the grass aloes. A return to the site in mid-January 2009 was rewarded with the sight of hundreds of aloes in full bloom; honey bees (*Apis mellifera scutellata*) were observed visiting the flowers and collecting pollen, but no other potential pollinators, such as sunbirds, were noticed. General seed set seems to be fairly good as plants of various sizes were observed up to several kilometres away. One of the authors (NRC) then brought this novelty to the attention of two of us (GFS and RRK). It was recognised as the long-lost KwaZulu-Natal Midlands plant and we described it as new. Quite evidently, the fire intensity prevalent in this undisturbed habitat is low enough not to destroy the plants themselves. Indeed, it seems likely that fire stimulates branching of young stems as well as offshoot production. Although *Aloe boylei* plants in habitat are similarly exposed to natural fire events, they appear unable to respond in the same vegetative manner: whereas more offshoots may be formed and thus clumps formed following annual burns, aerial stem branching is not induced.

Perhaps more so than with any other grass aloe recently described from South Africa, *Aloe neilcrouchii* confirms that, at least for identification purposes, the group of grass aloes could be usefully divided into two groups: the graminialoes and the leptaloos. The former includes the true grass aloes, i.e. the truly very small species, with leaves closely resembling blades of grass, that have in the past indeed been segregated in a formal taxonomic group, *Aloe* sect. *Graminialoe* Reynolds. The latter includes the much more robust, broad-leaved leptaloe species of *Aloe* sect. *Leptaloe* A.Berger. Both the true grass aloes and the leptaloos are sometimes placed in one broadly circumscribed *Aloe* sect. *Leptaloe*, reflected in recent taxonomic literature (Glen & Hardy 2000).

The material illustrated here was collected on 5 January 2010 from the type locality by two co-authors of this paper (GFS and NRC) and Ms Isabel Johnson of the KwaZulu-Natal National Botanical Garden in Pietermaritzburg. *Aloe neilcrouchii* grows there at 1 750 m on southeast-facing slopes of Drakensberg Foothill Moist Grassland (Mucina *et al.* 2006), in near-pristine rocky grassland (Figure 1). The population was found in full bloom, amidst a massive sward of flowering *Agapanthus campanulatus* and thousands of post-flowering bulbs of *Merwillia plumbea*. Other plants in the vicinity included the high-altitude fern *Blechnum inflexum*, as well as *Alepidea cordifolia* (Apiaceae) and *Senecio oxyriifolius* (Asteraceae).

Sadly, much of the known natural habitat of *Aloe neilcrouchii* in the KwaZulu-Natal Midlands has been transformed, largely by commercial tree plantations and sugar-cane plantations. Today, the species survives only in small pockets of comparatively undisturbed veld in one protected area, and near watercourses on farms in private hands.

Description.—Grass aloe. *Stem* up to 950 × 90 mm, decumbent to erect, branched mainly from base, forming robust offshoots along its length, without persistent dried leaves. *Leaves* deciduous, densely rosulate, erectly spreading, deltoid to ovate-lanceolate, up to 430 mm long, up to 135 mm wide at base, green, with numerous elongate, white, somewhat tuberculate spots on both surfaces; margin narrow, cartilaginous, whitish, with small whitish, deltoid, irregularly spaced teeth, 1–2 mm long, 2–5 mm apart. *Leaf sap* clear, drying clear, not bitter. *Inflorescence* erect, simple, 1 per rosette, 0.6–0.8 m high. *Peduncle* laterally compressed below, terete above, up to 25 mm wide at base, ± 10–15 mm diam. above, bright green; sterile bracts ± 9, ovate-lanceolate, acuminate, 30–50 mm long, 15–20 mm wide at base, pale whitish with pinkish tinge, thin, subscarious, many-nerved. *Raceme* capitate, ± 120 × 100 mm, erect, dense; buds erect to erectly spreading, flowers spreading to nodding when open. *Floral bracts* lanceolate-acuminate, subamplexicaul, ± 30 × 7 mm, pale whitish, thin, subscarious to almost fleshy, many-nerved. *Pedicels* 30–45 mm long, pale yellowish to salmon-pink. *Flowers* cylindric-trigonous, ± 45 mm long, 10–13 mm

across ovary, slightly narrowed above ovary to 8–10 mm, slightly constricted to ± 7 mm just before flared mouth, salmon-pink, green-tipped; outer segments free almost to base, tips spreading. *Stamens* with very pale greenish yellow, flattened filaments, not or only slightly exerted. *Ovary* ± 10 × 3–4 mm, light green; style very pale yellowish green, exerted by ± 5 mm. *Fruit* an oblong capsule, bright green to yellowish green, up to 40–45 × ± 22 mm. *Seeds* angular, black, 3 × 2 mm, with semitransparent, light brownish wing, ± 1 mm wide. *Flowering time*: December to February. *Chromosome number*: unknown. Plate 2262.

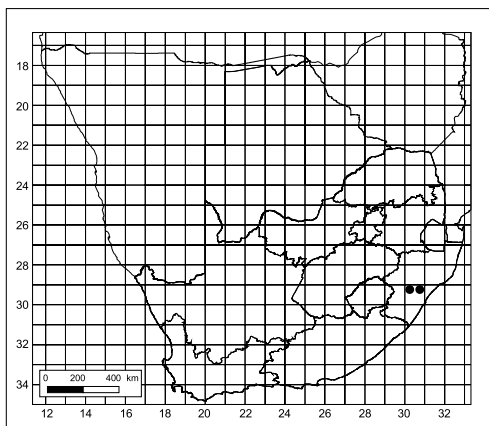


FIGURE 1.—Known distribution of *Aloe neilcrouchii*.

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Aloe nicholsii

Asphodelaceae: Aloodeae

*KwaZulu-Natal, South Africa**Aloe nicholsii* Gideon F.Sm. & N.R.Crouch in *Bradleya* 28: 103–106 (2010).

The publication in 2005 of Charles Craib's volume on the grass aloes of South Africa stimulated much interest, both academic and otherwise, in this subset of fascinating alooids. Craib's consolidated work, in conjunction with interest rekindled by the *Aloes of the World* project (Smith *et al.* 2008) and various popular books on aloes of southern Africa, has better contextualised four South African grass aloes described during the past decade—in chronological order, *A. craibii*, *A. challsii*, *A. neilcrouchii* and *A. nicholsii* (Smith 2003; Van Jaarsveld & Van Wyk 2006; Klopper & Smith 2010; Smith & Crouch 2010). Formal groupings within the genus *Aloe* have placed the grass aloes in *Aloe* sect. *Graminialoe* and *A.* sect. *Leptoaloe* (Berger 1908; Reynolds 1950) based essentially on their growth form. At times, though, the true grass aloes (*Aloe* sect. *Graminialoe*) have been included with the leptaloos in a broadly circumscribed *Aloe* sect. *Leptoaloe* (Glen & Hardy 2000). All four of the aforementioned new species fall in section *Leptoaloe*, the set that is considerably more robust and broad-leaved than plants of section *Graminialoe*, with their very small stature and more narrow grass-like character. One wonders then what novelties await discovery in that even more cryptic section!

Unlike most other regional members of the genus *Aloe*, which now totals some 160 taxa in the *Flora of southern Africa* region (Glen *et al.* 2004), many of these grass-like species are fully deciduous and flower in the moist summer months rather than the dry winters typical of their natural range. While most are small, and some—such as *Aloe minima*—truly diminutive, the recently described leptaloe, *A. neilcrouchii* (see Plate 2262, this volume), is larger even than most maculates, with old mature specimens weighing in at over 25 kg! In common with the subject of the current account, it hails from the ever-diminishing and sadly degrading grasslands of KwaZulu-Natal.

Our present subject, *Aloe nicholsii*, is known from somewhat further north than *A. neilcrouchii*, from the vicinity of Babanango near Nkandla in Zululand (Figure 1), where it was discovered in 1999. Mr Geoff Nichols, for whom this species was named, made the first recorded collection along the road verge between Eshowe and Babanango during the peak flowering period in February. His label annotations reveal that small flowering clumps were then frequent along that stretch of the R68. The Nichols specimen, with its narrow leaves and distichous leaf arrangement, was at first mistaken for *A. linearifolia*, but its novelty was recognised by Prof. Trevor Edwards, then Curator of the Natal University Herbarium, and referred for description. Although Reynolds (1950: 141) had earlier noted that 'near Babanango

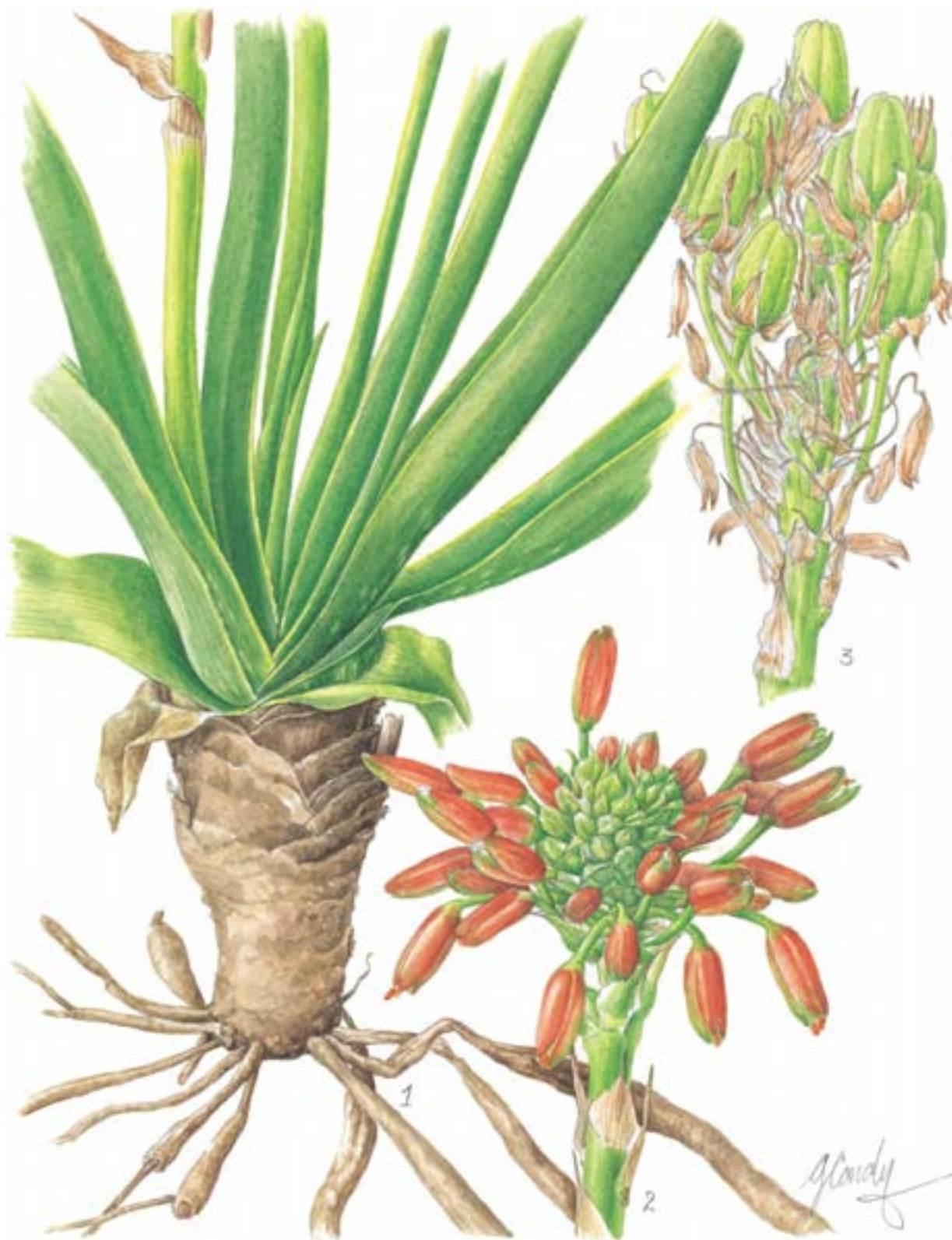


PLATE 2263 *Aloe nicholsii*

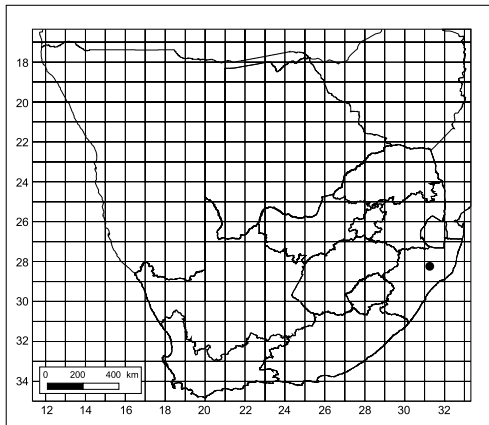


FIGURE 1.—Known distribution of *Aloe nicholsii*.

in Zululand, a form [of *A. linearifolia*] more robust than the typical is found' the plants to which he referred are doubtfully of this new species—we have been unable to trace any such specimens at the National Herbarium. Further, had Reynolds seen *A. nicholsii* flowering near Babanango, he would most certainly have distinguished it on flower colour alone.

In follow-up, four trips were made to the region during the flowering seasons of 2009 and 2010. Though none yielded a single plant alongside the vegetatively degraded verge of the R68, a population of about 80 individual

plants or clumps found in 2002 by Mr Gareth Chittenden of Eshowe was shown by him to one of us (NRC). At present, this is the last known locality for the species; Mr Chittenden had earlier successfully negotiated the preservation of the site with a local forestry concern, for he too had recognised the uniqueness of the plants. A broader search for other subpopulations of this distinct grass aloe is clearly necessary, particularly in the nearby Ophate Game Reserve which conserves similar grassland habitat—Northern Zululand Sourveld (SVI 22) (Mucina *et al.* 2006). In the interim, the Red List status of the species should appropriately be regarded as Data Deficient, despite the fact that the only known surviving plants occur in an area of $\pm 2\,000\text{ m}^2$, on a grassland island in the midst of extensive wattle and gum plantations. Unnoticed initially, this *Aloe* species seems to have been taken by man to the very verge of extinction, requiring the intervention of one determined individual to allow us a sighting, perhaps yet brief.

Aloe nicholsii has its closest affinities with *A. kraussii* Baker (*sensu* Reynolds 1950), from which it may immediately be separated on account of its distinctive flower colour. Flowers of *A. kraussii* are invariably lemon-yellow or yellow, with green tips, while those of the Babanango species are a distinct metallic salmon-pink colour above and green below. The flowers of the latter are also lightly pruinose and slightly smaller, with anthers that are exserted to a lesser degree and filaments that remain included. Plants of *A. nicholsii* tend to form clumps of up to 40 heads, each stem attaining a length of up to 140 mm, although most are about 60 mm long. In contrast, *A. kraussii* plants are solitary or present in clumps with fewer than 10 heads; each of these are acaulescent, or with stems shorter than 50 mm. In the general vicinity of the type locality one may encounter the unkeeled-leaf form of *A. cooperi*, an earlier-flowering grass aloe in that region that bears much longer and more orange flowers. Plants of this larger species are not fully sympatric with *A. nicholsii*, nor are hybrids evident.

The plant figured here was gathered from the Babanango type locality in mid-February 2010, at an altitude of nearly 1 300 m.

Description.—Grass aloe, small to medium-sized, herbaceous, slow-growing, succulent, perennial, total height excluding inflorescence $\pm$ 300–360 mm, usually clumped, up to 40 heads, sometimes solitary, a single head at midrosette up to 160 mm diam. *Roots* cylindrical when young, becoming fusiform with age, central portion 8(–10) mm diam. *Stems* short, erect, stout, $\pm$ 60(–140) mm long, 20–45 mm diam. *Leaves* 9–15, distichous becoming semirosette, not persistent when dry, narrowly linear-attenuate, tapering to apex, 200–460 mm long, 20–53 mm broad at base, basally sheathing, flaccidly spreading; upper surface distinctly and consistently concave, canaliculate, midgreen to light yellowish green, occasionally with few scattered white spots towards base, smooth; lower surface convex, midgreen to light yellowish green, scattered white spots common towards base; margins with a coarse, faintly ivory-coloured edge, marginal teeth $\pm$ absent, if present, tiny, widely spaced, harmless, triangular, ivory-coloured to greenish white, $<$ 0.5 mm long towards base of leaf, becoming increasingly smaller towards tip of leaf, 5–10 mm distant, $\pm$ unevenly and widely spaced; dry leaf sap translucent. *Inflorescence* an unbranched raceme, 300–460 mm tall, as tall as or exceeding height of rosette; each rosette producing up to 3 racemes; peduncle sparsely sterile bracteate, denser towards apical part of inflorescence; bracts varying from thickened, somewhat fleshy, light yellowish green with very broad, white margins to light salmon-brown, papery, central part same colour as peduncle when succulent, many-nerved, 18–170 mm long, 10 mm broad at base, tapering to sharp, harmless tip. *Peduncle* basally plano-convex, cylindrical above, 260–360 mm long, 6–8 mm broad at base, light yellowish green, dusty bloom lacking. *Racemes* densely capitate, flowering portion 30–35 mm long, 50–60 mm diam.; buds erect to suberect, congested at apex, lowest open flowers suberect to horizontal. *Floral bracts* amplexicaul around pedicel, large, 10–26 mm long, light yellowish green, somewhat fleshy, to salmon-brown, papery, with 4–7 prominent midgreen or light brown nerves. *Pedicels* 25–30 mm long, light green. *Flowers* zygomorphic, unscented, small, 13–16 mm long, slightly stipitate at base, tubular-cymbiform, lightly pruinose, tricoloured, salmon-pink above, greenish below, tip extremity purplish brown, enlarging towards throat and forming a very slightly open, distinctly upturned mouth; buds similar to open flowers, 5 mm diam. in middle; buds and flowers not trigonously or cylindrically indented above ovary; outer segments larger than inner segments, lorate to long-triangular, free for most of their length, basally fused for $\pm$ 0.5–1.0 mm, free portion with a prominent central nerve, borders the same colour as tepal blade, acute, segment margins folded lengthwise, apex slightly incurved; inner segments narrower than outer, with yellowish white border and more obtusely spreading apex, free for most of their length. *Stamens* 6, hypogynous; filaments cylindrically thread-like to very slightly flattened, light yellow, 11–13 mm long, all 6 of $\pm$ equal length, not exerted; anthers small, 1 mm long, bright orange, versatile, included or only very slightly exerted. *Ovary* 3–5 mm long, 2 mm diam., light green; style short, 8 mm long; stigma small, becoming exerted during female phase of flower, minutely capitate. *Fruit* an erect, bright green, trilobular capsule, cylindrical, 17–19(–22) mm long, 9–10 mm diam., apically truncate, dry remains of tepals persisting around fruit for a long time, dehiscing loculicidally, chartaceous to woody when dry. *Seeds* dark greyish brown, angled, laterally compressed, with off-white wing stretching around periphery of seed, 2.5–3.0 mm long. *Flowering time*: January to March, peaking in February. *Chromosome number*: unknown. Plate 2263.

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Prototulbaghia siebertii

Alliaceae

South Africa

Prototulbaghia siebertii Vosa in *Caryologia* 60: 277 (2007).

Tulbaghia is a small genus of the Alliaceae, but is the largest of the family in southern Africa, with some 30 species distributed throughout the warm temperate regions of the subcontinent (Vosa 1975, 2000). South Africa accommodates about 20 indigenous species (Germishuizen *et al.* 2006), of which six species and cultivars have been recorded in cultivation (Glen 2002). The only other genera of the Alliaceae found in southern Africa are *Allium* with a single representative, the highly polyploid *A. dregeanum* (Germishuizen *et al.* 2006), and *Prototulbaghia*, a monotypic genus represented by *P. siebertii* (Vosa 2007).

Prototulbaghia, as the name implies, is a possible precursor in the evolution of *Tulbaghia* from an *Allium*-like ancestor as is evident from its intermediate floral character states. Its flowers show some resemblance to those of *Tulbaghia* and *Allium*, but some features are also reminiscent of certain genera from South America, notably *Leucocoryne* and *Tristagma*. It is hypothesised that the resemblance to South American taxa may be due to parallel/convergent evolution. This hypothesis is especially meaningful in terms of the biogeography of Sekhukhuneland where the species is endemic, a region geographically so far removed from the current distribution of the South American taxa that a close phylogenetic link appears rather unlikely (Figure 1). Sekhukhuneland, and in particular the high-altitude parts of the Leolo Mountains to which our species is confined, is considered to be a refuge for taxa that were presumably widespread in southern Africa during previous cooler and wetter climatic conditions. These taxa, many which form part of the so-called Afromontane floristic element, have subsequently evolved independently due to geographic isolation (Siebert & Van Wyk 2005).

Sekhukhuneland is considered one of several local centres of plant endemism in southern Africa (Van Wyk & Smith 2001). Especially its main mountain range, the Leolo Mountains, is well known for the discovery of several endemic plant species in recent years (Hurter & Van Wyk 2005; Winter & Van Jaarsveld 2005). This high level of endemism correlates with the geological substrate, consisting specifically of norite and pyroxenite rock (Siebert *et al.* 2001).

But what makes the Leolo Mountains such a suitable refuge? It probably forms a mesic 'island' among the vast, dry lowlands of Sekhukhuneland, as the summit of the mountain lies at an altitude of between 1 800 and 1 950 m, while the sur-

PLATE 2264.—1, habit, $\times 1$; 2, stamens surrounded by the pseudo-corona, a membranous structure formed by large, dorsal, wing-like extensions of three of the filaments, $\times 7$; 3, centre of flower enlarged, showing six yellow anthers and style with whitish capitate stigma, $\times 20$. Voucher specimen: *Van Wyk 13577* in H.G.W.J. Schweickerdt Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2264 *Prototulbaghia siebertii*

rounding lowlands are between 650 and 850 m a.s.l. These conditions isolate the range, which lies more or less in the rain-shadow of the northeastern Drakensberg escarpment, and make it climatically different from prevailing xeric conditions in Sekhukhuneland. It is therefore not surprising that the mountains share floristic elements, such as *Nemesia zimbabweensis*, with the moist highlands of eastern Zimbabwe (Siebert & Van Wyk 2005).

The isolation of the Leolo Range has resulted in unique species assemblages and the summit vegetation, namely Leolo Mountain Sourveld, has been described as an endemic vegetation unit (Mucina & Rutherford 2006). Not only *Prototulbaghia siebertii*, but also four other new plant species have been described from this mountain in recent years, namely *Acacia ormocarpoides*, *Gladiolus sekukuniensis*, *Plectranthus porcatus* and *Raphionacme villicorona*. Two more plant species are also endemic to the mountain, *Plectranthus venteri* and *Zantedeschia jucunda*, bringing the total to seven.

Prototulbaghia siebertii was described by Vosa (2007), with the holotype designated as *Van Wyk & Siebert 1304* (H.G.W.J. Schweickert Herbarium, University of Pretoria), collected on 4 December 1999. On the label of another specimen, *Van Wyk 13577* (in the same Herbarium), collected on 11 December 2000, the plant is described as 'Geophyte with slender, near-prostrate leaves and erect inflorescence. Flowers white, often tinged pink. Crushed stems with a faint onion smell.' The locality of the species is indicated as the summit of the Leolo Mountains, its only known locality to date. The label of *Van Wyk 13577* describes the habitat as follows, 'Heavily grazed grassland. Seepage area associated with exposed rock sheet.'

In reality, *Prototulbaghia siebertii* does not grow in the wet zone of seepages, but rather in a unique habitat comprising large islands ($\pm 400 \text{ m}^2$) of norite rock sheets at ground level (Siebert *et al.* 2008). The runoff from these rock sheets feeds the seepages, but the taxon grows along the edges of the sheets where rock meets clay. The habitat of *P. siebertii* is unusual in that it may be parched during the dry winter months, but in the summer rainy season it becomes more or less permanently wet. The alternation of such dry and wet seasons is typical of all shallow soils and rock outcrops in seasonal climates. These habitats favour xerophytes because of their extreme insulation, temperatures and seasonal aridity. Similar habitats in many mesic and subtropical climates favour succulents, geophytes and annuals, and it is not surprising that *P. siebertii* grows together with succulent species such as *Aloe cryptopoda*, *Crassula alba*, *C. sarcocaulis*, *Huernia insigniflora* and *Plectranthus neochilus*, as

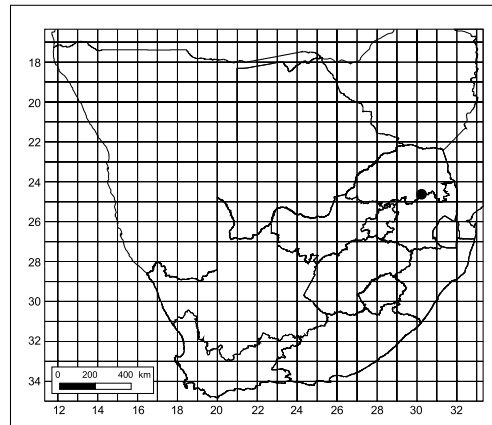


FIGURE 1.—Known distribution of *Prototulbaghia siebertii* based on specimens housed in the H.G.W.J. Schweickert Herbarium, University of Pretoria.

well as xerophytic resurrection plants such as *Myrothamnus flabellifolius*, *Cheilanthes involuta* and *Xerophyta viscosa*.

Prototulbaghia siebertii is a small (up to 150 mm tall when in flower), slender plant that exudes an alliaceous smell when the fleshy leaves and roots are crushed. The rootstock is a pear-shaped corm on a poorly defined rhizome. Emerging young leaves have coiled tips that unwind into spreading, shiny, dark green leaves. Plants come into flower just after the start of the summer rains, usually in November. The flowering season may continue throughout summer (November to March), with the odd plant still flowering as late as April (early autumn). Flowers usually open in the morning, but never fully so, remaining somewhat campanulate and fading to deep pink in the late afternoon as they age and close. Plants produce at least one flower a day for about a week, each lasting a single day. After a period of rest lasting a few days, the next inflorescence may emerge. A plant has only one inflorescence at a time, and a new one emerges if fruit-set does not take place. The taxonomic significance of these fugacious flowers, which appear to be absent in *Tulbaghia*, requires further study.

There are some important differences between *Prototulbaghia* and *Tulbaghia*, which is hypothesised to be its nearest generic relative (Siebert *et al.* 2008). The provisional generic differentiation between *Prototulbaghia* and *Tulbaghia* is based mainly on gross morphology and geographical distribution, but the determination of its true relationships must await comparative molecular studies. As a member of the Alliaceae, *Prototulbaghia* has winged filaments. Winged filaments are especially common in some sections of the genus *Allium* and some of the American genera of the family. However, in *Prototulbaghia* the wings of the three inner filaments are unusually enlarged. These petaloid filaments are united with the three other thread-like filaments, forming a complex structure which is one of the outstanding features of *Prototulbaghia* and is essentially a highly modified staminal tube, a *pseudo-corona* (Plate 2264, 2). This is to distinguish it from a 'true' corona as in *Tulbaghia*, a more prominent structure derived from the perianth. Essentially the corona in *Tulbaghia* results in an extension of the perigonal tube above the level of the tepals, with the anthers adnate to the corona or not. Phylogenetically the pseudo-corona of *Prototulbaghia* does not appear to be homologous to the corona of *Tulbaghia*.

Other differences are to be found in the arrangement of the stamens. In *Tulbaghia* the stamens are in two whorls on shorter filaments, one whorl inserted on the corona just above the stigma and the other also in the tube, but in its upper part near the mouth. In *Prototulbaghia* (Plate 2264, 3) the perigonal tube is reduced and insignificant, and the anthers are all more or less at the same level just protruding, together with the stigma, from the top of the pseudo-corona (united filaments). These morphological differences separate the two genera, although the differences may in fact be more of degree rather than of kind.

However, despite the apparent morphological dissimilarity between the two types of corona discussed above, the pseudo-corona of *Prototulbaghia* can be considered structurally homologous to the true corona as it exists in all species of

Tulbaghia. Studies on the ontogeny of the flower in *Tulbaghia* indicate that the corona derives from an initial dorsal outgrowth of the three inner staminal filaments and their subsequent fusion with their three simple outer counterparts together with the marked elongation of the perigonal tube. These early developmental events, apart from that concerning the perigonal tube, seem to correspond with the mature morphological state in *Prototulbaghia*. The staminal structure of *Prototulbaghia* therefore seems to reflect a developmentally intermediate stage towards the development of the proper corona of *Tulbaghia*. Our preferred hypothesis is that *Prototulbaghia* might be phylogenetically basal to *Tulbaghia*. Although it is certainly possible that the floral structure in *Prototulbaghia* may have been derived neotenously from a *Tulbaghia*-like ancestor, we consider it a less attractive hypothesis, bearing in mind that this is pure speculation at this stage.

The conservation status of *Prototulbaghia siebertii* was provisionally regarded as Critically Endangered based on its restricted range and potentially threatening land use (Siebert *et al.* 2008). The status had to be reconsidered after recalculating the area of occupancy, number of individuals and extent of threats to the species and its habitat. Population counts during a survey in April 2008 suggested that approximately 3 500 individuals occurred. Area of occupancy for the taxon was measured as $\pm 1\,600\text{ m}^2$ and the extent of occurrence as $\pm 5\text{ km}^2$. Based on this information, the species is re-assessed as Endangered (EN B1 + 2a; D2) according to the IUCN Red List criteria (IUCN 2001).

Rhizomes or seed should be cultivated in a 1:1:1 mix of soil, fine-grained sand and compost. In a greenhouse the temperature should be regulated to ensure a minimum temperature of not less than 7°C in winter and not above 27°C in summer. Plants should be watered with a fine mist spray for ten minutes once a day. The simultaneous addition of Multifeed® K also provides excellent results. Cool temperatures and sufficient air movement have proven most sufficient to cultivate this high-altitude species successfully. Greenhouse conditions bring the flowering season forward to early spring, lasting until early autumn.

Description (based on Vosa 2007 and expanded).—Small, geophytic herb, 50–150 mm high. *Rootstock* a short, vertical, corm-like rhizome, 15 × 20(–25) mm; roots few, semisucculent. *Leaves* 3–6, erect to spreading, semiterete with a poorly defined double keel, 100–150 × 1.0–1.5 mm, bright green with a purplish membranous base; apex distinctly acute and hooked. *Spathe valves* 2, longest 4 mm, purplish brown, scariose at anthesis. *Flower scape* thin, reddish brown, especially in lower half, as long as or little shorter than leaves, carrying 2–4 flowers. *Pedicels* 7 mm long, greenish purple. *Flowers* regular, bisexual, facing upwards, 5.5–7.0 mm long, bell-shaped, white fading pink to magenta, lasting a single day. *Perianth* segments connate for 2 mm in lower half; outer segments flaring outward, spatulate, white at anthesis, pinkish towards tips, keeled with purplish tips, pale pink midvein on inside, 4.5 mm long, 2 mm wide in upper third; inner segments broadly oblong-ovate, spatulate segments shorter than outer segments, 1.5 mm wide in middle, greenish hyaline with faint green midvein. *Staminal filaments* 6, filaments facing outer perianth segments 3, thread-like, fused to edges of petaloid appendages of inner

filaments for more than half their length; filaments facing inner perianth segments 3, originating at base of inner perianth segments, dilated into oblong retuse-erose petaloid wings on adaxial sides; 6 staminal filaments forming a cylindrical pseudo-corona. *Anthers* bright yellow, sagittate, 0.3×1.5 mm, attached to tips of thread-like filaments and middle of petaloid wings of short filaments, slightly protruding above rim of pseudo-corona. *Gynoecium*: ovary 3-locular, obovate-triangular with rounded corners, 1 mm long, as long as coalescing base of perianth segments, shiny green; style filiform, exerted shortly beyond dehiscing anthers, 3 mm long, thin; stigma capitate, papillate. *Capsule* mitre-like when ripe, with dry perianth segments persisting at base. *Seeds* triangular-elongated, 2 mm long, black. Plate 2264.

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PLATE 2265 *Albuca spiralis*

Albuca spiralis

Hyacinthaceae: Ornithogaloideae: Albuceae

South Africa

Albuca spiralis L.f., *Supplementarum plantarum*: 196 (1782); Thunberg: 65 (1794), 331 (1823); Baker: 289 (1873), 461 (1897); Müller-Doblies: 368 (1994); Manning et al.: 61 (2002). *Falconera spiralis* (L.f.) Salisb. ex B.D.Jacks.: 946 (1895), pro. syn. of *A. spiralis*. *A. viridiflora* Jacq.: t. 446, 98(1797).

The genus *Albuca* first appears in the second edition of *Species plantarum* (Linnaeus 1762), where it was described to accommodate two taxa that were treated as varieties of the southwestern Cape species *Ornithogalum canadense* in the first edition (Linnaeus 1753) but which differed from other species of *Ornithogalum* in their dimorphic tepal whorls. The genus was taken up by Thunberg (1794, 1823), who added a further three southwestern Cape species and defined it more precisely by the possession of alternating fertile and sterile stamens and by the obconical, tricuspidate stigma. Additional species with the characteristic *Albuca* perianth but with all stamens fertile were subsequently discovered, and by the time that the genus was revised by Baker (1897) its definition had reverted essentially to Linnaeus's.

Within this circumscription, Baker (1873, 1897) recognised four subgenera based on various combinations of style shape and androecium condition. Subg. *Albuca* was restricted to those species with an obconical style and the outer stamens sterile or with highly reduced anthers, and subg. *Falconera* accommodated those species with a similar obconical style but with all six stamens fertile. The few remaining species with narrower styles were placed in subg. *Leptostyla* (style cylindrical and outer stamens $\pm$ sterile) and subg. *Pallastema* (style filiform and all stamens fertile). A radically different and much more natural classification of the genus was proposed by Müller-Doblies (1995), who defined groups based on the shape and development of the apex of the inner tepals. On this basis subg. *Albuca* was redefined to include only species with a fleshy, hinged apical appendage to the inner tepals, and subg. *Falconera* as lacking a notable apical appendage. A third group that she proposed to name subg. *Mitrotepalum* but which she never formally described, included those species with a fleshy, cowl-like apex to the inner tepals. Subgenera *Albuca* and *Falconera* were also characterised by their mostly nodding or pendent flowers, whereas subg. *Mitrotepalum* included only species with erect flowers.

The first approximation of a monophyletic classification of Hyacinthaceae based on molecular data (Manning *et al.* 2004), adopted an extremely broad view of the ornithogaloid genera in which just the single genus *Ornithogalum* was recognized. All species of *Albuca* were accordingly transferred to *Ornithogalum*, and the new name *O. circinatum* J.C.Manning & Goldblatt was proposed for *A. spiralis*. A subsequent, more detailed analysis of subfamily Ornithogaloideae using additional plastid DNA

PLATE 2265.—1, flowering stem, $\times 1$; 2, bulb and foliage, $\times 1$; 3, portion of fruiting stem, $\times 1$; 4, detail of leaf margin with gland-tipped hairs, much enlarged. Voucher specimen: *Condy 231* in National Herbarium, Pretoria. Artist: Gillian Condy.

sequence data (Manning *et al.* 2009), resulted in a better resolved cladogram, from which it was possible to recognize four evidently monophyletic genera. The genera *Dipcadi* Medik. and *Pseudogaltonia* (Kuntze) Engl. were retained with their traditional circumscriptions. The inclusion of the small genera *Galtonia* Decne. and *Neopatersonia* Schonland in *Ornithogalum* was maintained but *Albuca* was substantially enlarged to include *Ornithogalum* subg. *Osmyne* plus most members of *O.* subg. *Urophyllon* (Manning *et al.* 2009). *Albuca* in this broader circumscription is defined by its thick-textured, $\pm$ oblong tepals with a distinct, broad, green to brown longitudinal band on the adaxial surface associated (at least in the inner tepals) with 3–5 medially aggregated veins.

Species of *Albuca* in its narrow, traditional sense are now accommodated in subg. *Albuca*, which numbers $\pm$ 70 species, mainly from sub-Saharan Africa, especially the winter-rainfall region, with one species extending into Ethiopia. Baker's subgenus *Albuca* has been down-ranked to sectional level and comprises $\pm$ 20 species, mainly from the winter-rainfall parts of southern Namibia and southwestern South Africa but with a few species extending into eastern South Africa. It contains arguably some of the prettiest species in the genus, with pleasantly scented, lantern-like flowers nodding elegantly from the tips of spreading pedicels.

Members of sect. *Albuca* are relatively conservative in their floral features and much of the specific variation in the group is in the vegetative characters, especially the vestiture of the leaves (Manning *et al.* 2002). *Albuca spiralis* is one of the more distinctive of the species in the section, readily recognisable by its slender, linear-canaliculate leaves ornamented on the adaxial surface with small, gland-tipped hairs. Similar hairs are found on the peduncle. Although typically present on the entire adaxial surface of the leaves, the glandular hairs are rarely restricted to the leaf margins. The leaves are mostly $\pm$ coiled at the tips. This is especially marked in some plants, which develop striking, tightly corkscrewed leaves, but the expression of this feature appears to be strongly affected by environmental factors, with hotter, drier conditions favouring tighter coiling. A superficially similar species, *A. namaquensis* (Plate 1255 in this series), is distinguished by its acute, nonglandular hairs.

Albuca spiralis was described by the younger Linnaeus (1782) from plants collected by C.P. Thunberg on Riebeek-Kasteel during the latter's visit to the Cape in 1772–1774. Although Thunberg made three journeys up the West Coast during his stay, only the third trip (September–December 1774) actually crossed Riebeek-Kasteel (Thunberg 1986) and it is probable that his collection of *A. spiralis* was made then. The species is widespread along the West Coast, ranging from the Cape Peninsula northwards to Springbok, where it occurs in sandy and gravelly soils (Figure 1). It can be encountered in flower throughout the spring months, from August to October. The flowers are pleasantly and sweetly scented but, like all members of the subgenus, close during the night, opening again the following morning.

Very little is known about the pollination biology of these intricately constructed flowers but it is clear that the florally specialised species of sect. *Albuca* use the ornamented style for secondary pollen presentation (Manning *et al.* 2002). In this strategy

the pollen, rather than being deposited directly onto the visiting insect, is shed onto the style, where it is retained by the papillae that ornament it, and from where it is then deposited onto the body of the pollinator. Kingston (1998) reports that germination of the pollen on the style or stigma is suppressed as long as the grains remain dehydrated. This condition lasts until the flowers senesce, at which time the tepals close around the stigma and a copious exudate is released from the papillae at the tepal apices. The exact significance of these observations is not yet clear but may be related to secondary pollen presentation, and are probably correlated with the development of the ornamented inner tepal apices. The species studied by Kingston (1998) were unfortunately all members of sect. *Pallastema*, which has the least extreme tepal ornamentation in the subgenus. Various large species of solitary bees in the families Apidae (Anthophorinae) and Megachilidae have been recorded visiting species of *Albuca* and they are likely to be the primary pollinators in the genus (Manning *et al.* 2002). Nectar is produced from sepal nectaries, and the septal crests that are developed on the ovaries of many of the pendent-flowered species probably play a role in retaining the nectar and preventing it from dripping out of the flowers.

Although some species of *Albuca* sensu lato, notably *A. bracteata* (= *Ornithogalum longibracteatum*) (Plate 2185 in this series), are widely cultivated, few species of subg. *Albuca* are grown, with the notable exception of *A. nelsonii*. This is a great pity as the flowers are not only attractive but the inflorescences are exceptionally long-lasting, keeping for up to several weeks on the plant or in a vase. They are certainly every bit as attractive as some species of *Galanthus* (Amaryllidaceae). Similar sentiments regarding the charm of the flowers were expressed by Dyer (1957) but his comments that the individual flowers of *A. namaquensis* last no more than a day or two after opening are not borne out by our observations on the genus, and flowers in the species studied by Kingston (1998) last three to six days each.

Ten species of *Albuca* from across the subgenus, plus some cultivars, are listed by Bryan & Griffiths (1995) as being known in cultivation, suggesting that there is at least some appreciation for the genus in horticultural circles. Not all species appear to be equally compliant, however. Müller-Doblies (1994), who cultivated numerous Cape bulbs in Berlin, reported that 'unusual patience' was often required in the cultivation of *Albuca* species from the arid parts of southern Africa as a bulb 'may sit in the pot for four to seven years without producing a single leaf or flower'. At Kirstenbosch in Cape Town, Graham Duncan has had similar experience with cultivating *A. clanwilliamgloria* (G. Duncan pers. comm.). Possibly other Cape species may

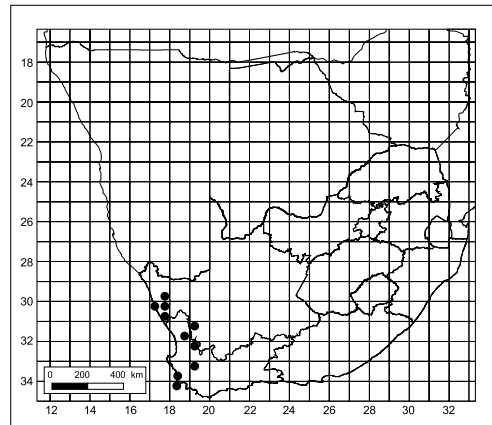


FIGURE 1.—Known distribution of *Albuca spiralis*, based on specimens in the Compton Herbarium, Kirstenbosch.

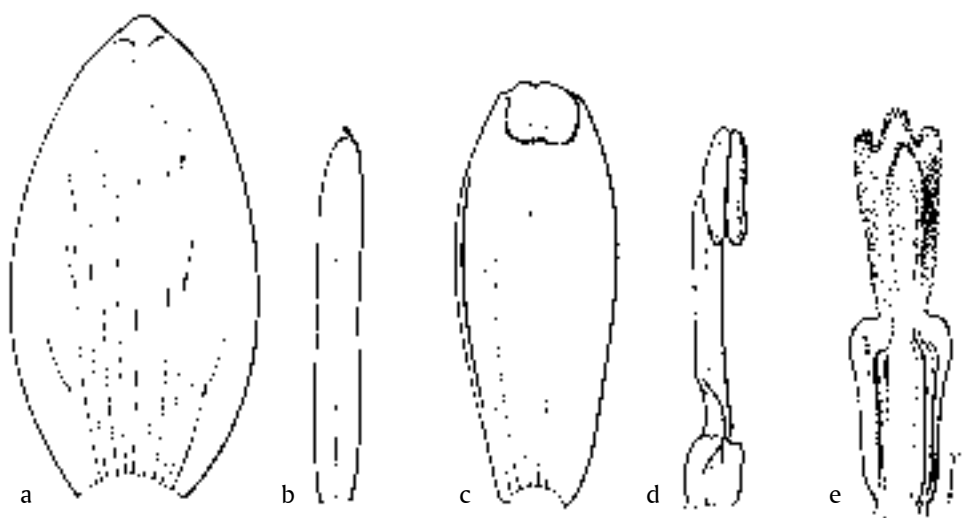


FIGURE 2.—a, outer tepal; b, outer stamen; c, inner tepal; d, inner stamen; e, gynoecium. Scale bar: 20 mm. Voucher specimen: *Condy 231* in National Herbarium, Pretoria. Artist: John Manning.

respond more readily. Certainly several species from the eastern parts of the country, notably *A. nelsonii* and *A. batteniana*, flower regularly in cultivation.

Albuca spiralis should be treated like other winter-growing bulbs and is best grown in 20–25 cm diameter pots. Plants should be grown in full sun in light, freely draining soils. Water regularly during the growing season but do not allow the soil to become waterlogged, and allow the pots to dry off as the bulbs enter dormancy in late spring. Plants will probably benefit from the application of dilute liquid feed when in full growth. The species seldom experiences frost in the wild and is therefore probably not hardy, although it is worth trying in a rockery in a sheltered position at the base of a warm wall in areas where frosts are light. Massed plantings are certainly the best way to show it off to greatest effect. In colder climates it should be grown in a cool glasshouse or conservatory. It is essential that the soil in potted plants does not overheat as it will result in bulbs entering dormancy immediately. The bulbs are highly susceptible to infestation by mealy bugs when grown in containers in an enclosed environment, a condition remedied by the application of an imidacloprid-based insecticidal drench once leaf growth has commenced in autumn, effective for the entire growing season.

Description.—Deciduous geophyte, mostly 0.15–0.40 m high. *Bulb* solitary, depressed-subglobose, 20–30 mm diam.; outer scales papery, whitish or greyish, inner tunic scales white, sometimes forming a short, translucent, papery collar around base of leaves. *Leaves* (3–)5–10, erect, mostly shorter than inflorescence, not or shortly clasping stem at base, linear-canaliculate, mostly $90\text{--}200 \times 1\text{--}2$ mm, attenuate, apically twisted or loosely to tightly coiled, covered with gland-tipped hairs adaxially or sometimes only along margins. *Inflorescence* lax, erect, (1)2–6-flowered, up to 120 mm long, 1.5–3.0 mm diam. at base, thinly or densely glandular-

haired towards base; bracts lanceolate-acuminate, lowermost up to 30×8 mm, veins numerous, glaucous with narrow whitish margins; pedicels strongly deflexed apically at anthesis, 20–50 mm long, suberect in fruit. *Flowers* pendulous on suberect pedicels; tepals biseriate with blades of outer series overlapping inner, united basally for ± 1 mm, yellow or cream-coloured with green keels, outer tepals ovate, $17\text{--}20 \times 8\text{--}10$ mm, apices papillate, inner tepals oblong-elliptical, 5-veined, concave, $13\text{--}15 \times 8\text{--}10$ mm, excluding hinged, fleshy apical expansion with papillae on outer face. *Stamens* adnate to perianth for ± 1 mm, dimorphic, erect; outer stamens sterile, filaments narrowly oblong, $12\text{--}15 \times 1\text{--}2$ mm; inner stamens fertile, filaments laterally expanded and pinched in lower 2 mm, $\pm 12 \times 1$ mm; anthers 4–5 mm long at anthesis, cream-coloured. *Ovary* oblong, 3-winged, 7–9 mm long, shortly stipitate, paraseptal ridges parallel; style obpyramidal, trigonous and tricuspidate, 5–6 mm long, densely verrucose. *Capsule* ovoid, 3-angled, $20 \times 12\text{--}15$ mm. *Seeds* unknown. Plate 2265. Figure 2.

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Dioscorea dregeana

Dioscoreaceae

South Africa and Mozambique

Dioscorea dregeana (Kunth) T.Durand & Schinz, *Conspectus florae africae* 5: 274 (1893); Baker: 250 (1897); Burkill: 371 (1939); Von Teichman et al.: 219, 220 (1975); Von Teichman: 69, Fig. 1–4 (1980); Wilkin: 34 (1999); Wilkin: 384, Fig. 2G (2001); Wilkin: 123, Fig. 32.6 (2009). *Helmia dregeana* Kunth: 437 (1850).

Dioscorea, the yam genus, has over 600 accepted species names worldwide (Govaerts & Wilkin 2010) and is by far the most diverse element of the family Dioscoreaceae. The latter comprises four genera, *Dioscorea*, *Tacca*, *Trichopus* and *Stenomeris*. The last three possess relatively few species found mainly in the wet tropics of Asia and Madagascar. The highest species diversity of *Dioscorea* is found in the seasonally dry tropics of Central South America, Mexico, the Caribbean, South Africa, Madagascar and Indochina. Most taxa are stem climbers and they can twine in either a left- or right-handed (sinistrorse or dextrorse) manner around a support. They are perennial plants with subterranean rhizomes and/or tubers.

Many yam species have tubers with different degrees of edibility (Coursey 1967). There are three major cultigens, the winged yam (*Dioscorea alata*), the guinea yams (*D. cayenensis* / *D. rotundata*) and the lesser or Asiatic yam *D. esculenta*, but the tubers of at least 50 species are sources of dietary starch both as subsistence and economic crops. In economic terms, medicines have perhaps been an even more important product of *Dioscorea* than food. Many species are rich in steroidal saponins. In particular, the New World species *D. mexicana*, *D. composita* and *D. floribunda* were used as the source plants for the contraceptive pill in the 1950s and 1960s (Coursey 1967; Marks 2001). Other taxa rich in steroidal compounds include *D. sylvatica* and *D. elephantipes* from southern Africa. As well as synthetic human hormones, yam steroids have also been used to make corticosteroid drugs such as cortisone. The range of medicinal uses of steroids is vast. However, such compounds are today usually synthesised *de novo* rather than precursors being sourced from plant material.

One of the characters shared by most species of *Dioscorea* is being dioecious, with small, often dull-coloured flowers. Thus they are relatively infrequently used in horticulture as ornamentals. A group of South American species (e.g. *D. dodecaneura*) with variegated leaves was popular as stove plants in northern Europe in the 19th century. More recently, the caudiciform succulent taxa such as *D. elephantipes* have attracted interest (see e.g. Durst 2009). Some species have been used as fast-growing climbers to cover pergolas or fences. *Dioscorea* leaves, with parallel primary veins at the blade base diverging and then reconverging at the apex are not unattractive. However, species bearing axillary bulbils such as *D. bulbifera* and *D. sansibarensis* can become serious pests as weeds.

PLATE 2266.—1, part of stem with female inflorescences, × 1; 2, part of stem with male inflorescences, × 1; capsules and leaves × 1. Voucher specimen: *Condy* 222 in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2266 *Dioscorea dregeana*

Dioscorea dregeana was first recorded in the Eastern Cape of South Africa in 1840. The specimen label gives its locality as Pondoland, between the St John's and Untsikaba Rivers. This collection comprised female flowering and fruiting material and bore the collecting number *Drège 4502b*. Ten years later, this specimen was used as the basis of the name *Helmia dregeana* (Kunth 1850). The holotype is believed to have been held at the Herbarium of the Christian-Albrechts University in Kiel, but has subsequently been lost. Isotypes are extant at the Herbarium of the Royal Botanic Gardens at Kew, the Herbarium of the Muséum National

d'Histoire Naturelle in Paris and possibly in other herbaria; Drège often made multiple duplicates of his collections which are now found in many European herbaria. Kunth (1850) placed all species with basally winged seeds in the genus *Helmia*, and restricted *Dioscorea* to those species with a wing all round the seed margin. Later in the 19th century the genus *Helmia* was sunk into *Dioscorea*, and *H. dregeana* was transferred to *D. dregeana* by Durand & Schinz in 1893. Many subsequent collections have been made and the range of the species extended to KwaZulu-Natal, Mpumalanga and the Northern Province of South Africa and to Swaziland (Figure 1). A solitary collection has been made outside South Africa, in southern Mozambique, in 1948. The extent of its distribution and number of collections suggest that it is not of immediate conservation concern and it is rated as of least concern by Raimondo *et al.* (2009).

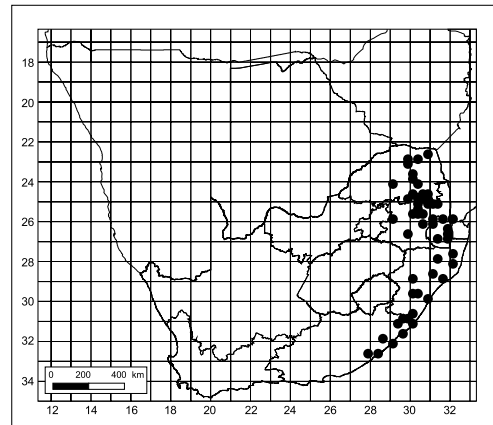


FIGURE 1.—Known distribution of *Dioscorea dregeana*.

There is considerable variation in the density of pubescence on the vegetative organs of this species. This variation also has a developmental component, with older parts being glabrescent in some individuals. Those with the most dense and velutinous indumentum were given varietal status as *Dioscorea dregeana* var. *hutchinsonii* by Burkill (1939). However, not only is the pattern of variation in pubescence density continuous but the name is invalid. Nevertheless, these densely hairy forms are among the most attractive, especially in young leaf, when they often also produce flowers (Plate 2266). The pubescence can also be golden yellow. Burkill (1939) referred to these forms as 'Rhodesian Velvet Creeper' and stated that they were cultivated in gardens in South Africa at that time.

Dioscorea dregeana is found on forest or scrub margins and in openings, usually in humus-rich or stony to talus soils, and often among rocks in ravines. It is found at elevations between approximately 400 and 1 400 m. The single collection from Mozambique was from a watercourse margin; the closely allied *D. dumetorum* is also often found near water. Both males and females flower towards the beginning of the rainy season from October to February, with a peak in December. Fruits are encountered from December onwards.

The most closely related species to *Dioscorea dregeana* are *D. dumetorum* and *D. cochleari-apiculata* from sub-Saharan Africa (Zimbabwe northwards, so they are not sympatric with *D. dregeana*) and the Asian *D. hispida* (Wilkin *et al.* 2005). All these species share trifoliolate compound leaves (the anterior leaflets are sometimes shallowly to deeply lobed) in which each leaflet has 3–7 main veins and the male flowers possess six functional stamens. *D. dregeana* is the most distinctive element of this species group. Male plants are particularly easily differentiated, with flowers spaced ± 2 –10 mm apart in cymules of two or three on the inflorescence axis; the inner tepals are larger than the outer, being up to 2.3 mm long and wide. In the other taxa the flowers are crowded in dense spikes, with the two whorls of tepals more or less equal in size and not more than 1.3 mm long. Female plants differ through more subtle variation in capsule shape (see Wilkin 1999, 2001). It is possible that the other three species are in fact conspecific, but more research is needed.

As Von Teichman (1980) and Kulkarni *et al.* (2007) have shown, *Dioscorea dregeana* is one of the most popular medicinal plants of South Africa. Its tubers are used for their sedative properties to treat ailments such as hysteria, convulsions and epilepsy. For example, one Zulu name for this species, *Isidakwa*, means ‘the drunkard’ and it is used as a remedy for fits. It is also used to treat sores, wounds, as an aphrodisiac and to facilitate childbirth. It has been suggested that the leaves and stems of *D. dregeana* have antibacterial properties. The active medicinal principles are not steroids, as in most *Dioscorea* species, but alkaloids such as dioscorine. These alkaloids are also found in *D. dumetorum*, *D. cochleari-apiculata* and *D. hispida*. Despite their toxicity, the tubers of both *D. dregeana* and its relatives are important as famine foods. They have easily extracted clusters of tubers near the soil surface. Thus they can be harvested quickly, but the toxic alkaloids have to be removed before they can be eaten safely, either by boiling and throwing away the water repeatedly or by cutting them into pieces and placing in a sack in running water for several days. In *D. dumetorum* and *D. hispida*, semidomesticated, less toxic forms have been observed, but there is no evidence that this is the case in *D. dregeana*. The morphological diversity of the *D. dumetorum*/*D. hispida*/*D. cochleari-apiculata* complex may in part be driven by domestication.

The plant illustrated here comes from the farm Ntsinini, near Waterval-Onder in the Mpumalanga Province of South Africa. The same species also grows in the Buffelskloof Nature Reserve.

The generic name *Dioscorea* was coined by Linnaeus for the ancient Greek author Dioscorides who published perhaps the first illustrated herbal in AD 60. The epithet *dregeana* was given to this species by Kunth to honour its collector, J.F. Drège. He was one of the most important early collectors of South African plants with his associates C.F. Ecklon and C.L.P. Zeyher (see Glen & Germishuizen 2010)

Description.—Herbaceous twining vine up to 12 m. *Stems* annual from a fleshy tuber. *Tuber* solitary and lobed, or main tuber with several smaller subsidiary tubers in a dense cluster near soil surface, persisting for several years, ovoid to spheroidal, ± 25 –70 mm diam., larger with age, periderm pale brown, parenchyma white.

Indumentum of vegetative parts and inflorescences sparse to $\pm$ dense, consisting of simple straight hairs 0.1–1.6 mm long, sometimes denser and velutinous but always sparse on upper leaf surface; stems and fruit sometimes glabrescent with age. *Stems* left-twining, up to 10 mm diam., often with ridged ascending prickles, concentrated towards base; prickles up to 15 mm long, fleshy to hard, similar in colour to stem. *Leaves* alternate, trifoliolate; posterior leaflets ovate, $47\text{--}160 \times 25\text{--}110$ mm, sometimes bifid (as in *Torre* 7137), asymmetric at base, rounded to acute at apex; anterior leaflet obovate to broadly so or elliptic, $43\text{--}180 \times 20\text{--}150$ mm, cuneate at base, rounded to acute or rarely truncate at apex and bearing an acumen up to 36 mm long; petiole 11–180 mm long; petiolules 2–14 mm long; cataphylls and lateral nodal organs absent. *Male inflorescences* compound, up to 300 mm long; partial inflorescences with axis visible for entire length, spicate, 3.5–78.0 mm long; flowers usually in 2(3)-flowered cymules, sometimes solitary towards apex of inflorescence, occasionally reduced to a single cymule; peduncles 1.5–37.0 mm long. *Female inflorescences* spicate, up to 140 mm long. *Male flower* sessile or on a very short pedicel; floral bracts 1.3–3.0 mm long; tepals $\pm$ free, outer tepals lanceolate to narrowly ovate, $1.1\text{--}1.9 \times 0.5\text{--}1.4$ mm, acute to short-acuminate apically and rounded at base, membranous, pubescent, inner tepals broadly obovate to orbicular, rarely $\pm$ spatulate, $1.2\text{--}2.3 \times 1.0\text{--}2.3$ mm, ventral face concave, cucullate at apex, sometimes irregularly and shallowly incised, glabrous, papyraceous; stamens 6; filaments fused at base to inner tepals, linear to narrowly triangular, 0.1–0.4(–0.7) mm long; anthers $0.3\text{--}0.6 \times 0.3\text{--}0.5$ mm. *Female flower* sessile; floral bracts often 2 per flower; tepals $\pm$ free, membranous, pubescent, each with a 0.3–0.4 mm long staminode at base, outer tepals lanceolate-acuminate, $0.9\text{--}1.3 \times 0.5\text{--}0.8$ mm, inner tepals broadly ovate, $1.0\text{--}1.6 \times 1.0\text{--}1.3$ mm, ventral face concave, cucullate; ovary narrowly obovate in outline, 3.5–6.0 mm long at anthesis, pubescent; styles erect, oblong to lanceolate, 0.4–0.9 mm long; stigmas deflexed. *Capsule* oblong to oblong-obovate in outline, $38\text{--}50 \times 18\text{--}27$ mm, base obtuse, rounded to rounded-truncate apically; indumentum similar to that of lower leaf surface and especially dense along axis. *Seed* 9–11 $\times$ 4–8 mm, winged at base; wing oblong to obovate, $12\text{--}15 \times 6\text{--}11$ mm, rounded to truncate apically, membranous to thinly chartaceous. Plate 2266.

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PLATE 2267 *Gladiolus cataractarum*

Gladiolus cataractarum

Iridaceae: Crocoideae

South Africa

Gladiolus cataractarum Obermeyer in Bothalia 14: 78 (1982); Fabian & Germishuizen: 84, t. 34 (1997); Goldblatt & Manning: 95 (1998).

A rare endemic of the Mpumalanga highlands in the summer-rainfall, eastern half of southern Africa, *Gladiolus cataractarum* is known from a few scattered populations along the eastern escarpment. It derives its name, *cataractarum*, ‘of the waterfalls’, from the nearby Lunsclip Waterfall where the species was first collected.

Herbarium collections indicate that *Gladiolus cataractarum* was first recorded in the late summer of 1981 on the upper escarpment near Lunsclip Waterfall in the Lydenburg District. The species was described the following year by A.A. Obermeyer, who had, some 10 years earlier, completed and brought to publication G.J. Lewis’s manuscript revision of *Gladiolus* in South Africa after Lewis’s death (Lewis *et al.* 1972). The species remained known from this one site until a survey made some years later to determine its conservation status, located several more small populations extending along the escarpment edge northwards towards Lydenburg for some 10 km. More recently the species has been found to be frequent on the cliffs in Verlorenkloof Nature Reserve (farm Welgedacht 137JT), about 6 km south of the type locality at Lunsclip Waterfall (Figure 1). At this new locality the flowers differ slightly from the typical population in being uniformly pink, thus lacking the dark median streak on the lower tepals.

Plants grow mainly on cliffs and steep rocky slopes on quartzite in sheltered, often south-facing sites. Flowering is in late summer, from February to mid-March. The long-tubed pink flowers resemble those of other species of *Gladiolus* that are known or thought to be pollinated by long-tongued nemestrinid flies. *G. varius* is one of the summer-flowering species from the Mpumalanga escarpment with similar long-tubed, pink flowers that has been shown to be pollinated by nemestrinid flies *Prosoeca ganglbaurii* and *P. robusta* (Goldblatt & Manning 2000) but the pollination biology of *G. cataractarum* awaits investigation.

The relatively large, pink to pale salmon-coloured flowers often streaked with red on the midline of the lower tepals, the long perianth tube, large green bracts and fan of broad leaves of *Gladiolus cataractarum* recall the other members of series *Scabridus* of the genus very closely, despite the lack of pubescence on the leaves or stem. Within the alliance, a perianth tube as long as 500 mm is known only in *G. microcarpus* and *G. scabridus* but both these species have pubescent leaves and sometimes pubescent stems and bracts as well. The general aspect of *G. catarac-*

tarum is of extreme robustness, the leaves being thick and leathery and up to 45 mm wide. The species is therefore unlikely to be mistaken for any other. *G. saxatilis*, which grows on the lower Mpumalanga escarpment near Graskop, superficially resembles *G. cataractarum*, especially in its broad leaves, but this cliff and rock outcrop species has smaller floral bracts that turn rusty brown as the flowers open and fade, a feature that seems to place the species in series *Densiflorus* close to *G. ferrugineus*. The mauve-pink flowers always lack darkly streaked nectar guides.

Gladiolus cataractarum is not yet in cultivation.

Description.—Deciduous geophyte up to 0.7 m high. *Corm* globose, ± 30 mm diam., outer tunics of coriaceous layers, with age these becoming irregularly fragmented and partially fibrous. *Stem* erect, unbranched, ± 5 mm diam. below base of spike. *Cataphylls* pale and membranous to firm, upper reaching up to 120 mm above ground and then pale green. *Leaves* 8 or 9, lower 6 basal and longest, reaching to shortly below base of spike, blades narrowly to broadly lanceolate, (20–)35–45 mm wide, margins and midribs slightly thickened and hyaline, glabrous, upper 2 or 3 leaves progressively shorter above, largely sheathing. *Spike* straight, erect, 8–16-flowered; bracts green, firm-textured, outer 50–60(–70) mm long, attenuate, wrapped around spike axis below, ± 2 internodes long, inner bract two thirds to three quarters as long as outer, minutely forked apically for ± 1 mm. *Flowers* pink, lower 3 tepals marked with longitudinal reddish lines in lower midline, unscented. *Perianth*: tube cylindrical below, 40–50 mm long, flared outward in upper 10 mm; tepals unequal, lanceolate, 3 upper largest, $44\text{--}48 \times \pm 16$ mm, dorsal arched to nearly horizontal, upper laterals spreading outward in distal half, lower lateral tepals $\pm 40 \times 14$ mm, spreading in distal half. *Stamens*: filaments ± 12 mm long, exserted ± 4 mm from tube; anthers ± 12 mm long, yellow; pollen yellow. *Ovary* oblong, ± 6 mm long; style arching over stamens, dividing 1–2 mm beyond anther apices, branches ± 5 mm long. *Capsules* oblong, ± 30 mm long, 3-lobed above and retuse. *Seeds* oblong, $7\text{--}8 \times 4\text{--}5$ mm, broadly and evenly winged, light translucent brown, seed body darker brown. Plate 2267.

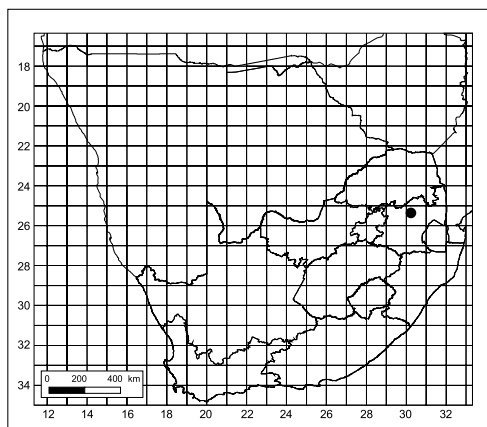


FIGURE 1.—Known distribution of *Gladiolus cataractarum*, based on specimens in the National Herbarium, Pretoria, and Compton Herbarium, Kirstenbosch.

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Ficus sur

Moraceae

Africa, Yemen

Ficus sur Forssk., Flora Aegyptiaco-Arabica: 180 (1775); Vahl: 199 (1805); Mildbraed & Burret: 199 (1912); Hutchinson: 100 (1916); Christensen: 30 (1922); Troupin: 448, t. 148,6 (1982); Beentje: 68 (1988); Berg: 56, t. 18 (1989); Friis: 287, t. 104.10 (1989); Keay: 291 (1989); Van Greuning: 604 (1990); Berg: 52 (1991); Friis: 164 (1992); Pooley: 70 (1993); Beentje: 328 (1994); Hepper & Friis: 204 (1994); Van Wyk & Van Wyk: 80 (1997); White et al.: 389, t. 134E (2001); Schmidt et al.: 82 (2002); Palgrave: 149, t. 18 (2002); Burrows & Burrows: 67 (2003); Loffler & Loffler: 119 (2005); Hawthorne & Jongkind: 276, t. 26e & f (2006). *F. capensis* Thunb.: 13 (1786); Mildbraed & Burret: 195 (1912); Hutchinson: 101 (1916); Sim: 101, t. 95B (1919); Hutchinson: 527 (1925); Eggeling: 135, t. 39 (1940); Exell: 306 (1944); Aubréville: 346 (1950); Hutchinson & Dalziel: 606 (1958); Dale & Greenway: 315 (1961); Irvine: 432, t. 89 (1961); White: 30 (1962); Van Wyk: 47 (1972); F. von Breitenbach: 176 (1974); J. von Breitenbach: 17 (1974); Drummond: 16, t. 4 (1981). *F. mallotocarpa* Warb. in Engler: 154 (1894); Hutchinson: 97 (1916); Hutchinson & Dalziel: 606 (1958).

This well-known fig is among a small number of African fig species that has suffered irritating name changes—irritating at least for South Africans—because of competing collections from the two extremes of its range. Since the early 19th century, up until the early 1980s, this fig was known in southern Africa as *Ficus capensis*. The name was based upon a collection made by the pioneering Swedish plant collector Carl Peter Thunberg (1743–1828) around 1773 when he travelled and collected plants throughout much of the then Cape Province of South Africa. The type locality was not stated by Thunberg and it has not yet been localised with certainty.

However, Thunberg records in his journal the following: ‘On the day following, being the 30th [November 1773], we proceeded to Essebosch [sic], a pretty little neat wood, which has acquired its name from the large essenboom or ash trees, (*Ekebergia capensis*) that grew here; the leaf of which greatly resembles that of the European ash (*Fraxinus*). Large fig-trees too (*Ficus capensis*), the fruit of which is eaten by baboons, grew here in abundance. As there was no farm as yet laid out hereabouts, we took up our night’s lodging in the open air, at the side of a few bushes, and our saddles served us for pillows.’ (Forbes: 223, 1986). Essenbosch is situated not far from Kromrivier, near Essenbos railway siding in the Langkloof, about 30 km west of the town of Humansdorp. It is therefore possible that Essenbosch is the type locality for *Ficus capensis* Thunb.

But South Africans were blissfully unaware that in 1763, some ten years before Thunberg had collected his Cape fig, a young Danish naturalist by the name of Pehr Forsskål (1732–1763) had collected the same species in present-day Yemen. Forsskål, a student of Carl Linnaeus, was sent out to Egypt and southwestern Arabia to collect plants and animals. When the expedition, of which he was a part, reached Yemen, then known as ‘Arabia Felix’, malaria began to take its toll on members of their party.



PLATE 2268 *Ficus sur*

Thus it was that Pehr Forsskål died of malaria on 11 July 1763, aged only 31 and just four months after he had collected the type specimen of *F. sur* at Jiblah on 30 March 1763 (Hepper & Friis 1994). While Thunberg's *F. capensis* was formally published in 1786, Forsskål's *F. sur* was published posthumously and eleven years earlier by Carsten Niebuhr in 1775. Based on the priority rule of botanical nomenclature, the name *F. sur* is the oldest of these two validly published species names and therefore the correct one to use for this fig.

In addition to the above-mentioned two earlier names for this fig, in West and eastern tropical Africa, the same species, bearing somewhat more hairy leaves, had been described by Otto Warburg (1859–1938) as *Ficus mallotocarpa* in 1894, based on a specimen collected in the Pare District of Tanzania. Despite its hairiness, it has been shown by Berg (1989) that in all other respects *F. mallotocarpa* is identical to *F. sur* and that name has therefore been relegated to a synonym of *F. sur*.

Our tree is found in a wide range of habitats, from open grassland, to mixed woodland, riverine forest, semi-deciduous forest and occasionally on rocky outcrops or hillsides. In open woodland the tree commonly displays a rounded crown and seldom grows to more than 10 m tall. In forest, the fig may become a canopy constituent of up to 25 m tall, the trunk straight and often buttressed at the base. *Ficus sur* is never a strangler or a rock-splitter, a characteristic feature of so many other fig trees. Seeds commonly germinate in the soil and grow independent of rocks or other trees.

Ficus sur is one of the most cold-hardy of the African figs. Although unable to withstand extreme cold and severe frost, it is found in the more sheltered ravines and protected sites of the northern Highveld of South Africa, a region that suffers from brief periods of sub-zero temperatures in winter. The specimen depicted in the plate accompanying this work was collected in the Verlorenkloof Nature Reserve along the eastern escarpment of the Steenkampsberg of Mpumalanga Province, South Africa. The Steenkampsberg rises to over 2 200 m near Dullstroom and the cold air draining down the escarpment from the high grassland-covered plateaux above results in frequent winter temperatures of as low as -5°C . In these colder areas the trees are usually deciduous, the leaves frequently being burnt off by frost. However, the new young leaves soon reappear in spring, as depicted in the accompanying plate. The only other African figs that display a similar frost tolerance is *Ficus burkei* and, to a lesser extent, *F. ingens*.

The fruit or, more correctly, the *syconia* (sing. *syconium*) of this fig tree are borne on large branched trusses of 10–100 figs. The trusses normally develop off the trunk or main branches but smaller clusters may also occur on the shallow root system, resulting in the figs appearing to be borne on the ground. This feature is more common on trees growing in forest where the figs are found in the leaf litter and are therefore made available for dispersal by forest-dwelling antelope or bushpigs.

All figs display curious obligatory relationship with a group of tiny pollinating wasps of the family Agaonidae. Technically known as a syconium, the so-called fig

fruit is a highly modified inflorescence with a hollow, inverted receptacle lined with many tiny male and female flowers internally. The particular female wasp lays her eggs within the ovaries of some of the minute female flowers inside the syconium, in the process pollinating the flowers, with pollen brought in from a syconium of another nearby fig tree. Generally each species of fig has its own specific pollinating wasp—each partner relies totally upon the other for its survival, a type of symbiotic relationship known as mutualism. Without the fig tree, that particular species of wasp cannot survive; without the specific wasp, the fig cannot reproduce. Because of the particularly wide distribution of *Ficus sur*, it has apparently evolved symbiotic relationships with different species of fig wasp in different parts of its range. In East and southern Africa the pollinator is *Ceratosolen capensis* Grandi. In West Africa it is pollinated by *Ceratosolen silvestrianus* Grandi, whereas in both West Africa and East Africa the wasp *Ceratosolen flabellatus* Grandi is found in the figs of *F. sur* (Berg & Wiebes 1992).

Ficus sur has a multitude of uses by the people of Africa. Apart from as a source of food, a wide array of medicinal and economic uses are recorded. The bark is used to make string; the latex is used as eye drops, as an emetic and for curing body pains; an infusion of the roots is used to treat a sore throat, a painful uterus, swollen legs, diarrhoea and infertility. The Zulu gives an infusion of the root to cattle to promote milk flow and in tropical Africa the same is used to stimulate milk flow in nursing women. The soft, whitish wood is used to make grinding mortars and drums. But, for a comprehensive overview of ethnobotanical usage, refer to Burkill (1997) and Burrows & Burrows (2003).

Throughout its range, *Ficus sur* has mythical and magical significance to the local people. Perhaps the most well known is the reverence of the *mukuyu* tree by the Kikuyu people of Kenya, from which they take their tribal name. Many trees within their tribal areas are used from generation to generation as sacred shrines or places of sacrifice to the ancestral spirits. Sacrifices, usually of male sheep or goats, are made to appease the ancestral spirits, to invoke rain, to ensure good crops, to bring relief from famine, and to generally ensure the well-being of the tribe. Sacrifice to the tree means also sacrifice to *Earth* and *Forest*, the two great divinities of productivity (Watt & Breyer-Brandwijk 1962). In West Africa *F. sur* is a widespread fetish plant because it symbolizes fertility.

The genus name *Ficus* is derived from the classical Latin name *ficus*, a name then applied to the cultivated fig, *Ficus carica* L. However, it is likely that the Romans took the word from the more ancient Persian name *fica*. The specific epithet is the unaltered Arabic name of *sur* for this fig in Yemen (Hepper & Friis 1994). Although long-known as the Cape fig in southern Africa, the less euphonious English common name of broom cluster fig (Afrikaans: *besemtrosvy*) has also been promoted in recent years. Other English names for this fig include Malabar tree and *kooman* fig. The latter name, *kooman*, *koma(a)n* or *koeman*, is applied to this fig in the southern Cape region and is derived from 'kuman', the original Khoekhoe name for the species (Boshoff & Nienaber 1967). The name survives in 'Koemansbos', a small coastal forest in the Tsitsikamma area of the southern Cape.

It is noteworthy that vernacular names for *Ficus sur* in the Bantu languages change little across the different tribes and tongues. The Nguni language groups of southeastern Africa use the word *umkhiwane* or variants of it (Xhosa, Zulu, Swati, Northern Ndebele), the Shona languages use forms of *muwonde*, while the Swahili-related groups of eastern Africa all use *mukuyu* or *mkuyu*.

Ficus is a pantropical genus of 750–800 species, of which about 500 occur in South-East Asia and roughly 100 in Africa (excluding Madagascar). *F. sur* shares with *S. sycomorus* subsp. *sycomorus* the widest distribution of all African figs, extending from Senegal in the west, to Yemen in the northeast, and the southern Cape in the south (Figure 1) (*F. sycomorus* only extends as far south as the northern half of KwaZulu-Natal). *F. sur*, together with *F. burtt-davyi*, are the southernmost-occurring African figs. *Ficus sur* belongs to the subgenus *Sycomorus*, a subgenus of *Ficus* it shares with *F. sycomorus* and *F. vallis-choudae*.

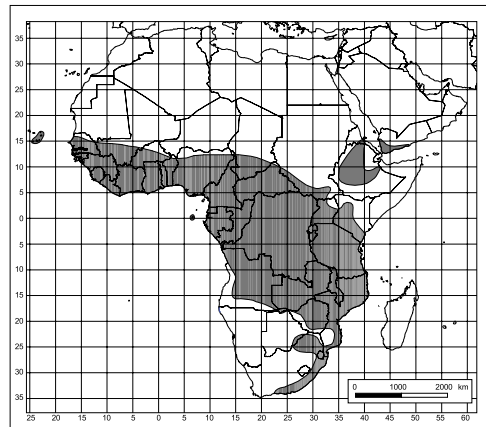


FIGURE 1.—Known distribution of *Ficus sur* (adapted from Beentje 1988; Friis 1992; Burkill 1997; Burrows & Burrows 2003).

Description.—Medium-sized tree with rounded crown, up to 12 m tall in woodland, sometimes reaching 25 m in forest. *Stem* crooked in woodland, straight and buttressed in tall forest specimens, often with suckers from roots or base of trunk. *Bark* grey to pale greyish or cream-grey, smooth at first, becoming rougher and darker with age and flaking into irregular squares; branchlets thinly hairy at first, glabrous with age; all parts with a milky latex when cut. *Leaves* alternate, spiralled, oblong-lanceolate to ovate or elliptic, 55–200 x 20–130 mm, thinly leathery, dark to mid-green, paler below, usually glabrous on both surfaces or with some fine hairs below, apex rounded to acute or acuminate, base cuneate, rounded or cordate; margins widely and irregularly dentate or toothed; venation evident, midrib and lateral veins raised on both surfaces; petiole 13–90 mm long, rather slender, glabrous or sparsely hairy. *Inflorescences* (figs or syconia): borne on much-branched leafless branches or trusses on larger branches, trunk, or roots where fruit are borne just below soil level; figs round to pear-shaped, and somewhat flattened at each end, 28–35 x 32–40 mm diam. when fresh, hairless or thinly hairy, green and dotted with minute cream-coloured spots, turning pink or red when fully ripe; peduncle $\pm$ 10 mm long, flaring into the narrow neck of receptacle; basal bracts minute and falling early (Burrows & Burrows 2003). *Chromosome number*: $2n = 26$ (Von Breitenbach 1965). Plate 2268.

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Brabejum stellatifolium

Proteaceae

Western Cape, South Africa

Brabejum stellatifolium L., Species plantarum, edn 1: 121 (1753); Brown: 165 (1810); Sim: 299, t. 132 (1907); Stapf et al.: 504, 505 (1912). *Amygdalus aethiopica* Breyne: 47, t. 265, fig. 3 (1678). *Brabyia capensis* L.: 137 (1767). *Brabejaria verticillata* Burm.f.: 30, err. typ. 26 (1768).

Brabejum stellatifolium, the wild almond, is a shrub or large, striking, spreading to erect, evergreen tree, first named (as *Amygdalus aethiopica*) by Jacob Breyne in 1678, from plants occurring wild on the Cape Peninsula. Historically it is an important plant as it marks the first tree used by early settlers in the 17th century. It was one of the first useful trees (food, wood, barrier plants and ornamentals) belonging to the protea family encountered by Van Riebeeck after the settlement of the Dutch East India Company (D.E.I.Co.) at the Cape in 1652. It was also considered as potential pig food (Van Riebeeck 1952 and 1958).

In 1661, Van Riebeeck (1952 and 1958) recorded his plans to plant a fence of wild almond trees to serve as the southeastern boundary of the D.E.I.Co.'s territory. The dense growth and leaning branches were to act as protection. The fence was planted with the help of French sailors and stretched over a distance of 13 km, from the mouth of the Salt River along the crest of Boschheuvel (Wineberg Hill) to the present-day Kirstenbosch National Botanical Garden on the southeastern slopes of Table Mountain. It became known as Van Riebeeck's Hedge. Today it is still fairly intact, especially at the eastern end of Wineberg Hill, above Bishopscourt. A remaining section in Kirstenbosch was declared a National Monument in 1936 and a fragment along Klaassen Road in 1945. On average, these trees are 8–10 m tall. The westernmost surviving tree of the fence can be seen in Kirstenbosch—a colossal multistemmed specimen spreading across 45 m.

Wild almonds were harvested annually and although extensively used by the Khoi as a valuable food source in former times, they were also the cause of the first recorded death by an indigenous plant in 1665: '*te veel bitter amandelen geeten*' (Van Riebeeck 1952 and 1958). Jan Wintervogel led an inland expedition and one of his members died from eating bitter almonds. The fruit are toxic when freshly eaten and have to be soaked for eight days in running water to rid them of *blousuur* (cyanogenic glycosides). Around 1685 *Brabejum* fruits were also exported to Holland by the early settlers, and seeds were germinated and cultivated in Amsterdam. The wood was used for 'joiners and turners'. The kernels, which resemble those of the much cultivated almond (*Prunus amygdalus*), were soaked, boiled and roasted as a substitute for coffee.

PLATE 2269.—1, inflorescence, × 1; 2, single flower, × 3; 3, young fruits, × 1; 4, mature fruiting branch with leaves, × 1. Voucher specimens: *Condy 219* (fruiting), *Van Jaarsveld 22862* (other material). Artist: Gillian Condy.



PLATE 2269 *Brabejum stellatifolium*

In 1997 the author visited the Cederberg area where he gathered data from Khoi descendants of the last users of *Brabejum stellatifolium* as a natural food source. On the farm Sederkloof, he interviewed Fredrick Joubert, 88-year old retired chief guide of the former Department of Forestry, and Abraham Ockhuis. According to Joubert, the 'almonds' were harvested when they were ripe and started falling from the trees in late autumn. The peels were first removed with a pocket knife and the kernels then dried in the sun. Once dry, they were placed in water for eight days (hence the common name *agt-dae-koffie*). The water was changed daily to remove the toxins. The kernels were then dried again, baked until light brown and ground or pounded to the right texture for use as a coffee substitute. According to Ockhuis and Joubert, the almonds were a godsend in times of famine. The dried almonds could be stored for a considerable time and used throughout the season. The processed kernels are very nutritious, with a taste like cacao.

Louis Leipoldt, well-known Afrikaans poet of the 19th century who spent his early years at Clanwilliam, was also well acquainted with '*ghoe koffie*'. When the German botanist Rudolf Schlechter visited Leipoldt, he was so impressed when he was offered a cup of *ghoe* coffee by his host, that he sent fruits to Germany for testing (Leipoldt 1927). *Brabejum* fruits show potential indeed and should be further investigated. It could add to the indigenous cuisine of the Western Cape.

Brabejum stellatifolium was also collected and documented several times by various well-known early European botanists visiting the Cape, for example Harry Bolus at Mitchell's Pass, William Burchell near Cape Town and between Garcia's Pass and Krombecks River, Franz Drège on Paarl Mountain, Peter MacOwan at Hottentots Holland, Carl Pappe at Paradise on the eastern slopes of Table Mountain and Carl Thunberg near Paarl along the Buffeljagts and Zondereinde Rivers (Glen & Germishuizen 2010).

Brabejum is the only South African member of the Proteaceae belonging to the subfamily Grevilleoideae, which is characterised by two ovules per flower. The genus is associated with the Australian Proteaceae and material has been grafted onto the related Australian macadamia nut (*Macadamia integrifolia*) and vice versa by Dr Hannes de Lange at Kirstenbosch National Botanical Garden some years ago. Although the grafts took, the experiment was not a great success but it proved their close kinship.

The wild almond is widely distributed in the Western Cape and follows more or less the mineral-poor quartzitic sandstone mountain range of the Cape Supergroup from the Gifberg in the north, just south of Vanrhynsdorp, to Swellendam in the east, a distance of about 350 km (Figure 1). It also grows in richer soil derived from granite such as found on Wineberg Hill and the lower slopes of Kirstenbosch. The typical habitat of *Brabejum* consists of riparian fynbos vegetation or afro-temperate forest. As a result of regular fires, *Brabejum* remains a dense, multistemmed shrub up to 4 m tall in fynbos vegetation and re-sprouts after fire. It is still fairly common along stream banks. However, in certain regions it competes with aggressive invasive alien growth, resulting in declining populations (Galatowitch & Richardson 2005).

In its afro-temperate forest habitat where fire plays a lesser role, trees become very large, often with a solitary, erect trunk and up to 12 m tall. There are very fine specimens in the natural forests of Kirstenbosch on the southeastern slopes of Table Mountain. The main trunk can be up to 1 m in diameter and over 3 m in circumference in old specimens. The branches often become drooping and the heavy trunks sometimes tear or break.

The seed of the wild almond is chiefly dispersed by mammals (porcupine and humans) or by water. The main growth period is in spring and summer and the flush of new growth is beset with golden hairs. The cream-coloured racemes appear from December to January. The flowers are very attractive, the reason for its popularity as a garden tree. They are pollinated by various insects such as bees, wasps and beetles. In spite of the high rainfall in the winter of 2009, flowering was very poor in its natural habitat at Kirstenbosch, probably the result of the wild almond weevil (*Setapion provinciale*) which predaes the young inflorescences. However, in the previous season the trees flowered en masse, a spectacular sight.

There is a host of other living organisms associated with *Brabejum* including fungi such as *Anthostomella brabeji*, *Phyllosticta owaniana* and *Harknessia capensis*, as well as a species of mite and two species of apionid weevils (Procheş 2007). The characteristic galls on the leaves of the wild almond are caused by minute mites, *Aceria rusti* (Eriophyidae). These mites are too small to be observed by the human eye (± 0.2 mm long). The two species of blackish apionid weevils, the wild almond weevil (*Setapion provinciale*) and the wild almond leaf weevil (*S. quantillum*), predate only on *Brabejum*. *S. provinciale* is ± 3 mm long, feeding seasonally only on the young inflorescences. *S. quantillum* is 1.5 mm long, feeds on the leaves and is active throughout the year. According to Procheş (2007) these weevils belong to the Tanaonini, an African endemic group associated with Proteaceae.

Brabejum will thrive as an ornamental in fynbos gardens but owing to its massive size, it is more suitable for larger gardens. Trees can be kept shorter by pruning. The strong northwesterly winds of the Cape regularly damage trees, but they recover quickly. The seeds are recalcitrant (soon losing viability). They should be harvested in autumn and then sown in sandy, slightly acidic, mineral-poor soil. Germination takes place within three months. Young seedlings grow fairly fast and transplant readily (Figure 2). The first leaves are opposite, the young leaves in whorls of four. Fallen fruits germinate spontaneously under the trees, sometimes forming dense stands after a good season. *Brabejum stellatifolium* is resistant to fungal attack by *Phytophthora cinnamomi*.

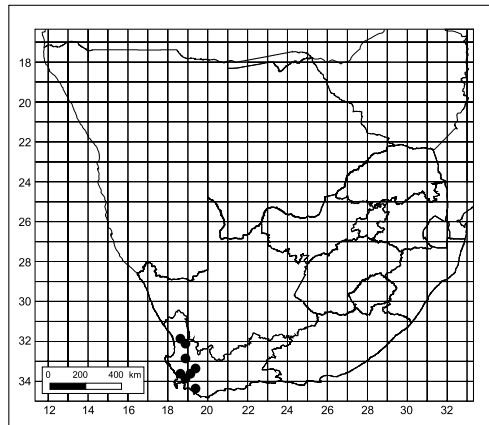


FIGURE 1.—Known distribution of *Brabejum stellatifolium*.

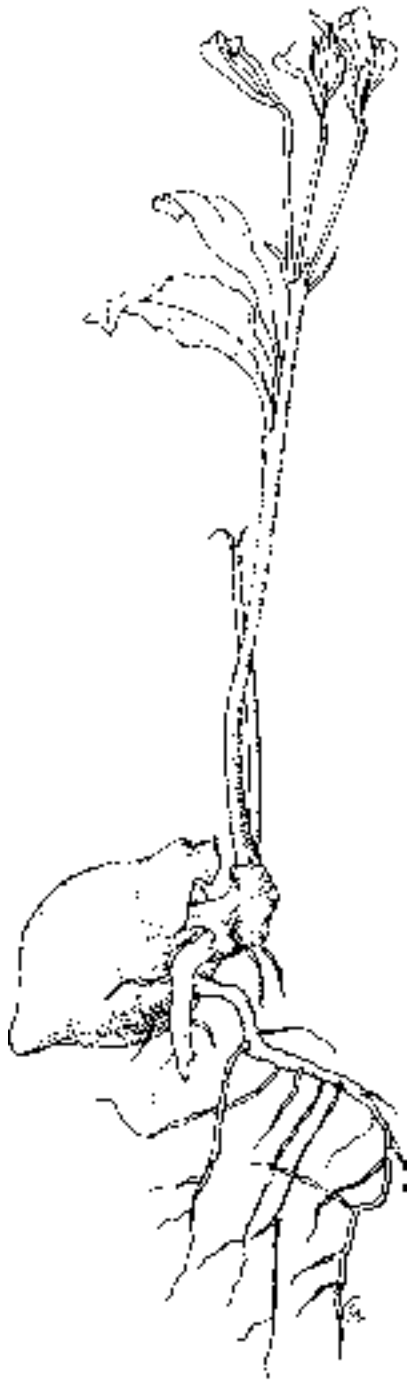


FIGURE 2.—*Brabejum stellatifolium*, young seedling. Voucher: Van Jaarsveld 22862 in Compton Herbarium, Kirstenbosch, Cape Town. Artist: Gillian Condy.

The generic name *Brabejum* is the Greek for a sceptre and pertains to the sceptre-shaped racemes (Jackson 1990). The specific epithet *stellatifolium* refers to the foliage radiating from the nodes. Some of its common names are *wilde-amandel*, *bitter-amandel*, *agtdae-koffie*, *ghoeboontjie*, *ghoe*, wild almond, Cape almond, bitter almond (Smith 1966; Palmer & Pitman 1972; Coates Palgrave 2002). National Tree List No.: 72 (Van Wyk & Van Wyk 1997).

The description below is based on living specimens in their natural habitat in the upper reaches of the Liesbeek River, and lower southeastern slopes of Table Mountain (Van Jaarsveld 22862 housed in Compton Herbarium, Kirstenbosch, Cape Town).

Description.—Tall, erect, single or multistemmed, evergreen tree, 8–12 m tall, often becoming sprawling; main trunk up to 1 m diam., up to 3.053 m in circumference (3.093 m in very old specimens); crown rounded, up to 45 m diam. *Roots* fibrous. *Branches* greyish brown, younger foliar branches terete, 5–8 mm diam., at first young branches covered with golden hairs, becoming glabrescent, purplish brown, later covered with distinctive whitish, horizontally arranged lenticels 1–2 mm wide, 0.5 mm high; internodes 95–140 mm apart; older bark greyish brown, covered with white lichens, with attractive mottled appearance. *Leaves* in whorls of 6 or 7, ascending spreading, lanceolate, (85–)170 × 32(–48) mm, apex acute, mucronate, coriaceous; surface velvety tomentose at first, becoming glabrous, dark green adaxially, pale green, often covered with galls abaxially; venation reticulate; margin slightly revolute, shallowly serrate, teeth acute in upper two thirds; petiole 7–8 mm long, yellowish green, continuing into leaf as midrib abaxially. *Inflorescence* axillary, in dense racemes, up to 80 mm long; bracts imbricate, obovate to elliptic, obtuse, membranous, velvety hairy, deciduous at flowering. *Flowers* hermaphroditic, white, scented;

pedicel 5–7 mm long. *Perianth* cylindrical in bud stage, 5 mm long, bearing a globose limb, once opened then with 4 linear-spathulate segments. *Stamens* slightly shorter than segments; filaments linear; anthers linear-oblong. *Ovary* sessile, beset with long hairs; style terete, glabrous; stigma terminal, minute. *Hypogynous disc* annular. *Fruit* an almond-shaped drupe up to 4.5×3 mm, densely ferruginous velvety, with corky exocarp and woody endocarp; young fruit covered with purplish velvety hairs. *Seed* solitary; embryo with hard, equal cotyledons. Plate 2269.

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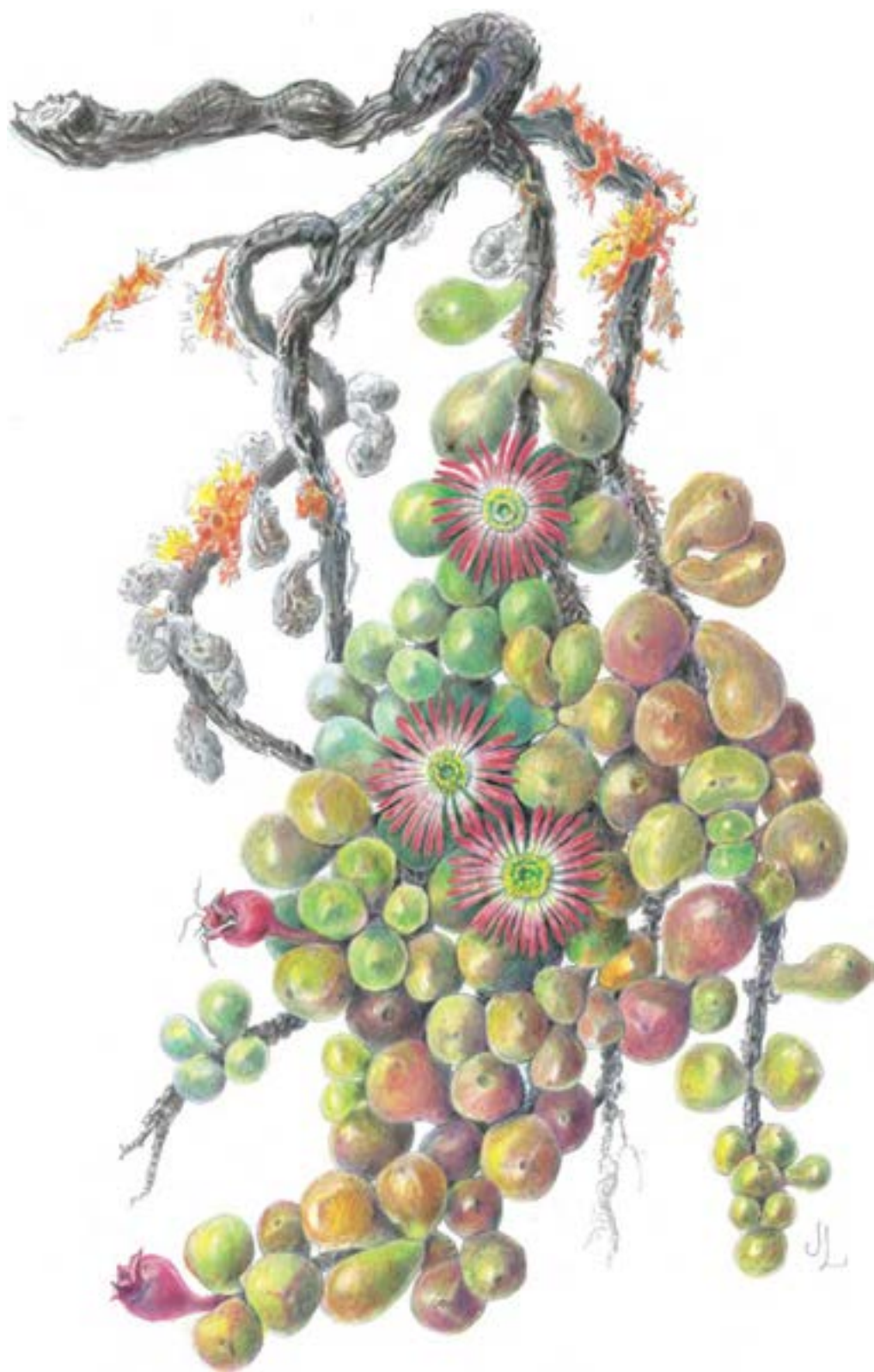


PLATE 2270 *Jensenobotrya lossowiana*

Jensenobotrya lossowiana

Mesembryanthemaceae

Namibia

Jensenobotrya lossowiana A.G.J.Herre in Sukkulantenkunde 4: 79–81 (1951).

Jensenobotrya lossowiana is a rare, range-restricted species from the south-central Namib Desert along the Atlantic coastline between Lüderitz and Walvis Bay. It is well established in succulent plant collections throughout the world as the plants are easily grown, but its rather inaccessible habitat is poorly known and is rarely visited. The plant has leafy branches reminiscent of bunches of grapes hanging from cliffs or sprawling over rocks on steep slopes below. As yet it is known only from the Dolphin Head and Spencer Bay region in southern coastal Namibia (Figure 1). Dolphin Head is an isolated promontory along the coastline 110 km north of Lüderitz. The region is isolated because of three factors—it falls within the Sperrgebiet, a prohibited desert area protected by a diamond mining company, it is situated away from any road infrastructure, and there is no fresh water. In the east the habitat of *J. lossowiana* is fringed by massive mountain-sized sand dunes and in the west by the Atlantic Ocean.

This remarkable species was discovered by Mrs Bodewitz of Lüderitz (Schwantes 1957). She brought it to the attention of Emil Jensen, succulent enthusiast of Lüderitz, who immediately recognised it as new. Realising the importance of Mrs Bodewitz's find, Jensen straight away arranged an expedition to Dolphin Head and thoroughly investigated and documented the plants. Upon his return to Lüderitz, he sent material for naming to Hans Herre, mesemb specialist and Curator of the Stellenbosch University Hortus Botanicus at the time. Herre, however, could not place it among the various known genera. The unusual fruiting capsules and peculiar pendent to sprawling growth habit with persistent woody stems that may reach a considerable age, made him place it in a genus of its own (Herre 1951).

Herre named the new genus *Jensenobotrya*, partly after Emil Jensen, who went to so much trouble collecting the type material and sending it to him, and partly for the likeness of the plants to a bunch of grapes. The Greek word for a bunch of grapes is *botrya* and the name thus literally means 'Jensen's grapes'. The specific epithet, *lossowiana*, honours a friend of Herre, Dr Otto von Lossow, a medical practitioner and naturalist of Lüderitz. Schwantes (1957), well-known author of publications on mesembs, documented the discovery of the plant very well in his account *Flowering stones and mid-day flowers*: 'Since, however, this latest discovery, the very curious *Jensenobotrya lossowiana* is among the oddest of the fantastic forms in which the family abounds, all those who had not anticipated a new discovery of this sort will be encouraged anew.' This find brought great excitement to succulent plant enthusiasts.

PLATE 2270.—Habit; note yellow-orange lichens on bark of older stems, $\times 0.8$. Drawn from a plant growing on Dolphin Head (southern Namibia). Voucher specimen: *Van Jaarsveld 21145* in Windhoek Herbarium, Windhoek. Artist: Jeanette Loedolff.

The genera of the Mesembryanthemaceae are currently classified mainly according to their fruit morphology (Hartmann 1988, 1991, 1993, 2001). Mesemb fruiting capsules are known for their extraordinarily complex structure and highly specialised seed dispersal mechanisms. The funnel- to top-shaped capsules have four to many locules and each locule is covered by a valve. The locules sometimes also have 'roofs' in the form of variously shaped covering membranes. Each valve is attached to a hygrochastically expanding keel. With moisture, the valves are pushed open by the expanding keels, closing again when dry. Seeds are dispersed locally by action of falling rain drops, the open capsules functioning as so-called splash-cups. The precise mechanism by which seeds are ejected by the raindrops differs according to the architecture of the various capsules. This rain-operated seed dispersal syndrome in plants is technically referred to as ombrohydrochory (Parolin 2006).

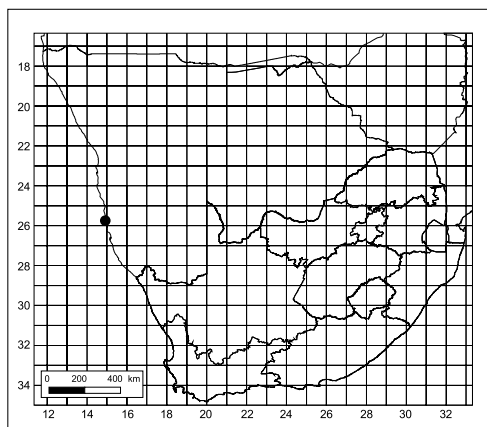


FIGURE 1.—Known distribution of *Jensenobotrya lossowiana*.

In *Jensenobotrya* the capsules are quite shallow and of the *Delosperma* type (Hartmann 2001). They are 5-locular and differ from those of *Delosperma* by their expanding keels, each which bears a unique ribbon-like awn at the tip. These awns, which represent highly modified valve wings, are curled up or embedded in the centre of the capsule when it is still closed. According to Burgoyne (1998), the awns are highly hygroscopic and once a capsule has opened, they prevent the valves from closing again. She suggests that when the capsule first opens, some of the seeds are drawn out by the awns and are thus locally dispersed. She further suggests that the awns may have developed as a mechanism to maximise the use of fog, instead of raindrops, to expel the seeds. *Jensenobotrya* capsules differ further by often becoming pendent, with the seeds then released passively. The capsule is soft and soon disintegrates. Dispersing seed locally is crucial for the survival of this species as its isolated cliff face and rocky habitat is essentially an island in a sea of sand.

In December 2007 one of us (EJVJ), accompanied by Danny Gildenhuys, visited the habitat of *Jensenobotrya lossowiana* and found the plants at Dolphin Head as well as on similar rocks outcropping about 10 km further north. The plants are locally abundant and often dominant. When growing on cliffs, the plants become pendent but on steep slopes, screes or rocky outcrops they tend to sprawl. The plants are much branched, each ultimate branchlet with two or three pairs of compactly arranged functional leaves. The succulent leaves are quite turgid, egg-shaped and sharply narrowing towards the base, hence often appearing subglobose when viewed from above. They are up to 15 mm in diameter, very smooth and resemble swollen grapes. The resemblance to grapes also extends to older leaves, which become wrinkled like raisins. Due to their high water content, the foliage represents

a significant weight burden, but this is overcome by the sprawling growth of the plants, a habit that is also ideal in their windy coastal habitat. In fact, the stems of the larger plants can become longer than 1 m, weighing several kilograms.

Plants of *Jensenobotrya lossowiana* are extremely slow-growing. A particular plant photographed by Willie Giess in 1974 and again by the first author in 2007 showed hardly any differences (see Van Jaarsveld 2008). The stems and older main branches are woody and can become as thick as a man's arm. A very large plant recorded by Emil Jensen had a stem circumference of 230 mm (Schwantes 1957). Herre (1951) estimated this plant to be at least 200 years old. However, if the plant depicted in the photographs mentioned above did not change much over a period of 30 years, then these larger specimens should be much older. The old dried out leaves of *Jensenobotrya* are persistent on the stems for quite some time. Stems are extremely brittle and the plants are therefore very fragile, without any mechanical defence. *J. lossowiana* probably evolved in its isolated cliff habitat in the absence of large herbivores or other forms of major disturbance, except for the wind.

Dolphin Head, the main stronghold of *Jensenobotrya lossowiana*, consists of hard quartzitic sandstone of the Spencer Bay Formation, Nosib Group, Damara Sequence (South African Committee for Stratigraphy 1980). This low head is about 200 m high and is said to be the highest point along the Namibian coastline. It is situated on a promontory, which was an isolated island when sea levels were higher during past warmer periods. The rocks on Dolphin Head are hard but brittle and plants grow in crevices on ledges or simply among rock fragments. The rocks are covered with various species of lichen.

Although the area is just south of the Tropic of Capricorn, it has a cool temperate climate throughout the year caused by the north-flowing cold Benguela Current. This peculiar coastal situation results in regular fog (more than 125 days per annum, Mendelsohn *et al.* 2009) and when one of us (EJv) visited the region in December 2007, dense fog settled in (see Van Jaarsveld 2008). Located in the core Namib Desert, the extremely low rainfall in this part of southern Africa is brought about by three climatic systems. A subtropical high pressure zone dominates the climate of southern Africa (preventing rain especially in winter) and strong prevailing southwesterly winds caused by the South Atlantic anticyclone blow cold air from the coast. In winter, the prevailing westerly winds bring low pressure systems (so-called cold fronts) and occasional rain to the coastal parts, mainly from Lüderitz southwards. The fog is the result of air cooled down by the cold Benguela Current that does not rise sufficiently to produce rain-bearing clouds, instead leading to dense fog. Considerable additional precipitation is supplied by the fog through condensation on rocks and vegetation.

Although the vegetation at Dolphin Head is described as Southern Desert, it leans towards Succulent Karoo (Mendelsohn *et al.* 2009). The region represents perhaps the extreme northernmost extent of the winter-rainfall region along the Atlantic coastline of southwestern Africa. Although the rainfall at Dolphin Head is estimated to be less than 20 mm per annum, regular fog ensures a constant supply of moisture. In fact, precipitation from fog is considered vital for the survival of many Namib plants, including *Jensenobotrya lossowiana*. Plants of this species wit-

nessed by one of us (EJvJ) during a foggy spell were dripping with moisture (see Van Jaarsveld 2008). Other typical Succulent Karoo plant species growing with *J. lossowiana* include *Didelta carnos*a, *Drosanthemum luederitzii*, *Pelargonium ceratophyllum*, *P. cortusifolium*, *Tetragonia decumbens* and *Tylecodon schaeferi* (summer-deciduous). The vegetation in the habitat is very sparse and the large *Jensenobotrya* shrubs make a bold, lasting impression.

The main population of *Jensenobotrya lossowiana* grows on shady, south-facing cliffs and slopes. The average daily maximum temperature is only about 19°C and average daily minimum about 10°C. Frost is absent. However, temperatures can rise sharply due to hot berg winds, reaching about 40°C or more for short periods. In more exposed settings on outcrops of Spencer Bay Formation rocks just north of Dolphin Head (at Arkona) the leaf colour of *J. lossowiana* is a fleshy pink, but on the steep south-facing cliffs and slopes it is grey-green to orange-green. The leaves are sometimes partially covered with a black fungal growth ('sooty mould') but it does not seem to have a negative effect. What appears to be the same fungus was also observed on another mesemb, *Namaquanthus vanheerdei*, at Steenbok in northern Namaqualand, South Africa, and its association with the plants should be investigated. Various lichen species, of which a bright orange-yellow one is shown on the illustrated plant, growing epiphytically on the bark of *J. lossowiana* and are also nourished by the fog.

Plants mostly flower sparsely, with only one or two flowers per plant open at any one time. This is in contrast with the mass flowering displayed by many other fast-growing shrubby mesembs. The conspicuous pink to pale pink flowers are pollinated by honey bees. They open around noon and close by dusk and are reported to be self-fertile (Smith *et al.* 1998). Plants can be found in flower throughout the year and seeds are dispersed at any time of the year. This is in harmony with the fog experienced throughout the year and supports the notion of *Jensenobotrya lossowiana* as a fog- rather than rain-dependent plant.

Jensenobotrya lossowiana is easily grown in cultivation, with cuttings rapidly rooting when planted in sand. It is best to keep them in a sunny or partially shady situation and to water sparingly throughout the year.

EJvJ is grateful to the University of Pretoria for sponsoring an expedition to Dolphin Head, to Danny Gildenhuys for companionship and Volker Jahnke of Lüderitz who took them to Dolphin Head and Arkona.

Description.—Much-branched, densely leafy shrubs, pendent from cliffs, procumbent or sprawling on ledges to lengths of more than 2 m. *Roots* fibrous. *Branches* woody, brittle, dark brown to blackish, with flaking, longitudinally fissured bark (bare for up to two thirds of their length in old specimens), in adult plants up to 70 mm diam., younger branches with spongy internodes 5–10 mm long, 5 mm diam., brownish at first and with remnants of old persistent leaves. *Leaves* decussate, crowded, with 2 or 3 functional pairs at each branch tip, basally connate, oblong trigonous-clavate (linear-oblongate viewed from the top) to subglobose, somewhat laterally compressed, 20–30 long, 15–18 mm diam. at apex, 8 mm diam. at

base, apex obtuse, faintly keeled; surface greyish, pinkish to purplish or orange-green, smooth and turgid; second or third pair withering (as moisture recycled to first pair), upper half of older leaves often covered with a blackish fungal growth; epidermis flat, stomata not sunken. *Flowers* pale to dark pink, terminal, solitary, opening during the day, 20–25(–35) mm diam. when fully opened, ebracteate, pedicellate, buds reddish; pedicel terete, 10 mm long, 3 mm diam. *Sepals* 5, obtuse, 4–5 mm long, reddish purple, inner hyaline. *Petals* in two series, 10–12 × 2 mm. *Filamentous staminodes* absent. *Stamens* diffuse, numerous, 3–4 mm long, white. *Ovary* flat or concave; glands annular, in a dark green lophomorphic ring (crenulate); stigmas 5, subulate; placenta parietal. *Fruiting capsule* drooping, funnel-shaped, flat at the top, 10–12 mm diam., opening hygrochastically, soft and disintegrating soon, valve wings broad, expanding keels contiguous, diverging, ending in coiled tape-like awns, locules 5, covering membranes absent. *Seed* oval to subglobose, 0.5 × 0.8–1 mm, reddish brown, papillate. Plate 2270.

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Tylosema fassoglense

Fabaceae: Caesalpinioideae

Northeastern, eastern, central and southern Africa

Tylosema fassoglense (Kotschy ex Schweinf.) Torre & Hillc. in Boletim da Sociedade Broteriana, Sér. 2, 29: 38 (1955); Torre & Hillcoat: 198 (1956); Brenan: 213 (1967); Schreiber: 20 (1967); Drummond: 213 (1972); Coetzer & Ross: 77 (1976); Coetzer & Ross: 61 (1977); Fox & Norwood Young: 218 (1982); Onderstall: 105 (1984); Blundell: 95, t. 321 (1987); Lock: 44 (1989); Plowes & Drummond: t. 79 (1990); Bolnick: 8, t. 21 (1995); Germishuizen & Fabian: 172, t. 78d (1997); Retief & Herman: 426 (1997); Pooley: 256, photo depicting *T. esculentum* (1998); Castro et al.: 107 (2005); Brink: 190 (2006); Brummitt: 26, t. 3.2.3 (2007). *Bauhinia fassoglensis* Kotschy ex Schweinf.: 14, t. 12, t. 13 (1868). *B. cissoïdes* Oliv.: 287 (1871). *B. kirkii* Oliv.: 288 (1871). *B. welwitschii* Oliv.: 287 (1871).

Prior to the mid-1950s, members of the all-African genus *Tylosema* were usually included under a broadly defined genus *Bauhinia*, albeit as a distinct subgroup, namely section *Tylosema*. Torre & Hillcoat (1955) and De Wit (1956), among others, raised some of these subgroups to generic level, resulting in a narrowly defined *Bauhinia* and several segregated genera, including *Tylosema*, an approach which is also followed here. *Tylosema* resembles *Bauhinia* in having simple, palmately veined leaves with an apical incision, hence the leaves are distinctly bilobed. It differs, however, from *Bauhinia* and related genera in having trailing or climbing stems, often with tendrils (modified stems), a large underground tuber, flowers which in the same species have markedly different style lengths (heterostyly), two fertile stamens and a lobed but not spathe-like calyx (Castro et al. 2005). Members of *Bauhinia* in a narrow sense are usually woody shrubs or trees without tendrils, and in flowers of the same species the styles are more or less constant in length (homostyly).

In a proposed evolutionary tree for the legumes (Fabaceae in a broad sense, also referred to as Leguminosae), *Tylosema* is part of a distinct basally diverging branch classified as the tribe Cercideae (Lewis et al. 2005). Other genera of this tribe with representatives in Africa and/or Madagascar are *Adenolobus*, *Bauhinia*, *Brenierea*, *Gigasiphon*, *Griffonia* and *Piliostigma*. The name of the tribe derives from the Eurasian and North American genus *Cercis*, two species of which are widely cultivated as ornamentals, namely *C. siliquastrum* (Judas tree) and *C. canadensis* (redbud). Tribe Cercideae is of special interest in that it is not only sister to all other members of subfamily Caesalpinioideae, but also to all other legumes.

Species demarcation in *Tylosema* has always been difficult owing to a lack of pronounced morphological differences among members of the group, but also the considerable morphological variability displayed by the plants, even within the same population. Here we follow Castro et al. (2005) in accepting five species in the

PLATE 2271.—1, branch with flowers (short-styled or thrum morph), $\times 1$; 2, flower in longitudinal section showing size and shape of hypanthium and arrangement of flower parts, $\times 0.75$; 3, stem with old inflorescence and two young pods, $\times 0.1$. Voucher specimen: Coetzer 814 in H.G.W.J. Schweickhardt Herbarium, Department of Plant Science, University of Pretoria, Pretoria. Artist: Elise Buitendag.



PLATE 2271 *Tylosema fassoglense*

genus. *T. fassoglense*, the most wide-ranging species, forms the subject of the present account. Occurring from Sudan southwards through eastern and central tropical Africa to southern Africa, it reaches the southernmost limits of its range in northeastern KwaZulu-Natal (Figure 1). This distribution closely matches the geographical range of the genus as a whole. Each of the remaining four species are much more restricted in their distribution, and one of these, *T. esculentum* (= *Bauhinia esculenta*), has previously been figured in this series (Verdoorn 1959: Plate 1311).

The generic name *Tylosema* is derived from the Greek *tylos*, a knob, swelling or callus, and *sema*, a sign or mark, but in this case meaning a flag or vexillum (Schweinfurth 1868). There are three different opinions in the literature regarding the choice of this name. According to several sources (e.g. Coetzer & Ross 1977; Germishuizen & Fabian 1997; Castro *et al.* 2005) the name alludes to the torulose seed. However, this explanation cannot be correct because the seed of *Tylosema* is not at all torulose, i.e. cylindrical with alternate swellings and constrictions. It has also been suggested that the name refers to the U-shaped mark on the seed (Jackson 1990). The correct explanation is that the name was inspired by the two peculiar thickened areas (callosities) at the base of the upper or standard petal, also known as the flag or vexillum (Schweinfurth 1868). The functional significance of these two thickened protuberances, clearly visible in the accompanying plate, remains unexplained. The specific name *fassoglense* means ‘coming from Fesoglu, also spelt Fazoghli or Fazoglu’, the place (ancient kingdom) on the Blue Nile in Sudan where our species was first collected by a Mr Boriani in 1839 (Schweinfurth 1868; Plowes & Drummond 1990).

Tylosema esculentum is the best studied species (Van der Maesen 2006), but because members of the genus are so similar, many attributes of that species may possibly be applied to *T. fassoglense*, a species with which it is often confused in southern Africa. In fact, a lumpers’ approach would be to recognise a single species in the genus, with a number of infraspecific taxa. *T. fassoglense* has larger leaves (lobes 60–200 mm long), divided apically along the central main vein for one tenth to one third (very rarely for half) of their length and the petiole is relatively long (30–70 mm). Leaves in *T. esculentum* tend to be smaller (lobes 30–75 mm long), divided apically along the central main vein for more than half of their length and the petiole is relatively short (15–35 mm) (Verdoorn 1959; Coetzer & Ross 1977; Castro *et al.* 2005). The distribution ranges of the two species are largely mutually exclusive, with *T. esculentum* mainly confined to deep Kalahari sand under more arid and temperate climatic conditions. *T. fassoglense* prefers subtropical and tropical conditions and is found on a wide range of substrates, including rocky and clay soils.

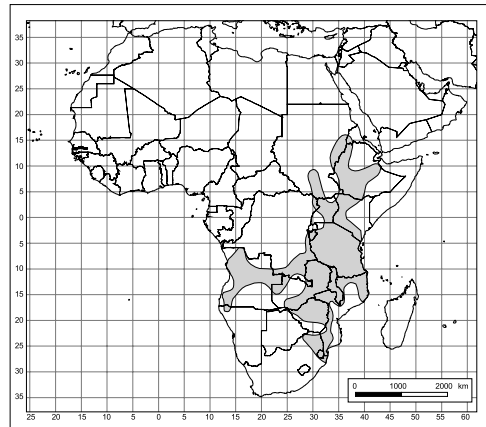


FIGURE 1.—Known distribution range of *Tylosema fassoglense* (shaded areas) based on Castro *et al.* (2005) as well as specimens housed in the H.G.W.J. Schweickerdt Herbarium, University of Pretoria, and National Herbarium, Pretoria.

Tylosema fassoglense is predominantly associated with open areas in savanna and woodland, less often with grassland. In many parts of its range, plants are regularly subjected to fire during the dry season. The root tubers can grow very large and are known to exceed 80 kg. When active growth resumes in spring, often following a fire, new shoots sprout very rapidly from these tubers, with young stems elongating at a growth rate of up to 50 mm per day (Brink 2006). As in most legumes belonging to subfamily Caesalpinioideae, the roots of *Tylosema* do not form nitrogen-fixing bacterial nodules (Grobelaar & Clarke 1975).

Of the many uses recorded for species of *Tylosema* (Fox & Norwood Young 1982; Van Wyk & Gericke 2000; Castro *et al.* 2005), most refer to *T. esculentum*, commonly known as marama or gemsbok bean (Leffers 2003; Van der Maesen 2006). The name 'marama' is derived from *morama*, the Tswana name for *T. esculentum* (Cole 1995), but as a common name it is also applied in southern Africa to *T. fassoglense* (albeit often with slightly different spelling), e.g. in Afrikaans, Northern Ndebele and Shona (Fox & Norwood Young 1982; Tredgold 1986; Mullin 2006; Rood 2008). *T. fassoglense* has slightly larger seed, but in composition and taste they closely match those of *T. esculentum*. Hence in recent years we have noted a growing tendency for the name 'marama' to be used in a generic sense to refer to the seeds/beans of both these species; this is also the sense in which we use the name in the present contribution. Marama beans are highly nutritious, comparing favourably with many existing legume crops and are widely collected for food (Wehmeyer *et al.* 1969; Dubois *et al.* 1995). They form an important part of the diet of rural people, particularly in parts of Namibia, Botswana, Mozambique and Zimbabwe (Tredgold 1986; Leffers 2003; Van Wyk & Gericke 2000; Brink 2006; Van der Maesen 2006).

In Zimbabwe, the tubers of *Tylosema fassoglense* are grounded to make a meal which is cooked as porridge (Tredgold 1986). Roots in this species contain lithospermoside, a cyanoglucoside (Fort *et al.* 2001). Except for being of chemotaxonomic significance, this compound is noncyanogenic and *in vitro* results suggest it might be of biological importance as a potentially strong antitumour promoter (Ito *et al.* 1999). Elsewhere in the Cercideae, lithospermoside is also known in *Lasiobema*, a genus related to *Tylosema* and also bearing tendrils, *Griffonia* and *Cercis* (Josien-Lefebvre & Le Drian 2003).

Various parts of *Tylosema fassoglense* are used in traditional medicine for a wide range of conditions (Gelfand *et al.* 1985; Bossard 1996; Neuwinger 2000; Tabuti *et al.* 2003; Brink 2006). In traditional veterinary medicine, a decoction of the tuberous root is administered as a galactagogue to cows before calving, and as a drench for a retained placenta (Watt & Breyer-Brandwijk 1962). The leaves and young branches are grazed by game and stock, while in arid regions water is obtained from the fibrous tuber. Stems of *T. fassoglense* are used in basket-making, to make rope and yield a strong fibre which is suitable for the weaving of cloth (Liengme 1981; Maundu *et al.* 1999; Brink 2006). The roots yield a brown dye when crushed in water (Liengme 1981).

According to Dubois *et al.* (1995), *Tylosema fassoglense* seed contain high levels of lipids (240–300 g kg⁻¹) and proteins (446 g kg⁻¹ dry weight). Major fatty acids

contained in the oil are linoleic (36–42% of the total fatty acids), oleic (32–35%) and palmitic (11.5–15.7%) acids. The proteins are characterised by high levels of lysine, proline and tyrosine. Owing to their very low content, both methionine and cystine appear to be the limiting amino acids. The defatted seed meal contains substantial amounts of trypsin inhibitors (295 TUI mg⁻¹) and phytates (35 g kg⁻¹ dry weight). Further nutritional information on the seed of this species is supplied by Malaisse & Parent (1985) and Brink (2006). *T. esculentum* has been the focus of recent studies on the nutritional profile of marama beans with regard to its amino acid composition (Maruatona *et al.* 2010) and fat content (Ketshajwang *et al.* 1998). The oils represent 22% saturated and 78% unsaturated fats. Regarding it as an important potential source of nutrients, including polyphenols, phytates and oligosaccharides, the Department of Food Sciences at the University of Pretoria, in collaboration with several other universities, is currently undertaking studies on *Tylosema* to encourage its domestication as a crop plant. One objective is to develop prototypes of high-quality and healthy marama bean food products such as roasted marama beans, milk, oil and protein-rich flours for niche markets.

Marama beans are traditionally baked in hot ash, but they can also be cooked; raw beans are rather tasteless and slimy. The heat causes the hard shells to crack and enables one to remove the edible kernel, which is most tasty when roasted to a brownish colour. Mixed with clean sand and baked in an oven, *Tylosema fassoglense* beans are said to be tastier than roasted peanuts (Rood 2008). The beans of this species are also shelled, dried and then fried like coffee beans in a pot until brown. These are then grounded and used as a substitute for coffee (Rood 2008).

Among legumes, structural heterostyly—styles differing markedly in length or shape in flowers of the same species—has hitherto only been reported in *Tylosema* (Coetzer & Ross 1976). In all members of the genus it finds expression in distyly, with short-styled flowers (so-called thrum morphs) and long-styled flowers (so-called pin morphs) occurring on different plants, but in the same plant population. Typically, the short-styled flowers have stamens with long filaments and inversely the long-styled flowers have stamens with short filaments. The material illustrated in the accompanying plate is from a short-styled plant, with the stamens extending well beyond the short pistil. The size of the short-styled pistils closely corresponds with the size of the short stamens and, likewise, the size of the long-styled pistils with that of the long stamens. This phenomenon clearly promotes cross-pollination by insects, in this case mainly by honeybees. The position on the body of a visiting bee where pollen is usually deposited coincides with the corresponding position where the stigma touches the bee's body. No significant difference was found in the size of the ovary between the short- and long-styled pistils. Breeding experiments involving *T. esculentum* have since confirmed that it is also functionally heterostylous and that plants are self-incompatible (Hartley *et al.* 2002).

During a study of the pollination biology of *Tylosema esculentum*, it was found that the fertile anthers produce mucilage in which the pollen is suspended soon after opening to release the mature pollen (De Frey *et al.* 1992). In *T. fassoglense*, pollen is similarly viscid and somewhat oily (Rand 1909). This is a unique phenomenon because pollen

is usually released in a semidry state and dries even more after shedding. A possible explanation of the function of this mucilage is that it protects the pollen from dehydration and promotes adhesion to a pollinator's body and, therefore, positively influences the germinability and longevity of the pollen. Pollen grains are similar in size and morphology between the two flower morphs, unlike the grain dimorphism frequently reported in other distylous species (Hartley *et al.* 2002; Castro *et al.* 2005). All species of *Tylosema* have rather similar pollen grains, although slight interspecific differences, mainly in size, do exist (Coetzer *et al.* 1981; Castro *et al.* 2005).

Considering its natural distribution, *Tylosema fassoglense* is likely to do best as a crop plant under conditions of relatively high rainfall in subtropical and tropical areas. Species of *Tylosema* are best propagated by seed. These should be scarified before planting by filing a notch in the hard seed coat; germination results within two weeks (Powell 1987). Plants first flower after two or three years, although initially rather sparsely so. A good seed crop may be expected after five years. Several plants need to be grown together to ensure ample numbers of thrum and pin flowers. Seed set is often very low (also in the field) owing to high levels of fruit abortion. This, together with the heterostylous breeding system and seed requiring scarification, are major obstacles towards the development of *Tylosema* as a crop. Compared with equivalent seed crops such as soybean and peanut, marama bean is clearly not suitable for mass production and are likely to at most succeed as a specialised crop, particularly in the roast nut market. Harvesting from the wild may be a more viable option and also create income for often impoverished rural communities, although the often patchy distribution of the species may pose limitations. It is essential to select for superior genotypes with high seed production if any of the marama beans is to become successfully domesticated (Hartley *et al.* 2002). For this purpose, molecular techniques may prove useful for mapping important traits that can then be followed in subsequent breeding programmes (Nepolo *et al.* 2009).

Throughout its extensive range, *Tylosema fassoglense* is known under very many vernacular names, the following being a selection, arranged according to language. Afrikaans: *gemsbokboon(tjie)*, *maramaboon*, *maramaboerboon*, *rankboerboon*, *wildeboerboon*. Dholuo: *ombasa*. English: camel's foot, creeping bauhinia, gemsbok bean, marama bean, tamani berry, yellow bauhinia. Kamba: *ivole*. Lubukusu: *chingaayu* (seed), *kamachayu* (seed). Manica: *gwangwandiza*. Northern Ndebele (Zimbabwe): *inkwapau*, *inkwopan*, *murama*, *umbama*, *umdabula*, *umdabule*, *umrama*. Nyaneka: *(otyi) ngangu* (plant), *(oma)ngangu* (plant), *(e)ngangu* (seed). Nyanja (Chewa): *mpandakwaya*, *mpandopansi*, *mp(h)wandwapansi*. Olumarachi: *imbasa*. Samburu: *dalamboi*. Shona: *ingwaila*, *lamoora*, *mamoora*, *mubamura*, *mudamura*, *mudavara*, *mugwamura*, *mumbopa*, *mumbopo*, *mumbova*, *munhamura*, *murama*, *mutewa*, *mutukutupasi*, *umrama*. Somali: *bassac*. Swahili: *kifumbe*. Swati: *khubakhulu*. Tonga (Mozambique): *marumama*. Tonga (Zambezi River Valley): *umbama*. Tshwa: *tade*. Tsonga: *nthamula*. Tswana: *marama*, *morama*. Yao (Malawi): *mkulumu*. Unspecified: *kiyugeyuge* (Uganda, Bulamogi County); *messalasi*, *m'páu(a)* (Mozambique).

Description.—Shrub with a large or very large (> 80 kg), woody, perennial tuber from which several annual stems arise; proximal part of stems woody; stems

prostrate and trailing or climbing, up to 6 m long; young parts rusty tomentose or rusty pubescent, indumentum becoming greyish or $\pm$ disappearing. *Tendrils* axillary, forked, 40–80 mm long, lateral branches 10–20 mm long. *Leaves* alternate, simple, palmately veined with 7–11 main veins; lamina shallowly bilobed apically to about one tenth to one third (very rarely to half) of length of leaf lobes, deeply cordate basally, broadly circular, 60–110(–200) $\times$ 50–120(–180) mm, usually rusty pubescent below, sometimes subglabrous or densely tomentose, slightly folded along median main vein, lobes ovate-oval to obovate; petiole 30–70 mm long. *Stipules* $\pm$ 2–4 $\times$ 2 mm, persistent. *Racemes* solitary and terminal on sympodial branching, 3–10-flowered; peduncle (20–)50–175 mm long; axis (20–)50–230(–400) mm long. *Flowers* bisexual, irregular, medium to small, yellow. *Hypanthium* 3–8 mm long, lightly sulcate outside. *Sepals* 5, upper two completely or partly fused, other three free, 10–15 $\times$ 3–4 mm, $\pm$ conspicuously keeled along back. *Petals* 5, yellow, fading to pink; upper one (vexillum) smaller than the rest and bicallose basally, the four larger ones obovate to obovate-suborbicular, crinkled-bullate, 20–40 $\times$ 10–30 mm, tapering into basal claw. *Stamens* 2, fertile, remaining 7 or 8 staminodial, unequal, 3–6 mm long; filaments of fertile stamens 6–10 mm long; anthers dorsifixed. *Pistil* superior, long-stipitate, glabrous; gynophore 10–15 mm long, adnate to inside of hypanthium; ovary 1-loculed, 5–6 mm long, 2- or 3(4)-ovuled; style elongate, 4–8 mm long; stigma very small, not wider than top of style. *Pod* woody, dehiscent or (rarely) indehiscent, obovate to oblong-ovate, oval to circular when containing only 1 seed, 50–100 $\times$ 30–60 mm, 1 or 2(3)-seeded. *Seed* large, oblate, seed coat chestnut-brown to black, with a U-shaped line extending for a short distance from hilum, suborbicular or ellipsoid, 15–28 $\times$ 10–20 mm, funicle short. Plate 2271.

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Millettia grandis

Leguminosae: Papilionoideae

South Africa

Millettia grandis (E.Mey.) Skeels in Fairchild, Bulletin, Bureau of Plant Industry, United States Department of Agriculture 248: 55 (1912); Palmer & Pitman: 923 (1972); Lock: 358 (1989); Pooley: 164 (1993); Van Wyk & Van Wyk: 458 (1997); Grant et al.: 132 (1998); Coates Palgrave: 377 (2002); Da Silva et al.: 70 (2004); Thomas et al.: 148 (2004); Germishuizen: 477 (2006); Klopper et al.: 345 (2006); Verdcourt: 111 (2007). *Virgilia grandis* E.Mey.: 1 (1836). *M. caffra* Meisn.: 99 (1843); Harvey: 211 (1862); Sim: 203 (1907); Wood: 42 (1907); Dunn: 206 (1912); Ross: 203 (1972). *Fornasinia ebenifera* Bertol.: 589 (1849).

The genus *Millettia* is a large group of about 150 species in the Leguminosae (subfamily Papilionoideae) distributed in tropical and subtropical Africa, Asia and Australasia. Species usually occur in forests and woodlands (Leistner 2000; Schrire 2005). *Millettia grandis* belongs to the pantropical and subtropical tribe Millettieae. The circumscription of the tribe is rapidly changing and is being updated based on recent molecular evidence which shows *Millettia* to be highly polyphyletic, e.g. Hu *et al.* (2000, 2002). This means the placement of *M. grandis* within *Millettia* is in some doubt until a more detailed phylogeny of *Millettia* species is undertaken. The genus has a generally Old World distribution, with possible New World sister groups yet to be found (Schrire 2005).

The genus was named after Dr Charles Millett of Canton, China, who worked for the British East India Company in the 1830s and collected many Chinese plants. The specific epithet, *grandis*, means large. The English and Afrikaans common name, umzimbeet, is a direct phonetic transcription of the Zulu and Xhosa common name, *umsimbithi*. Another Xhosa name for *Millettia grandis* is *umKunye*. Owing to the exceptional strength and density of the wood, the tree is also commonly known as ironwood (Sim 1907; Smith 1966; Palmer & Pitman 1972). After the formal publication of the name *Millettia* which Wight & Arnott (1834) based on two Indian species, *M. grandis* (= *M. caffra*) was the first species recognised as belonging to this genus, recorded and known to science in Africa (Meisner 1843; Dunn 1912).

The natural distribution of this species (Figure 1) has been the subject of some controversy. *Millettia ebenifera* (= *Fornasinia ebenifera* Bertol.) was previously included under *M. grandis* (Verdcourt 2007). However, the Mozambique taxon differs considerably from the South African *Millettia grandis*. A closer look at the two taxa revealed that they are completely different and worthy of splitting with the plant from Mozambique retaining its original name, *M. ebenifera* (J. Burrows pers. comm.; Burrows *et al.* in prep.). *Millettia grandis* is an important species of the Pondoland Centre of endemism within the greater regional mosaic of the Maputaland-Pondoland Region (White 1983; Van Wyk &

PLATE 2272.—1, branched panicle showing centripetal development of individual flowers, × 1; 2, branchlets showing the characteristically curved striate bud in leaf axil as well as spent inflorescence and developing velvety pods, × 1. Voucher specimen: *Condy* 228 in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2272 *Millettia grandis*

Smith 2001). Furthermore, *M. grandis* is the southernmost species of this genus (as currently circumscribed), in Africa. The southern boundary for its natural distribution is around East London in the Albany Thicket but it also occurs in forest patches within Sub-Escarpment Grassland, Sub-Escarpment Savanna and along the Indian Ocean Coastal Belt (Mucina & Rutherford 2006). It occurs in coastal and associated vegetation up to about Richard's Bay in KwaZulu-Natal Province. *M. grandis* is very rarely found more than 20 km from the coast or at altitudes greater than 600 m (Sim 1907; Coates Palgrave 2002), even though it is successfully cultivated and grown as far inland as the South African highveld and in cities in Zimbabwe that are subject to very different climatic conditions. In fact, the specimen used for figuring this plate was collected from a tree cultivated in a garden in Waterkloof, Pretoria. Several magnificent specimens grow in the Pretoria National Botanic Garden.

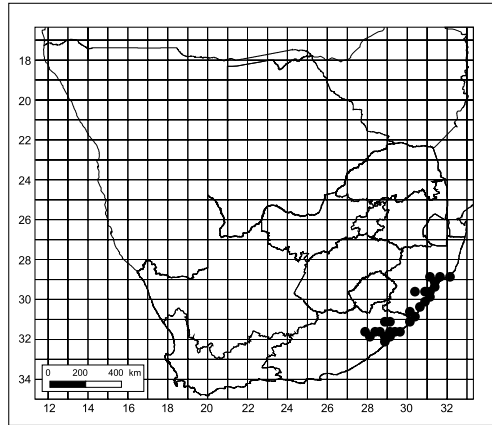


FIGURE 1.—Known natural distribution of *Millettia grandis* in South Africa based primarily on specimens in the National Herbarium, Pretoria. The species occurs from the Kei River in the Eastern Cape Province, along forest patches up to about Richard's Bay in KwaZulu-Natal Province.

Except for *Millettia stuhlmannii* with its somewhat anomalous bushveld distribution in the Limpopo Province of South Africa, *M. grandis* is the only species in the genus occurring in the *Flora of southern Africa* region. Even though the two *Millettia* species have an overlapping distribution in some areas, they are easily distinguished. *M. grandis* has flaking bark, 11–15 dark to bluish green leaflets per leaf, often with a reddish brown pubescence below, and the standard of the flowers is pubescent on the outside, whereas *M. stuhlmannii* has smooth bark, 15–19 leaflets per hairless leaf and the standard of the flowers is glabrous (Van Wyk & Van Wyk 1997; Coates Palgrave 2002; Verdcourt 2007).

Because of its relatively widespread distribution, *Millettia grandis* is Red-listed in the least concern category and the species has no specific conservation requirements or associated legislation (Raimondo *et al.* 2009).

Minute hair-like stipels are present at the base of each pair of leaflets. Although stipels often have an evolutionary apomorphic or advanced function in many plants—for example having developed into glandular structures—in *Millettia grandis* the stipels seem to be a relict of its foliar morphology. The stipels serve to protect the young leaflet in its primordial stage as they are then approximately the same size as the leaflets (Guédès & Dupuy 1980).

The wood of *Millettia grandis* is exceptionally beautiful. The hardwood is dark reddish brown and the sapwood a contrasting yellow, with a very clear dividing line

between the two. The wood, which is hard and durable, is much favoured for making walking sticks and the more traditional knobkerries. A skilled carpenter would often be able to make a walking stick or similar object more aesthetically pleasing with one side dark and the other side pale-coloured using this clear dividing line between the hardwood and sapwood. These types of walking sticks are easily recognised where they are sold in curio shops and other places frequented by tourists in Pondoland (Sim 1907; Palmer & Pitman 1972; Schrire 2005). In earlier times, Zulu warriors used the straight branches on trees for assegai shafts. The Dutch colonists in present-day KwaZulu-Natal preferred the wood of *M. grandis* to any other kind for making wagon axles. These would, reportedly, last for more than a decade (Smith 1966).

The bark is somewhat significant in often being covered with moss, especially in forests. Baboons are known to strip off and eat the bark (Palmer & Pitman 1972).

Several species of *Millettia*, including *M. grandis*, are used in agroforestry to fix nitrogen, thus supporting the rehabilitation of soil. Different parts of the tree are used as a fish and arrow poison and as an insecticide. Fish poisoned with the pounded roots have to be boiled before they can be safely eaten. An effective vermifuge, especially for roundworm, is prepared with only one or two seeds ground and soaked in milk. The seeds are, however, poisonous when taken in large quantities. The powdered roots, prepared in various ways, are noted for their potent means to induce sleep and are used as a tranquiliser. In the past, the roots mixed with other compounds were reportedly also burnt in huts to dismiss vexing concerns. *Millettia grandis* exudes a resin resembling that of guaiacum or the so-called *lignum vitae*—translated from Latin as ‘wood of life’. This is a medicinal resin obtained from *Guaiacum* species of the family Zygophyllaceae. It is uncertain whether the resin from *M. grandis* is as effective as that reported for guaiacum, in particular for the treatment of syphilis (Watt & Breyer-Brandwijk 1962; Grant *et al.* 1998; Coates Palgrave 2002; Thomas *et al.* 2004).

At least three species of butterfly, *Deudorix diodes*, *Coeliades forestan* and *Charaxes pondoensis*, have been recorded to breed and forage specifically on *Millettia grandis*. *D. diodes* employs an interesting strategy ensuring a very successful initial stage in its life cycle. The entire larval and pupal stage of this butterfly, also known as the Orange Barred Playboy, is spent in the pods of *M. grandis*, which are found on the tree from February to July. The chrysalises bore little holes through the valves of the pods, enabling them to escape and complete their metamorphosis. Caterpillars of the Striped Policeman butterfly, *Coeliades forestan*, also eat the pods. Caterpillars of *Charaxes pondoensis*, which is endemic to Pondoland, eat the leaves (Palmer & Pitman 1972; Dickson & Kroon 1978; Grant *et al.* 1998; Thomas *et al.* 2004).

Millettia grandis trees are often kept for their horticultural value, since they are fast-growing, decorative and able to withstand some degree of frost, quite an unusual attribute considering their frost-free natural distribution. They are easily grown from seed. Although they are more or less deciduous, they often become evergreen when growing under favourable conditions. They are striking in cultivation, mostly noted for their attractive, dense, V-shaped form, the somewhat flat canopy with the rusty brown buds and purple flowers often produced above the canopy (hence they

are highly visible), even though the tree may still be fairly young (Grant *et al.* 1998; Coates Palgrave 2002; Thomas *et al.* 2004).

Description.—Medium-sized, usually multi-stemmed, shrub to large tree up to 13 m high under favourable conditions. *Stems* gnarled and stunted when growing in shale soil. *Roots* with nitrogen-fixing bacterial nodules. *Bark* dark grey to brown, often gnarled on older stems, smooth to flaky; young branchlets sparsely pubescent to almost glabrous. *Leaves* imparipinnate, 3–7-jugate; petiole and rachis channelled, finely appressed-pubescent; petiole 10–45 mm long; rachis 45–110 mm long; leaflets elliptic to oblong-elliptic or ovate-elliptic, 20–80 × 10–25 mm, apex rounded to apiculate, base rounded to cuneate, glabrous, dark bluish green adaxially and finely appressed-pubescent abaxially, lateral nerves in 9–14 parallel, evenly spaced pairs; margins entire; stipules 4–6 mm long, deciduous; stipels 3–5 mm long, persistent; leaf-axils with characteristic curved striate buds; new growth with young leaves and veins a distinctive dark reddish brown; petiolules 2–4 mm long. *Inflorescence* a branched panicle, 140–280 mm long, branches 10–50 mm long; bracts 1–2 mm long; pedicels 3–5 mm long; bracteoles ovate, 1.5–2.0 mm long, deciduous. *Calyx* with pale silvery (Mozambique specimens) to dark brown (South African specimens) velvety pubescence; tube 2–5 mm long; lobes ovate, 2–3 mm long, upper two united except for apical slit of up to 1 mm. *Corolla* violet; standard 130–160 × 120–130 mm, rounded, with transverse callus, silver velvety pubescent outside, claw 2.5–3.0 mm long; wing blades 13–14 × 4–5 mm, oblong-elliptic, with spur 1 mm long and claw 3 mm long; blades of keel petals elliptic, 8–11 × 5 mm, finely toothed at base on upper side, with claw 3 mm long. *Stamen* sheath 10–13 mm long; free parts of filaments 4–5 mm long; anthers 1 mm long; upper filament free at base. *Ovary* up to 10 mm long, with light brown velvety pubescence, ovules 5; style 3.5–5.0 mm long, glabrous, bent through 40–45° in lower third. *Pods* woody, 1–3-seeded, oblong to oblanceolate, 50–130 × 15–30 mm, densely covered with dark brown pubescence when young becoming glabrescent with age, splitting transversely and explosively dehiscent. *Seeds* oblong, compressed, 13 × 9 mm, brownish black. *Flowering time*: November–March. Plate 2272.

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PLATE 2273 *Plumbago hunsbergensis*

Plumbago hunsbergensis

Plumbaginaceae

Namibia

Plumbago hunsbergensis Van Jaarsv., W.Swanepoel & A.E.van Wyk, sp. nov., differt *P. wissii* foliis linearibus-oblancoelatis vel spathulatis, (10–)12–25(–30) × 1–4 mm, margine denticulato et pagina rugosa, pilos glandulosus ferente, corolla flavescens vel tractu temporis punicea, tubo 20–22 mm longo differt.

TYPE.—Namibia, Hohenzollern, western outlier of the Hunsberg, on steep upper south face of Blokberg. *Van Jaarsveld & Swanepoel 1994* (WIND, holo.).

The genus *Plumbago* consists of about 25 species and has a worldwide distribution, occurring from the warm-temperate to subtropical and tropical regions of the world (Kubitzki 1993). It is the largest of the four genera comprising subfamily Plumbaginoideae of the family Plumbaginaceae (Lledó *et al.* 1998, 2005).

Plumbago hunsbergensis, a rare and little known species, is a spreading shrub endemic to the Hunsberg mountain complex in southwestern Namibia (Garipe Centre of Endemism, Van Wyk & Smith 2001) (Figure 1). It occurs mainly at altitudes of 1 000–1 600 m, on the mountain summit, as well as on steep, south-facing, middle and upper slopes. The species is locally abundant in a high-altitude, sclerophyllous vegetation type (related to Renosterveld of the Western and Northern Cape Provinces of South Africa) within the Succulent Karoo Biome. The plants grow on rocky sandstone screes in full sun. Rainfall is about 200–300 mm per annum and occurs mainly in autumn and winter.

Hitherto five species of *Plumbago* have been recognised as indigenous to South Africa and Namibia (Dyer 1963; Germishuizen & Meyer 2003), three of which are present in Namibia, namely *P. pearsonii*, *P. wissii* and *P. zeylanica*. The new *P. hunsbergensis* is the fourth species recorded for Namibia. In habit it somewhat resembles another rare Namibian endemic, *P. wissii*. Both are spreading, stoloniferous shrubs with ribbed stems and superficially similar flowers, but here the resemblance ends.

Plumbago hunsbergensis is immediately distinguished from *P. wissii* by its smaller, leathery, linear-oblancoelate to linear-spathulate leaves of which the margin is crisped and distinctly denticulate. The leaf surface is rugose and the margin is rolled under towards the apex. The stems are 9–12-ribbed. Most plant parts are covered with a sticky exudate that collects dust. The flowers are carried in loose slender panicles (initially a slender raceme, subsequently forming side axes) and have a shorter (20 mm long) corolla with a partly dark maroon tube and cream-coloured

PLATE 2273.—1, young flowering branch (later becoming loosely racemose when up to four side branches sprout from base of raceme), × 1; 2, leaf, viewed from below, × 4; 3, flower, side view, × 4; 4, flower from above, × 5; 5, pin flower opened up, × 5. Voucher specimen: *Van Jaarsveld & Swanepoel 1994*. Artist: Vicki Thomas.

lobes that are rose-pink towards the tip and margins. The plant flowers in spring and summer and the colour of the flowers tend to darken with age.

Plumbago wissii has much longer, linear to linear-obovate leaves with an entire margin and smooth surface. It flowers mostly in summer, the flowers are larger (tube 23–25 mm long) and are borne in slender racemes. *P. wissii* is endemic to the summit of the Brandberg granite massif at altitudes of 2 000–2 400 m (Friedrich 1957). The Brandberg is located well within the tropics and is 750 km north of the eastern Hunsberg (Nordenstam 1974; Craven & Craven 2000).

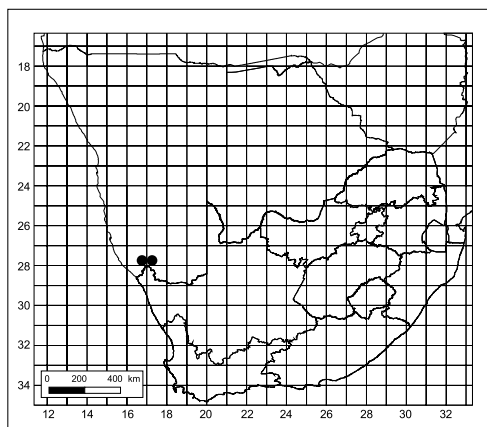


FIGURE 1.—Known distribution of *Plumbago hunsbergensis*.

Both species grow very easily from soft-tip cuttings as well as from seed. The plants adapt well to the summer-dry Mediterranean-type climate at Kirstenbosch and prove to be extremely hardy, showing no signs of stress during periods of drought. They are floriferous, *Plumbago hunsbergensis* flowering from autumn to spring and *P. wissii* in summer. The plants can be pruned back hard when they become untidy and will simply re-sprout.

Some of the other southern African species of *Plumbago* are already well established in ornamental horticulture. One of them, *P. auriculata* (= *P. capensis*) (see Plate 222 in this series), a dense, scandent shrub becoming 2–3 m tall and found mainly in the Eastern Cape of South Africa, is extensively cultivated for its attractive blue or white flowers. The white-flowered *P. zeylanica* is closely related to *P. auriculata*. It is a smaller, scrambling shrub from savanna regions in the north (Kaokoveld in Namibia, and Gauteng, Limpopo, North West, Mpumalanga and KwaZulu-Natal in South Africa). The remaining two species are from the arid southern and western parts of the subcontinent. *P. tristis* is a dwarf shrublet in Succulent Karoo vegetation of the Western Cape in South Africa. *P. pearsonii* from central Namibia is the closest to *P. wissii*. It is an erect shrub up to 1 m tall, with much broader, obovate, silvery green leaves and occurs in arid savanna. See Table 1 for a comparison of *P. hunsbergensis*, *P. pearsonii* and *P. wissii*.

Plumbago hunsbergensis was first collected in 1973 by Willie Giess in Namuskluft and subsequently at the same location by John Lavranos and Inge Pehlemann. Two of us (EJvJ and WS), assisted by five colleagues, then collected it on the western Hunsberg (Hohenzollern Mountain) in November 2006. Plants of the new species were recorded at Blokberg, the eastern flank of Hohenzollern, growing on a steep south-facing slope among *Aloe gariepensis*, *Conophytum rostratum*, *Crassula macowanii*, *Diospyros ramulosa*, *Eberlanzia spinosa*, *Montinia caryophyllacea*, a species of *Ruschia* and *Salvia gariepensis*. Shortly thereafter, one of us (WS) and Freddie Versveld collected it

TABLE 1.—Comparison of selected characters of *Plumbago hunsbergensis*, *P. pearsonii* and *P. wissii*

Characters	<i>P. hunsbergensis</i>	<i>P. pearsonii</i>	<i>P. wissii</i>
Habit	Stoloniferous, spreading shrub up to 0.6 m tall	Stoloniferous, spreading shrub up to 1 m tall	Stoloniferous, spreading shrub up to 1 m tall
Stems	9–12-ribbed	9-ribbed	7-ribbed
Leaf arrangement and shape	Leaves ascending, recurved at apex, linear-oblongate to linear-spathulate, (10–)12–25(–30) × 1–4 mm, cartilaginous and sclerophyllous, apex acute, apiculate	Leaves ascending spreading, oblanceolate to ovate-lanceolate, 30–38 × 12–15 mm, not fleshy	Leaves ascending, curving upwards, linear-oblongate to linear, (40–)50–80(–95) × 1–4 mm, slightly fleshy, apex acute, apiculate
Leaf surface	Rugose, beset with glandular hairs, becoming glabrescent; lower surface foveate	Lepidote owing to grey-white, scaly wax	Smooth, sparsely beset with glandular hairs, becoming glabrescent
Leaf margin	Denticulate, upper half rolled under and crisped	Entire, wavy in upper half	Entire to obscurely sinuate
Leaf exudate	Yellowish green, rubbing off	Grey-white, rubbing off	None
Inflorescence	Racemose, becoming paniculate	Racemose	Racemose
Calyx length	6–8 mm	7–9 mm	6–7 mm
Corolla	Cream-coloured at first, becoming rose-pink, opening during the day, 12–15 mm in diameter when fully opened, with slender dark maroon to pale rose-pink tube 20 × 1.0 (base)–1.5 mm (throat)	Yellowish at first, becoming rose-pink, 15–17 mm in diameter when fully opened, with slender pale rose-pink tube 25 × 1.3 mm	Violet to rarely cream-coloured, 13–15 mm in diameter when fully opened, with slender pale maroon tube 23–25 × 1.0 (base)–1.5 mm (throat)

again at Zebrafontein, the highest peak of the Hunsberg. On yet another expedition in July 2007 plants were also collected at Aalwynberg (just north of the Sonneberg) by EJV and WS. Although the Hunsberg falls mainly within the winter-rainfall zone, the eastern flank receives some rain in summer as well. The Hunsberg range consists of the southern outliers of the western escarpment (part of the Great Escarpment).

Semihardwood cuttings from several individuals were rooted at Kirstenbosch. Seeds of *Plumbago hunsbergensis* were sown in the spring of 2007, germinated within three weeks and flowered for the first time in December 2007. The accompanying colour plate was painted from these plants, which produced strong lateral branches that soon became spreading. The fruits are typical of *Plumbago*, retained in the glandular hairy calyx and becoming detached and adhering to roaming animals, which seem to be the main dispersal agents.

The thin, long-tubed flowers suggest an insect pollinator with a long proboscis. The flower colour varies from shades of light rose-pink to rose-pink and becomes darker with age. In most plants observed, the style was shorter than the stamens (thrum flowers), but in a few individuals the styles protruded at the mouth, overtopping the stamens (pin flowers). This phenomenon is known as heterostyly and we also observed it in *Plumbago wissii* for the first time. Heterostyly of the distylous type (Ganders 1979) has been reported in some of the other species of *Plumbago* and is widespread in subfamily Plumbaginoideae (Dahlgren 1918; Kubitzki 1993; Lledó *et al.* 1998).

We are grateful to the following people: Holger Kolberg of the Ministry of Environment and Tourism in Namibia for plant collecting permits; John Lavranos for the Latin diagnosis; colleagues who assisted in expeditions to the Hunsberg—Werner Voigt, Pikkie Hoffman, Freddie Versveld, Paul Emms, Matt Buys and Gregory Nichols.

Description.—Spreading, multistemmed, stoloniferous shrub usually $\pm$ 0.6 m tall and up to 1.5 m diam.; vegetative parts with yellowish green resinous mucilage. *Stolons* horizontal with erect aerial branches. *Branches* woody at base, distinctly ribbed (up to 9–12 ribs) and $\pm$ 4 mm diam., purplish brown; young branches green, up to 2 mm diam.; nodes 8–20 mm apart. *Leaves* ascending, spreading and recurved at apex, alternate, sessile, linear-oblong to linear-spathulate, (10–)12–25(–30) $\times$ 1–4 mm, cartilaginous and sclerophyllous, apex acute, apiculate, base attenuate; surface rugose, beset with glandular hairs, becoming glabrescent, lower surface foveate; margin denticulate, upper half revolute and crisped, partially amplexicaul at base. *Inflorescence* a terminal panicle, 80–160 mm long, initially racemose but subsequently sprouting shorter (up to 4) side branches from base to form a loose panicle; all parts densely glandular hairy. *Flowers* heterostylic and alternately arranged, 10–20 mm apart at base but becoming denser towards apex; pedicel 1 mm long. *Bracts* leaf-like, gradually becoming smaller; floral bracts triangular, acuminate, 3 $\times$ 1.5 mm, glandular-hispid, amplexicaul at base. *Calyx* green, 5-lobed, tubular, 6–8 $\times$ 2 mm, densely glandular hairy; lobes linear-lanceolate, hyaline between ribs but free for up to 5 mm. *Corolla* opening during the day, 12–15 mm diam. when fully opened, with slender dark maroon to pale rose-pink tube 20 $\times$ 1 mm (at base) widening to 1.5 mm at throat, midribs whitish; lobes obovate, acute, apiculate, (5–)7 $\times$ 3(–5) mm, cream-coloured to pale rose-pink, margins rose-pink. *Stamens* 14 mm long in thrum flowers, 10 mm long in pin flowers; filaments white; anthers oblong, 2 $\times$ 1.5 mm, blackish, pollen cream-coloured. *Ovary* ovate, 2 $\times$ 0.8 mm, greenish; style 15 mm long in thrum flowers, 23 mm long in pin flowers, 5-lobed, lobes 1 mm long, papillose. *Capsule* membranous, circumscissile. *Flowering time*: September–March. Plate 2273.

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Strophanthus speciosus

Apocynaceae

Zimbabwe, South Africa and Swaziland

Strophanthus speciosus (N.B.Ward & Harv.) Reber in Die Fortschritte aus dem Gebiete der Botanik (Geneva) 3: 299 (1887); Pax: 376 (1892); Franchet: 287 (1893); Gilg: 3 (1903); Stapf: 511 (1907); Wood & Evans: t. 555 (1911); Codd: 289 (1963); Compton: 442 (1976); Beentje: 143 (1982), 478 (1985); Van Wyk & Van Wyk: 360 (1997); Coates Palgrave: 964, t. 270 (2002). *Christya speciosa* N.B.Ward & Harv.: 134 (1842); De Candolle: 416 (1844); Pichon: 62 (1949), 62 (1950). *S. capensis* A.DC.: 419 (1844); Hook.f.: t. 5713 (1868); Reber: 299 (1887); Wood: 82 (1907); Marloth: t. 18 (1932).

The genus *Strophanthus* is distributed in the tropics of the Old World in both Africa and Asia. What makes this species unique, is that it was once placed in a monotypic genus, *Christya*, based mainly on the morphology of the seed. This is the only southern African species of *Strophanthus* in which the coma of the seed seems to be sessile, having almost no beak. The genus is renowned for its attractive flowers and three other species have been published in this series (Codd 1969; Retief 1972; Nyamhanga *et al.* 2003).

The relevant position and global distribution of the genus is summarised by Nyamhanga *et al.* (2003). The genus consists of 38 species of which 30 are found on the African continent, one on Madagascar and seven in Asia (Beentje 1982; Leistner 2000). Southern Africa is home to six species (*Strophanthus amboensis*, *S. gerrardii*, *S. kombe*, *S. luteolus*, *S. petersianus* and *S. speciosus*). It is only *S. amboensis* that is geographically isolated (occurring in northern Namibia and further north), with the other species all overlapping in distribution. *S. speciosus* can easily be distinguished from the others in its distribution range by the following characters: 1, leaves are mostly in whorls of three; 2, the infra-axillary glands (colleters) at the base of the petioles are scale-like and overlap like tiles (tooth-like and transversely arranged in the others); and 3, the plumose awn on the seed is almost sessile (the coma is attached to the seed by a 20–30 mm long stalk in the others) (Codd 1963).

In southern Africa this species is more commonly known by its vernacular name poison rope, which refers to the glycosides in the seed and latex that can cause cardiac arrest and to the long, lax branches and climbing habit. In the past, members of *Strophanthus* (including *S. speciosus*) were widely used as arrow poison by hunters throughout Africa (Van Wyk & Van Wyk 1997). Hunters would crush a single seed, mix it with some kind of adhesive and smear it on their arrows. Glycosides have been isolated from the seed and latex. These compounds are responsible for increasing the speed of contraction of the heart, eventually causing heart seizure in the prey. Some indigenous people use the roots medicinally. The roots are roasted, made into a powder and are then used as an antidote for snakebite in both cattle and humans (Watt & Breyer-Brandwijk 1962). The latter authors further reported



PLATE 2274 *Strophanthus speciosus*

our species as the source of poison used in cases of homicide. The glycosides are responsible for the extremely bitter taste of the plant but because it is poorly absorbed when taken orally, it is usually not lethal and rather only invokes vomiting (Van Wyk *et al.* 2002).

The flowering branch depicted here came from a cultivated plant grown at the Cavern Berg Resort in the Mount-aux-Sources area, collected by the artist in October 2009. In February 2010, the owner of the resort supplied the young fruiting follicle and it was added to the plate. Even though cultivated, this plant seems to cope well with the Drakensberg climate as it survives the low temperatures of the harsh winters. This is about the upper altitudinal limit for the species in South Africa. It is reasonably common in cultivation (at least in South Africa). Plants naturally grow in forests in areas somewhat protected from frost (where it is especially noticeable along the forest margins) and in ravines or scrub forests at an altitudinal range of 300–1 800 m a.s.l. It is distributed in the summer-rainfall areas in the eastern parts of South Africa, extending northwards to Swaziland and Zimbabwe (Figure 1). Although flowers are borne mainly from September to November and fruit in May and June, flowering and fruiting may occur throughout the year.

Marloth (1932) reported that a cultivated plant in Cape Town was pollinated by the butterfly *Danaus chrysippus*. It is better known as the African Monarch butterfly or the specific race as the Southern Milkweed butterfly (Migdoll 1988) and is widely distributed (sympatric to the distribution of *Strophanthus speciosus* but not restricted to the distribution range of the latter). Many different species in the Apocynaceae, including members of the genera *Asclepias*, *Ceropegia*, *Gomphocarpus*, *Huernia* and *Stapelia*, are known to be larval host plants of this species of butterfly but none of them are known to be pollinated by the butterfly. In general, the pollination biology of very few southern African milkweeds has been studied and there is certainly much scope for research in this field.

Codd (1963) noticed a degree of variation in leaf and sepal length from south to north. Leaf size tends to decrease and sepal length to increase from south to north. Plants from the southern areas have longer leaves and shorter sepals, the leaves gradually becoming shorter and the sepals longer northwards. He further noticed that the sepals are more pubescent in the south and become glabrous towards the northern parts of the distribution range. In all other aspects there is not much variation.

Description.—Woody scrambler or climber, shrub or small tree 1–4 m tall. Branches up to 16 m long, 30 mm thick, branching trichotomously, densely lenticellate and with distinct leaf scars of fallen leaves, glabrous throughout, with white latex to watery sap. Leaves simple, mostly ternate but rarely opposite, narrowly elliptic to lanceolate to ovate, 15–118 × 5–34 mm, tapering to both ends, apex acute to apiculate, base attenuate, leathery, shiny dark green above, dull pale green below; margin entire, sometimes slightly undulating towards tip, very slightly revolute; petiole 2–10(–12) mm long, with 3(–5) scale-like axillary glands at base on slightly furrowed adaxial side. Inflorescence in terminal clusters, 3–16-flowered, with 1 or 2

open at a time, somewhat congested, glabrous or puberulous; peduncles 3–18 mm long; bracts deciduous, narrowly ovate, $1-10 \times 1-2$ mm, acute, sepal-like. *Flowers* 5-merous, sweetly scented; pedicels 6–20 mm long. *Calyx* divided to base, 4–12 mm long; lobes narrowly ovate, $3-12 \times 1-3$ mm, acute, pale green, puberulous, with 2–4 col-eters (sometimes forked) per lobe. *Corolla*: tube 9–22 $\times$ 4–10 mm, expanding from base to mouth, mouth 5–12 mm wide; lobes spirally twisted when in bud, spreading or slightly recurved at anthesis, narrow, $16-32 \times 2-5$ mm, yellow on both sides with a reddish to orange patch at base of each lobe on inside, becoming cream-coloured towards base of tube on outside and red-streaked on inside; appendages paired, alternating with lobes at rim of mouth of tube. *Corona lobes* subulate, $1.8-4.8 \times 1.0-2.2$ mm, acute or obtuse, fleshy, minutely papillose, white. *Stamens* arising 4.0–6.5 mm from base of tube; anthers with apical appendages forming a cone around stigma, $3.0-6.0 \times 0.4-1.0$ mm, apical third hairy, tails 0.2–0.7 mm long, acumen 0.9–2.5 mm long. *Gynoecium* of 2 free carpels, $0.8-1.8 \times 1.2-2.1$ mm, puberulous; style 3.5–5.5 mm long; clavuncula $0.8-1.6 \times 0.7-1.9$ mm, pubescent at apex; stigma minute. *Fruit* a follicle, usually paired, slender, $65-192 \times 6-22$ mm, spreading at angles of $(80-120-180^\circ(-280))$, tapering towards narrow apex and ending in a knob, without lenticels, initially green, maturing to pale brown, dehiscent. *Seed* numerous, grain $13-22 \times 2.0-4.5$ mm, beak glabrous for up to 2 mm, coma 15–43 mm long. Plate 2274.

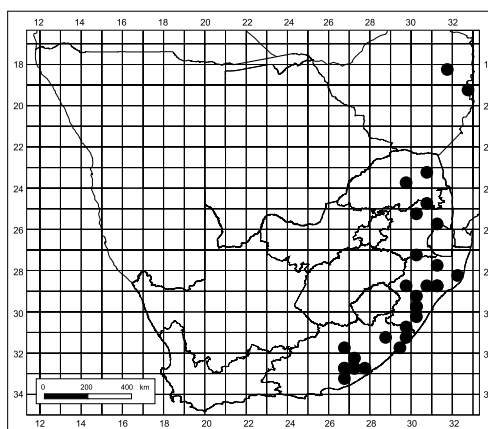


FIGURE 1.—Known distribution of *Strophanthus speciosus* based on specimens in the National Herbarium, Pretoria.

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Xysmalobium pedifoetidum

Apocynaceae: Asclepiadoideae

South Africa

Xysmalobium pedifoetidum Bester & Nicholas, sp. nov., *X. gerrardii* Scott-Elliot affinis a qua corona dentibus duobus ventralibus ad basin partis liberae lobi coronae dignoscenda, lobi rimam vadosam formantes ubi a interiore parte visus, lobi atromarronini. Praeterea corona intus crenea ad pallide rosea extusque rosea magis saturate ad marronina.

TYPE.—South Africa, Lydenburg District, $\pm$ 2 km SE from turn-off from R577 between Roossenekal and Lydenburg towards Verlorenvallei [Verloren Valei] Nature Reserve, 29 November 2008, *Bester 8709* (PRE, holo.; E, K, LYD, MO, NH, PRU, Z, iso.).

The opening up of previously inaccessible areas has facilitated botanical exploration and has inevitably led to the discovery of taxa new to science. With increased mining activity, for example, access to the Sekhukhuneland region (straddling the Mpumalanga and Limpopo Provinces) has led to the description and naming of many such taxa over the last decade. However, the existence of an undescribed species is sometimes known for many years before it is eventually named. This is exactly the case with the new species described in this contribution.

While botanising on the farm Wanhoop in Sekhukhuneland in 2008, the first author found and collected an apocynaceous specimen which he immediately perceived to be an undescribed species. It was so striking that it could not be mistaken for any known *Xysmalobium* species. Inspection of the collections of the National Herbarium in Pretoria revealed that a number of earlier specimens of this unknown taxon, from various localities, had already been lodged there. As far as could be established, the first specimen (at least among those in the National Herbarium) had been collected in 1960. This specimen (*Devenish 243*) came from the farm Oshoek in the south of Mpumalanga in the vicinity of Wakkerstroom, on the Mpumalanga–KwaZulu-Natal border (Figure 1). A short description by Sanette Buys (a scientist who worked at the National Herbarium in the early 1960s) on another specimen of the same collector and from the same locality (*Devenish 1069*) was filed with the specimen in 1963. Dr R.A. Dyer, researcher working on the group at the time, elaborated on her description in 1969 and this note in his handwriting was also filed with *Devenish 1069*. Annotations on the specimens by both Buys and Dyer referred them to the genus *Xysmalobium*.

Xysmalobium is an African endemic of about 40 species of which 21 are found in southern Africa (Victor *et al.* 2000). The only other *Xysmalobium* that has been covered in this series is *X. undulatum* (Pole Evans 1926). The phylogenetic integrity of the genus has, however, been questioned by a number of authors. Bullock (1952) commented that it should only contain *X. undulatum* and that all other species



PLATE 2275 *Xysmalobium pedifoetidum*

should be transferred to other genera. In 1980 Langley revised the southern African members as part of a dissertation and, in line with Bullock, proposed the transfer of a number of species to several other genera, some of them new. However, his classification was never formally published. The taxon described here was omitted from that work (Langley 1980). On a determination label dated 1981, Langley assigned the *Devenish 1069* specimen to a new species that he had proposed in his dissertation of the previous year. We think that the undescribed species of Langley was, however, not the same as the one described here. By 1999, neither of these taxa had been formally published and in a revision of the genus, also never published, Nicholas (1999) mistakenly combined both species under Langley's proposed name. However, recent collections and the study of more material by the first author have clarified this erroneous taxonomy. In his thesis, Nicholas (1999) points out that convergent evolution has probably led to the placement of phylogenetically unrelated species in *Xysmalobium*. Like Bullock (1952) and Langley (1980), he proposed that *Xysmalobium sensu lato* be divided into a number of genera, some of which would be new. However, his classificatory hypotheses are awaiting confirmation from molecular studies before being formally published. In the past, the coronal morphology was used as the main diagnostic character for many genera in the Apocynaceae. Fishbein (2001) and Goyder *et al.* (2007) show that although the morphology of the corona may be useful in delimiting species, it is largely unsuitable as indicator of phylogenetic relationships.

For the reasons given above, the species described here has remained unnamed for half a century. At first it seemed odd that the taxon has remained formally unpublished for so long, but it was only with the dissection of the specimen *Bester 8627* that it became clear why it was difficult to assign the taxon to a particular genus. According to the key in Leistner (2000), it does not key out to *Xysmalobium* (as would be expected), but rather to *Asclepias*. It is probably exactly for this reason, the instability in the generic circumscriptions of both *Xysmalobium* and *Asclepias*, that the taxon has not been formally published to date. Given that the resolution of this situation is still some way off, we place our new species in the genus *Xysmalobium*, albeit with some reservations and even though it does not key out to *Xysmalobium* but rather to *Asclepias* (Leistner 2000). This situation is due to the new species possessing a corona lobe that contains two small keels at the base of the ventral face that form a sinus. The possible demise of the genus *Asclepias* in Africa may also have implications for the species described here (see Bester & Condy 2011), although some authors still uphold the genus *Asclepias* as a measure of precaution (Goyder *et al.* 2007; Goyder 2009).

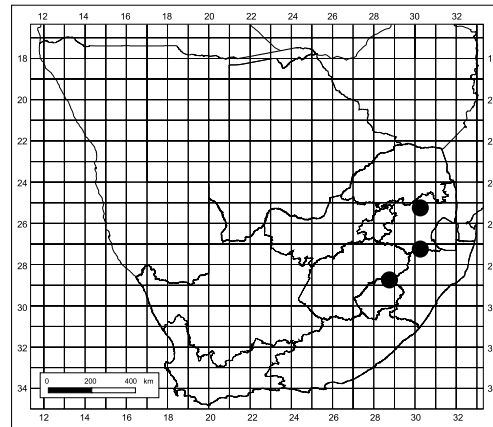


FIGURE 1.—Known distribution of *Xysmalobium pedifolium* based on specimens in the National Herbarium, Pretoria.

The nearest relative of our species was found to be *Xysmalobium gerrardii*, which differs mainly in not having ventral appendages but a solid, fleshy corona lobe (as in all the other *Xysmalobium* species) and in the coloration of the flower. It could also have been placed in *Schizoglossum*, but here the corona is dorsiventrally flattened and is generally not as fleshy, the plants are generally erect and have a tuber rather than a rootstock. In our opinion it is closest to *X. gerrardii*, hence the decision to assign it to *Xysmalobium*. The main differences between the two species are listed in Table 1.

The flowering plant illustrated in the accompanying plate was collected at Verloren Valei Nature Reserve to the northwest of Dullstroom in Mpumalanga Province in early December 2009. The fruiting stem with a dry follicle held erect on a deflexed pedicel comes from material collected from the same locality in mid-January 2010. The plants grew in reasonably gently sloping grassland with quartzite outcrops here and there (Figure 2, 3). Flowering takes place from November to January (mainly in November). The material depicted is the only known and verified fruiting specimen. All known specimens come from 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.

Notes on at least three specimens remark on the bad odour of the flowers. This, coupled with personal observations of the first author, has led to the choice of the specific epithet. The flowers have a sourish scent reminiscent of fermenting fruit at first and then of malodorous feet. The epithet thus literally means the feet (*pedi-*) that stink (*-foetidum*). Various species of flies were observed to be attracted to the

TABLE 1.—Comparison between *Xysmalobium pedifoetidum* and *X. gerrardii*

Character	<i>Xysmalobium pedifoetidum</i>	<i>X. gerrardii</i>
Calyx	4.5–6.9 × 0.7–1.5 mm	2.0–3.8 × 0.5–1.1 mm
Corolla	cream-coloured to pale pink inside and darker pink to maroon outside	homogeneously yellow to yellowish green or cream-coloured
	6.4–8.7 × 1.3–3.2 mm	3.3–4.5 × 1.5–2.9 mm
Corona	with two ventral teeth at base of free part forming a slit when viewed from within	solid without appendages
	with two lateral bulges at point where upper part is free from gynostegial column	no lateral bulges
	tip acute	tip rounded
	lobes 4.2–6.9 mm long and 0.5–1.5 mm broad	lobes 2.2–3.1 mm long and 0.8–1.1 mm broad
	maroon to dark purple	green
Anther appendages	ovate or sometimes emarginate	acute
Distribution	restricted to high montane grasslands in northern and northwestern KwaZulu-Natal, the border between the eastern Free State and KwaZulu-Natal and the central montane grasslands of Mpumalanga (Figure 1)	lower grasslands of central and eastern KwaZulu-Natal
Altitude (a.s.l.)	1 964–2 243 m	180–1 150 m



FIGURE 2.—*Xysmalobium pedifoetidum* in habitat at type locality. Photograph: S.P. Bester.

flowers—presumably after the putrid smell. Various ants and other insects were also attracted to the flowers, possibly scouting for nectar.

Description.—Perennial geophytic herb, up to 0.5 m diam., all parts with milky latex. *Rootstock* deep-seated, fleshy, cylindrical and elongated, at least 140×20 mm. *Stem* 3–14-branched at soil level, secondary branching mainly near base, decumbent from base, 60–340 mm long, 0.5–4.0 mm diam., internodes 22–67 mm long, longitudinally slightly ribbed with some sections intermixed hirsute and sparsely tomentose and other sections only hirsute. *Leaves* opposite, simple, entire, erect to spreading erect, 6–16 per branch; lamina $\pm$ triangular in outline, broadly ovate to lanceolate-ovate, sometimes oblique, up to $10\text{--}54 \times 5\text{--}25$ mm, apex acute, margins smooth and revolute, base truncate to rounded to attenuate to cordate, ventrally densely hirsute, dorsally thinly hirsute and slightly paler; primary and secondary veins prominently raised dorsally, sunken ventrally; petiole 6.0–14.0 mm long, 0.4–1.2 mm diam. *Inflorescence* usually solitary and terminal or axillary, up to 11 umbels per plant, up to 5 umbels per branch, seemingly undetermined, erect, semispherical, (9–)18–36(–44) mm diam.; peduncles 16–72 mm long, pubescent, deflexed at apex after flowering; bracts filiform to linear to thinly lanceolate with attenuate to acute tip, $1\text{--}7 \times 0.1\text{--}2.5$ mm, one side only pilose, other side intermixed longer pilose and tomentose to villous. *Flowers* rotate, (1–)5–14 flowers per umbel, $6\text{--}10 \times 7.0\text{--}8.5$ mm; pedicels shorter than peduncle, 8–12 mm long, one side only pilose, the other side intermixed pilose and tomentose to villous, with an unpleasant smell (*fide* Devenish 243, Drews 109, Condy 235 and specimens of first



FIGURE 3. —*Xysmalobium pedifoetidum* in habitat at type locality: extensive wetlands with exposed quartzite outcrops in the Verlorenvallei [Verloren Valei] Nature Reserve northwest from Dullstroom. Photograph: S.P. Bester.

author) or with no scent (*fide Cameron 345*). *Calyx* 5-merous, erect to spreading-erect, lobes linear to linear-lanceolate, $4.5\text{--}6.9 \times 0.7\text{--}1.5$ mm, apex acute, base truncate, ventral surface glabrous, dorsal surface sparsely hirsute to villous, hairs up to 0.6 mm long; colleters 4–6, lanceolate, $0.07\text{--}0.47 \times 0.10\text{--}0.13$ mm, apex rounded, arising between calyx and corolla. *Corolla* 5-merous, $\pm$ divided to base, erect to slightly spreading erect, lobes oblong-ovate to elliptic, $6.4\text{--}8.7 \times 1.3\text{--}3.2$ mm, basal half $\pm$ cucullate, apex rounded to obtuse, sometimes with a terminal oblique notch, membranous margin 0.13–0.27 mm broad, pale pinkish on both sides, cream-coloured inside, pinkish to maroon on outside or only central part maroonish becoming pink or cream-coloured towards lateral ends, or red (*fide Devenish 1069*), reddish brown (*fide Devenish 243*), deep purple (*fide Cameron 345*) or deep pink (*fide L'Ange 16A*); two basal convex 'swellings' due to the basal constriction of corolla lobes, $\pm$ two fifths the height of corolla; ventral surface glabrous, dorsal surface sparsely hirsute to villous except at margins. *Staminal corona* 5-merous, arising from base of gynostegial column and adnate to it for $\pm$ half its height, up to 3.2 mm long, in dried specimens appearing to have a stipe 1.0–2.4 mm long, 1.8–2.8 mm diam., extending beyond style apex; lobes free in terminal half, erect, fleshy, slightly spreading and somewhat falcate, dorsally convex with only extreme tip slightly concave and curving towards style apex, extending above gynostegial column, smooth, rounded, distal half convex ventrally; two proximal appendages at $\pm$ middle, 0.38–1.33 mm high, fused with gynostegial column from base of teeth downwards, laterally compressed, broadest at base of teeth, (see figure 4e–g) forming two lateral bulges, $4.2\text{--}6.9 \times 0.50\text{--}1.54$ mm, 1.1–2.0 mm thick from face to back at base of free portion, proximal appendage well below gynostegial head, inner face $\pm$ flat with 2 keels at base forming slender slit between them and 0.5–1.1 mm long, stipe 1.3–2.1 mm high, mauve



FIGURE 4.— *Xysmalobium pedifoetidum*. Corolla: a, ventral side; b, dorsal side. Calyx: c, ventral side; d, dorsal side. Corona: e, side view; f, dorsal view (back); g, ventral view (face). Anther: h. Pollinarium: i. Scale: a–g (between c & d), 1 mm; h & i (below h), 0.5 mm. Voucher specimen: *Bester 8627* in National Herbarium, Pretoria. Artist: Gillian Condy.

to dark purple and maroon, sometimes cream-coloured to greenish yellow at base. *Staminal column* 1.6–3.8 × 2.0–2.6 mm, discoid with central depression. *Anthers* ± 1.20–1.50 × 0.38–1.21 mm; anther wings triangular, broadest at middle or below, 0.85–1.29 × 0.21–0.65 mm, with notch at point furthest from column, 0.33–0.52 mm exerted from staminal column, groove 0.5–0.7 mm long; anther appendages

broadly obcordate to obovate to ovate in outline, $0.7\text{--}1.2 \times 0.30\text{--}0.57$ mm, apex sometimes emarginate, obtuse or rounded, with tips inflexed onto and marginally just over rim of style apex. *Style apex* exposed, in cross section rounded with central depression, truncate, just exceeding anthers, $0.6\text{--}2.1$ mm high, $1.6\text{--}2.5$ mm diam., white or pink or maroon. *Pollinaria*: pollinia pendulous in each anther sac, narrowed for $\pm$ apical quarter of height, crescent-shaped or obliquely pear-shaped, $0.71\text{--}1.14 \times 0.27\text{--}0.43$ mm; caudicles widely diverging, filiform, slender, $0.16\text{--}0.50$ mm long, attached apically to pollinia, attached terminally to corpusculum; corpusculum elongated-ovoid, $0.17\text{--}0.50 \times 0.08\text{--}0.46$ mm, winged; wing $0.03\text{--}0.08$ mm broad, tip subacute, base truncate with semicircular indentation in middle. *Follicle* usually solitary, $70\text{--}77$ mm long, $14\text{--}17$ mm diam., broadest in $\pm$ middle, with pale purple-maroon longitudinal stripes or blotches on green background, beak suddenly tapering to a rounded point, scattered tubercles up to 0.5 mm long in upper half of fruit; surface minutely puberulous with hairs up to 0.5 mm long; fruiting pedicel swirled and recurved and then turned upwards (distinctly S-curved), thickening to $12\text{--}17$ mm long, $1.5\text{--}2.5$ mm diam. with age. *Seed* not seen. Plate 2275. Figure 4.

SPECIMENS EXAMINED

Mpumalanga: 2530 (Lydenburg). (–AA): Lydenburg District, Farm Wanhoop 78JT, ± 20 km SSE of Roossenekal on road R577 to Lydenburg; ± 34 km SW of Lydenburg and 21 km N of Dullstroom, 26 Nov. 2008, *Bester 8627* (B, K, LYD, MO, NU, P, PRE, Z, UDW). (–AC): Dullstroom, Verlorenvallei [Verloren Valei] Farm 95 JT, 25 Nov. 1980, *Drews 109* (PRE); Dullstroom, 3 Jan. 1984, *Cameron 345* (PRE); Dullstroom on road from Verlorenvallei [Verloren Valei] to Steenkampsberg Pass, 6 Nov. 2001, *Hankey 1297* (PRE); Belfast District, Verloren Vallei [Verloren Valei] Nature Reserve, ± 15 km NNE of Dullstroom, 12 Jan. 2010, *Bester 9836* (PRE, fruit); Lydenburg District, ± 2 km SE from turn-off off R577 between Roossenekal and Lydenburg towards Verlore Vallei [Verloren Valei] Nature Reserve, 29 Nov. 2008, *Bester 8709* (E, K, LYD, MO, NH, PRE, PRU, Z); Lydenburg District, ± 5 km SSE from turn-off off R577 between Roossenekal and Lydenburg towards Verloren Vallei [Verloren Valei] Nature Reserve, 29 Nov. 2008, *Bester 8710* (NU, PRE, UDW); Belfast District, Verloren Vallei [Verloren Valei] Nature Reserve, ± 15 km NNE of Dullstroom, 1 Dec. 2009, *Condy 235* (PRE). 2730 (Vryheid). (–AD): Wakkerstroom District, Farm Oshoek, 18 Nov. 1960, *Devenish 243* (PRE), 14 Nov. 1963, *Devenish 1069* (K [photocopy at PRE], PRE); Wakkerstroom District, ± 14 km directly E of Wakkerstroom, Farm Oshoek 127 HT, 12 Dec. 2008, *Bester 8934* (LYD; NH; PRE).

KwaZulu-Natal: 2730 (Vryheid). (–AD): Altemooi, *Thode 2580* (STE not seen, but due to distribution most probably this taxon). 2828 (Bethlehem). (–DB): Natal-Free State border near Witzieshoek, Dec. 1964, *L'Ange 16A* (PRE).

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Asclepias albens and *A. macropus* Apocynaceae: Asclepiadoideae

Lesotho, South Africa and Swaziland

Although *Asclepias* was published by Linnaeus in both his *Species plantarum* (1753) and *Genera plantarum* (1754), the name is pre-Linnaean and had already been used by Pliny in 1 A.D. (Nicholas 1982). The name is derived from the name of a medicinal herb, in turn named in honour of the Greek god of medicine, Aesculapius (Howes 1974).

The genus *Asclepias* consists of $\pm$ 150 species (Victor *et al.* 2000) distributed throughout Africa and the Americas. Species previously listed for the Arabian Peninsula are now referred to *Gomphocarpus* (Goyder & Nicholas 2001). About 50 species are found in the *Flora of southern Africa* (FSA) region. Of the FSA species, only four have been covered in this series: *A. adscendens*, *A. fruticosa* (since moved to *Gomphocarpus*), *A. eminens* and *A. dregeana* var. *calceola* (Pole Evans 1926a, b, c, 1931). All species in the genus have extremely interesting floral structures, but the two in this contribution are extremely charismatic as the flowers are quite fragrant, crowded together to form a dense hemispherical or spherical inflorescence that is visually attractive and pronounced.

The genus is distinguished from other members in the Asclepiadoideae in having laterally flattened corona lobes with a central coronal sinus (Brown 1907; Nicholas 1982; Victor *et al.* 2000). There is still controversy about whether the African members of the genus belong to *Asclepias* or whether they should be referred to other genera. Some workers are of the opinion that members of the genus *Asclepias* on the African continent do not have the same origin as those in the Americas (Bullock 1952; Nicholas 1982, 1999). When the genus was revised for North America, Woodson (1954), however, disagreed with Bullock and suggested that the genus had an Old-New World distribution. Woodson assigned the origin and expansion to either continental drift or trans-boreal migration. Woodson's ideas have, however, not been upheld by recent molecular studies which show American *Asclepias* to be sister to a polyphyletic African group (Goyder *et al.* 2007; Rapini *et al.* 2007). Indications of this parallel radiations of Old World and New World members of the subtribe Asclepiadinae, if confirmed, would probably result in major generic realignments on both continents. There is currently no workable hypothesis for assigning Old World species to other genera (Goyder 2009). It is for this reason that Goyder (2009: 370) recently published a synopsis of *Asclepias* in tropical Africa, retaining the genus *Asclepias* as a conservative measure. Molecular techniques have, as yet, been unable to resolve the finer generic structure of the African members (Goyder *et al.*

PLATE 2276—*Asclepias albens*: 1, flowering stem with inflorescence, $\times$ 1; 2, flower, $\times$ 4; 3, fruiting stem with follicle, $\times$ 1. *Asclepias macropus*: 4, flowering stem with inflorescence, $\times$ 1; 5, flower, $\times$ 4. Voucher specimens: 1, 3, *Bester 8511*; 2, *Bester 4521*; 4, 5, *Steyn 1415*; all in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2276 *Asclepias albens* and *A. macropus*

2007) and more molecular work, using faster evolving genes, is needed to clarify the situation.

A number of species in the Apocynaceae are referred to in southern Africa as cartwheels, for example *Asclepias adscendens* (pompom cartwheel), *A. albens* (cartwheel), *A. macropus* (tailed cartwheel) and a certain species of *Xysmalobium* (red-flowered cartwheel) (Pooley 2005). The origin of the vernacular name is unknown but it probably refers to the dried inflorescence in certain pressed herbarium specimens (Figure 1). The two cartwheels discussed here can easily be distinguished from one another by the structure and coloration of the corona lobes. In *Asclepias macropus* the lobes are usually brownish, with an extended tail-like dorsal end, but in *A. albens* the lobes have a much deeper and distinct sinus and are usually green. Furthermore, *A. albens* usually has a more hemispherical inflorescence and the corolla lobes are reflexed, but are not as tightly pressed against the petioles as in *A. macropus*.

In isiZulu, *A. albens* is called *umadoye*, *idoyi* or *ishongwe* and in Venda it is known as *Tshalale*. Both cultures cook the young leaves as a type of spinach or *imifino* (Bryant 1966; Fox & Norwood Young 1982; Pooley 2005). As far as we could establish, *A. macropus* does not have a specific indigenous common name—it is known only by the collective name *sewgete* used by the Ndebele for most herbaceous asclepiads.



FIGURE 1.—*Asclepias macropus*. Inflorescence, showing the possible origin of the common name 'cartwheel'. Voucher specimen: Killick & Vahrmeijer 3718 in National Herbarium, Pretoria.

Asclepias albens (E.Mey.) Schltr. in Botanische Jahrbücher 21, Beibl. 54: 5 (1896b); Rand: 340 (1903); Brown: 709 (1908); Retief & Herman: 260 (1997); Pooley: 416, t. 417 (2005). *A. affinis* (Schltr.) Schltr.: 455 (1896a); Brown: 710 (1908); Compton: 454 (1976); Germishuizen & Fabian: 316, t. 150c (1997); Retief & Herman: 260 (1997); Van Wyk & Malan: 290, t. 749 (1997). *Gomphocarpus affinis* Schltr.: 27 (1895). *G. albens* (E.Mey.) Decne.: 559 (1844); Schlechter: 7, 17 (1896b). *Pachycarpus albens* E.Mey.: 214 (1838); Hooker: 545 (1843). *Xysmalobium albens* (E.Mey.) D.Dietr.: 902 (1840).

Both our species are endemic to southern Africa. *Asclepias albens* has a wider distribution (Figure 2) and is found in South Africa (Limpopo, North West, Gauteng, Mpumalanga, KwaZulu-Natal and Eastern Cape) and Swaziland. It is widespread and fairly common in some areas and although not threatened (Raimondo *et al.* 2009), it grows in the Grassland Biome—one of the most heavily exploited biomes in southern Africa. The widespread distribution of the species over many habitat types has resulted in the recognition of a number of ecotypes by Nicholas (1999), some of them almost grading into *A. vicaria*, *A. macropus* and *A. crispa*.

Asclepias albens grows in different soil types of varying geology, in open, annually burnt grassland, usually appearing when the grass cover is still short and where it receives full sunlight. The species is often found in rocky areas, road reserves and fire breaks, and near the coast in grass-covered dune systems. Plants flower from October to March but on rare occasions as early as June at altitudes ranging from 10–1 800 m a.s.l. Fruits are borne from November to January.

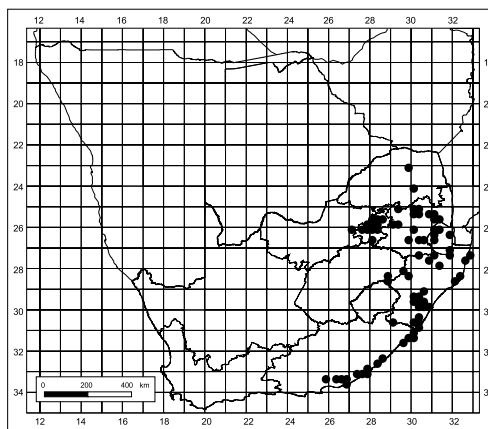


FIGURE 2.—Known distribution of *Asclepias albens* in southern Africa, based on holdings in the National Herbarium, Pretoria.

The plant on which the illustration of the flowering *Asclepias albens* is based was collected on 29 October 2008 by the first author on the farm Rietfontein near Rayton in the Cullinan District, Gauteng. The plants were growing abundantly in grassland on the gentle slope of a rocky outcrop in loam soil and in full sun. The corolla was distinctly pale above and greenish below, with a much darker green corona—possibly the same colour form from which the epithet for the species was derived—*albens* refers to the whitish flowers. The habitat had been burnt the previous season and most plants were flowering profusely. The stems were prostrate, the tips becoming erect and carrying the umbels. The fruiting branch depicted in the plate comes from a similar habitat but just below the crest of the Magaliesberg in Pretoria West (Danville) where it was collected on 14 December 2003. The fruit had a green background fading to grey-purple on the lumpy and echinate prickles. Only two of the eight stems of this plant had fruits, with four other stems in full flower.

Until recently *Asclepias affinis* was upheld as a distinct species. Brown (1908) maintained that *A. albens* usually had a more densely flowered umbel and a corona with an oblong shape and upward sloping top margin. With the material available at that time, these characters were constant and could be used to distinguish between *A. albens* and *A. affinis*. However, Nicholas (1999) explains how the differences between these species as indicated by Brown break down as more material becomes available. Not only the latter but also the realisation that the two species intergrade with each other has eventually led to *A. affinis* being placed in synonymy with *A. albens* (Nicholas 1999; Victor *et al.* 2003; Bester *et al.* 2006).

Description.—Perennial geophytic herb with milky latex. *Rootstock* fleshy, elongated, 8–18 mm diam. *Stems* 3–8, formed annually, 2–7 mm diam., erect or spreading-erect, sometimes $\pm$ decumbent and then with tips erect, 250–650 mm high, branching at or near base; branches 120–400 mm long, stout, hispid or sub-hispid or scabrous-pubescent. *Leaves* 6–16 pairs, opposite, erect to spreading-erect or flat on ground; main vein prominent, up to 3 mm thick at base, narrowing to tip, harshly hairy; lamina ovate to ovate-lanceolate, 20–78 $\times$ 7–50 mm, rather

coarsely and harshly or scabrous pubescent or hispid or harshly pubescent on both sides, tip acute, rarely obtuse, base broadly rounded, subcordate, cordate or truncately rounded, sometimes almost hastate; margins slightly thickened, scabrous, rarely revolute, sometimes undulating, slightly paler below; petiole 1–7 mm long. *Inflorescence* solitary, rarely 2 umbels per stem and then mostly somewhat fused, spherical to hemispheric, usually somewhat nodding, 32–76 mm diam., 10–52-flowered; peduncles 25–115 mm long, puberulous on one side and thinly subhispid throughout; bracts linear-subulate or linear-lanceolate, $3.8\text{--}11.4 \times 0.5\text{--}1.8$ mm, acute; pedicels 12–28(–38) mm long, nearly glabrous to thinly hispid to densely pilose; fragrant. *Calyx* 5-merous, ovate to lanceolate, $2.5\text{--}6.4 \times 1.3\text{--}2.8$ mm, broadest just below middle, narrowing slightly to base where 1.1–1.8 mm broad, acute, roughly pubescent or thinly to densely pilose-hispid outside, glabrous inside. *Corolla* 5-merous, basally fused for $\pm$ a quarter of their length, 1.4–2.3 mm long, lobes ovate, acute to subacute, reflexed or reflex-spreading, upcurved at tips, $5.3\text{--}9.5 \times 3.5\text{--}4.8$ mm, broadest just above middle, glabrous on both sides or thinly pubescent on back especially at tip, variously coloured, white, white and yellow, yellow-green, mauve, cream-coloured inside and green outside, pale to dark pink, mauve to purple-green, pink-white, cream-purple or occasionally light purple, fragrant. *Staminal corona* 5-merous, lobes erect, arising from base of staminal column, fused with it for basal 1.3–1.7 mm, and not or only slightly exceeding it, $2.0\text{--}6.1 \times 1.4\text{--}3.1 \times 1.6\text{--}3.4$ mm, in side view quadrate to subquadrate and from distinctly longer than broad to scarcely so, slightly laterally compressed, cucullate, without a tooth or other processes in cavity, truncate and marginate at base or with wing-like rim at base, rim with acute angles, top margins subtruncate or sloping from teeth outwards and downwards to dorsal apex, near inner margins with a distinct wing curving outwards to middle of side at base, yellow tinged green, greenish, yellow, dark green or even pink; proximal teeth 0.5–0.7 mm long at apex, inflexed on sides of style head (Figure 3). *Staminal column* $1.9\text{--}5.4 \times 1.2\text{--}2.8$ mm, style head truncate, style apex with slight depression becoming sharp and quite deep right in centre; anthers $1.3\text{--}2.3 \times 0.9\text{--}1.5$ mm, anther appendages subtruncate, orbicular, obtuse or slightly emarginate, somewhat reflexed at sides, $\pm$ as broad as or broader than long, $0.38\text{--}1.10 \times 0.7\text{--}1.0$ mm, $\pm$ replicate, inflexed on margin or just over and covering style apex, white to yellow (fide Williams 855 in National Herbarium, Pretoria, collected in 1992); anther wings broadest at base, 1.3–1.9 mm high, projecting 0.4–1.0 mm from staminal column. *Pollinarium* solitary, pendulous in each anther sac; pollinia obliquely pyriform with inner side straight, $0.54\text{--}1.12 \times 0.20\text{--}0.45$ mm; caudicles linear, twisted, sometimes winged, if winged then $0.18\text{--}0.42 \times$ up to 0.03 mm, attached apically to pollinia and lateral-basally to centrally to corpusculum; corpusculum narrowly ovoid in outline, $0.14\text{--}0.36 \times 0.08\text{--}0.16$ mm, apex acute, side with indentations laterally and a basal notch. *Follicles* usually 1(–4) per umbel, fusiform, not inflated, broadest at $\pm$ a third of length from base, tapering at terminal end or abruptly ending in a rounded beaked tip, $43\text{--}108 \times 8\text{--}26$ mm, with echinate prickles 0.5–4.0 mm long, bumpy with fleshy ridges pink to purple, background green, minutely puberulous; fruiting pedicel distinctly S-shaped at maturity, thickening with age, 2.0–4.0 mm diam. *Seeds* broadly ovate, $5.0\text{--}8.0 \times 0.5\text{--}1.2$ mm, strongly convex on upper surface and strongly concave on lower surface, dark brown; coma at apex, spreading, 28–34 mm long. Plate 2276.

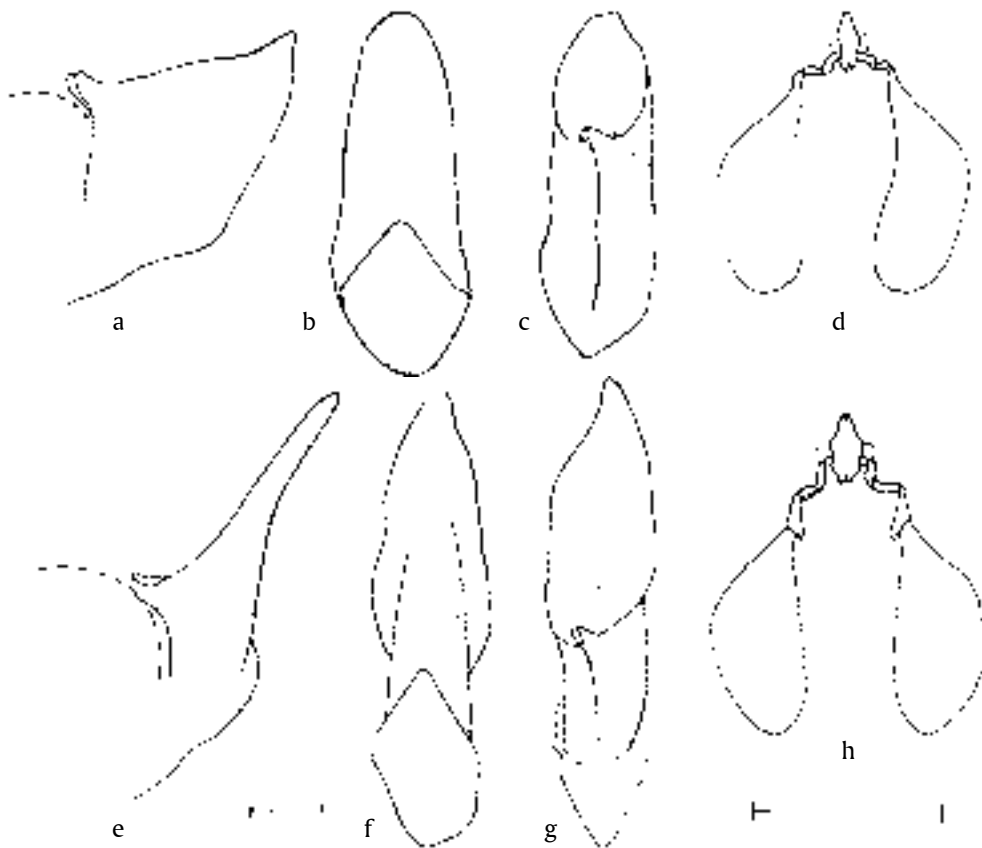


FIGURE 3.—*Asclepias albens* corona: a, side view; b, dorsal view; c, ventral view; d, pollinarium. *Asclepias macropus* corona: e, side view; f, dorsal view; g, ventral view; h, pollinarium. Voucher specimens: a–d, *Steyn 1416*; e–h, *Steyn 1415*; both in National Herbarium, Pretoria. Scale: a–c & e–g (between e & f), 1 mm; d & h (below h), 0.5 mm. Artist: Gillian Condy.

Asclepias macropus (Schltr.) Schltr. in *Journal of Botany*: 456 (1896a); Brown: 711 (1908); Pooley: 580, t. 581 (2005). *Gomphocarpus macropus* Schltr.: 353 (1894).

This species can immediately be distinguished by its very large corona lobes with their distal ends extending into a long, erect, tail-like appendage that greatly overtops the style apex. It is very similar to *Asclepias albens* but differs in its remarkable corona lobes, globose rather than hemispherical inflorescences and corolla that is completely reflexed so that it hugs the pedicel tightly.

Plants grow sporadically in midland and upland grassland (often sourveld) that is usually (but not always) annually burnt, and occur at altitudes of 900–2 230 m a.s.l. in Mpumalanga, Free State, KwaZulu-Natal and Eastern Cape (Figure 4). The tailed cartwheel flowers between December and March, mainly January–February. Although listed as of Least Concern (Raimondo *et al.* 2009), Nicholas (1999) considered it as vulnerable in many areas and threatened in Mpumalanga and the Eastern

Cape mainly as a result of the degradation of the general habitat.

The epithet *macropus* refers to the corona, which has the shape of a foot and is a large structure compared to the other structures of the flower. The specimen depicted here was drawn from *Steyn 1415* collected on 19 January 2008 in the Harrismith District on a gentle grassland slope between the Oliviershoek and Retief Passes. The plant grew in sandy to loam soil in full sun, and the flowers were sweetly scented.

We have not seen positively identified fruit of *Asclepias macropus*. In fact the identity of fruiting specimens in the Apocynaceae, especially in the tribe Asclepiadeae, is still problematic. This is highlighted by the note of Brown (1908) on the identity of fruiting specimens. Fruiting herbarium specimens are often extremely difficult to identify. An appeal is made to all collectors living in the vicinity of localities where they collected members of the Apocynaceae, to mark and revisit sites where flowering specimens were collected, in order to collect fruit from the same plants. In this way researchers will be sure of the identity of fruiting specimens. It will enable them to gather accurate information from complete records of both the flowers and the fruit. We have not seen positively identified fruit of *Asclepias macropus*.

Description.—Perennial geophytic herb with milky latex. *Rootstock* fleshy, elongated. *Stems* 4 or 5, formed annually, 75–406 mm long, usually decumbent, branching at or near base, rather stout, uniformly pubescent and thinly hispidulous. *Leaves* 6–10 pairs per stem, opposite, spreading, leathery; primary veins prominent below and mostly paler; lamina lanceolate, ovate, ovate-oblong or elliptic-oblong, 12–65 × 8–35 mm, harshly hairy, slightly scabrous or sparsely subhispid on both sides, tip mostly acute, sometimes apiculate, base rounded or cordate; margins scabrous; petiole 3–11 mm long. *Inflorescence* solitary, an erect umbel, dense, terminal and upturned, globose, 32–66 mm diam., 12–32-flowered; peduncles 55–165 mm long, pubescent along one side or hispid all round, stout; bracts lanceolate to linear-lanceolate, 4–9 × 1.5–2.5 mm, acute, hispid; pedicels 10–28 mm long, hispid intermixed with smaller, finer villous hairs, stout. *Calyx* 5-merous, erect to spreading, ± a third as high as corolla; lobes lanceolate to narrowly-ovate to ovate, 4.0–5.3 × 2.0–2.5 mm, tip acute and thickened, sometimes appearing as if keeled, abaxial side hispid, adaxial side glabrous, dark green. *Corolla* 5-merous, lobes reflexed, tips curving upward, oblong-ovate, 6.0–8.0 × 3.5–5.5 mm, minutely notched at obtusely pointed apex, glabrous on both sides, green to yellow to brown above, veined with purple to maroon to brown, paler green below, tips usually dark maroon to brown. *Staminal corona* 5-merous, arising 1.0–2.1 mm up staminal column, fused with column for ± a third of height, lobes erect, ± quadrate, cucullate without appen-

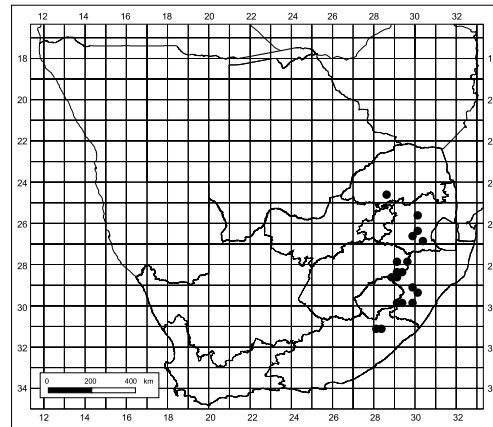


FIGURE 4.—Known distribution of *Asclepias macropus* in southern Africa, based on holdings in the National Herbarium, Pretoria.

dage within, slightly compressed sideways, upper dorsal lobe extended to a long, pointed tail-like appendage, $3.2\text{--}7.2 \times 1.5\text{--}2.7 \times 1.7\text{--}2.7$ mm; proximal teeth $0.58\text{--}0.92$ mm long, partly overtopping gynostegial column, base with narrow wing-like margins (Figure 3). *Staminal column* $3.2\text{--}4.2 \times 3.6\text{--}3.9$ mm, style apex truncate; anthers $3.8\text{--}4.2 \times 2.7\text{--}3.2$ mm, anther appendages suborbicular to broadly ovate, inflexed over and covering style apex, anther wings triangular, broadest at base, $1.2\text{--}2.0$ mm high, projecting $0.4\text{--}0.7$ mm from staminal column. *Pollinarium* solitary, pendulous in each anther sac; pollinia obliquely pyriform with inner margin straight, $0.54\text{--}0.58 \times 0.23\text{--}0.25$ mm, attached terminally to caudicles; caudicles linear, twisted, winged, diverging, attached to lateral and subbasal portion of corpusculum; corpusculum narrowly ovoid to ovoid, $\pm 160 \times 80$ mm, apex acute, with two lateral indentations above attachment with caudicles, with acute notch basally. *Fruit* and *seed* not seen. Plate 2276.

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Barleria macrostegia

Acanthaceae

Namibia, Botswana, South Africa

Barleria macrostegia Nees in *Prodromus systematis naturalis regni vegetabilis* 11: 235 (1847); Clarke: 50, 51 (1901); Obermeyer: 135 (1933); Retief & Herman: 217 (1997). *B. burchelliana* Nees: 235 (1847). *B. burkeana* Sond.: 92 (1850).

The genus *Barleria* is widespread in the Old World, with the highest number of species in the eastern parts of Africa and Asia (Balkwill & Balkwill 1997; Balkwill & Batten 1999). It consists of approximately 250 species of which 63 occur within the *Flora of southern Africa* region. In southern Africa it is widespread, but it is rare in the winter-rainfall area (Balkwill & Welman 2000). Representatives of the genus are easily recognised by a combination of three features: a four-partite calyx with two large outer lobes and two smaller, inner ones; globose, honeycombed pollen; and the predominance of double cystoliths in the epidermal cells (Balkwill & Balkwill 1997).

The plants range from perennial herbs to shrubs and according to Obermeyer (1933) the habit of the southern African species is dependent on geographical factors and climatic conditions. Therefore, small, herbaceous, spinous plants with small, leathery leaves are more frequently found in the dry, western parts of the distribution range, whereas predominantly spineless shrubs with well-developed leaves are more frequent in the eastern parts.

According to the latest classification, the genus *Barleria* is divided into two subgenera (*Barleria* and *Prionitis*) and seven sections (Balkwill & Balkwill 1997). The subgenus *Barleria* is characterised by unbeaked, four-seeded capsules, with a small membranous portion in the septum, whereas subgenus *Prionitis* has predominantly two-seeded capsules with or without a woody or hollow beak and a septum with a broad membranous portion. *B. macrostegia* falls within the subgenus *Barleria*, section *Barleria*, which is distinguished by simple, axillary inflorescences based on scorpioid cymes; a calyx with toothed or spinous margins; leaves with a sharp point and a variable indumentum that is usually not yellow. This species is distinguished from the closely related *B. lichtensteiniana* and *B. media* by a hispid indumentum (Clarke 1901; Obermeyer 1933) and a posticous sepal with a short spine tip (Clarke 1901). In most members of the genus the bracts are simply ordinary leaves in the axils of which an inflorescence unit is borne and each flower is subtended by a pair of opposite bracteoles. In *B. macrostegia* the bracteoles are stiff, leaf-like, with bristly to softly hairy margins and a spinous tip.

Although Nees (1847) cited the type specimen of *Barleria macrostegia* as being collected by Burchell from the Katrivier, Sonder (1850) and Clarke (1901) realised that

PLATE 2277.—1, 2, branches, showing decumbent growth form and thick, axillary cymes, $\times 1$; 3, infructescence $\times 1$; 4, outer calyx lobes (posticous and anticous), $\times 1$; 5, anticous calyx lobe with lateral lobes and developing capsule, $\times 1$; 6, posticous calyx lobe with short spiny tip, $\times 1$. Voucher specimen: *Condy 215* in National Herbarium, Pretoria. Artist: Gillian Condy.



PLATE 2277 *Barleria macrostegia*

Nees had perhaps supposed 'Burke' to be an abbreviation for 'Burchell'. They also correctly cited the type locality as Fat (Vet) River (grid 2826 Brandfort) in the present-day Free State Province, South Africa. Since then, this species has been collected from a broad band in the central regions of southern Africa.

Barleria macrostegia is one of the few widespread species in the genus and is a representative of the herbaceous western group, although it has a more central distribution. Its distribution ranges from Namibia in the northwest, through Botswana and then in South Africa through the Northern Cape, North West, Gauteng and the Free State to Mpumalanga in the east and Limpopo in the north (Figure 1). It is mostly found on sandy or gravelly soils in open grassy areas of the Savanna and Grassland Biomes (Mucina & Rutherford 2006) where it is not easily noticed among tall grasses. *B. macrostegia* flowers from mid- to late summer (January to April) (Retief & Herman 1997) and the attractive mauve to lilac flowers last only a day.

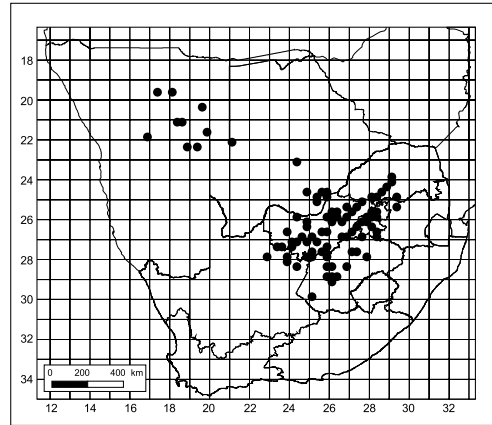


FIGURE 1.—Known distribution of *Barleria macrostegia*.

Watt & Breyer-Brandwijk (1962) noted that *Barleria macrostegia* is used medicinally by Tswana women 'about the time of the climacteric' and that it is commonly referred to as *sephatla* in Tswana. No reference to other common names could be found. The closely related *B. lichtensteiniana* is commonly known as *klapperbossie* or *rolvarkie* (Afrikaans) (Smith 1966).

The name *Barleria* commemorates Jacques Barrelier (1606–1673), Dominican monk and French botanist (Pooley 2005). The specific epithet is derived from *macro* meaning 'long, large or great' and the Greek *stegē* or *stegos* meaning 'a shelter'. Therefore *macrostegia* presumably refers to the large outer calyx segments surrounding and 'sheltering' the flowers and fruit (H.F. Glen pers. comm.).

The specimen illustrated was collected by the artist from the natural grassland area in the Pretoria National Botanical Garden in March 2007.

Description.—Perennial herb, hispid, decumbent, up to 100 mm high. *Branches* trailing, up to 600 mm long. *Leaves* shortly petiolate, opposite, lanceolate with mucronate tip, up to 30 × 7 mm; margin spinous, thickened (sometimes white); long, stiff hairs occurring on lower midvein and along leaf margins; midvein prominently raised below. *Inflorescence* a thick, unilateral, axillary cyme, up to 80 × 30 mm, especially thick when in fruit. *Bracteoles* 2 per flower, subequal, leaf-like, lanceolate, up to 30 × 10–12 mm, with attenuate, spinous tip and hairy margins. *Calyx* 4-partite, segments unequal; 2 outer lobes (posticous and anticous) broadly ovate, 25–28 × 16–18 mm, foliaceous, covered with soft, long hairs, venation conspicuous and

reticulate, posticous lobe with sharp spiny tip; inner lobes (lateral) lanceolate, equal in size, up to 10 mm long, softly hairy. *Corolla* weakly zygomorphic, $\pm$ 45 mm long, cylindrical tube almost twice as long as lobes; lobes 5, subequal, pale lilac to mauve with a creamy throat. *Stamens* 4+1, arising from upper part of tube, 2 on long filaments, 12 mm long, protruding from mouth; 2 shorter ones, 3 mm long; one rudimentary. *Anthers* 2-theous, thecae parallel. *Ovary* superior, 2-locular, glabrous. *Style* 30 mm long, with collar of short hairs at junction with ovary. *Stigma* exserted, with 2 subconfluent, capitate lobes. *Fruit* a dry, dehiscent capsule, unbeaked, 14 $\times$ 6 mm, dark shiny brown, concealed by outer calyx segments when ripe, with 2 seeds per locule. *Seeds* 4, round, flattened, covered with hygroscopic hairs. Plate 2277.

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PLATE 2278 *Sclerochiton triacanthus*

Sclerochiton triacanthus

Acanthaceae

Mpumalanga, South Africa

Sclerochiton triacanthus A.Meeuse in Bothalia 6: 446, 447 (1961); Hilliard & Burt: 113 (1970); Vollesen: 26–29 (1991).

South African botanical science benefitted greatly from the work of Adrianus Meeuse following the relatively short period (1952–1960) that he was employed on the staff of the then Botanical Research Institute, based at the National Herbarium in Pretoria. His significant contributions were notably accomplished without computer or word processing aids—save inputs from the Typing Pool—to which his very neat, legible handwritten texts were at that time sent for transformation! His commitment to botany is exemplary, and although his desktop appeared cluttered and disorderly, he was always able to produce any required item at the drop of a hat. He was a keen fieldworker amassing at least 10 000 herbarium specimens, including about 3 500 from southern Africa (Otto Leistner pers. comm.). Doubtless, many of these would have proved valuable in his execution of regional monographs for the complex families Sapotaceae, Convolvulaceae and Cucurbitaceae (Glen & Germishuizen 2010). Meeuse also published notes on, inter alia, the Acanthaceae (Meeuse 1961) and in the process he authored the subject of this account, *Sclerochiton triacanthus*. The genus *Sclerochiton* is restricted to southern and tropical Africa where it is widely distributed and represented by 19 species and a total of 21 taxa (Vollesen 1991). Six of these species occur in South Africa.

The family Acanthaceae as a whole in sub-Saharan Africa accounts for 85 genera and 1 545 species. Despite its relatively small area, South Africa fares respectably in terms of acanth diversity, for a full 50% of the aforementioned genera are known locally. At species level, however, the country features rather less well, with only 17% of the sub-Saharan complement represented (Klopper *et al.* 2006; Welman 2006).

Indigenous gardeners in southern Africa have drawn extensively on the horticultural merit of the Acanthaceae, with colourful, firm favourites found in genera such as *Thunbergia* (e.g. *T. alata*; black-eyed Susan), *Barleria*, *Metarungia*, *Duvernoia*, and even the intergeneric hybrid, $\times$ *Ruttyruspolia*. A few however, have entered horticulture to be later recognised as somewhat rampant and troublesome garden introductions, because of their growth rate and reproductive capacity. In this regard, *Asystasia gangetica* and *Peristrophe cernua* immediately come to mind, unaffectionately referred to by some seasoned KwaZulu-Natal gardeners as the ‘acanth from hell’. Despite the two known rogues, the overall attractiveness of most of this family has resulted in 37 of the 264 South African species (14%) having been justifiably illustrated in previous issues of *Flowering Plants of Africa*, amongst this set the genera *Barleria* and *Justicia* six times

PLATE 2278.—1, habit, much reduced; 2, flowering raceme, $\times$ 1; 3, flower, side view, $\times$ 2; 4, half flower, $\times$ 4; 5, seed, $\times$ 8. Voucher specimen: Crouch, McMurtry & Burns 1162 in KwaZulu-Natal Herbarium, Durban. Artist: Angela Beaumont.

apiece, with *Asystasia* and *Petalidium* each figured on three occasions. Surprisingly, no species of the rather showy genus *Sclerochiton* has until now been figured. Similarly, distinctive species of *Dyschoriste* and *Rhinacanthus*—many of which have also become well utilised in indigenous horticulture—await exposure through this series.

Sclerochiton triacanthus is a component of the exceptional botanical richness bounded by the topocadastral square 2531CA, which falls within the Barberton Centre of Plant Diversity (Van Wyk & Smith 2001) (Figure 1). With reference to this general area, Balkwill & Balkwill (1988) related compelling reasons for further exploration of its serpentine flora, most notably the high plant endemism levels that result from the long-term interactive influences of metalliferous soils, climate and ecological factors. The serpentine outcrops are heterogeneous in terms of slope, altitude and soil conditions. Over the past two decades, extensive studies have accordingly been conducted (for references, see Williamson & Balkwill 2006). These authors have identified 29 species—among them *S. triacanthus*—endemic to outcrops of serpentines (rocks derived from serpentinite, a metamorphic rock) of the Barberton Greenstone Belt in southeastern Mpumalanga. Of this edaphically restricted *Sclerochiton*, these authors estimated that only 250 to 300 individuals exist at between two and four subpopulations, within an extent of occurrence (EOO) of 16 to 20 km² and a total area of occupancy (AOO) of 1 to 2 km². They accordingly recommended that its Red List status be VU D1+2, this based on mining threats coupled to the apparent incapacity of the taxon to reproduce sexually. Lötter *et al.* (2009) subsequently confirmed this Vulnerable status (as VU D2), again citing mining concerns. To these threats can be added likely road-widening activities near the Ngodwana subpopulation, which would certainly destroy the plants growing immediately adjacent to the N4 highway. Whereas many of the members of *Sclerochiton* are known to be rarely encountered and highly localised and to exhibit relic-like distribution patterns, only *S. triacanthus* is restricted to serpentines (Vollesen 1991).

The species is known first hand to the current authors from four localities within a limited semicircular area north, east and just south of Barberton with a 40 to 46 km disjunction, westwards, to just north of Ngodwana. Rather surprisingly, this latter site is west of the steep Kaapsehoop escarpment. It occurs in open bushveld on rocky slopes—but not in dense closed woodland—usually at altitudes ranging from 700 to 950 m, although Vollesen (1991) records it to 1 200 m. At a locality just south of the town of Barberton it grows on a northwest-facing slope between rocks of Moodies Group quartzite that has been intensely altered geologically. The Moodies Group is the youngest part of the ancient Barberton Supergroup in which carbon-

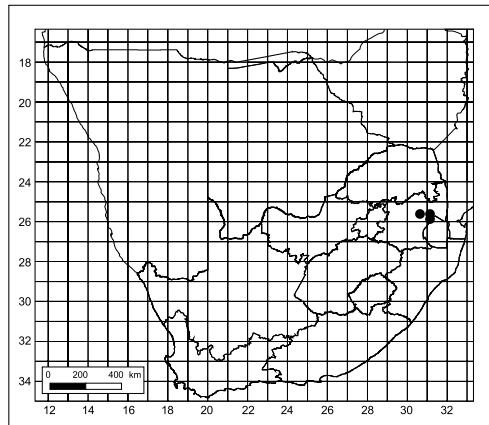


FIGURE 1.—Known distribution of *Sclerochiton triacanthus*.

ate alteration and green fuchsitic (a chrome mica) alteration is present. This metamorphic rock is approximately 3.2 billion years old and weathers positively—that is, it persists after the softer surrounding rocks have eroded, consequently presenting thin, tombstone-like slabs (Chris Rippon pers. comm.).

Plants observed to be associated with *Sclerochiton triacanthus* at the locality south of Barberton include *Acacia davyi*, *Bauhinia galpinii*, *Combretum apiculatum*, *C. here-roense*, *Faurea rochetiana*, *Kirkia wilmsii*, *Pavetta edentula*, *Tarchonanthus parvicapitulatus*, *Tinnea galpinii*, *Vangueria infausta* and *Vitex obovata* subsp. *obovata*. Some associated species north of Ngodwana were *Acacia ataxacantha*, *A. caffra*, *Combretum molle*, *Dovyalis zeyheri*, *Euclea divinorum*, *Faurea rochetiana*, *Ocimum serratum* (= *Orthosiphon serratus*) and *Peltophorum africanum*. All localities from which our subject is known occur within the Barberton Serpentine Sourveld (SVI 13), a vegetation unit considered vulnerable and with only 6% statutorily conserved (Rutherford *et al.* 2006).

A most intriguing conundrum relating to the history of the discovery of *Sclerochiton triacanthus* remains unresolved—how the name of the ‘Prince of Collectors’, Ernest Edward Galpin, has never been associated with this species. Between 1889 and 1892 Galpin lived in Barberton while he was engaged by the Bank of Africa, servicing the tail end of the ‘Moodies gold rush’. His abode was a rondavel on a hillside property owned by one Mr Keay of Hectorspruit, a site that we have been able to precisely locate. Although Galpin is reputed to have botanised regularly on the hillside behind the southern boundary of the Keay property (Rhona Milstein pers. comm.), in an area that currently boasts a colony of our showy acanth, we have been unable to trace any herbarium specimens of *S. triacanthus* made by this industrious South African collector. We have dubbed the site ‘Galpin’s Hill’, as on its slopes one can find several species known to have been discovered by him from the Barberton surrounds, including *Bauhinia galpinii* (Fabaceae), *Tinnea galpinii* (Lamiaceae) and *Jamesbrittenia grandiflora* (Scrophulariaceae) (Stephens 1942).

During his brief stay in Barberton, Galpin is reported to have botanised after work and on weekends, producing carefully preserved and meticulously labelled specimens (Glen & Germishuizen 2010). From this Barberton specimen set, many of which are types, over 50 new taxa were named in his honour—approximately half of these names are current (ALUKA 2010). It is remarkable that during Galpin’s half century of active plant collecting, over a quarter of the more than 200 species based on his discoveries were gathered around Barberton, during a period of less than three years (Glen & Germishuizen 2010). How Galpin could have missed collecting *Sclerochiton triacanthus* is a mystery, unless of course he never had the good fortune of encountering this striking entity in flower, or perhaps he missed it as it appears to occur only in localised colonies. From the Barberton surrounds he did though collect a sister species, *S. harveyanus* (Galpin 964, in National Herbarium, Pretoria). The subsequent discovery at Barberton of *S. triacanthus* in 1921, by the indefatigable Archdeacon Frederick Rogers—who himself gathered an astounding 24 000 southern African specimens—and its re-collection 34 years later by Brenda (née Stiemans) Clarke with her husband Percy, have been fully recounted by Meeuse (1961).

One of us (DM) first encountered our subject in July 2003, eight km north of Barberton during a Botanical Society outing convened to scrutinise a population of *Protea curvata*, another relic serpentine endemic. On returning down the southern slope of the hill, a number of rather untidy sprawling shrublets were noticed. Closer inspection revealed that the plants were all sterile, except for a few dry floral bracts persisting from the previous flowering season. The material that was subsequently pressed from this locality lacks the three small apical spines (only one or two were present) on the persistent fertile bracts, a feature highlighted by Meeuse (1961) as characteristic of *Sclerochiton triacanthus*. However, the diagnostic narrow linear-oblong leaves with deflexed margins and mucro facilitated identification. Vollesen (1991), in the course of his revision, similarly observed that other (nontype) specimens had undivided bracts and dorsal sepals. The fact that tri-fid bracts are atypical of this taxon rather indicates a misnomer for the specific epithet. The generic name *Sclerochiton* is derived from the Greek *skleros* for 'hard' and *chiton*, 'covering', in reference to the woody capsule. The specific epithet *triacanthus* derives from *tri*, 'three' and *acanthus*, 'thorn', describing the three-spined fertile bracts present in the holotype.

Vollesen (1991) established sect. *Illicifolia* in subgen. *Isacanthus* to accommodate three closely related but allopatric South African species, *Sclerochiton illicifolius*, *S. triacanthus*, and an undescribed species (sp. A) known from a single collection in the Loskop Dam area, south of Groblersdal. The species that typifies this section can be separated readily from our subject on account of its holly-like leaves—in outline they are elliptic rather than linear-lanceolate, and with far more pronounced marginal teeth. Furthermore, the corollas of *S. illicifolius* are white to cream-coloured rather than pale violet marked with darker veins. Whereas the flower colour of *Sclerochiton* sp. A is reportedly very similar to that of our subject, it bears both flowers and leaves that are very much smaller, and neither it nor *S. illicifolius* occur on serpentine-derived soils (Vollesen 1991). *S. apiculatus* was placed in sect. *Isacanthus* while the remaining two South African taxa, *S. harveyanus* and *S. odoratissimus*, were assigned to subgen. *Sclerochiton*, this latter group considered by Vollesen (1991) to be primitive relative to subgen. *Isacanthus*.

A feature shared by all local representatives of the genus except *Sclerochiton illicifolius* and perhaps *Sclerochiton* sp. A, is the habit of the longer shoots arching and often inclined to root when they touch the ground. This feature is most obvious in the best-known garden subject from this genus, *S. harveyanus*—commonly known as blue lips or *mazabuka*—although it has also been observed in *S. odoratissimus* and our present subject, *S. triacanthus*. This vegetative propagation does not occur to the extent that a nuisance is created in cultivation, but rather results in dense localised clumps with more concentrated blooms. Plants in habitat have been described as forming clumps of up to 2.5 m across (Vollesen 1991), a character that may be attributed to their natural tip layering ability rather than to multiple shoots arising from the base. Individual stems though can attain lengths of up to 1.2 m but those of 0.7 m are more usual. It has been observed that after fire plants regenerate easily from the persistent underground rootstock, revealing their fire-adapted perennial character.

Although propagation material has been collected from three different localities and planted in a garden a mere 30 km north of the closest subpopulation, none

of the plants cultivated have ever bloomed, even after as many as four years after establishment. This was initially perhaps owing to localised drought, and later to too much shade. However, a rooted side piece from an adult plant encountered east of Sheba Mine was successfully transplanted to a garden in Kloof, KwaZulu-Natal, and it subsequently flowered within a year! Clearly, *Sclerochiton triacanthus* can be successfully cultivated in soils other than those derived from serpentinite, which reportedly contain high concentrations of chromium and nickel (Van Wyk & Smith 2001). The Kloof plant is figured here. In cultivation, plants become far less straggly and untidy, and are not deciduous. Large, pale violet blooms are presented in spike-like racemes between early and midsummer, the tube of each attractive flower about 7 mm long with a limb projecting 19 mm beyond.

Description (after Meeuse 1961; Vollesen 1991).—Low straggling shrub, up to 1 × 2.5 m, perennial. *Stems* usually arching, often rooting at apex when in contact with ground, subterete, woody, dark brown and shortly pilose with whitish patent hairs, usually rather densely so, later glabrescent turning ash grey or cinnamon; bark thin, smooth to longitudinally wrinkled. *Leaves* aggregated at branch tips or on short side shoots, slightly anisophyllous, oblong-elliptic to linear-lanceolate, 20–55 × 4–9(–15) mm, narrowing at base into a very shortly pilose petiole up to 2 mm, subcoriaceous, glossy, glabrous to ciliate near cuneate base, sometimes sparsely pilose on midrib, distinctly veined, apex subobtuse to acute, mucronate, mucro 1–2 mm long, flexible not hard; midrib prominent below, usually convex on underside where passing through deflexed margins to form mucro; margin entire or with few(–4) fine teeth per side. *Inflorescences* terminal and subterminal on short side shoots, dense, up to 15-flowered. *Bracts* oblong to linear-oblong, firm, green to brownish; lower sterile ones short, innocuous or pungent, fertile ones larger, ± 14 × 4 mm, ± concave to boat-shaped and somewhat carinate. *Bracteoles* 2, linear-lanceolate, somewhat carinate, 16–18 × 3–4 mm, sparsely puberulous or glabrous, usually ciliate along margins, especially about the middle, with 1–3 small apical spines. *Pedicels* stout, 3–5 mm long. *Sepals* 5, acute, pungent, subglabrous, often somewhat ciliate; posticous sepal broadly linear, acute with 1–3 apical spines, 23–24 × 4–5 mm; 2 anticus sepal linear-lanceolate, 16–18 × 3 mm; 2 lateral sepals linear-lanceolate, 15–17 × 2.0–2.5 mm. *Corolla* light violet with darker reticulate veins, buttermilk-yellow in bud; tube ± 7 mm long, glabrous; limb ± 19 mm long, silky pubescent beneath, with two broad lines of hairs above, its lobes subequal obovate-oblong rounded at apex, 4–5 mm long. *Stamens* retrorsely silky pubescent towards base; filaments up to 11 mm long; anthers shortly hirsute-pubescent, pale saffron-yellow, 3–4 mm long. *Ovary* densely puberulous to velutinous, with a dense tuft of erect stiff, fawnish hairs, 3–4 mm long; ovules 4; style 14–15 mm long, with fawnish setaceous hairs forming an abaxial line becoming denser and broader towards base. *Fruit* a narrowly oblong, glabrous capsule, ± 14 mm long. *Seed* obovate in dorsal view, laterally flattened, 4.5–5.0 × 3 mm, obliquely truncate at hilum, lacking scales but occasionally ridged, light brown, matt. Plate 2278.

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PLATE 2279 *Pavetta zeyheri* subsp. *zeyheri*

Pavetta zeyheri* subsp. *zeyheri

Rubiaceae: Cinchonoideae–Pavetteae

Botswana, South Africa

Pavetta zeyheri* Sond. subsp. *zeyheri P.P.J.Herman in Bothalia 35: 85 (2005). *P. dissimilis* Bremek.: 211 (1929); Bremekamp: 183 (1934). *P. pseudozeyheri* Bremek.: 211 (1929); Bremekamp: 183 (1934). *P. zeyheri* Sond. var. *brevituba* Bremek.: 212 (1929); Bremekamp: 184 (1934). *P. zeyheri* Sond. var. *pubescens* Bremek.: 212 (1929); Bremekamp: 184 (1934). *P. zeyheri* Sond. var. *sonderi* Bremek.: 184 (1934).

The genus *Pavetta* belongs to the family Rubiaceae, the gardenia or coffee family, and comprises some 400 species occurring in the Old World tropics (Bridson 2003), with about 24 species in the summer-rainfall areas of southern Africa. They are commonly known as bride's bushes or Christmas bushes, certainly referring to the masses of fragrant white flowers usually produced in December.

The genera *Pavetta*, *Psychotria* and *Sericanthe* are unique in the family Rubiaceae in having bacterial nodules on the leaves. In *Pavetta* it was originally thought that the bacteria in the nodules fix atmospheric nitrogen (Grobbelaar *et al.* 1971; Palmer & Pitman 1972). However, after several experiments, it could not be positively concluded that the bacteria fix nitrogen (Grobbelaar & Groenewald 1974). The bacteria are already present in the seeds and anatomical studies showed that the bacteria are present in the developing ovaries of the floral buds (Von Teichman & Robbertse 1982; Von Teichman *et al.* 1982). When the seed germinates, the bacteria can be found in the growth points. Anatomical studies of the vegetative growth points showed that there are special glandular hairs, known as dendroid colleters, present on the inner surface of the stipules enveloping the growth points. These glandular hairs secrete a mucilaginous substance in which the bacteria occur. The very young developing leaves in the growth point have already fully developed stomata on their upper (adaxial) surface but none on the lower (abaxial) surface where they occur in the mature state. The mucilage containing the bacteria enters the young leaves through these stomata on the adaxial surfaces from where the bacterial nodules develop in the leaves (Herman *et al.* 1986; Herman 2007). In other experiments, the seeds were treated with boiling water in an effort to kill the bacteria. Plants that developed from these seeds showed abnormal growth ('cripples'). This led to a theory that the bacteria produced a growth regulator necessary for the 'normal' growth of the plant (Grobbelaar 1971). Yet another theory is that the bacteria are responsible for the fact that some species (e.g. *Pavetta harborii*) are poisonous to stock (Van Wyk *et al.* 1990).

Another interesting feature of many *Pavetta* species is the occurrence of cavities or pockets, covered by hairs or leaf tissue and known as domatia, on the abaxial leaf

PLATE 2279.—1, habit, much reduced; 2, flowering branch, × 1; 3, side view of flower, × 2; 4, apical view of flower, × 2; 5, fruiting branch, × 1; 6, upper leaf surface, × 1; 7, lower leaf surface, × 1. Voucher specimens: *Hyde-Johnson 1* (flowering) and *Hyde-Johnson 2* (fruiting) in National Herbarium, Pretoria. Artist: Jenny Hyde-Johnson.

surfaces, in the axils of the main and secondary veins (Herman 2007). This is, however, not a unique character for the genus *Pavetta*, but occurs in many other genera of the Rubiaceae and other families. Domatia are inhabited by tiny arthropods such as mites.

Pavetta zeyheri subsp. *zeyheri* is only the second representative of this genus being treated in *Flowering Plants of Africa*. The other species was *P. revoluta* (Vorster 1978). This is surprising as the masses of fragrant white flowers produced from about October to February cause these plants to be very conspicuous and attractive in the field. Most species are fairly common in the areas where they occur. The flowers attract many pollinators, which in turn attract their predators. The flowers are replaced by pea-sized black fruits, relished by birds which are obviously responsible for their distribution. Only a few species are known to be in cultivation, for example *P. lanceolata* (Herman 2006, 2007), *P. gardeniifolia* (Joffe 2002), probably *P. cooperi* (Viljoen 2010), *P. revoluta* (Mbambezeli 2007) and *P. schumanniana* (Glen 2007). The author and the artist both observed spiky, green larvae (Figure 1) attacking the leaves of *P. lanceolata* (Herman 2006) and *P. zeyheri*. These larvae belong to a species of limacodid moth (Dr M. Kruger, Ditsong National Museum of Natural History, pers. comm.). Two species of *Pavetta* in southern Africa are known to be poisonous to stock, causing *gousiekte*—*P. harborii* and *P. schumanniana* (Vahrmeijer 1981).



FIGURE 1.—Larva of a limacodid moth feeding on leaves of *Pavetta zeyheri* subsp. *zeyheri*. Photo: Jenny Hyde-Johnson.

Pavetta zeyheri was originally described by Sonder (1865) from a specimen collected somewhere along the Vaal River in the former Transvaal (Gauteng). In a revision of the South African species of *Pavetta*, Bremekamp (1929) included *P. zeyheri*, *P. microlancea* from Komatipoort (Mpumalanga) as well as *P. middelburgensis*, a newly described species from Middelburg (Mpumalanga), in his Subsection 4 Brevipedae, Group 4 Acutifoliae. In his monograph of the genus, Bremekamp (1934) used different infrageneric names. *P. zeyheri*, *P. microlancea* and *P. middelburgensis* together with *P. lasiopeplus* from Namibia and Angola were included in his Section 18 Brachypus, Series 8: Campicolae.

When Launert (1966) revised the Rubiaceae for the *Prodromus einer Flora von Südwestafrika*, he sank *Pavetta lasiopeplus* under *P. zeyheri*. Bridson (1978) and Kok & Grobbelaar (1984) maintained that Bremekamp recognised too many species and

that some species delimitations were unsatisfactory. They subsequently placed several species in synonymy. Although these treatments solved some taxonomic problems, some new problems were created. Kok & Grobbelaar (1984) listed 10 names as synonyms under *P. zeyheri*, including *P. microlancea*, *P. middelburgensis* and *P. lasiopeplus*. Bridson (2003) resurrected the geographically disjunct *P. lasiopeplus* on the grounds of differences in the length of the calyx lobes (0.5–1.5(–2.0) mm in *P. zeyheri* and 2–3 mm in *P. lasiopeplus*) and inflorescence branches (apparent in *P. zeyheri* but suppressed in *P. lasiopeplus*). In a note she also suggested that *P. microlancea* should be excluded from synonymy. Herman (2005) reinstated *P. middelburgensis* and *P. microlancea* as subspecies of *P. zeyheri* on the grounds of differences in growth form (*P. zeyheri* subsp. *zeyheri* a shrub or small tree, *P. zeyheri* subsp. *middelburgensis* and subsp. *microlancea* dwarf shrubs or shrubs) and with a disjunct geographical distribution (*P. zeyheri* subsp. *middelburgensis* endemic to the Middelburg area in Mpumalanga and *P. zeyheri* subsp. *microlancea* endemic to the Komatipoort District in Mpumalanga; *P. zeyheri* subsp. *zeyheri* widely distributed).

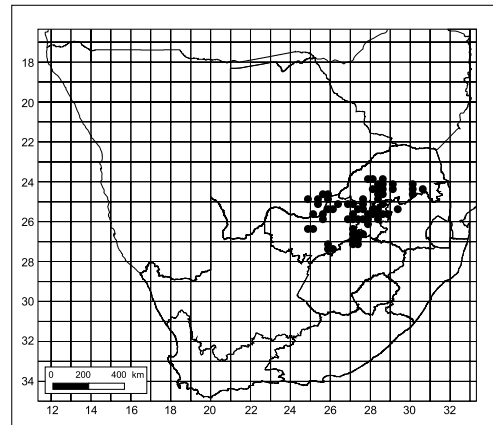


FIGURE 2.—Known distribution of *Pavetta zeyheri* subsp. *zeyheri* in southern Africa.

Pavetta zeyheri subsp. *zeyheri* is a shrub or small tree, usually single-stemmed, growing mainly on rocky outcrops and hillsides, but also flats, often on sandy soil in Botswana, Limpopo, North West, Gauteng, Mpumalanga and the Free State (Figure 2). It is commonly known as small-leaf bridesbush and *fynblaarbruidsbos* with SA Tree No. 722 (Von Breitenbach *et al.* 2001; Schmidt *et al.* 2002), but also as greyleaf bridesbush, *vaalbruidsbos* (Coates Palgrave 2002; Schmidt *et al.* 2002), narrowleaf bridesbush, *smalblaarbruidsbos* (Schmidt *et al.* 2002). Flowering has been recorded from October to February. According to Fox & Young (1982), the leaves of *P. zeyheri*, *P. edentula* and *P. lanceolata* are edible and are used as a vegetable.

Description.—Shrub or small tree 1–4 m high, usually single-stemmed. *Leaves* decussate, sessile or subsessile, narrowly obovate, oblanceolate to narrowly elliptic, (20.5–)28.0–57.0(–68.0) × (4.5–)5.0–12.0(–15.5) mm, glabrous and dull green, apex acute, rounded to obtuse, base cuneate, margin entire; domatia absent; bacterial nodules black, round or slightly elongated and scattered over leaf surface; interpetiolar stipules truncate-triangular, acuminate-apiculate. *Inflorescence* few-flowered, little-branched, subumbellate, on apparent, leafless, short side branches, 1–6 mm long. *Pedicels* 3–10 mm long; bracts with silky hairs inside. *Calyx* tube 1.2–2.0 mm long; lobes 4, 0.5–2.0 mm long, persistent in fruit. *Corolla* white to cream-coloured, with slight pink tinge when young, tube cylindrical, 7–14 mm long, hairy inside; lobes 4, contorted to left in bud, 6.0–9.5 × 2–3 mm, spreading perpendicular to tube, twisting clockwise, apices initially green. *Stamens* 4, arising between corolla



FIGURE 3.—Range of flowers from unopened to mature and eventually the fruit, $\times 2$. Artist: Jenny Hyde-Johnson.

lobes; filaments very short; anthers 5.5–9.0 mm long, greenish, turning yellowish and finally black, twisted, exserted. *Pollen presenter* 18–33 mm long, apical part thickened to club-shaped, greenish, turning yellowish, long-exserted, persistent for some time (Figure 3); ovary inferior, 2-locular. *Fruit* a drupe, 6–10 mm diam., green turning black when mature. *Seeds* 2 but mostly 1 by abortion, hemispherical with circular excavation in centre of ventral face, convex dorsal face usually rugulose. Plate 2279.

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Tripteris aghillana var. *aghillana*

Asteraceae: Asteroideae–Calenduleae

Namibia, Botswana, Lesotho, South Africa

Tripteris aghillana DC. var. *aghillana*, De Candolle in Prodrômus 6: 457 (1838); Harvey: 429 (1865). *Osteospermum scariosum* DC. var. *scariosum*, De Candolle: 464 (1838); Norlindh: 311 (1943); Merxmüller: 128 (1967). *O. picridioides* De Candolle: 465 (1838); Harvey: 440 (1865); Norlindh: 311 (1943). *Tripteris flexuosa* Harv.: 429 (1865); Norlindh: 312 (1943). *T. glandulosa* Turcz. var. *dentata* Harv.: 430 (1865); Norlindh: 312 (1943). *T. natalensis* Harv.: 430 (1865); Norlindh: 312 (1943).

The genus *Tripteris* belongs to the tribe Calenduleae in the subfamily Asteroideae of the family Asteraceae. It consists of about 22 species occurring from southern to tropical Africa northwards to Egypt, the Arabian Peninsula and Jordan, of which 16 occur in southern Africa (Nordenstam 1994a, 2007). Although widespread in southern Africa, the genus is absent in Swaziland.

The tribe Calenduleae comprises 12 genera, of which 11 occur naturally in southern Africa, many of them endemic (Nordenstam 2007). As research on the taxa in this tribe is continuing, the number of genera may change, especially concerning the delimitations among *Osteospermum*, *Tripteris*, *Chrysanthemoides*, etc. (Nordenstam & Källersjö 2009). Only one genus, *Calendula*, is confined to the northern hemisphere but some of its species are cultivated or occur as weeds in southern Africa. The tribe Calenduleae is economically important as some species are highly palatable to livestock and game, for example *Chrysanthemoides incana*, *C. monilifera* subsp. *pisifera* and subsp. *subcanescens*, *Garuleum bipinnatum*, *Tripteris sinuatum* (= *Osteospermum sinuatum*) (Van Breda & Barnard 1991; Le Roux *et al.* 1994). However, other species such as *Dimorphotheca cuneata* and *D. spectabilis* are poisonous to stock (Watt & Breyer-Brandwijk 1962; Vahrmeijer 1981; Van Wyk *et al.* 2002; Kellerman *et al.* 2005). Some southern African representatives are becoming more popular as garden plants, for example *Chrysanthemoides monilifera* (Van Jaarsveld 2001), *Dimorphotheca cuneata* (Oliver 2010), *D. ecklonis* (Herman 2005a), *D. jucunda* (Herman 2005b), *D. pluvialis* (Van der Walt 2000), *D. sinuata* (Dlamini 2002) and *Tripteris oppositifolia* (Swelankomo 2009).

The generic name *Tripteris* is derived from the Greek words *tri*, meaning three, and *ptēris*, meaning wing, and refers to the characteristic fruit (cypsela) with three wings. Some fruits without wings are occasionally found in a flower head. Another interesting feature of the fruits are the apical windows between the wings, enclosing an air chamber (Figure 1). Some species have three, others only one apical window and some species totally lack these apical windows—reflected in Norlindh's

PLATE 2280.—1, habit with yellow flower heads, × 1; 2, flower head showing reddish apices of the involucre bracts and reddish lines on lower surface of ray florets, × 1; 3, nodding head with three-winged fruits showing pinkish margins of wings, × 1; 4, ray floret, × 2; 5, disc floret, × 2. Voucher specimens: Herman, Swelankomo & Condry 1591, 1–3; Herman 1593, 4 & 5 in National Herbarium, Pretoria. Artist: Gillian Condry.



PLATE 2280 *Tripteris aghillana* var. *aghillana*

(1943) classification under the subgenus *Tripteris*, sections *Trifenestrata*, *Unifenestrata* and *Efenestrata*. A pappus is absent in representatives of the tribe Calenduleae. The wings on the fruits of the genus *Tripteris* are undoubtedly an adaptation for wind dispersal. The apical air chambers contribute by decreasing the overall weight of the fruits, making them more suitable for wind dispersal. It is also possible that the thin, membranous covering of the windows disintegrates and that water enters the fruit through these pores, facilitating germination.

De Candolle (1838) originally described the same species under two different names in the same publication: *Osteospermum scariosum* and *Tripteris aghillana*. Norlindh (1943), a Swedish botanist, then at the Botanical Museum, Lund, wrote a monograph on some genera of the Calenduleae. He viewed *Osteospermum* in a very broad sense and recognised two subgenera and several sections in the genus. One subgenus was *Tripteris* in which he put all the species with three-winged fruits, *inter alia* *O. scariosum*. In that publication he placed *T. aghillana* into synonymy under *O. scariosum*. Bertil Nordenstam, a Swedish botanist and former Curator of the Herbarium of the Swedish Museum, Stockholm, is a life-long student of the taxonomy and phytogeography of the Asteraceae, especially the tribes Calenduleae and Senecioneae. As part of a generic revision of the tribe Calenduleae, Nordenstam (1994a, b) re-instated certain genera and transferred some species to different genera, one of which was the genus *Tripteris*. As *T. aghillana* was the oldest name available, *O. scariosum* now becomes a synonym of *T. aghillana*. When Nordenstam (1994a, b) re-instated the genus *Tripteris*, he initially included all the species possessing three, one and no apical windows on the fruits in this genus. However, as a result of further research on the generic limits, he described three new genera to accommodate species with one apical window (*Monoculus*) and no apical windows (*Norlindhia* and *Inuloides*) (Nordenstam 2006).



FIGURE 1.—Digital image of fruit of *Tripteris aghillana* var. *aghillana* showing one of the apical windows between the wings. Scale bar = 5 mm. Voucher specimen: Mogg 15344 in National Herbarium, Pretoria.

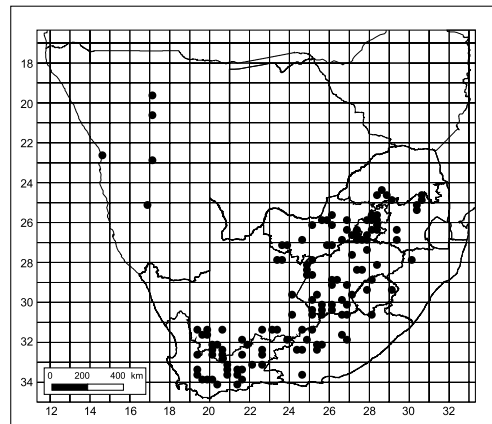


FIGURE 2.—Known distribution of *Tripteris aghillana* var. *aghillana* in southern Africa. According to the literature also in Botswana, but no records in the National Herbarium, Pretoria.

Tripteris aghillana var. *aghillana* has the widest distribution of all the *Tripteris* species in southern Africa. It occurs in Namibia, Botswana (according to Norlindh 1943) and all nine provinces of South Africa and in Lesotho (Figure 2). Like most species distributed over extensive areas with different climatic conditions and soils, it is a very polymorphous species that shows strong variation, especially in respect of leaf shape, pubescence and size. The conservation status of this species is given as Least Concern in Raimondo *et al.* (2009).

The species epithet *scariosum* of the synonym refers to the scariose (thin and dry) wings of the fruits. Another synonym, *glandulosa*, alludes to the densely glandular peduncles and upper part of the stem of most specimens. This plant is resistant to drought and can withstand harsh climatic conditions, even in the Karoo and Kalahari areas. This is reflected by dwarfed specimens found in dry areas in the Karoo as opposed to the more lush plants growing along rivers and streams. Labels of herbarium specimens refer to a wide variety of soils and habitats such as dry, sandy, rocky outcrop, well-drained, loamy-clay soil, sandy loam, shale, dolerite ridge, TMS plateau, Eccca shale with some dolerite, limestone, basaltic loam, black turf, outcrop, hill and mountain slopes or tops, disturbed places in grassland, savanna, semidesert and succulent karoo. The altitude ranges from 100 to 1 900 m a.s.l. Flowering is recorded throughout the year, but the main flowering time is from September to about March.

The type specimen of *Tripteris aghillana* was collected by Drège at Cape Agulhas in the Bredasdorp District and was named after this locality (Candolle 1838; Norlindh 1943). Van Breda & Barnard (1991) and Le Roux *et al.* (1994) listed *T. aghillana* (= *Osteospermum scariosum*) as very palatable and good grazing for stock. It is commonly known as *sagtebietou* (Van Breda & Barnard 1991; Le Roux *et al.* 1994).

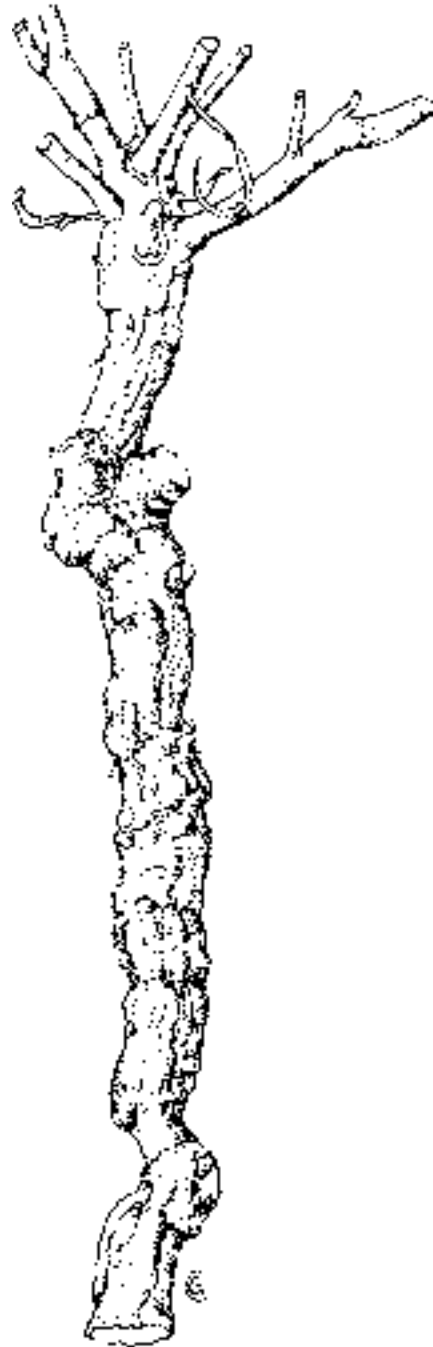


FIGURE 3.—Underground rootstock of *Tripteris aghillana* var. *aghillana*, $\times 1$. Voucher specimen: Herman & Swelankomo 1592 in National Herbarium, Pretoria. Drawing: Gillian Condy.

Description.—Perennial herb or dwarf shrub up to 0.6 m high from woody rootstock (Figure 3), with one to several erect or ascending annual stems, glabrous or hairy and/or glandular. *Leaves* alternate, semisucculent, green to glaucous, variable: basal leaves more or less rosulate, obovate, narrowly obovate to oblong, basally narrowing to petiole, 20–130 × 3–30 mm, apex obtuse or subacute, margin remotely dentate to sinuate-dentate to repand, sometimes entire; cauline leaves scattered, similar but smaller and decreasing in size upwards, linear to narrowly obovate, sessile, often auriculate, apex acute to acuminate, margin remotely dentate or entire to subentire, densely to sparsely hairy to glabrescent and/or glandular; petiole 10–30 mm long. *Capitula* heterogamous, radiate, terminal, solitary or rarely laxly corymbose, pedunculate, nodding in fruiting stage. *Peduncle* up to 170 mm long, ribbed, hairy and glandular with few scattered bracts; bracts linear-lanceolate to linear-subulate, lower often denticulate, upper entire, apex acuminate. *Involucre* campanulate, involucre bracts 12–15, subuniseriate, almost equal, narrowly oblong to narrowly elliptic to elliptic, apex acute or acuminate, margin of ‘inner’ bracts broadly white scariose, those of ‘outer’ bracts narrowly white scariose, often reddish or purplish towards apex, 4–6 × 1.0–2.5 mm, glandular and hairy. *Receptacle* epaleate. *Ray florets* female, fertile, as many as involucre bracts, 8–20 mm long, corolla shortly tubular below, tube about 1 mm long, with uniseriate, multicellular hairs on outside, apex of limb 3-toothed, yellow with brownish, reddish or purplish stripes below, sometimes with dark spot at base of limb. *Style* 1–2 mm long, bilobed, lobes 1–2 mm long, apex rounded, stigmatic areas confined to margins of lobes, confluent at apex. *Disc florets* functionally male, actinomorphic, corolla narrowly tubular below, abruptly widened and tubular above, 5-lobed, tube 2.5–3.0 mm long, lobes erect, 1.0–1.5 mm long, yellow. *Anthers* 2.0–2.5 mm long, calcarate, caudate, with large, ovate, acute-obtuse, purplish apical appendage, exserted. *Style* 2–4 mm long, apex broadly conical, shortly bifid, papillate with ring of hairs at base of cone. *Cypselae* (fruits) glabrous, slightly curved, 8–15 mm long, 3-winged; wings membranous, semitranslucent, greenish with pinkish margins, turning brown at maturity, 4–6 mm broad, with 3 apical windows enveloping air chamber. *Pappus* absent. Plate 2280.

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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.

If practical, the electronic submission should be accompanied by a hard copy. The requirements are as follows:

- Data must be IBM-compatible and written in MSWord. If files are saved as Rich Text Format, other word processing packages may also be used.
- All paragraphs (including headings) must be left-aligned. Do not justify or centre anything. Do not indent paragraphs. Use Normal paragraph style throughout. Put an empty paragraph sign between text paragraphs.
- Do not break words, except hyphenated words.
- Use italics and bold where necessary.
- Use an N-dash for 'to' (Alt code is 0150) (e.g. 5–10 mm).

- Use an M-dash instead of parenthesis or to replace a colon, where appropriate (Alt code is 0151) (e.g. Description.—Small tree ...).
- Use the lower case x as times sign, with one space on either side of the x, for example 2 x 3 mm.
- Special characters such as degree signs, plus-minus, Greek letters, symbols for maps, etc.: please do not use the symbols provided by your word processing program—the graphic designer experiences problems with conversions from some word processing packages; rather use your own word or code which should be unique, self-explanatory, consistent and placed between angle brackets, for example <mu> for the Greek letter μ ; <degrees> for °; <pm> for $\pm$; <open square> for $\square$, <solid dot> for $\bullet$. Please attach a list of your codes to the manuscript.

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

ARTISTS

1. **Supervision.** All illustrations should be executed under the supervision of the botanist writing the text—to ensure botanical accuracy and 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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Other technical publications of the South African National Biodiversity Institute

1. **Bothalia**: medium for publication of botanical papers dealing with the flora and vegetation of southern Africa, presenting new facts and items of general interest. Published: Vol. 1–41,1.
2. **Strelitzia**: a series of occasional publications on southern African flora replacing *Memoirs of the Botanical Survey of South Africa** and *Annals of Kirstenbosch Botanic Gardens**. Published: 1–28.
3. **SANBI Biodiversity Series**: occasional reports on projects, technologies, workshops, symposia and other activities initiated by or executed in partnership with SANBI. Published: 1–19.
4. **Flora of southern Africa**: a taxonomic treatment of the flora of the Republic of South Africa, Lesotho, Swaziland, Botswana and Namibia. Published: Vol. 1 (1966); 4,2 (1985); 5,1,1 (First part) (2000); 5,3 (1992); 7,2,1 (First part) (1999); 7,2,2 (1983); 9, Urticaceae (2001); 10,1 (1979); 13 (1970); 14 (1985); 16,1 (1975); 16,2 (1977); 16,3,6 (1988); 18,3 (1986); 19,3,1 (1993); 21,1 (1984); 22 (1976); 26 (1963); 27,4 (1980); 28,1 (2000); 28,4 (1985); 30,3,1 (1995); 31,1,2 (1986); 33,4,1 (2001); 33,7,2 (1983); 9 (Cryptogams: Characeae) (1978); Bryophyta 1,1 (1982); Bryophyta 1,2 (1987); Bryophyta 1,3 (1998); Hepatophyta 1,1 (1999); Pteridophyta (1986).
5. **Palaeoflora of southern Africa**: Molteno Formation (Triassic) Vol. 1, Introduction, *Dicroidium*; Prodrum of South African megaflores, 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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