Flowering Plants of Africa

Volume 64

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Flowering Plants of Africa

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

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

The illustrations are mostly prepared by artists on the staff of the South African National Biodiversity Institute (SANBI), but we welcome other contributions of suitable artistic and scientific merit. Please see *Guide for authors and artists* on page 168.

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History of this series

(note Afrikaans translation and changes in title)

Volume 1 (1921) to Volume 24 (1944):
The Flowering Plants of South Africa

Volume 25 (1945–1946) to Volume 26 (1947):
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Cover illustration: *Acanthopsis disperma* (Plate 2314)

Flowering Plants of Africa

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

Edited by

Alicia Grobler

with assistance of

Gillian Condy

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All maps (except those for *Abutilon grandifolium*, *Vaccinium exul* and *Ceropegia terebriformis*) produced by H.M. Steyn, South African National Biodiversity Institute, Pretoria, RSA

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This volume is dedicated to

AURIOL URSULA LUYT BATTEN (1918–2015)

Auriol Batten was one of South Africa's finest botanical artists, and her receipt of the Lifetime Achievement Award for Botanical Art at the Kirstenbosch Biennale in September 2008 crowned a career devoted to botanical education and excellence. Her long and productive life as a botanical artist was launched with the publication of a field guide to the flora of the Eastern Cape with fellow artist Hertha Bokelmann in 1966. Since then her work has illustrated several botanical monographs, most recently a treatment of *Freesia* that she commenced one year before her 90th birthday. Her work has been exhibited widely locally and internationally and she held gold medals from the Royal Horticultural Society (1986) and the Kirstenbosch Biennale (2000). She served on the Board of Trustees for the East London Museum for almost three decades and held an honorary Doctorate from Rhodes University, awarded in recognition for her contribution to South African botany. She is commemorated in several plant species, a tribute to both her zeal and her professionalism.

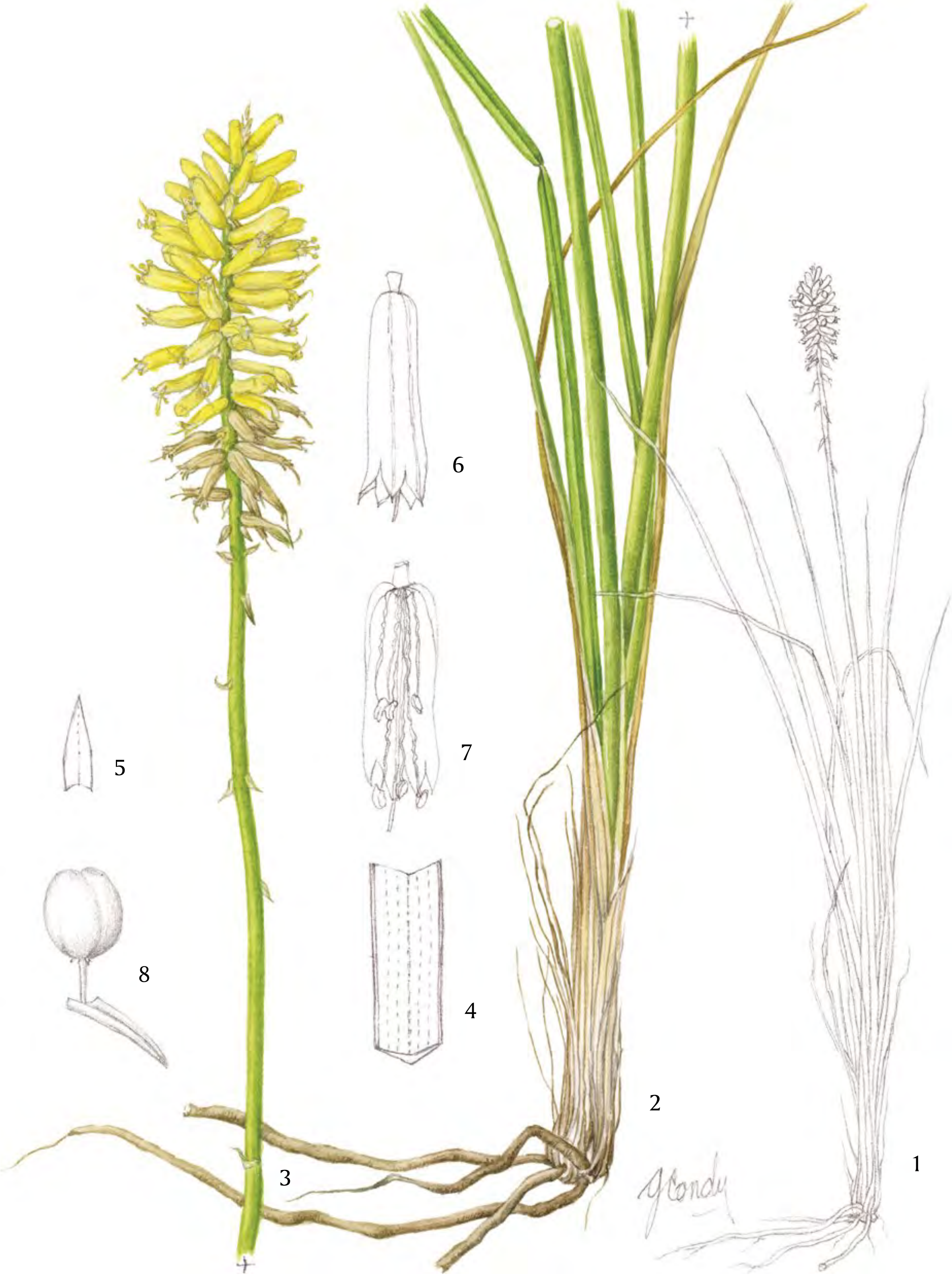

PLATE 2301 *Kniphofia breviflora*

Kniphofia breviflora Asphodelaceae

South Africa

Kniphofia breviflora *Harv. ex Baker* in Journal of the Linnean Society, Botany 11: 361 (1871); Baker: 277 (1896); Baker: t. 7570 (1897); Berger: 40 (1908); Codd: 413 (1968); Codd: 14 (2005). *Tritoma breviflora* (Harv. ex Baker) W.Mast.: 500 (1874). *K. schlechteri* Schinz: 10 (1900). *K. concinna* Baker: 784 (1901). *K. fibrosa* sensu J.M.Wood: t. 322 (1903). *K. breviflora* var. *concinna* (Baker) A.Berger: 40 (1908). *K. buchananii* var. *flavescens* A.Berger: 40 (1908), partly, excl. *Wood 1972*. *K. parviflora* var. *albiflora* A.Berger: 40 (1908).

Kniphofias are showy garden plants treasured for their fiery coloured flowering heads. They have become popular in European gardens since the introduction of the Cape *Kniphofia uvaria* prior to 1687 (Hermann 1687). The genus is known by different common names which include red hot pokers, flame flowers and torch lilies. The most popular name is red hot poker because of the more robust species' striking flame-coloured flowering heads that are made up of numerous red buds. See plate 2302 depicting *K. caulescens* in this volume (Baijnath & Fothergill 2015).

Kniphofia contains ± 70 species, found mainly in southern and eastern Africa (Ramdhani et al. 2006) and occurs in grassland and moist habitats from the coast to the interior where it reaches altitudes up to 3 000 m above sea level. In the Flora of southern Africa region (South Africa, Swaziland, Lesotho, Botswana and Namibia), 48 species of *Kniphofia* are recognised with the highest diversity and endemism in the Drakensberg Mountains (Ramdhani et al. 2009). In tropical Africa, there are ± 23 species of *Kniphofia* (Marais 1973; Kativu 1996; Whitehouse 2002) with a concentration of species in south to central Africa (Malawi [5], Zambia [4], Zaire [8], Tanzania [8], Uganda [8] and Ethiopia [7]). Species are endemic either to southern or tropical Africa, except two species, *K. linearifolia* and *K. splendida*, which are common to both regions and occur in South Africa, Swaziland, Mozambique, Zimbabwe and Malawi. *Kniphofia linearifolia* also occurs in Lesotho. Outside the African continent, one species (*K. sumarae*) is endemic to the Ibb Mountains of Yemen and two species (*K. pallidiflora* and *K. ankaratrensis*) are endemic to Madagascar.

Kniphofia was named by Conrad Moench in honour of Johann Hieronymus Kniphof (1704–1763), a German physician and botanist. Kniphof used a technique called nature printing, where he coated plant specimens with black printers' ink and pressed them onto paper to produce life-size images which were then coloured in by hand (Oakeley 2012). He used the images in his famous publication, *Botanica in Originali* (Kniphof 1762). Among English gardeners *Kniphofia* is also known as *Tritoma*, a name given to the genus by Ker Gawler in 1804 when he described *Tritoma uvaria* in *Curtis's Botanical Magazine*, ten years after Moench (1794) established the genus

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PLATE 2301.—1, habit sketch, × 0.2; 2, leaves up to midway, × 1; 3, inflorescence, × 1; 4, portion of leaf at midway showing keel, × 2; 5, bract, × 3; 6, whole flower, × 3; 7, internal structure of flower, × 3; 8, capsule with bract, × 3. Voucher specimen: 1–7, *Condy 271* in National Herbarium, Pretoria, 8, *Condy 153* in National Herbarium, Pretoria. Artist: Gillian Condy.

as *Kniphofia*. Baker's (1871) description of *Kniphofia breviflora* is based on a specimen collected by Thomas Cooper from the Free State in 1862, named in an earlier manuscript by Professor W.H. Harvey. The epithet *breviflora* is derived from Latin and translates to 'short flowers' which according to Baker (1871) measured 6.0 to 7.5 mm for this species. The Sesotho name for *K. breviflora* is *leloele*, which is also used for other species in the genus like *K. hirsuta*, *K. northiae*, *K. ritualis* and *K. stricta* (Guillarmod 1971).

The *Flowering Plants of South Africa* series was started in 1921 to showcase 'the botanical gems of nature' and stimulate the 'study and cultivation of our wild flowers'. Subsequently, the name was changed to *The Flowering Plants of Africa* (*FPA*) from volume XXV in 1945–1946. Over a period of 67 years (1922–1989), 28 members of southern African *Kniphofia* were featured in *FPA*. Of these, eight were described as new species – three by Bruce (1955a,b,c) and five by Codd (1960a,b,c, 1964a,b). Codd popularised a further 14 species between 1959 and 1989 through the series. Connected to the *Kniphofia* publications are recognised artists with the majority of the artwork executed by Cythna Letty (later Mrs Forssman, 1895–1985) while two plates were prepared by Mary Connell and single plates by Kathleen Lansdell, Adele Walters, Fay Anderson and Gillian Condy. Letty illustrated 22 members of *Kniphofia* and most of the plants were portrayed between 1955 and 1966.

Letty was one of the most talented and renowned botanical artists in South Africa. Her mother, Josina Christina Lindenberg Letty (1861–1938), also an artist, produced an album of the Transvaal Veld Flowers which may have been the stimulus for Letty's well-known publication, *Wild Flowers of the Transvaal* (Letty 1962). This publication is lavishly illustrated with 174 colour plates, each plate portraying between one and seven species. The publication contains three plates depicting seven species of *Kniphofia*, images of which were incorporated in *FPA*. Volume 30 of *FPA* was dedicated to Letty in recognition of her service to South African botany and the art of botanical illustration. The volume comprised 41 plates illustrated by Letty with four of these being *Kniphofia* species.

Dr Leslie Codd (1908–1999), past director of the Botanical Research Institute (now South African National Biodiversity Institute) championed the taxonomy of the genus *Kniphofia* in southern Africa. His early comprehensive account of *Kniphofia* (Codd 1968) was published in *Bothalia*. In this work, 29 plates were included, 27 illustrated by Letty and one each by Walters and Van der Merwe. In a recent publication (Codd 2005), the earlier colour plates (Codd 1968) were depicted in monochrome. These included 25 plates by Letty and one each by Walters, Van der Merwe, Connell and Condy. In this publication (Codd 2005), line illustrations for a further 18 species (including *K. breviflora*) were done by Condy, and these were of taxa not illustrated in Codd (1968) or in the *FPA* series.

Recognising *Kniphofia* species continues to challenge both the plant breeder and taxonomist mainly because of the overlap in characters between related species. In order to separate species a combination of characters has to be used. This approach is evident in the treatments by Codd (1968, 2005) for the Flora of southern Africa region, Marais (1973) for tropical Africa, Kativu (1996) for the Flora Zambesiaca region and Whitehouse (2002) for tropical east Africa. In *FPA*, the combination of characters for a single species is well illustrated, providing the much needed morphological basis for distinguishing them.

In his monograph of *Kniphofia*, Berger (1908) placed *K. breviflora* in section *Parviflorae* together with two other species, *K. parviflora* and *K. buchananii*, and he based this on perianth length of 4–12 mm, flowers that are either campanulate or cylindrical, white or yellow, and plants with narrow, linear leaves, often toothed along their margins. Codd (1968) in his treatment of the South African species of *Kniphofia* created 10 sections and placed *K. breviflora* with *K. albescens* (Codd 1960a, plate 1325), *K. buchananii* (Codd 1965, plate 1446A), *K. crassifolia*, *K. fibrosa* and *K. flammula* (Codd 1960b, plate 1326) in Section 3. He recognised members of the section by plants of fairly small stature, narrow grass-like leaves, small dense inflorescences, and short to medium-sized white or yellow flowers.

Kniphofia breviflora is most closely related to *K. buchananii* (Codd 1968, 2005) and *K. fibrosa* in its grass-like leaves. In comparison to *K. buchananii* and *K. fibrosa*, it differs mainly in the size of flowers. See Table 1 for a comparison of diagnostic characters of *K. breviflora* and its closely related species. The species is also similar to *K. albescens* and *K. flammula*. However, these species are more robust plants with broad, strap-like leaves and longer flowers. *Kniphofia breviflora* also shows affinity to *K. parviflora* and *K. acraea*, species belonging to Section 2 of the classification by Codd (1968). *Kniphofia breviflora* and *K. acraea* differ from *K. parviflora* in having shorter inflorescences that are not secund (all flowers turn to face one direction). In *K. parviflora*, inflorescences are secund, a distinct feature, even in pressed herbarium specimens. *Kniphofia breviflora* is similar to *K. acraea* in length and colour of flowers but it differs from *K. acraea* in having narrower leaves with smooth margins and shorter inflorescences. Up until 2005, *K. acraea* was known from a single locality, Bankberg in the Mountain Zebra National Park, Cradock, Eastern Cape, and was only known to have yellow flowers. Dold & McMaster (2005) reported their finding of a second population on the upper slopes of the Boschberg (Somerset East, Eastern Cape) and recorded flowers in this population as white, making the species similar to *K. breviflora* where both colour forms occur. Attempts by Ramdhani et al. (2006, 2009) to resolve relationships among species through molecular studies were inconclusive. Their studies concluded that the genus is probably Afromontane in origin and is still evolving.

Following Cooper's collection in 1862, John Medley Wood made a collection of *Kniphofia breviflora* in 1895 in Natal (now KwaZulu-Natal). He sent it to Max Leichtlin of Baden-Baden (Germany), who introduced the species to cultivation and it first flowered at Kew Gardens in October 1896 (Baker 1897). The grass-like *K. breviflora* has emerged more as a curiosity plant than as a beauty in recent trials at the Royal Horticultural Society, Wisley (Whitehouse 2010). In the past, the species received attention from horticulturalists as a potential garden plant. Crosses involving *K. breviflora* are known since 1906. Mallett recorded a hybrid between *K. pauciflora* (female) and *K. breviflora* (male) which he described as having produced 'a race of nodding

TABLE 1.—Differences between *Kniphofia breviflora* and related species

	Character							
	Leaves			**Inflorescence**		**Open flowers**		**Distribution**
	appearance	size (mm)	margins	arrangement	size (mm)	colour	length (mm)	
K. breviflora	grass-like	400–700 × 2.5–7.0	smooth	flowers face all sides	35–80 × 15–25	yellow or white	7–12	KwaZulu-Natal: Mooi River, Greytown, Newcastle, Harrismith
K. buchananii	grass-like	400–600 × 2.5–4.0	smooth	flowers face all sides	35–90 × 10–14	white	4.0–4.5	KwaZulu-Natal: semi-coastal from Umzinto to midlands up to Nkandla
K. fibrosa	grass-like	350–600 × 3–4	with teeth	flowers face all sides	25–70 × 25–35	yellow	15–20	Eastern Cape and southern KwaZulu-Natal: from King Williams Town to Underberg/ Polela
K. parviflora	grass-like	200–750 × 3–7	smooth or with teeth	secund (all flowers turned to face one side)	60–280 × 12–17	cream, yellow, greenish brown	7–10	Eastern Cape and southern KwaZulu-Natal: from King Williams Town to Underberg/ Polela
K. flammula	strap-like	600–900 × 6–12	smooth	flowers face all sides	30–70 × 20–35	yellow or orange	13–15	KwaZulu-Natal: restricted to Glencoe
K. albescens	strap-like	600–1 000 × 8–15	smooth or with teeth	flowers face all sides	60–100 × 27–35	white or cream	11–15	KwaZulu-Natal and Mpumalanga: from Bergville to Ermelo
K. acraea	strap-like	500–700 × 10–15	with teeth	flowers face all sides	60–120 × 22–25	yellow or white	8–9	Eastern Cape: Somerset East and Craddock

Kniphofias that resemble giant Lachenalias of singularly beautiful colouring, and which flower in two relays annually, once in midsummer and again in September' (Mallett 1906). Other crosses with *K. breviflora* (for its short, tubular white flowers) were reported by Irving (1923). These were with the well-known scarlet-flowered *K. macowanii* (now a synonym of *K. triangularis* subsp. *triangularis*). This resulted in two striking forms, one with red flowers similar to *K. triangularis* subsp. *triangularis*. The other cross with yellow flowers was named *Kniphofia* x *irvingii* after the raiser and was noted as one of the best among the grassy-leaved, elegant flowering border plants (Watson 1920). Although an attractive bed plant if grown en masse, *K. breviflora* is not used much in South African gardening and is not readily available from nurseries. Among the small, grass-like pokers *K. pauciflora* is more favoured as bedding plants.

Kniphofia breviflora is endemic to South Africa and occurs in the foothills of the uKhahlamba-Drakensberg Mountains. It is widespread in KwaZulu-Natal where it is found from Mooi River from where its range extends northwards through Greytown to Newcastle. Its distribution extends slightly into the Free State, up to the Harrismith District (Figure 1). The species grows on mountain slopes in open grassland or rocky hillsides, and like most species of *Kniphofia*, it occurs in shallow marshy and seepage areas (Figure 2). It grows at altitudes of 1 000 to 2 200 m above sea level. *Kniphofia breviflora* is recorded as growing with *K. albescens* in northern KwaZulu-Natal where its white-flowered form could be confused with this species (Codd 2005).

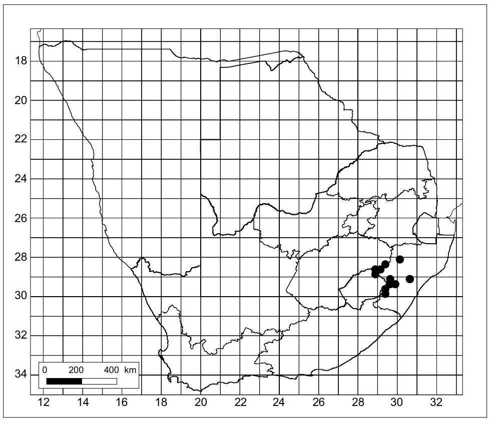

FIGURE 1.—Known geographical distribution of *Kniphofia breviflora*.

The accompanying plate features a plant found early in April 2014 by the artist, Gillian Condy, at the Natural Pools, Cavern Berg Hotel, northern Drakensberg, where it was growing through shrubs in a seepage on the bank of the river.

FIGURE 2.—*Kniphofia breviflora*: a, habitat; b, flowering head, taken at Dumbe, Qwa-Qwa, Free State. Photographs: Christopher Whitehouse.

Description.—Small, acaulescent herb, growing solitary with a number of spreading, fleshy, thick cylindrical roots. *Leaves* 4–10, narrowly linear, grass-like, at first ascending, later recurving ± in middle, 400–700 × 2.5–7.0 mm, keeled, triangular in cross section, margin and keel smooth. *Peduncle* overtopping the recurved leaves, slender, 300–800 × 3–7 mm with 1–3 sterile bracts below the inflorescence, lowermost bract sometimes elongated and leaf-like. *Inflorescence* oblong, short, narrow, 35–80 mm long, 15–25 mm in diameter, number of flowers 50–100 (estimate from herbarium sheets), dense at apex, buds erect to spreading, flowers ascending to spreading, eventually becoming pendulous; buds yellow- (or white-) green, often tinged with red, flowers yellow or white. *Bracts* ovate-lanceolate to lanceolate, acute to gradually acuminate, 4.5–8.5 × 1.5–3.0 mm, margin usually entire, minutely denticulate towards the apex. *Pedicels* 1–2 mm long at anthesis, remaining same at fruiting. *Perianth* oblong to shortly subcylindrical, 7–12 mm long, 1.5–2.0 mm wide at base widening gradually to 3 mm at apex; lobes facing upwards, margins recurving, broadly ovate, 2.0–2.5 mm long. *Stamens* of two lengths, the longest exserted by 1.0–1.5 mm at anthesis, later withdrawn into perianth tube. *Ovary* ellipsoid, ± 2.5 × 1.5 mm. *Style* equalling the longest stamens at anthesis, eventually exserted by 3.0–4.5 mm. *Fruit* a capsule, ovoid, 4.5–5.0 mm long, loculicidal dehiscence. *Seeds* deltoid, 2.3 ×1.8 mm, brownish black. *Flowering time*: February to March mainly but has been collected in flower as early as October. Plate 2301.

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H. BAIJNATH* and GILLIAN CONDY**

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* Ward Herbarium, School of Life Sciences, University of KwaZulu-Natal, Private Bag X54001, Durban, 4000 South Africa.
* Author for correspondence: baijnathh@ukzn.ac.za
** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

Kniphofia caulescens Asphodelaceae

Lesotho, South Africa

Kniphofia caulescens *Baker ex Hook.f.* in Curtis's Botanical Magazine t. 5946 (1872); Baker: 281 (1885); Baker: 284 (1896); Mallett: 82 (1906); Berger: 65 (1908); Codd: 455 (1968); Codd: 45 (2005). *Tritoma caulescens* (Baker ex Hook.f.) W.Mast.: 500 (1874). *T. caulescens* (Baker) Carrière: 556 (1884), 132, t. 28 (1887), nom. superfl. *K. tysonii* sensu Phillips: 294 (1917).

Popularly known as the caulescent or Lesotho red hot poker, *Kniphofia caulescens* is a distinctive stemmed species noted for its silvery grey-green leaves and dense colourful flowering heads. The species name *caulescens* is derived from the Greek *kaulos* or from Latin *caulis* meaning stem in reference to plants of this species that form visible stems above the ground. The local vernacular names for *K. caulescens* in South Africa are *Basoetovuurpyl* (Afrikaans), *Icacane*, *Umathunga* (isiZulu) and *Leloele-la-loti*, *Leloelele-lenyenyane* (Sesotho).

Kniphofia caulescens represents another species described from the gathering by Thomas Cooper (1815–1913). See plate 2301 on *K. breviflora* in this volume which also covers a background to the genus *Kniphofia*. Cooper, a collector and grower of plants, was employed to collect plants by Mr William Saunders (1809–1879) of Reigate, Surrey, an entomologist and horticulturalist. The plant collected by Cooper in the Stormberg Mountains (Eastern Cape) was grown by Saunders, and used for the plate accompanying the description of *K. caulescens* as a new species in *Curtis's Botanical Magazine* in 1872. There appears to be no preserved voucher of the plant (Codd 1968). Records of early collections of *K. caulescens* in the South African National Biodiversity Institute's herbaria indicate that Galpin collected the species twice in April 1895 and January 1896 from Andriesberg near Queenstown, Eastern Cape. This was followed by a collection by John Medley Wood from Nelson's Kop in the Drakensberg Mountains, KwaZulu-Natal in March 1896.

Since their early introduction abroad, the different kniphofias have been trialled as garden plants and their excellent potential publicised in various gardening books and reports. Shirley Hibberd, together with the artist Edward Hulme, described a series of familiar garden flowers and listed *Tritoma caulescens* (= *Kniphofia caulescens*) for its value as a garden plant and described it as '… bearing a dense head of flowers of a fiery-red colour passing into yellow' (Hibberd & Hulme 1879). Maxwell (1903) noted, '[t]he handsomest in foliage is *T. caulescens* (= *K. caulescens*), with a yucca-like crop of glaucous leaves growing from the top of a thick stem and flowering earlier than the rest of the family'. From the time of its introduction, the growing of *Kniphofia* in cold and frosty conditions posed a great challenge to growers in England. During a meeting of the Scientific Committee of the Royal Horticultural

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PLATE 2301.— 1, habit, × 0.075; 2, inflorescence and leaves, × 1; 3, leaf margin, × 3; 4, leaf sections, × 1; 5, bract, × 2; 6, flowers, slit and external view, × 1.5; 7, stigma and style, × 10; 8, fruit, × 1.5. Voucher specimen: *Halliwell 5118A* in Kew Herbarium, Royal Botanic Gardens; duplicate in Ward Herbarium, University of KwaZulu-Natal. Artist: John Mark Fothergill.

PLATE 2302 *Kniphofia caulescens*

Society (9 March 1880), a Sub-Committee was formed to gather data on 'the effects of the severe frost on vegetation'. This was following damages to and loss of many plants during the severe winter of 1879–1880. Schedules were issued to nurserymen and plant enthusiasts to provide detailed information on the impact of frost on all plants including herbs, shrubs and trees. This exercise was repeated for the winter of 1880–1881, which was recorded as 'exceptionally severe' (Henslow 1887). Outcomes of the impact surveys were presented in the *Journal of the Royal Horticultural Society* and it was reported that *K. caulescens* proved to be extremely hardy, as plants of this species were unharmed or only partly damaged by frost in comparison to *K. uvaria* and *K. sarmentosa*, both of which had perished (Henslow 1887).

From the attention accorded to *Kniphofia* as a garden plant, it was also recognised that the taxonomy of the genus was affected by the ease with which species hybridise. Nicholas Edward Brown (1849–1934), a Kew botanist and son-in-law of Thomas Cooper, presented several comments on the nomenclature of *Kniphofia* cultivated in England (Brown 1914). He emphasised the value of floral rewards, especially nectar and pollen, to beekeepers. Brown (1914) concluded from his experience at Kew that red hot poker species cross easily and in considering the taxonomy of this group noted '… that the industrious bee is chiefly responsible for this erroneous nomenclature'. He further noted that the only route to obtain the true form of a species of *Kniphofia* was by division of the original parent clump and not by seed, because of the likelihood of hybridisation. Close onto a century later, the taxonomy of *Kniphofia*, though well researched by Codd (1968, 2005), Marais (1973), Kativu (1996) and Whitehouse (2002), continues to challenge the taxonomist and plant breeder.

Brian Halliwell was the Assistant Curator of the Alpine and Herbaceous Plant Department at the Royal Botanic Gardens, Kew, England, until his retirement in 1989. He was a well-known plantsman, author and plant hunter who worked at Kew for over 20 years. Halliwell had a distinguished career and took part in many plant collecting expeditions, including one to South Africa in early 1983. Amongst the many species he collected during his field trip to South Africa was *Kniphofia caulescens*. Seeds were harvested from plants growing on a rocky escarpment, where several *Watsonia* species also occurred, at an altitude of 2 000 m in the Little Berg of the Drakensberg Cathedral Peak area. These were planted in the beds of the Duke's Garden next to the Jodrell Laboratory in the Royal Botanic Gardens, Kew. The featured plate by Mark Fothergill was illustrated from these plants. The painting was subsequently exhibited at the Royal Horticultural Society in January 1987 and awarded a Silver-gilt Medal. Fothergill, a Kew-trained artist, was based at Kew from 1986 to 1999 and several of his paintings have been featured in *Curtis's Botanical Magazine*.

In grouping *Kniphofia* species, Berger (1908) placed *K. caulescens* as a single species in the section *Caulescentes*, recognising them as plants with stems. Codd (1968) placed *K. caulescens* with seven other species (namely *K. coralligemma*, *K. ensifolia*, *K. hirsuta*, *K. praecox*, *K. ritualis*, *K. sarmentosa* and *K. splendida*) in Section 5 of his classification of *Kniphofia* which included ten sections. He described Section 5 as containing 'plants of medium to robust stature; leaves medium to broad; inflorescence very dense, often large, oblong; bracts lanceolate, acuminate; flowers medium-length to long, anthers conspicuously exserted in some species'. He considered the shape and apex of bracts as diagnostic for this section. Following on from the comments and discussions by Codd (1968), Baijnath (1987) described *K. albomontana*, also a species in Section 5, from Thabamhlope (KwaZulu-Natal). The notion that certain specimens of *K. northiae* (in Section 6), as listed by Codd (1968), represented this new entity was established earlier by Baijnath (1980), based on their distinctive leaf anatomical characters. A comparison of the diagnostic features of the three stemmed species in South Africa (namely *K. albomontana*, *K. caulescens* and *K. northiae*) was presented by Baijnath (1987). A striking character of *K. caulescens* is the colouration of the aging leaf which turns purple on drying, mainly towards the base, as depicted in the accompanying plate. This character was also recorded for old leaves in herbarium specimens studied at Kew Herbarium and National Herbarium, Pretoria. Further, *K. caulescens* differs from *K. northiae* and *K. albomontana* in its almost fleshy and glaucous leaves.

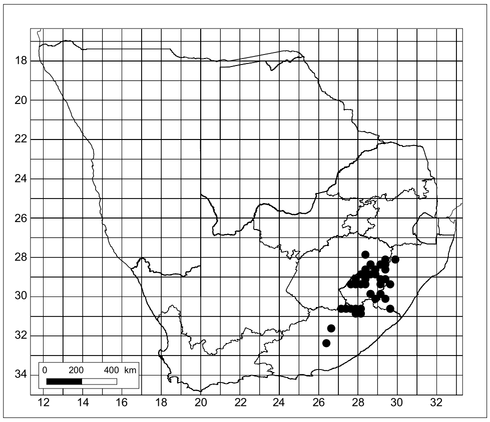

FIGURE 1.—Known geographical distribution of *Kniphofia caulescens*.

Kniphofia caulescens is an endemic to the Drakensberg Grassland Bioregion in South Africa and Lesotho, where it occurs at altitudes of 1 520–2 900 m above sea level (Figure 1). It is one of seven species of *Kniphofia* in the Flora of southern Africa region that reach the altitude range of 2 500–2 900 m, the other species being *K. albomontana*, *K. angustifolia*, *K. northiae*, *K. ritualis*, *K. stricta* and *K. thodei*. Mucina & Rutherford (2006) reported that, although *K. caulescens* has a wide altitudinal distribution, they form large colonies (often hundreds of square metres in extent) in the upper half of the altitudinal range that corresponds to large seepage areas. They also note that most mass flowering displays are best observed at altitudes around 2 700 m in Lesotho. The southernmost occurrence for *K. caulescens* is the Great Winterberg Mountains near Tarkastad in the Eastern Cape, from where the species extends northwards into KwaZulu-Natal, reaching Clarens in the Free State and Leribe in Lesotho. Plants thrive in wet areas on grassy slopes, in rock crevices and along streams where they grow in loam soil (Figure 2).

Christopher Whitehouse embarked on a *Kniphofia* expedition to South Africa during January and February 2012 to observe populations of various species. His expedition culminated in a well-illustrated report with comments on localities, populations and habitat (Whitehouse 2012a). For *K. caulescens*, Whitehouse (2012a) noted a population at Ben McDhui as having narrower leaves and smaller flower heads than those in cultivation. Ben McDhui is close (±70 km) to the small village of Rhodes, about 80 km from Barkly East, and is the highest point (3 001 m) of the Drakensberg in the Eastern Cape Province. Whitehouse (2012a) reports that hybrids in the genus are rare in the wild. He drew attention to a potential hybrid between *K. caulescens* and *K. northiae* at Ben McDhui where both species occur at different levels on the mountain slope. He describes plants in the hybrid population as superficially similar to *K. caulescens* with blue-green leaves, but differ in growing singly (non-clump forming) and having much broader leaves than those in the nearby population of *K. caulescens*. He also noted that the hybrid population grew on well-drained upper slopes, differing from typical *K. caulescens* plants that prefer to occupy seepage areas.

Kniphofia flowers are attractive to insects and birds. Brown et al. (2009) conducted studies on the pollination of *K. caulescens* based on a natural population of ± 500 plants in the Sani Pass area of KwaZulu-Natal. They found that flowers of this species presented both hexose-rich nectar and pollen as rewards to visitors, which included several species of insects and birds. Furthermore, they reported that experimental plants exposed to pollination by both insects and nectar-loving birds produced almost twice as many fruit capsules and set more seeds than when visited only by insects. From their experiments, self-pollinated and control flowers set no fruit and it was concluded that *K. caulescens* is self-incompatible.

FIGURE 2.—*Kniphofia caulescens*: a, inflorescences; b, in colony, Butha-Buthe, Lesotho. Photographer: Darius van Rensburg.

In their natural habitat, red hot pokers afford beauty and colour to the landscape and being showy plants, they are favoured as garden plants in South Africa (Van Jaarsveld 2003). The Lesotho red hot poker develops by suckers and if conditions in the garden are ideal, it forms large clumps – wonderful for attracting sunbirds and bees. Cultivars of *Kniphofia caulescens* include 'Coral Breakers', 'Helen Dillon' and 'John May' (Whitehouse 2010, 2012b). It is noteworthy that *K. caulescens* has become naturalised in the Firth of Forth region in Scotland (Thomas 1976). It is considered by the South African Basotho people to be a charm against lightning strikes. In the past they would selectively grow *K. caulescens* near their huts (Codd 1968).

Description.—Plants rhizomatous forming large colonies, with upright single or branched stems. *Stems* up to 600 mm tall, crowned with a large rosette of leaves. *Leaves* many per stem, widely V-shaped and almost crescentiform in cross section towards the base, fleshy in texture, glaucous, erect or bending over towards apex, outer leaves 450–950 × (10–)25–30 mm at middle, tapering rapidly (inner leaves much narrower), margin and keel distinctly and finely toothed, teeth 0.2 mm long, sheathing (not breaking up into fibres) at base, old leaves drying with a purplish tinge towards basal end. *Peduncle* overtopping or subequal to leaves, stout, 300–600 mm tall, 8–12 mm in diameter at middle, with several sterile bracts below inflorescence. *Inflorescence* oblong to subcylindrical, very dense, 90–300 mm long, 50–60 mm in diameter, tapering slightly towards apex; buds facing downwards, coral-pink to flame-coloured; flowers pale greenish yellow to creamy yellow. *Bracts* purplish brown, papery, linear-oblong to linear, 7–12 mm long, 1.5–2.5 mm wide, acute to acuminate at apex, margins entire or sometimes denticulate at apex. *Pedicels* 2–5 mm long at anthesis, increasing to 5–8 mm long and erect at fruiting. *Perianth* subcylindrical, 22–24 mm long, slightly constricted to about 1.5 mm in diameter above ovary, widening gradually to 3.5 mm above middle, up to ± 4 mm at mouth; lobes ovate-oblong, 2.0–2.5 × 1.0–1.5 mm, not or slightly spreading. *Stamens* markedly exserted by 8–13 mm at anthesis, filaments zigzag on withdrawing and aging, anthers 1.0–1.5 × 0.5 mm. *Ovary* ellipsoid, 2.5–3.5 × 1.0–1.5 mm. *Style* subequal to stamens at anthesis, eventually exserted by 8–16 mm after anthesis. *Fruit* a capsule, upright, purplish to blackish brown, ovoid-triquetrous, erect, 4–6 × 3–4 mm, mouth on dehiscence up to 6 mm wide. *Seeds* deltoid, outer face 2.6–3.5 × 1.9–2.5 mm, surface with yellow powdery coating. *Flowering time*: October–April, peaking in February–March. Plate 2302.

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H. BAIJNATH* and MARK FOTHERGILL**

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* Ward Herbarium, School of Life Sciences, University of KwaZulu-Natal, Private Bag X54001, Durban, 4000 South Africa.

* Author for correspondence: baijnathh@ukzn.ac.za

** *ex* Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, United Kingdom.

Aloe huntleyana Asphodelaceae

Northern Namibia

Aloe huntleyana *Van Jaarsv. & Swanepoel* in Bradleya 30: 3–8 (2012).

Aloe huntleyana is a small to medium-sized sprawling shrubby aloe, which appears to be endemic to the escarpment margin of northwestern Namibia. It grows in savanna vegetation on broken east-facing quartzitic sandstone cliffs in full sun.

Aloe huntleyana is named in honour of Brian Huntley (1944–), a botanist and ecologist, who was the former director of the National Botanical Institute, based at Kirstenbosch (Gunn & Codd 1981). He was instrumental in leading a natural history expedition to southern Angola in January 2009 where the close relatives of *A. huntleyana* grow (i.e. *A. catengiana*, *A. palmiformis*, *A. vallaris* and *A. scorpioides*). This gave the first author the opportunity to study these plants in habitat, leading to the description of *Aloe huntleyana* as a separate species (Van Jaarsveld 2010a). Since Huntley's appointment as director in 1989, the organisation grew rapidly in spite of the politically difficult years leading up to the new government in 1994 when President Nelson Mandela was appointed. He was also instrumental in establishing the new visitor centre, Botanical Society Conservatory, restaurant and the Kirstenbosch Research Centre. Under his leadership research flourished and many noteworthy publications followed (including *Vegetation of South Africa, Lesotho and Swaziland* by Mucina & Rutherford 2006; and *Red List of South African Plants* by Raimondo et al. 2009). Brian Huntley is also commemorated in the monotypic mesemb genus *Brianhuntleya* (Chesselet et al. 2003) and the cultivar *Aloe arborescens* 'Huntley' (Van Jaarsveld 2002a). He retired in 2006 to Betty's Bay after a period of 20 years' involvement in the National Botanical Institute.

This small aloe was discovered on 7 July 2004 during an expedition that explored the cliffs of the Baynes Mountains (Figure 1), as part of the author's study of cliff-dwelling succulents in southern Africa (Van Jaarsveld 2008, Van Jaarsveld & Swanepoel 2012). During an earlier expedition (June 2001) to the north end of the Baynes Mountains along the Kunene Valley with Karel Haumann, an aloe was spotted growing on the sheer east-facing cliffs. All attempts at reaching it failed. The Baynes Mountains are isolated and due to a lack of infrastructure, walking becomes the only option. There was a distance of at least 5–6 km before the foot of the mountain could be reached. Another expedition was planned during July 2002 to investigate this plant. A hint from one of the visitors at the Epupa Waterfall campsite led us to a rough 4×4 track, which brought us to about 5 km from the southeastern end of the mountain. We planned it well and with our equipment we set off on foot to the mountain through dense *Colophospermum mopane*, *Terminalia prunioides* and *Commiphora africana* shrubs and the occasional baobab tree (*Adansonia digitata*).

PLATE 2303.—1, plant in flower, × 1; 2, fruit, × 1; 3, seeds, × 1. Voucher specimen: *Van Jaarsveld, Swanepoel & Steven Carr 18805* in Compton Herbarium, Cape Town. Artist: Gillian Condy.

PLATE 2303 *Aloe huntleyana*

FIGURE 1.—The Baynes Mountains at Omavanda where *Aloe huntleyana* was discovered. Photograph: E.J. van Jaarsveld.

We reached a wide amphitheatre-like, well-watered valley just below the mountain where we set up camp under jackal-berry trees (*Diospyros mespiliformis*). Early the next day we climbed up the steep slope to just below the cliffs where we discovered a ledge. In the distance we spotted a cave and saw numerous individuals of the aloe we were looking for hanging from the cliffs. The cave was large with fresh water trickling from the side, forming a small pool. Next to the cliff we noticed mature specimens of *Ficus bubu* and some unknown plants: a species of *Aeollanthus* in full flower, and a tree that was clearly a species of *Cussonia* but which we could not identify at the time. We also discovered a small path up the steep cliff used by the Himba people, which one can negotiate without the use of ropes. This enabled us to reach the top and with the help of ropes the author was able to collect the aloe, later named *Aloe omavandae* (Van Jaarsveld & Van Wyk 2004) and also written up in the *Flowering Plants of Africa* series (Van Jaarsveld 2005). The *Aeollanthus* was described as new, namely *A. rydingianus* (Van Jaarsveld & Van Wyk 2005) and the *Cussonia* identified as *Cussonia angolensis*, the first record of this species occurring in Namibia (Van Jaarsveld 2002b). These discoveries prompted us to plan more expeditions to see if the area would yield further botanical treasures. On the subsequent expedition during July 2004, using the Omavanda Cave as base camp, *Aloe huntleyana* was spotted by the first author (accompanied by Steven Carr and Wessel Swanepoel) shortly after reaching the highest peak (2 065 m). The aloe grew in a rock crevice on a broken, upper east-facing cliff face (Figure 2).

A young plant was grown on at Kirstenbosch from where its growth behaviour could be studied. This plant produced extended leafy horizontal stems that branch from its base and started flowering during the month of May from its second year (Figures 3 & 4). At first it was thought to be *Aloe catengiana* from Angola. However, when *A. catengiana* plants from Reynolds' type gathering were observed and compared, it became clear that this was a new species and it was subsequently described as *Aloe huntleyana* (Van Jaarsveld & Swanepoel 2012).

FIGURE 2.—The original plant in its rock face habitat on an east-facing cliff, collected in July 2004. Photograph: E.J. van Jaarsveld.

FIGURE 3.—Stem of *Aloe huntleyana*; note the distinct striation of the amplexicaul leaf bases. Photograph: E.J. van Jaarsveld.

Aloe huntleyana forms part of a group of six closely related species from southern Angola. These aloes (other species: *A. scorpioides*, *A. vallaris*, *A. catengiana*, *A. palmiformis* and *A. gossweileri*) belong to a group of aloes with shrubby growth (Group 19, Reynolds 1966). Leaf exudate of *A. huntleyana* is translucent, but dries to a light yellowish-brown colour. From this group, *A. huntleyana* is immediately separated by its leafy stem; its leaves that remain persistent along the stems; its horizontally spreading to drooping inflorescence (often markedly curved as illustrated in the accompanying plate) with relatively short, subdense racemes, consisting of subsecund, 28–29 mm long flowers and 8–10 mm long pedicels. Flowers are spreading-nutant and not pendent when fully open. The inflorescence is usually solitary, but can have up to three racemes. In vegetative and floral features it comes closest to *A. vallaris* that occurs just west of Humpata (about 400 km to the north) along the western escarpment margin in southwestern Angola (Leach 1974). Pedicels of *A. vallaris* are 4.0–4.5 mm long and the flowers 20–25 mm. Stems tend to lose their leaves from the base, only bearing apical rosettes at the branch ends. The amplexicaul leaf bases are mottled in *A. vallaris*, but distinctly striate in *A. huntleyana*. Another distinct feature of *A. huntleyana* is the stems (internodes 15–20 mm apart) that tend to zigzag. Furthermore, the plant rests on its leaves when scrambling on rocks.

Aloe huntleyana occurs on east-facing quartzitic sandstone cliffs of the northeastern Baynes Mountains (Damara Sequence) at an altitude of 1 800–2 000 m (Figure 5). It grows firmly wedged in crevices, and the rosette becomes pendent or scrambling from the rock face from a young age. Plants are rare, restricted to inaccessible cliffs, and are pollinated by sunbirds. The dominant vegetation type is savanna with species such as *Combretum apiculatum*, *C. zeyheri*, *Cyphostemma currorii*, *Entandrophragma spicatum*, *Kirkia acuminata* and *Mundulea sericea* prominent. *Aloe huntleyana* flowers mainly during autumn (April–June) with a peak in May. Seeds are dispersed by wind in winter, just before the spring rains. The succulent leaves allow the plant to tolerate dry conditions during the winter or periods of drought, when leaves become slightly purplish green (see accompanying plate). This anthocyanin colour pigment can be seen in many succulent plant species and acts to slow down photosynthesis during periods of drought stress.

FIGURE 4.—*Aloe huntleyana* in cultivation at Kirstenbosch, flowering during May. Photograph: E.J. van Jaarsveld.

Species observed in the same cliff-face habitat include *Cotyledon orbiculata* var. *orbiculata*, *Cyphostemma currorii*, *Euphorbia subsalsa*, *E. monteiroi*, *Kalanchoe lanceolata* and *Cynanchum viminale*. Non-succulent species observed include *Ficus glumosa*, *F. ilicina* and *Petalidium coccineum*. Omavanda is situated within the tropics, with hot summers and dry, warm winters without frost. Rainfall occurs mainly in summer, 300–500 mm per annum.

Aloe huntleyana grows well in cultivation, both in containers or, if the climate permits, in dry, well-drained savanna gardens. It is best grown in dry bushveld gardens (Van Jaarsveld 2010b). It is best propagated from cuttings planted in sandy soil. These root rapidly and should flower from the first or second season. Outdoors it can also be grown on steep embankments, gabions, in large hanging baskets, or on windowsills. In regions where frost is frequent, it is best grown under controlled conditions in containers within a greenhouse. Plants grown at Kirstenbosch in the Botanical Society Conservatory have been established on dry stone walls and gabions, despite the high winter rainfall.

Type specimen examined: Namibia, 1713AA (Swartbooisdrif): Omavanda, upper east facing sandstone cliffs. *Van Jaarsveld, Swanepoel & Steven Carr 18805* (WIND, holo.).

Description.—Arborescent, much-branched from its base, spreading to pendent shrubs, up to 0.5 m high and 2 m wide. *Roots* fleshy. *Branches* not straight, leafy,

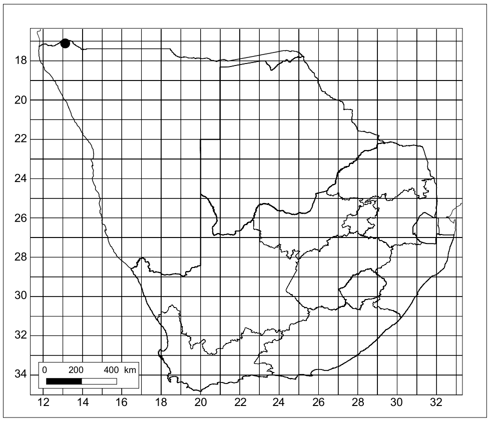

FIGURE 5.—Known distribution of *Aloe huntleyana* in northern Namibia.

often with a slight zigzag, 12–14 mm in diameter, with leaves tending to be crowded in apical rosettes of about 300–400 mm in diameter; internodes 15–20 mm long. *Leaves* linear-lanceolate, 160–180 × 20–30 mm, spreading, recurved in upper half, slightly falcate, greyish green but turning reddish in the dry season; upper surface flat to convex, slightly channelled during the dry season, lower surface convex, sparingly spotted in lower half, distinctly striate at the amplexicaul internodes; margin sinuate-dentate, armed with yellowish-green pungent teeth 3–5 mm long and 8–12 mm apart; apices acuminate. *Inflorescence* up to 300–400 mm long, simple, divaricate or up to 3-branched in lower half, at first pendent and apices bending up, the lower branch distinctly arcuate ascending. *Peduncle* plano-convex at its base, 7–10 mm in diameter, purplish green to green, with few sterile bracts, the longest 10 × 15 mm. *Racemes* conical-triangular, subdensely and subsecundly flowered, 130–150 × 40–50 mm, the lateral 80–110 mm long; buds ascending spreading, open flowers spreading, but slightly drooping; pedicels 8–10 mm long; bracts ovate-acuminate, scarious, up to 5 × 3 mm, becoming smaller upwards. *Perianth* red, becoming whitish and yellowish at the apex in open flowers, cylindrical, slightly decurved, 28–29 mm long; base obtuse, very shortly stipitate, 6 mm in diameter; outer segments free for 10 mm, 3–4 mm broad; inner segments 4–5 mm broad, apices obtuse. *Anthers* about 3 mm long, pollen reddish pink, becoming shortly exserted (about 2 mm). *Ovary* green, 5 × 2.5 mm. *Stigma* exserted to 2 mm. *Capsule* 15–16 × 9–8 mm; seed not seen. Plate 2303.

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E.J. VAN JAARSVELD* and GILLIAN CONDY**

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* South African National Biodiversity Institute, Kirstenbosch, Private Bag X7, Claremont, 7735 South Africa / Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville, 7535 South Africa.

* Author for correspondence: e.vanjaarsveld@sanbi.org.za

** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

Aloe succotrina Asphodelaceae

South Africa

Aloe succotrina *Weston* in Botanicus universalis et hortulanus 1: 5 (1770); Allioni: 65 (1773); Lamarck: 85 (1783); De Candolle: 85 (1801/2); Haworth: 19–20 (1804); Haworth: 75–76 (1812); Salm-Dyck: Sect. 22: t. 1 (1842); Baker: 173 (1880); Baker: 321 (1896); Marloth: 213–215 (1906); Berger: 282–284 (1908); Anon.: t. 400 (1914); Reynolds: 1–8, pls. I–IV (1948); Adamson: 171 (1950); Reynolds: 389–396 (1950); Jeppe: 50 (1969); Bornman & Hardy: 212–213 (1971); Wijnands: 126–127 (1983); Smith & Van Wyk: 57–58 (1996); Glen & Hardy: 105–106 (2000); Newton: 177 (2001); Smith & Van Wyk: 66 (2008); Guglielmone et al.: 179–180 (2009); Carter et al.: 379 (2011); Grace et al.: 148–149 (2011); Van Wyk & Smith: 102–103 (2014). *A. vera* Mill., non (L.) Burm.f.: No. 15 (1768). *A. perfoliata* var. *succotrina* Aiton: 466 (1789); Curtis: t. 472 (1800). *A. perfoliata* var. *purpurascens* Aiton: 466 (1789). *A. purpurascens* (Aiton) Haw.: 20 (1804); Haworth: 75 (1812); Salm-Dyck: Sect. 22: t. 2 (1842); Baker: 322 (1896); Berger: 284 (1908). *A. sinuata* Thunb.: 61 (1794); Thunberg: 311 (1823). *A. succotrina* var. *saxigena* A.Berger: 283 (1908).

Aloe succotrina has a very long and complex taxonomic and nomenclatural history with wrong synonymy that is rivalled by few other aloes. This is mostly due to early authors wrongly assuming that this plant is from the Island of Socotra (Reynolds 1950). It has been in cultivation in Europe for over three hundred years, so consequently it is rather surprising that this iconic fynbos species has not featured in this journal until now. Interestingly, the species is also not widely used in horticulture in Cape Town, its native habitat; there *Aloe ferox* and the natural hybrid between *Aloe ferox* and *Aloe arborescens*, both occurring much further afield, are far more commonly planted in public and private gardens and on road verges.

The earliest published figure of *Aloe succotrina* appears to be in Munting (1680: 20, fol. 21) as *Aloë vera minor.* As is typical of many of the images of plants published by the Dutch botanist Abraham Munting (1626–1683), the plant illustrated is shown growing in a rather ornate pot (reproduced in Reynolds 1950: 76, Fig. 49). Haworth (1804: 20) is the first author to link the Munting figure to *A. succotrina* and gives *A. vera minor* as a synonym of *A. soccotrina* (note spelling). The image itself is highly stylised, but does show the main features of a sterile plant of *A. succotrina*.

The second published image of *Aloe succotrina* is from Plukenet (1691–1696: t. 240, Fig. 4) (Figure 1). Building up the confusion surrounding this species, Plukenet names this *Aloe americana ananifolia floribus suave-rubentibus*, implying an American origin. This too is similarly placed under the synonymy of *A. soccotrina* by Haworth (1804: 20).

By far the most botanically and artistically significant early, highly accurate depiction of this species was published by Commelin (1697: 91–2, t. 48), (Figure 2). For this species Commelin used the polynomial *Aloe succotrina angustifolia spinosa, flore purpureo*, so here is the origin of the specific epithet as we know it today. Commelin

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PLATE 2304.—1, habit, much reduced; 2, cylindric acuminate raceme, × 1; 3, cut section of leaf, × 1; 4, capsules, × 1. Voucher specimen: *Van Jaarsveld 22442* in Compton Herbarium, Cape Town. Artist: Gillian Condy.

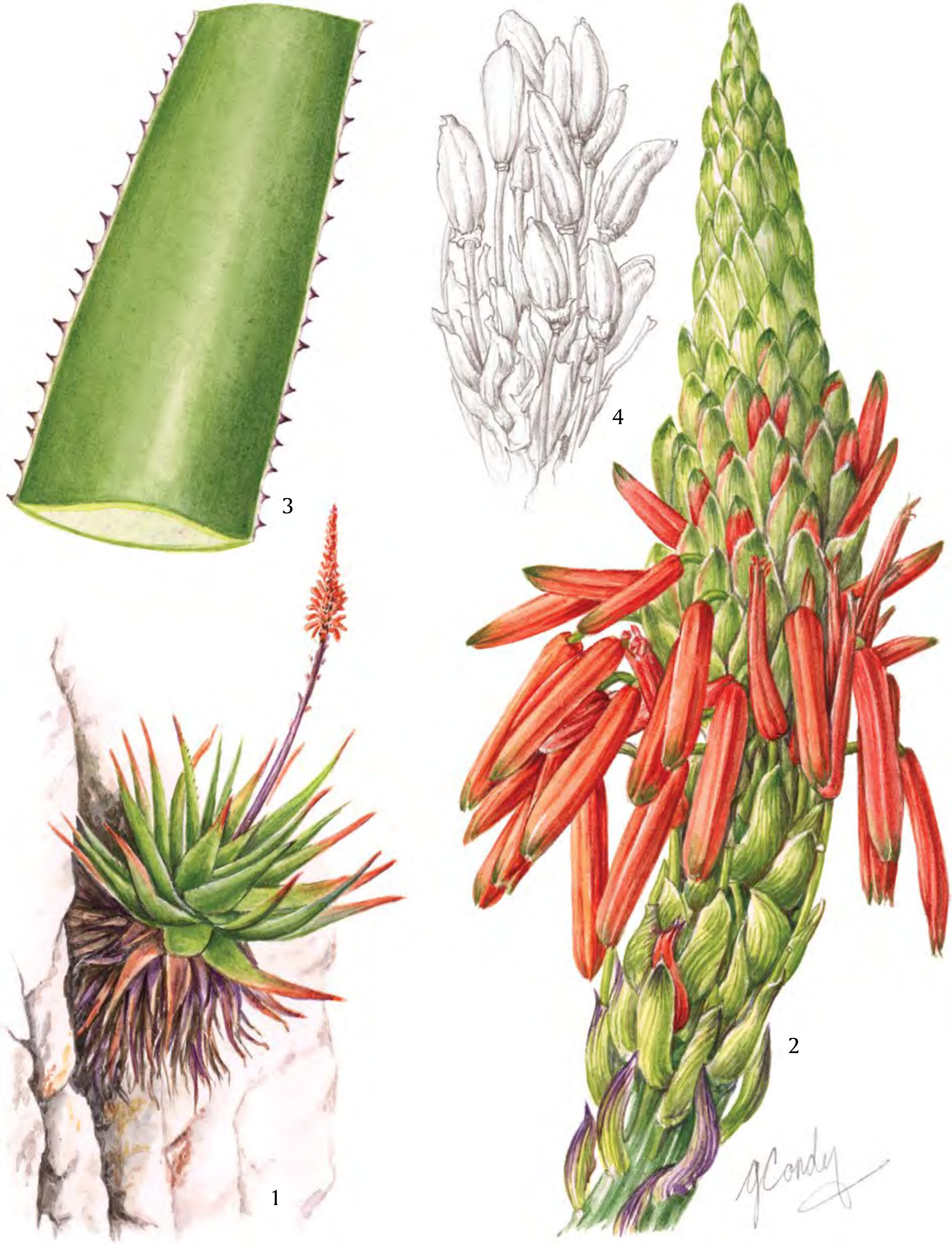

PLATE 2304 *Aloe succotrina*

obtained a small plant from Simon van Beaumont sometime before 1685. Van Beaumont (1640–1726) was secretary of the states of Holland and West-Friesland from 1673 and he owned a rich botanical collection in The Hague, of which a catalogue was published by Frans Kiggelaer in 1690 (Wijnands 1983). The plant flowered at the Hortus Medicus Amstelodamensis in Amsterdam in January–February 1689–1690 (Wijnands 1983), so this is the first record of it flowering in cultivation. There the plant was painted by the talented Dutch artist Jan Moninckx in 1689–1690, of which the original expertly executed watercolour painting is preserved in Amsterdam, whilst the engraved image appears as t. 48 in Commelin (1697). Commelin (translated into English in Reynolds 1950: 395) says that 'when the leaves are cut through, they give a yellow bitter sap which is better and more pleasant to the smell than that of the usual and true *Aloe*, whose sap is unpleasant and stinks, but the smell of this one conforms with that of the true *Aloe succotrina*'. Notice significantly here that Commelin is distinguishing clearly between *A. succotrina* and what we now know as *A. vera*.

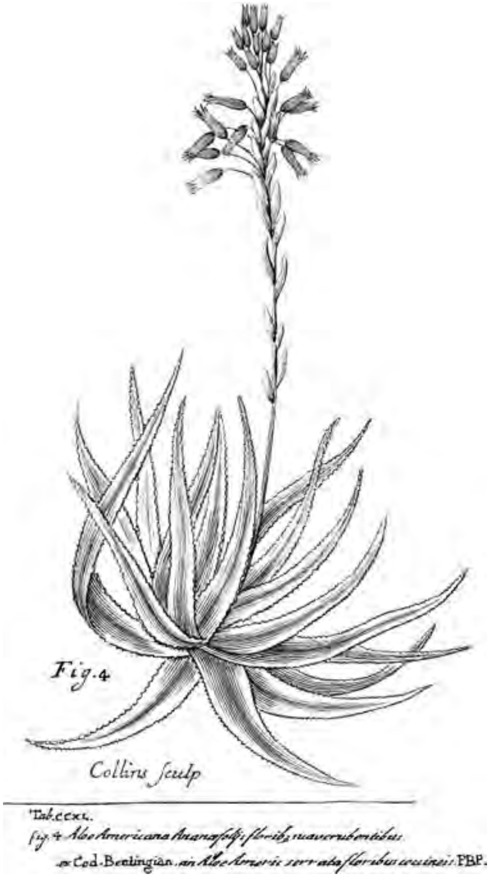

FIGURE 1.—One of the earliest published images of *Aloe succotrina*, from Plukenet (1691–1696).

To summarise our discussion of the early history of *Aloe succotrina*, we can conclude that this species was in cultivation in Europe as early as 1680, possibly even earlier. It is therefore surprising that *A. succotrina* was not among the aloes grown at the Dutch East India Company's (DEIC) garden in Cape Town when Heinrich Bernhard Oldenland was superintendent there in 1695 (Reynolds 1950; Karsten 1951), bearing in mind that the DEIC established a victualing station at the southern tip of Africa in 1652, some 40 years earlier.

Aloe vera Mill. (Miller 1768) is the first name for our plant at the species level. This is not *A. vera* (L.) Burm.f. for what is now the more familiar species and the basis of the multibillion dollar cosmetics and toiletries industry; the Burman name antedates Miller by a few weeks (Wijnands 1983). Miller (1768) wrote that this '… is the true Succotrine *Aloe*, from whence the best sort of *Aloe* for use in medicine is produced. This hath long, narrow, succulent leaves, which come out without any order, and form large heads. The stalks grow three or four feet high, and have two, three, and sometimes four of these heads, branching out from it: the lower leaves spread out on every side, but the upper leaves turn inward toward the center; the flowers grow in long spikes, upon stalks about two feet high, each standing on a pretty long foot-stalk; they are of a bright red colour tipped with green: these generally appear in the winter season. This sort may be preserved through the winter in a warm green-house, but the plants so managed will not flower so frequently, as those which have a moderate degree of warmth in winter.' However, the earliest record of *A. succotrina* in cultivation at the Chelsea Physic Garden is Miller (1731), where the same *Aloe* appears in the first folio edition of his famous *Gardeners Dictionary* (Le Rougetel 1990). Clearly Miller had been very successful in cultivating this species at Chelsea, and presumably its introduction there was even earlier than 1731.

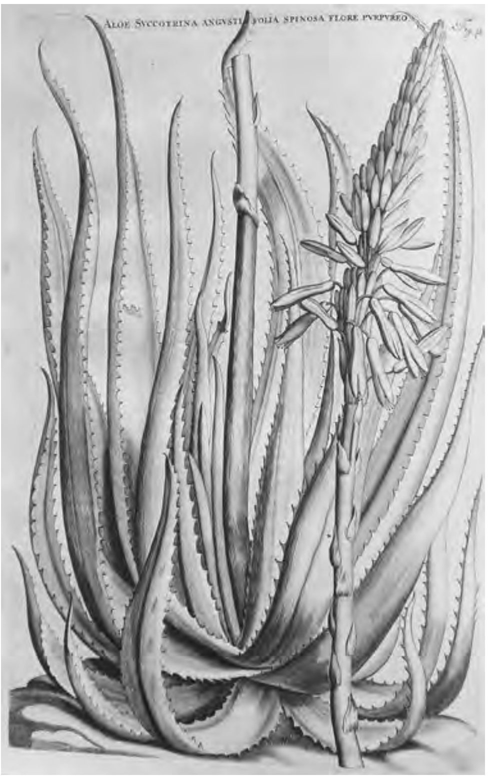

FIGURE 2.—*Aloe succotrina angustifolia spinosa flore purpureo* (= lectotype of *Aloe succotrina* Weston) from Commelin (1697).

The living material at Chelsea was later used by Blackwell (1737–39) for her herbal (more anon) and even later by Curtis (1800) who included a hand-coloured plate in his famous *Botanical Magazine*. He said that 'the figure here given was drawn in January 1799, from a plant in full bloom in the dry stove of the Apothecaries Garden at Chelsea; Mr. Fairburn informs me that it flowers regularly every year: the plant itself, supposed to be fifty years old.' Curtis went on to say that 'this undoubtedly is the *Aloë vera* of Miller, and the *perfoliata* var. *succotrina* of Mr. Aiton, that which produces the Succotrine Aloes of the shops, and is said to grow in the Island of Zocotra or Socotora, in the Straits of Babelmandel; it is therefore highly interesting as a medicinal plant, and very desirable as an ornamental one.' Here, then, we suggest, is a major source of the confusion regarding *Aloe succotrina* and its apparent, but incorrect, origin from the Island of Socotra.

Adrian Hardy Haworth (1768–1833) was the leading English authority on succulent plants during the first part of the nineteenth century (Stearn 1965). He first surveyed the genus *Aloe* in 1804 where amongst the species in his *Grandiflorae*, namely those species that we consider to be 'true' aloes today, he included both *Aloe soccotrina* and *A. purpurascens*, the latter being newly described and accepted at species level. For the former he observed that ‘by age [it] becomes dichotomous, but has no radical offsets like all the species of this section which precede it’ and for the latter he said that ‘like the last, when aged, it has a dichotomous stem, and no radical offsets’. He therefore made no attempt to distinguish between these two species. Indeed, these species are indistinguishable and were treated as being synonymous by Reynolds (1950). The specific epithet *purpurascens*, however, appropriately describes a diagnostic feature of *A. succotrina*, in that the dry leaves turn a very distinctive purple colour making this a useful character by which to identify mature plants, especially when they are not in flower (Van Wyk & Smith 2014).

The confusion regarding the true natural habitat of *Aloe succotrina* was solved by Marloth (1906). He reported that ‘… it grows in profusion a few miles outside of Cape Town. So far one spot only is known to me, which, however, is well hidden. It is situated about 1,200 feet above Newlands, on an immense field of boulders which must have been formed by the falling of an enormous cliff from the mountain above. There are hundreds, nay thousands, of boulders of all sizes, some as big as a house, with abysses between them that seem to lead into the interior of the earth. Where the spaces between the boulders have become filled with debris and leaf-mould, trees have succeeded in establishing themselves and are at present overshadowing some large groups of aloes. These are doomed, for the trees must win in this struggle for existence. But where the boulders are freely exposed to air and light, where the aloes have been able to find a little soil in a crack or on a ledge, they have taken full possession of the place. That no botanist or collector of the last century should have come across the plant is evidently due to the difficulty of access to the locality, for it is out of the track of the ordinary rambler. Only mountaineers who want to try the Window Gorge would pass it.’ So, the mystery was solved and a natural habitat for *A. succotrina* recorded for the very first time, well over 200 years after its first record of cultivation in Europe. This population described by Marloth is probably the one illustrated in a photo (Anon. 1914) and encountered on the Silvertree Trail (just below Window Gorge) in the Kirstenbosch National Botanical Garden. These plants grow in a huge boulder field with their dichotomous stems creeping over the rocks (Figure 3).

As we have seen, the modern name and spelling of *Aloe succotrina* had its origin in the polynomial used by Commelin (1697). Generally, however, the author of the binomial has been given as Lamarck (1783) or Allioni (1773). However, as shown by Guglielmone et al. (2009), the first valid publication of the specific epithet *succotrina* was by Weston (1770). They followed Wijnands (1983) who had designated the figure in Commelin (1697: t. 48) as lectotype, but also designated an epitype.

In terms of derivation of the epithet *succotrina*, the name refers to either the plant being thought to be the source of the drug socotrine aloes and originating from Socotra (yet it grows wild only in the extreme southwestern part of the Western Cape, South Africa), or to the compound word meaning ‘succus’ (sap) and ‘citrinus’ (lemon-yellow). Although the purple juice is characteristic of the plant, it was reported that it turns yellow when it dries (Grace et al. 2011), however, the fresh juice is in fact yellow and it turns purple when dry.

FIGURE 3.—*Aloe succotrina* in habitat in the boulder field on Table Mountain above Kirstenbosch National Botanical Garden, photographed in July 2010. Photograph: A.W. Klopper.

Aloe succotrina has a long history in herbals and books dealing with the medicinal use of plants. Here only selected exemplars will be given to indicate the confusion as to which species of *Aloe* have been used commercially as the source of material used in the manufacture of aloe products. An early example comes from Elizabeth Blackwell's herbal of 1737–39. Blackwell's *Curious Herbal* came about because Elizabeth needed income as her husband was in a debtor's prison. Elizabeth took lodgings in Chelsea, London, so she had ready access to the exotic plants being cultivated at the Chelsea Physic Garden, where her work was supported by Philip Miller and Sir Hans Sloane (Le Rougetel 1990; Madge 2001). She painted and engraved all 500 plates for the herbal that included two aloes now known as *A. vera* and *A. succotrina*. Her text accompanying the plate of *A. succotrina* is as follows: 'The stalks grow about three foot high, the leaves are a blue green and the flowers a light red. It is a native of the East Indies and flowers here [London] in December. The best Aloes of this species comes over in skins from the Island Succotora. Aloes is a great Ingredient in most of the officinal pills, being accounted a good Stomatic and useful to carry off tough & slimy Humors from the Bowels. Outwardly it is used for fresh wounds a little of the fine powder being put in them.' Notice already at this early date the confusion between the South African species and its apparent origin from the Island of Socotra. Figure 4 is from the later German edition (Blackwell 1747–1773).

Over a century later Bentley & Trimen (1875–1880), in their *Medicinal Plants*, correctly figured and described the South African species, but questioned its origin

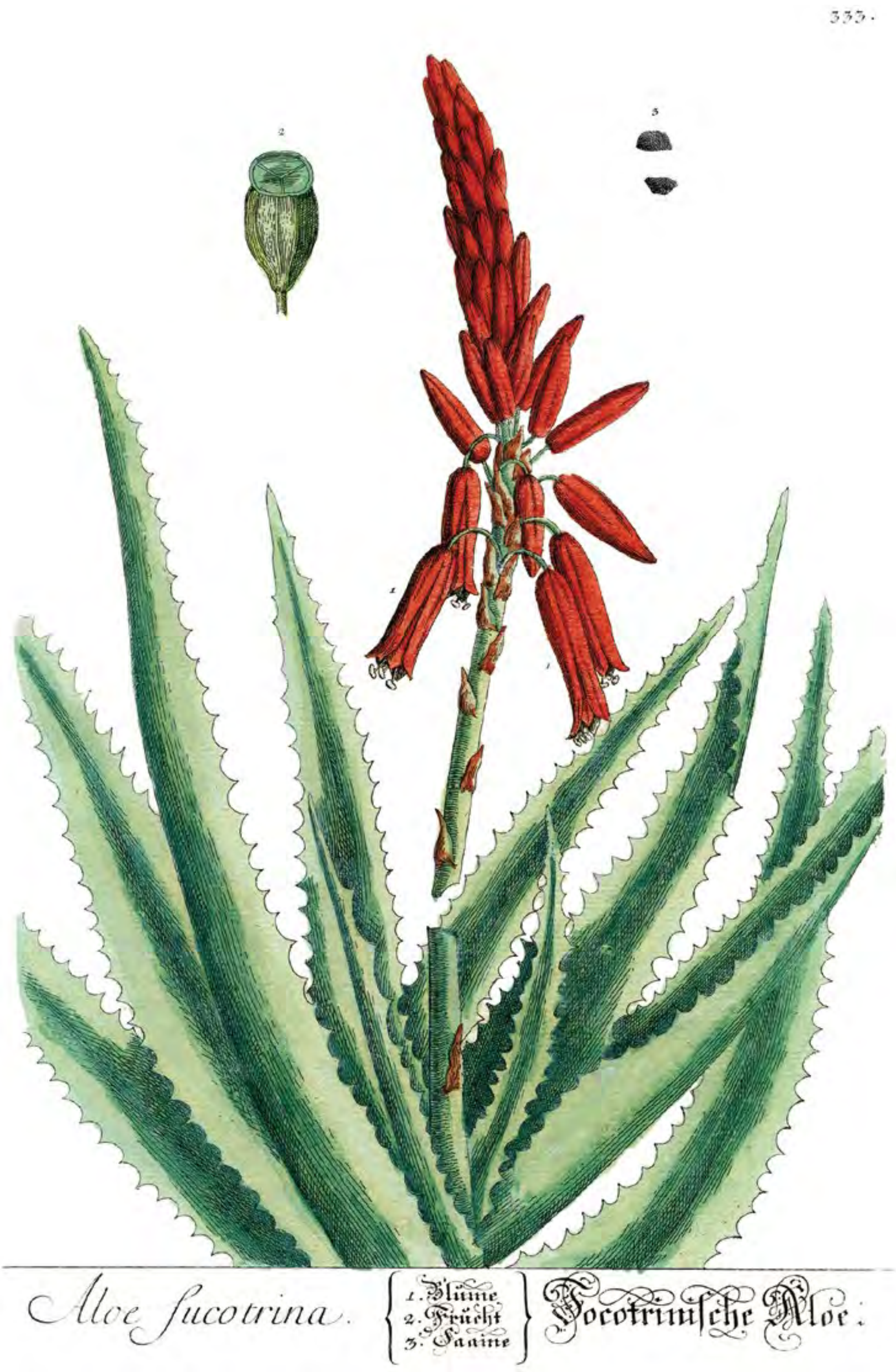

FIGURE 4.—*Aloe succotrina* from the German edition of Elizabeth Blackwell's *Curious Herbal* (Blackwell 1747–1773).

FIGURE 5.—*Aloe succotrina* growing on the Cape Peninsula were regarded as being distinct from plants from Hermanus, Kleinmond and other mainland localities. Photograph: A.W. Klopper.

from Socotra, namely: '… nor indeed do we know where the species has ever been collected in a wild state in Socotra or elsewhere. The aloe which is so abundant in Socotra has been seen by many travellers … Whether this abundant plant is *A. succotrina* further examination must determine. That it is the present species may well be doubted, since an aloe undoubtedly gathered in Socotra by Mr. Wykeham Perry in 1878 (the only species he saw there) and sent in a living state to Kew … was, as Mr. Baker informs us, a totally different species with short leaves.' The Wykeham Perry species was named by Baker as *Aloe perryi* (Baker 1880).

Watt & Breyer-Brandwijk (1962), in their exhaustive survey of medicinal plants of southern and eastern Africa, include no mention of *Aloe succotrina*, whereas in contrast they state that '*Aloe ferox* Mill. seems to be the most important source of Cape aloes'. We can therefore conclude that there is a long history of confusion between the South African species *A. succotrina* (as clarified by Marloth, 1906) and the Socotran species, and possibly even with *A. ferox* and its products. Indeed *A. perryi* is the principal source of Socotran aloes that was a major export commodity from Socotra in ancient times and it continues to be harvested today (Miller &

Morris 2004). There is no evidence to support the conjecture that *A. succotrina* has ever been used commercially for the production of aloe products in South Africa.

FIGURE 6.—*Aloe succotrina* growing on the coast at Kleinmond, a popular coastal resort. This form was previously treated as a separate species, *A. purpurascens*. Photograph: A.W. Klopper.

Aloe succotrina is the type species of *Aloe* Section *Purpurascentes* Salm-Dyck. This section currently comprises six species, namely *A. framesii* L.Bolus, *A. gariepensis* Pillans, *A. khamiesensis* Pillans, *A. knersvlakensis* S.J.Marais, *A. microstigma* Salm-Dyck and *A. succotrina* Weston (Carter et al. 2011; Grace et al. 2011). Other authors recognise fewer species, some with infraspecific taxa (e.g. Glen & Hardy 2000). Members of this section all occur in western and other parts of southern South Africa, with two of the currently recognised species entering Namibia in the south (Reynolds 1950). The placement of *A. succotrina* in Section *Purpurascentes* has been questioned though (Kemble 2011). It is argued that *A. succotrina* might have closer affinities with *A. arborescens* from *Aloe* Section *Arborescentes* Salm-Dyck than it has to other members of the Section *Purpurascentes*. Reasons for this include a strong resemblance to *A. arborescens* in terms of the size and shape of the floral bracts, the overall appearance of the racemes, the white marginal teeth on the leaves and the appearance of the seed (S.J. Marais, pers. comm.).

Aloe succotrina is a somewhat variable species. Solitary plants with short, simple or branched, erect stems occur, or where conditions are favourable, large dense groups are found. The largest forms have stems of 1–2 m long that are dichotomously branched and form a large, rather unwieldy, canopy of many rosettes (Reynolds 1950). Historically, the disjunct distributions, which also exhibit very slight morphological differences, were considered to be separate species: plants growing on the Cape Peninsula (Figure 5) were regarded as being *A. succotrina*, while plants from Hermanus, Kleinmond (Figure 6) and other mainland localities were treated as *A. purpurascens* (Aiton) Haw. (Haworth 1804). As already mentioned, Reynolds (1950) concluded that these are merely geographical growth forms and do not warrant distinction at either specific or varietal level. We agree with this view. Diagnostic characters of *A. succotrina* are the erect, dull grey-green leaves with white marginal teeth, leaves and leaf exudate drying purple; inflorescence up to 1 m long, mostly unbranched, with fairly large purplish floral bracts and red flowers of ± 40 mm long.

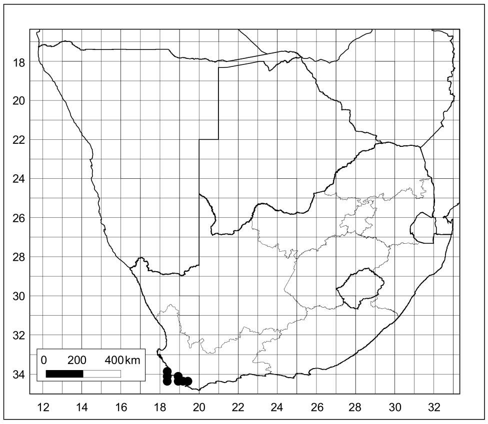

FIGURE 7.—Known distribution of *Aloe succotrina* in South Africa.

Aloe succotrina is restricted to mountain slopes from the Cape Peninsula to Hermanus, Western Cape, South Africa. There is a disjunction between the populations on the Cape Peninsula and those at the Steenbras River mouth, Kleinmond and Hermanus (Figure 7). It is confined to Sandstone Fynbos (Peninsula Sandstone Fynbos and Kogelberg Sandstone Fynbos) (Mucina & Rutherford 2006), and grows on steep cliffs and rocky slopes, generally close to the sea and at elevations of up to 600 m above sea level. The area receives high winter rainfall (400–2 000 mm per annum). Flowering time is July–August (southern hemisphere).

On the Cape Peninsula and Hottentots Holland Mountains most populations are confined to sheer cliffs. The featured plant (*E.J. van Jaarsveld 22442*, NBG) was gathered at De Boer, just south of Judas Peak, in the Cape of Good Hope Section of the Table Mountain National Park, on a sheer east-facing sandstone cliff (Peninsula Sandstone Fynbos). The shrubby plants have stems that droop, but carry the heads in a horizontal or ascending position. Here *Aloe succotrina* is locally abundant and grows together with other succulent plants, such as the endemic *Ruschia promontorii* and *Drosanthemum stokoei*. Other associated species include *Crassula nudicaulis*, *C. lanceolata*, *C. coccinea*, *C. saxifraga*, *Ruschia macowaniana*, *Curio serpens*, *Tylecodon paniculatus* and *Kedrostis nana*. Some plants were infected with the aloe ring fungus (*Uromyces aloes*). Plants grow in acidic soil that is low in mineral content.

Conservation status: although *Aloe succotrina* is listed as Least Concern in the Red List of South African Plants (Raimondo et al. 2009), it is rare with only relict populations consisting of relatively small groups. Possibly the largest populations are found on the north-facing cliffs at Karbonkelberg. Elsewhere populations are small and isolated. The coastal population at Kleinmond has recently been largely destroyed by municipal activities during enlargement of the harbour. Plants at Hermanus show signs of hybridisation, which threatens the genetic integrity of this population.

Aloe succotrina is pollinated by local sunbirds (double-collared and orange-breasted sunbirds) when it flowers during late autumn and winter. Seeds ripen during spring to early summer and are dispersed by wind (local thermals). Germination takes place within three weeks and plants will reach flowering size in about three to five years.

If grown outdoors in a region with a Mediterranean climate, *Aloe succotrina* is easy to cultivate and requires no special conditions, but must be kept frost-free in

FIGURE 8.—Seedlings of *Aloe succotrina* about four and a half years old growing in cultivation in England. Pot sizes range from 70 to 240 mm. Photograph: C.C. Walker.

the winter. A batch of seedlings (Figure 8) was raised in England by Tina Wardhaugh and subsequently grown on by one of us (CCW). The differences in growth rates of the seven seedlings four and a half years after germination are quite remarkable. These seedlings have yet to flower in cultivation in England. One of us (GFS) successfully grew the species in the mild-climate Eastern Cape of South Africa where plants do well in the open. However, above South Africa's climatically severe inland escarpment, plants benefit from protection from frost and too much summer rainfall.

Aloe succotrina has the common names of Table Mountain aloe (English), and *berg-aalwyn* and *Tafelbergaalwyn* (Afrikaans).

Description.—Caulescent or sometimes acaulescent plants, solitary or forming dense groups. *Stem* short or up to 2 m long, 100–150 mm diameter, simple or dichotomously branched, erect or procumbent, with persistent dried leaves; rosettes solitary or usually in dense large groups. *Leaves* densely rosulate, arcuate-erect, dull green to grey-green, drying purple, obscurely lineate, sometimes with few white spots, especially when young, lanceolate-attenuate, 250–500 mm long, 70–100 mm wide at base; margin narrow, dull white, cartilaginous, with firm, deltoid, white teeth, 2–4 mm long, up to 10 mm apart; exudate honey-coloured, drying purple. *Inflorescence* 0.75–1.00 m high, arcuate-erect, cone-shaped, mostly simple, rarely 1-branched. *Peduncle* with many sterile bracts, ovate-acute, up to 20–25 mm long, 15 mm wide, thin, rather scarious, many-nerved. *Raceme* cylindric-acuminate, 250–350 mm long, erect, subdense; buds erect to spreading, flowers nodding to pendent when open, buds partly obscured by large imbricate bracts. *Floral bracts* lanceolate, up to 20 mm long, 10 mm wide, turning purplish, thin, scarious, many-nerved. *Pedicels* 20–30 mm long. *Flowers*: *perianth* glossy red to reddish salmon, green tipped, 25–40 mm long, not narrowed above ovary, cylindric-trigonous; *outer segments* free to base, tips slightly spreading; *stamens* with pale lemon, filiform flattened filaments, exserted 3–5 mm; *ovary* 7–8 mm long, 2–3 mm diameter, green; *style* exserted to 5 mm. *Fruit* a capsule. *Chromosome number*: $2n = 14$. Plate 2304.

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C.C. WALKER*, R.R. KLOPPER**, G.F. SMITH*** and GILLIAN CONDY****

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* Department of Environment, Earth and Ecosystems, The Open University, Milton Keynes, MK7 6AA England.

* Author for correspondence: Colin.Walker@open.ac.uk

** Biosystematics Research and Biodiversity Collections Division, South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa / Department of Plant Science, University of Pretoria, Pretoria, 0001 South Africa.

*** Office of the Chief Directorate: Biosystematics Research and Biodiversity Collections Division, South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa / Department of Botany, P.O. Box 77000, Nelson Mandela Metropolitan University, Port Elizabeth, 6031 South Africa / Centre for Functional Ecology, Departamento de Ciências da Vida, Universidade de Coimbra, 3001-455 Coimbra, Portugal.

**** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

PLATE 2305 *Sansevieria hallii*

Sansevieria hallii Dracaenaceae

South Africa, Zimbabwe

Sansevieria hallii *Chahin*. in The Sansevieria Journal 5: 7–10 (1996).

Sansevieria hallii is a very distinct species from southeastern Zimbabwe and the northeastern corner of the Limpopo Province. It is easily distinguished from the other South African *Sansevieria* species by its curved, ascending, spreading, shallowly channelled leaves, and its capitate inflorescence with emerging flowers produced at or just below ground level. All other South African *Sansevieria* species have elongated racemes. However, there are a number of other central African species with capitate racemes. *Sansevieria longiflora* from the Caprivi in Namibia has a condensed inflorescence but with a dorsiventrally compressed leaf blade. *Sansevieria stuckyi* is another relative from Mozambique and further north but with erect, much broader, subterete leaves to 1.5 m tall. The main distribution of *S. hallii* falls within southeastern Zimbabwe, and the Levuvhu River (in the Kruger National Park) appears to be its southernmost point of distribution (Figure 1).

Brian Chahinian named *Sansevieria hallii* after Harry Hall (1906–1986) who collected this species from the Birchenough Bridge in southeastern Zimbabwe in 1957 (Chahinian 1996). Harry Hall was appointed by Professor Harold Compton to take charge of the Kirstenbosch succulent plant collection in 1947 and where he remained until his retirement in 1968 (Gunn & Codd 1981). Harry was a keen botanical explorer who made a large contribution to the knowledge of succulent plants mainly in the winter rainfall parts of South Africa (Van Jaarsveld & Hall 1986a,b,c). Another collection of *S. hallii* was subsequently recorded in 1961 by Larry Leach, an engineer with a passion for succulent plants who contributed to our knowledge of *Aloe*, *Euphorbia* and stapeliads in tropical southern Africa.

The depicted plant first flowered in January 2012 at the succulent plant nursery in Kirstenbosch. This plant was originally collected from a rocky part of the Levuvhu River in northwestern Punda Maria during an expedition investigating the cliffs of the dry river valleys in the Kruger National Park in July 2003. It was collected by Ernst van Jaarsveld (*Van Jaarsveld 18063* in the National Herbarium, Pretoria), accompanied by Phakamani Xaba and one of the park's rangers. The plants were found growing among quartzitic sandstone rocks on steep slopes (Figure 2) in the western extreme of the Soutpansberg in association with succulent plants that include *Aeollanthus rehmannii*, *Aloe angelica*, *Crassula expansa* subsp. *fragilis* and *Plectranthus verticillatus*, and three succulent climbers, *Cissus rotundifolia*, *Cynanchum viminale* and *Senecio angulatus*. Associated dry woodland species include *Euphorbia tirucalli*, *Ficus abutilifolia*, *F. tettensis*, *F. ingens*, *Hymenodictyon parvifolium*, *Obetia tenax* and the ironwood (*Androstachys johnsonii*). *Sansevieria hallii* proliferates from subterranean stolons,

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PLATE 2305.—plant in flower, × 1. Voucher specimen: *Van Jaarsveld 18112* in Compton Herbarium, Cape Town. Artist: Gillian Condy.

forming small groups. Plants were found scattered in light shade among leaf debris.

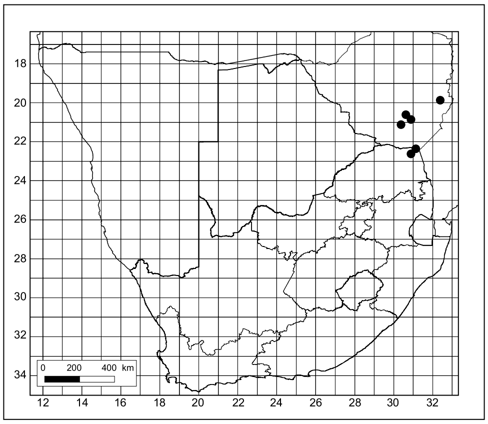

FIGURE 1.—Known distribution of *Sansevieria hallii*.

Separate populations of the same species were sighted in three different localities along the Levuvhu River and in each case species were associated with rocky outcrops. We visited one of these populations (*Van Jaarsveld 18112* in the Compton Herbarium, Cape Town) in Lanner Gorge within the Kruger National Park close to the Zimbabwean border on 7 July 2003. The Levuvhu River deeply dissects the rhyolitic formations which are particularly rich in succulent plant species such as *Aloe chabaudii*, *A. lutescens*, *A. spicata*, *Stapelia gigantea*, *Sansevieria pearsonii*, *Tinospora fragosa*, *Huernia procumbens*, *Euphorbia aeruginosa*, *Ceropegia stapeliiformis*, *Eulophia petersii* and *Kalanchoe lanceolata*. The habitat in this locality is classified as Limpopo Ridge Bushveld, Mopane Bioregion (Mucina & Rutherford 2006).

Sansevieria hallii is one of six species of the genus indigenous to South Africa and Namibia. The other species are *S. hyacinthoides*, *S. pearsonii*, *S. aethiopica*, *S. concinna* and *S. longiflora*. As with some other monocotyledonous succulent plant groups (e.g. *Aloe*, *Haworthia* and *Gasteria*), the genus *Sansevieria* is extremely variable in growth form, which makes its classification a challenge for taxonomists.

The genus *Sansevieria* consists of about 60 species (Newton 2001), mainly distributed in Africa. It is popular in horticulture, as most species have decorative mottled leaves and grow well under indoor conditions, especially office buildings and complexes. The firm leaves and their succulent nature make the plants ideal pot plant subjects; they are great survivors in spite of neglect and erratic watering. *Sansevieria hallii*, with its spreading leaves, is easily grown as a container plant and thrives as a house plant even though they grow slowly. It is best grown in a sandy loam soil enriched with compost and should be given an organic fertiliser during spring. Plants are easily propagated by division or from seed sown during spring in a sandy mixture that is kept in a shady position. It can be grown outside and does best in dry bushveld gardens (Van Jaarsveld 2010a). The establishment of *The Sansevieria Journal* (launched June 1992) with Brian Chahinian as founder and president, reflects the genus' popularity and many cultivars have been described. *Sansevieria hallii*, with its variable leaf colour and foliage shape, has two cultivars: 'Lundi bat', introduced from the Lundi River in Masvingo, and 'pink bat', a selection made from Venda (Chahinian 1996).

The savanna habitat in Africa is well known for its great diversity of herbivores. *Sansevieria* usually grows in dense stands in frequently disturbed and grazed areas.

Most sansevierias, except the species with sharply pointed leaves, lack mechanical or chemical defence. Although the plants are often grazed to the ground by larger mammals, their subterranean stolons remain and, true to their prolific nature, have the ability to resprout without significant damage to the clone. When a sansevieria is pulled, the leaves usually detach from the underground rhizome, which then resprouts to form new growths. Furthermore, leaves or leaf cuttings that lie on the ground can also root and sprout to form new plantlets in a similar fashion to *Gasteria* (Asphodelaceae). These are effective vegetative strategies that the plants use to deal with herbivory (Van Jaarsveld 2010b).

Most sansevierias have strong fibres which are used by the San people to make string. Some weaver birds use the fibres for nest construction (Smith 1966).

FIGURE 2.—*Sansevieria hallii* in habitat along the banks of the Levuvhu River. Photograph: E.J. van Jaarsveld.

Description.—Plants acaulescent. *Rhizome* short, fleshy ± 45 × 35 mm, articulated, grey to pink, dividing and forming clusters along rhizome 300–800 × 30–35 mm. *Roots* fleshy, 3–5 mm, grey when exposed to light. *Leaves* usually three, sub-cylindrical oblong elliptic, arcuate, ascending, spreading, very fleshy, firm, dark grey-green with conspicuous to inconspicuous cross-bands; upper surface flat or with a shallow groove; lower surface rough, with longitudinal grooves that become conspicuous during dry conditions; base tapering, pinkish to grey; apex obtuse. *Inflorescence* a capitate raceme 180 × 160 mm produced at or just below ground level, scape 50 × 10 mm; exposed flowers slightly fragrant during the night; sterile bracts triangular, 33 × 16 mm; fertile bracts membranous, 18 × 6 mm; perianth white, 56–98 mm oblong tubular; tube 45–78 × 2 mm, slightly inflated at base; lobes recurved oblong 25–29 × 3 mm; filaments 27–32 mm, anthers 3–4 mm, exserted; pistil 70–114 mm, exceeding the stamens at maturity. *Fruit* a globose berry, surface rugose, orange when mature, 10 mm in diameter; seed bony, 6 mm in diameter. Plate 2305.

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E.J. VAN JAARSVELD* and GILLIAN CONDY**

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* South African National Biodiversity Institute, Kirstenbosch, Private Bag X7, Claremont, 7735 South Africa / Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville, 7535 South Africa.

* Author for correspondence: e.vanjaarsveld@sanbi.org.za

** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

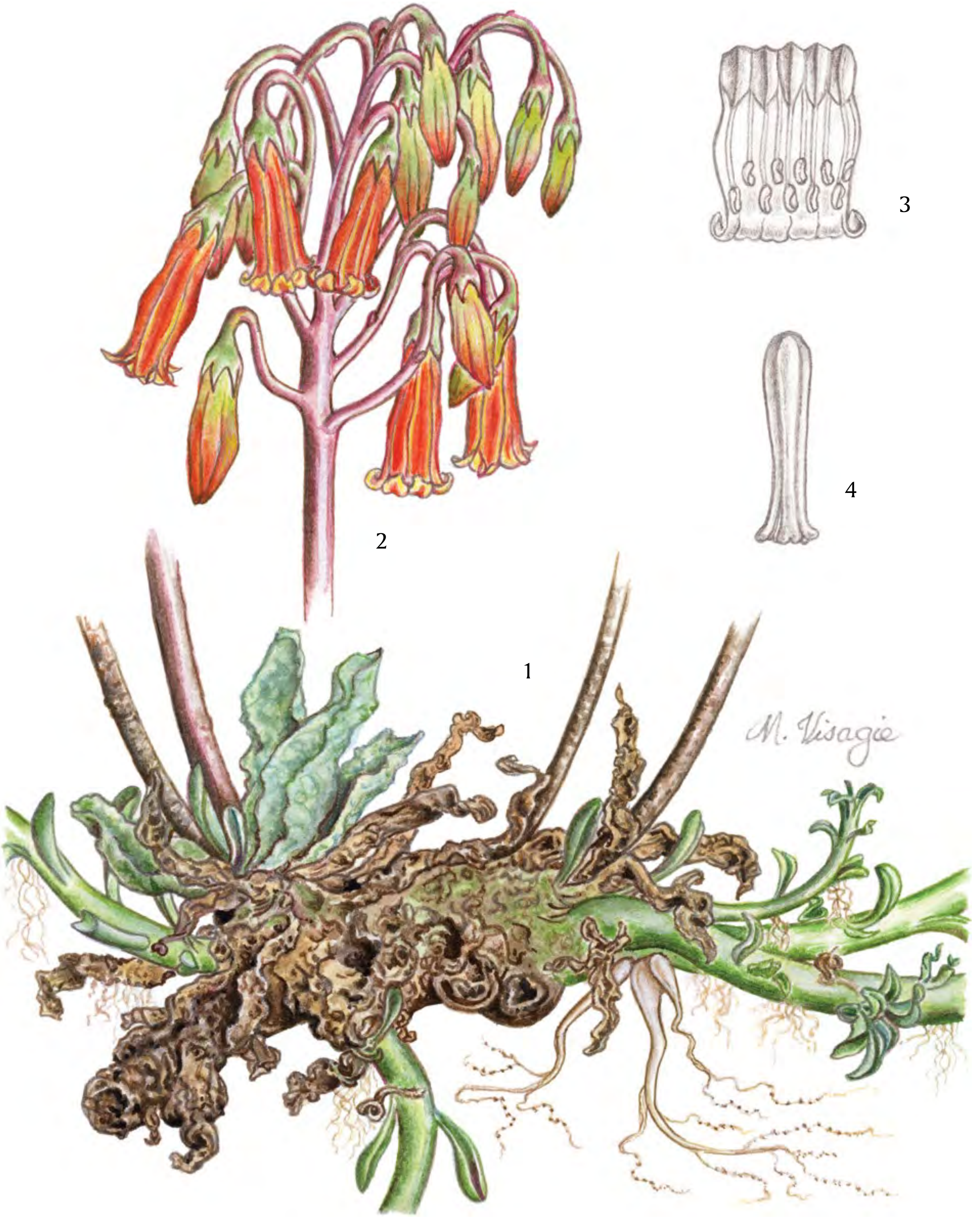

PLATE 2306 *Adromischus phillipsiae*

Adromischus phillipsiae Crassulaceae

South Africa

Adromischus phillipsiae *(Marloth) Poelln*. in Feddes repertorium specierum novarum regni vegetabilis 48: 88 (1940). *Cotyledon phillipisae* Marloth: 46 (1907).

Adromischus phillipsiae is a succulent plant endemic to the western inland escarpment margin of the Northern Cape. It occurs in the Succulent Karoo biome and grows on hills and mountainous terrain, mainly confined to the shade of small karoo shrubs, and only becomes conspicuous during its flowering season. It is well established in succulent plant collections, as stem cuttings are easily grown.

Rudolph Marloth (1855–1931), well-known South African botanist from the University of Stellenbosch, named his new species in 1907 in his article, 'Some new South African succulents' published in the *Transactions of the South African Philosophical Society*. He named his plant for the South African, Lady Dorothea Phillips (née Ortlepp, 1863–1940) patron of arts and science (Marloth 1907). Lady Phillips was the wife of Sir Lionel Phillips, politician and mining magnate, who was instrumental in convincing Parliament in establishing Kirstenbosch National Botanical Garden in 1913. Lady Phillips commissioned Marloth to write a book on South African wild flowers (Marloth 1907; Gunn & Codd 1981) which led to his famous *Flora of South Africa* (six volumes appearing between 1913 and 1926). The type of *Adromischus phillipsiae* was gathered by Marloth from the southern Roggeveld at an altitude of 1 500 m close to Sutherland in March 1906. Marloth had a keen interest in succulent plants as can be seen from his descriptions of new succulents in the *Transactions of the South African Philosophical Society* as well as the *Royal Society of South Africa*.

Adromischus phillipsiae is one of six *Adromischus* species that belongs to section *Brevipedunculati* which Von Poellnitz established in 1940 to accommodate those species characterised by funnel-shaped, glaucous-green (rarely pink) corolla tubes that are slightly grooved towards their apices, and with club-shaped trichomes on inner surfaces of lobes and throats. The colour of the lobes varies from white to dark mauve and rarely orange (*A. phillipsiae*). Other members of this section include *A. caryophyllaceus*, *A. diabolicus*, *A. fallax*, *A. humilis* and *A. nanus*. *Adromischus phillipsiae* is unique in the genus, deviating from all the known *Adromischus* species by bearing conspicuous pendent orange flowers that are pollinated by sunbirds. It superficially resembles members of the genus *Cotyledon* and is the reason why Marloth originally published this plant as a species of that genus in 1907. The soft leaf rosette of *A. phillipsiae* (lacking a horny leaf margin) is not unlike the two closely related species, *A. humilis* and *A. fallax*, both from the escarpment margin east of Sutherland to Graaff-

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PLATE 2306.—1, central rosette and lateral branches, × 1; 2, inflorescence, × 1; 3, dissected corolla, × 1; 4, gynoecium × 4. Voucher specimen: *Van Jaarsveld 24294*, Compton Herbarium, Cape Town. Artist: Marieta Visagie.

Reinet. However, the latter two usually grow on ledges and in crevices of cliffs. The leaves of *A. phillipsiae* and *A. fallax* are oblanceolate to elliptic, grey-green (much smaller and obovate to orbicular in *A. humilis*), but often distinctly purplish mottled in *A. phillipsiae*. In cultivation at Kirstenbosch the leaves of *A. humilis* and *A. fallax* become faintly purplish mottled during the dry season. In typical *Adromischus*, the leaves are brittle with a horny margin and rooting soon when becoming detached from the mother plant.

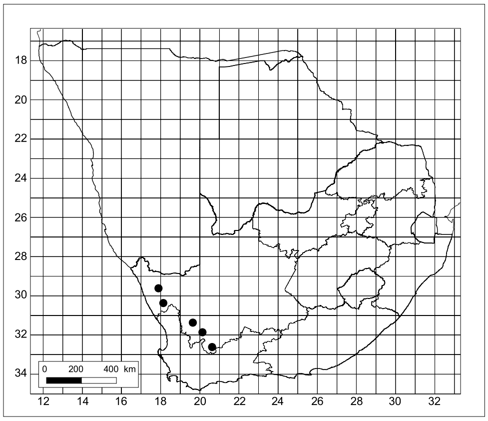

FIGURE 1.—Known distribution of *Adromischus phillipsiae.*

Adromischus was established by Lemaire in 1852 but only became in use in 1930 due to the activities of the succulent authority Alwin Berger (Pilbeam et al. 1998). It belongs to the Crassulaceae family. With a few exceptions, all *Adromischus* species are endemic to South Africa. The last revision of *Adromischus* was by Toelken in the *Flora of southern Africa* (1985) in which 23 species were recognised. Three taxa have been added since: *A. inamoenus* subsp. *orientalis*, *A. cristatus* subsp. *mzimvubuensis* and *A. schuldtianus* subsp. *brandbergensis* (Van Jaarsveld & Van Wyk 2003; Van Jaarsveld et al. 2004). Modern classification of *Crassulaceae* begins with Linnaeus's *Species Plantarum* in 1753. Currently it comprises about 1 500 species of which most are succulent with between 26 and 35 recognised genera (Heywood 1978; Toelken 1985). The Crassulaceae have a wide distribution, mostly in warm temperate and subtropical semi-arid climates, and occurs in parts of the Palaeotropical, Neotropical and Boreal plant kingdoms, but is absent from the Australasian flora. Centres of endemism are clearly in the winter rainfall Succulent Karoo of South Africa, the Mediterranean region, and southern parts of central and southern North America in regions dominated by winter rainfall. There are five genera indigenous to southern Africa. *Crassula* is the largest (150 species) followed by *Tylecodon* (47), *Adromischus* (23), *Cotyledon* (11) and *Kalanchoe* (13). Most of the taxa are leaf and stem succulents, with *Tylecodon* the exception in being summer deciduous usually with markedly swollen succulent stems.

Adromischus phillipsiae has been found widely distributed (Figure 1) but mainly from Verlatenkloof in the Roggeveld (Tanqua Escarpment Shrubland) in the south to the Kamiesberg and Springbok in Namaqualand (Namaqualand Blomveld). The vegetation in the south consists of Tanqua Escarpment Shrubland (near Sutherland) and Hantam Karoo (near Calvinia) (Mucina & Rutherford 2006). The geology along the Roggeveld Escarpment consist of mudstones and shales (Karoo Supergroup) and granites of the Namaqua Natal Province on the Kamiesberg (Johnson et al. 2006).

Our depicted plant was collected on 23 February 2013 from the farm Tierhoek (Hantam District), close to Calvinia, belonging to Francois van der Merwe (Figure

2). He accompanied one of us (EJvJ) to the mountaintop during a search for cliff-dwelling succulent plants when *Adromischus phillipsiae* was unexpectedly encountered on top of the plateau growing below *Pteronia incana* and other low karoo shrubs, among fragments of mudstone at about 1 600 m above sea level. The plants grow close to the ground forming compact tufts; they produce lateral subterranean branches to form new rosettes where they protrude from the leaf litter. The ascending inflorescences protrude above the canopy of the nurse plants, where they stand out and attract attention of the main pollinators: malachite and other sunbirds of the region. When not in flower, plants are very difficult to detect below the shrublets. Other succulents commonly encountered in this habitat include *Crassula muscosa*, *C. tetragona* subsp. *connivens*, *Stomatium pyrodorum* (particularly on sand-filled bedrock), *C. deltoidea*, *Cotyledon orbiculata* and *Tylecodon wallichii*. The plant was observed and depicted during a very dry part of the season, hence the partially desiccated leaves. The plant invests a great deal of resources in producing flowers and subsequently fruits, following successful pollination (for sexual reproduction) – drawn at the cost of the vegetative parts. Seeds are released in autumn and winter when some rain is expected. Flowering is thus timed so that seed would be released at the onset of the rainy season.

FIGURE 2.—Plant in habitat at Tierhoek in the Hantam District, Northern Cape. Photograph: E.J. van Jaarsveld.

Although the plants have been listed by Raimondo et al. in the *Red List of South African Plants* (2009) as being rare, it is locally abundant and populations are thus not threatened. It grows in a region of mainly sheep farming.

Rainfall occurs mainly during winter, ranging from 100–150 mm per annum (mainly cyclonic winter rain). However spring and autumn rains may occasionally be experienced (mainly thundershowers), especially along the Roggeveld Escarpment in the south. The summers are hot with temperatures frequently above 30°C. The winters are cold with frost and occasional snow especially along the southern section of its distribution.

Adromischus phillipsiae flower in summer and autumn (February to April in the southern hemisphere). The floral architecture and colour is clearly linked to sunbird pollination. After flowering, the pendent flowers become erect when the seeds are dispersed by wind.

Adromischus phillipsiae is easily grown in a well-drained succulent soil mixture that is kept in semi-shade. The plants can be watered sparingly throughout the year, especially in summer. It is easily propagated by stem cuttings, rooted in moist sand during spring or summer. Although the plants are evergreen, the leaves often wither during dry periods, rapidly becoming turgid after moisture has been applied. *Adromischus phillipsiae* grows well in cultivation when grown in karoo and succulent karoo gardens and particularly in rockeries (Van Jaarsveld 2010). When grown in areas outside of this dry habitat, it is best grown in a glasshouse under controlled climatic conditions.

Specimen examined: South Africa, Northern Cape, *Van Jaarsveld 24294* (NBG).

Description (based on Toelken 1985).—Spreading, moderately branched succulent forming tufts below shrubs, branches succulent and decumbent with leaves in a flat apical rosette, vegetative parts glabrous. *Branches* 20–50 mm long, suckering from the base. *Leaves* softly succulent (flaccid), alternately arranged, oblanceolate to elliptic 15–45 × 4–13 mm broad; dorsiventrally compressed, grey-green, often becoming purplish mottled during the dry season; base cuneate, the blade convex below and concave on the upper surface; apex obtuse to sub-acute; older leaves becoming deciduous from below. *Inflorescence* an ascending thyrse, 200–350 mm tall, bearing several monochasia each with 1–5 flowers; pedicels 15–35 mm long, green; buds terete and slightly longitudinally grooved, gradually tapering towards the apex, pendent. *Calyx* 3–5 mm long, green. *Corolla* cylindrical, broadened slightly in the middle, forming a funnel-shaped tube 18–20 mm long, orange-red; lobes ovate-triangular, 3–5 mm long, acute, papillose in lower part, deep orange-red, with yellow around throat. *Anthers* not protruding. *Squamae* oblong 2.0–2.3 × 0.9–1.0 mm, emarginated, scarcely constricted towards base. Plate 2306

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E.J. VAN JAARSVELD* and MARIETA VISAGIE**

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* South African National Biodiversity Institute, Kirstenbosch, Private Bag X7, Claremont, 7735 South Africa / Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville, 7535 South Africa.

* Author for correspondence: e.vanjaarsveld@sanbi.org.za

** 12 Molteno Court, Molteno Drive, Stellenbosch, 7599 South Africa.

Adansonia madagascariensis Malvaceae

Madagascar

Adansonia madagascariensis *Baill.* in Stirpes Exoticae Novae 11: 251 (1876). *Baobabus madagascariensis* (Baill.) Kuntze: 67 (1891). *Adansonia bernieri* Baill. ex Poiss.: 20 (1912).

Madagascar has almost unparalleled levels of endemism and species diversity. For vascular plants species endemism is 92%, and for tree and large shrub flora around 96% (Goodman & Benstead 2005). This includes six endemic baobab species that are dominant in several Malagasy ecosystems. They are iconic and serve as a major tourist attraction. The baobab is also the national tree of Madagascar.

The *Adansonia* species in Madagascar belong to a monophyletic clade, though their relationship to the African and Australian species remains unresolved. While Madagascar is the centre of diversity for the genus, it is not considered the centre of origin (Baum et al. 1998). Molecular dating suggests that the divergence of *Adansonia* from other Bombacoideae might have occurred approximately 58 Ma with the deepest split within *Adansonia* being perhaps 23 Ma (Baum 2003). This is too recent to attribute speciation events within *Adansonia* to the breakup of Gondwana. Instead, the ancestral baobab or proto-baobab is believed to have migrated by transoceanic dispersal (Baum et al. 1998; Baum 2003).

Phylogenetic analysis of other Malagasy biota indicates a clear pattern of sister-group relationships to taxa in continental Africa and molecular evidence overwhelmingly supports Cenozoic colonisation of Madagascar via an oceanic ‘sweepstakes’ dispersal (De Queiroz 2005; Yoder & Nowak 2006). Reconstruction and modelling of Cenozoic currents and cyclonic activity in the Mozambique Channel indicate that dispersal was facilitated by periodic, cyclonic storms that generated the possibility of floating tree ‘islands’ and a relatively short, month-long passage from Africa because of vigorous currents that flowed towards Madagascar until about 20 Ma (Ali & Huber 2010). By this time the island had drifted, with Africa, 15°, or ± 1 650 km northwards (Ali & Aitchison 2008), positioning the northern half of the island in the tropics. Between 20 Ma to the present, Madagascar has drifted a further 5° north (Samonds et al. 2012) and the bulk of the island (about 87%) now lies within the tropics.

Adansonia madagascariensis was the first of the Malagasy baobabs to be named. In 1876 Henri Baillon published the description of the species from collections made by his colleague, Alfred Grandidier, and some 50 years earlier by Alphonse Bernier, a naval surgeon who had observed the species in 1831 at Diego Suarez (Antsiranana).

Baillon admitted in his description to not having seen an adult tree and this omission led to 15 years of confusion; the fruit Baillon said was elliptical (instead of

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PLATE 2307.—Opened flower, × 1. Voucher specimen: *Condy & Mayne 1* in National Herbarium, Pretoria. Artist: Gillian Condy.

PLATE 2307 *Adansonia madagascariensis*

globose), leaves were long and the tree was exceptional – up to 30 metres tall and erect (in contrast with Bernier's bulbous 8 metre-high baobab). The first illustration of *Adansonia madagascariensis*, published in the 1889 *Atlas for Histoire Naturelle des Plantes*, showed the correct flower for the species but mistakenly showed the fruit of *A. grandidieri* and the morphology of *A. digitata* (Plate 79B). The continental African *A. digitata* had been introduced into the northwest coast of Madagascar centuries before. The errors were finally corrected in plate 79B of the subsequent edition of the *Atlas* a few years later (Baillon 1893) and the fruit and seed of *A. madagascariensis* were accurately illustrated for the first time (Plate 79E).

In 1908, Hochreutiner divided *Adansonia* into three sections with *A. madagascariensis* designated as the type of section *Longitubae*. The *Longitubae* were named for species with elongated flower buds – a characteristic now considered to be ancestral in the genus. Based on the floral biology and revised taxonomy (Baum 1995a,b), the *Longitubae* includes four Malagasy species plus the Australian species, *Adansonia gregorii*.

Adansonia madagascariensis is one of three northern baobabs overlapping in range with *Adansonia suarezensis* and the rare *Adansonia perrieri*. *Adansonia madagascariensis* is sometimes found occurring sympatrically in the same habitat in either mixed or adjacent stands with one or other species, but rarely with both species. Stands of *A. madagascariensis* are generally small and despite it being the first Malagasy baobab recognised, it remains only partially understood. Its scattered distribution stretches across northern Madagascar (including offshore islands) from near Cap d'Ambre at the northern tip of Madagascar in the Cap Diego region, to the karstic ridges of Montagne des Français at Antsiranana (Diego Suarez) down the east coast, to just beyond Vohémar and down the west coast to southwest of Majunga (Figure 1).

As both Bernier and Baillon stated (Baillon 1876), *Adansonia madagascariensis* favours locations close to the sea and has been observed at the tidal edge in beach sand (Figure 2j), around river estuaries, on islets in tidal flats and on offshore islets and islands. Further inland *A. madagascariensis* is found in dry, deciduous forests like Analamera, Daraina and Analafiana, near Vohémar in the northeast, Anjajavy in the northwest, and along riparian corridors. Its most prominent location is Ankarana National Park (Figure 2f) where it occurs mainly on

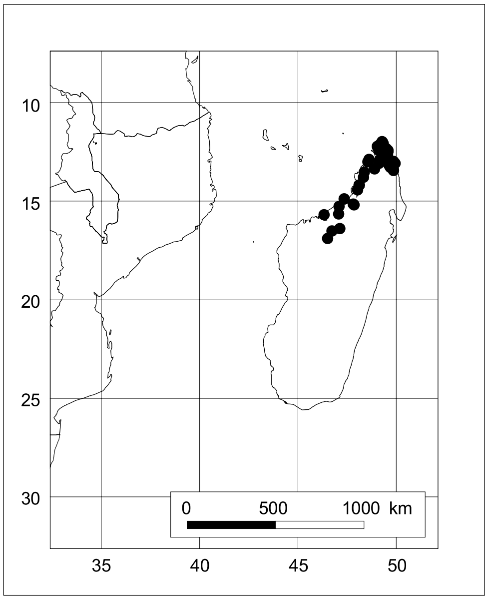

FIGURE 1.—Known distribution of *Adansonia madagascariensis* in Madagascar.

limestone or karst, but also on basaltic soils in dense, semi-evergreen forest where it dominates the forest canopy (Cardiff & Befourouack 2003). In the wetter and subhumid Sambirano region in the northwest the species is more scattered but occurs sympatrically with *A. za*. Despite non-overlapping flowering, molecular data suggests possible gene flow between these two species (Baum et al. 1998).

Adansonia madagascariensis is a small to medium tree of 5 to 20 metres in height, but rarely taller than 15 metres with the tallest specimens measured in inland forests or patches of former forests. The growth morphology of the tree varies; the stem often tapers (Figure 2b) but can be cylindrical or bottle-shaped (Figure 2a). The tree can also grow tall and erect as the photo of a tree at Ankarana illustrates (Figure 2f). Like all baobabs, the species is deciduous and in leaf from the beginning of November until April or even May. Its spectacular red flowers are produced during the wet season between February and April, although the lighter coloured flower illustrated here was found in the Ankarana area in mid-June. The flower bud is long and tubular, ± 20–27 mm (Figure 2g). Nectar is located at the base of the calyx where it fits tightly around the petal bases. The staminal tube is the shortest of the Malagasy *Longitubae* at ± 55 mm but its stamens are the second longest at ± 106 mm (Ryckewaert et al. 2011). The hawkmoth (*Coelania solani*) with its long proboscis is the main observed pollinator (Ryckewaert et al. 2011). Bees, butterflies, small moths and some birds are also thought to contribute to pollination through pollen or nectar collection. The distinctive globose fruit (Figure 3) ripen in the late dry season in November. Figure 2e shows a variety of sizes varying from 15.0–19.5 mm high, by 28.5–43.0 mm in circumference. The fruit pericarp is the toughest and thickest in the genus (4.5–7.5 mm at the widest point of the circumference and even thicker at the top and base). Some of the many reniform and laterally flattened seeds in a pod are shown in Figure 2d.

Germination appears to be erratic and triggered by exceptional rain. If seeds fail to germinate they can be replanted for at least five years without rotting like other *Adansonia* species. Research on *A. madagascariensis* seedlings indicates that the species is not adapted to drought and that drought may be a factor influencing its distribution. It was also found that the species allocates resources to foliage and faster growth rather than root system development, which is prioritised by species from drought prone regions (Randriamanana et al. 2012). The botanist Perrier de la Bâthie (1953) commented on the prodigious growth of *A. madagascariensis*, reporting a growth rate of 12–15 m and a diameter of 400–600 mm after 12 years. Growers of this baobab also report a very rapid growth rate with trees flowering in as little as eight years without artificial irrigation – a phenomenally quick time for *Adansonia*.

The fruit of *Adansonia madagascariensis* are the least palatable of the Malagasy baobabs for man, but seedling roots have been used as a vegetable (Perrier de la Bâthie 1952). In traditional medicine, fruit pulp is used to treat fevers and uterine problems, a decoction of leaves are used to treat fever and dysentery and bark is used to treat epilepsy, asthma, malaria and fevers (Plotkin et al. 1985; Wickens & Lowe 2008). While lemurs are known to eat baobab fruit, leaves, flowers and pollen, there are no reports documenting their utilisation of this species.

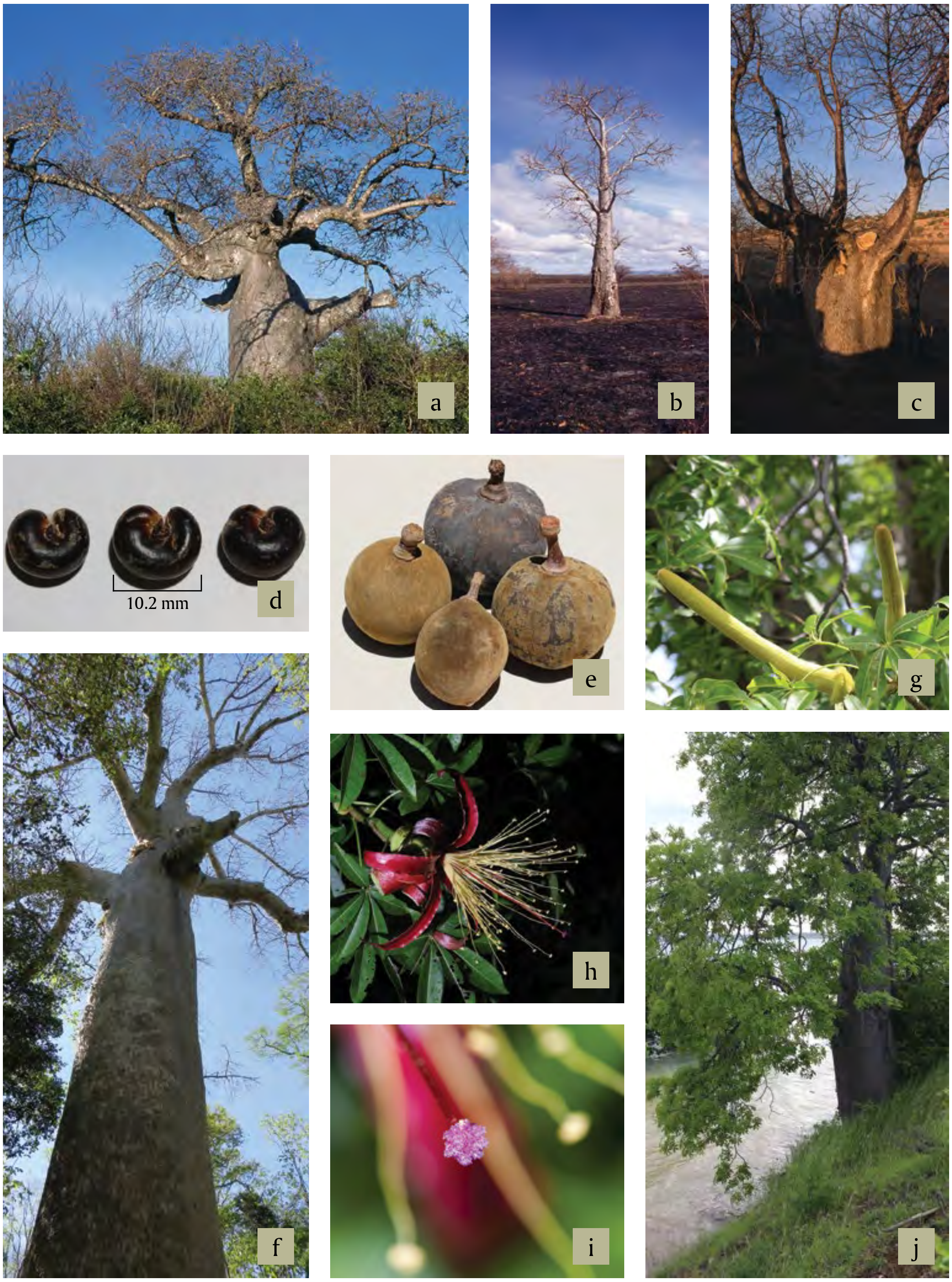

FIGURE 2.—*Adansonia madagascariensis*: a, bottle-shaped tree at Sakalava Bay east of Antsiranana (Diego Suarez); b, slash and burn activity (*tavy*) around tree south of Antsiranana in the north; c, sepulchre used for babies in Antsiranana; d, reniform seeds; e, globose fruit; f, tree in Ankarana; g, flower bud at Antsiranana showing pronounced annular swelling at base; h, flower at Antsiranana; i, stigma of same flower with pollen grains; j, tree overhanging the sea near Ramena. Photographs: a–e, g, h, j, D.H. Mayne; f, N. Karimi; i, L. Jasper.

FIGURE 3.—Line drawing of a globose fruit and leaf showing comparative size and venation, collected from Montagne des Français, Antsiranana. Artist: Gillian Condy.

Many individual baobabs are sacred in Madagascar as they are believed to contain the spirits of the ancestors. Offerings are made at the bases of trees or white cloth is tied around trees and rituals performed to honour the ancestors or for couples wanting children. A unique example of a sacred *Adansonia madagascariensis* tree is illustrated in Figure 2c. Stillborn babies or infants who died before their first year are put in a raffia basket and placed in the baobab.

The regeneration of baobabs in Madagascar has been adversely affected by the lack of suitable frugivores for seed dispersal (Ganzhorn et al. 1999) because of extinctions and anthropogenic habitat degradation – particularly deforestation. Given the various maritime locations of the species and the thickness of the pericarp, it is very likely that water dispersal occurs. Fruits with viable seeds have been reported floating off the coast of northern Madagascar (Du Puy 1996). A recent paper has attempted to prove marine hydrochory (Cornu et al. 2014). At least one mature, fruiting tree is growing on a beach in Mayotte in the Comores – a minimum distance of some 350 km from Madagascar. This could represent natural dispersal, though some believe that the tree or trees were planted (Louette 1999).

Adansonia madagascariensis is currently listed as Near Threatened by the International Union for Conservation of Nature (IUCN 2014). This assessment has not been revised since 1998 but with the impact of continued habitat degradation, the classification status needs to be raised to at least Threatened in the pending revision in 2015. The species is only directly protected in the Montagne des Français Protected Area. This protection is recent, the area is already degraded and there are few known specimens. In Ankarana and Nosy Hara National Parks and Analamera Special Reserve the species only has indirect and limited protection. Calls have thus been made for a specific conservation strategy for the species (Raveloson et al. 2014). Its conservation in Anjajavy Forest in the northwest is due largely to difficult access and private ownership and management. Like all Malagasy baobabs, the species has been noticeably affected by continuing degradation and deforestation, exacerbated by high poverty levels and subsistence agriculture using slash and burn techniques called *tavy* (Figure 2b). In the Daraina forests in 2013, artisanal gold miners were seen excavating around the trees and the sole known habitat of the Critically Endangered lemur species *Propithecus tattersalli*. Although the area is not protected, it is managed by a non-governmental organisation called Fanamby. This situation highlights the conflicts surrounding conservation in Madagascar where successful retention of biodiversity and sustainable conservation requires the integration of community livelihood needs and aspirations.

Description (modified from Baum 1995b).—Small to large deciduous trees with bottle-shaped to cylindrical or tapering trunks and irregular crowns, 5–20 m; primary branches erect, horizontal, or descending. *Bark* smooth, pale grey. *Leaves* 5–7-foliolate; petiole 60–120 × 1–2 mm, tapering; stipules caducous; leaflets subsessile with winged petiolules, elliptic to oblanceolate with a prominent midrib (markedly raised below when dry), medial leaflet 70–120 × 20–30 mm with 8–16 pairs of irregularly spaced secondary veins, glabrous, apex obtuse to acute; margins entire. *Flowers* produced when in leaf during the wet season; buds erect to horizontal, elongated to cylindrical, 150–270 mm; flower stalk 20–30 mm, green above, brownish below. *Calyx* lobes linear, up to 180 mm, reflexed and twisted at the base of the flower, green and scabrous outside, crimson and villous within; calyx tube ca. 250 mm long, fitting tightly around petal bases with a pronounced annular swelling (Figure 2g), 2–4 mm wide. *Petals* red/orange to crimson (rarely yellow), linear, approximately 10 times as long as broad, longer than the androecium but usually shorter than the style, ca. 150–200 × 8–15 mm. *Androecium* ivory to yellow comprising a cylindrical or tapering tube, 50–60 mm long, 6–10 mm diam., surmounted by 90–100 free filaments, each 70–130 mm long. *Ovary* globose to ovoid, densely covered in brownish upward-pointing hairs. *Style* straight or kinked, crimson (Figure 2h), glabrous above with dense upward-pointing hairs below, fitting tightly in the staminal tube and falling with it. *Stigma* mauve (Figure 2i), lobes irregular, spreading. *Fruit* globose to subglobose, often broader than long (rarely almost ovoid), small (usually less than 100 mm in length), with a sparse indumentum of short brown hairs; pericarp thick, 70–90 mm, very tough and woody, with many longitudinal fibres. *Seeds* distinctly reniform and laterally flattened (10–11 × 7–9 × 4.5–6.0 mm). *Germination* phanerocotylar. Plate 2307.

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D.H. MAYNE* and GILLIAN CONDY**

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* School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Private Bag X3, Johannesburg, 2050 South Africa.

* Author for correspondence: baobab@icon.co.za

** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

Adansonia za Malvaceae

Madagascar

Adansonia za *Baill*. in Bulletin Mensuel Société Linnéenne Paris 1: 844 (1890). *Adansonia alba* Jum. & H.Perrier: 1511 (1909). *A. bozy* Jum. & H.Perrier: 447–451 (1910). *A. za* var. *boinensis* H.Perrier: 14:304 (1952): *A. za Baill.* var. *bozy* (Jum. & H.Perrier) H.Perrier: 14: 304 (1952).

The six endemic baobabs of Madagascar grow along virtually the entire 1 580 km length of the western side of the island facing Africa; a region described as the 'kingdom of baobabs' (Guillaumet 1984). Each baobab species has a distinct distribution but with some overlap; predominantly amongst the three drought-tolerant species from the south, and amongst the three northern species. *Adansonia za* is unique in covering almost the entire latitudinal range of the island in very varied climate and vegetation overlapping the ranges of four of the other five Malagasy *Adansonia* species (the exception being *A. suarezensis* in the far north). *Adansonia za* is the only Malagasy species to show distinct intraspecific variation in leaf, fruit, and stem morphology between its southern and northern ranges. Variation occurs more locally in petal and calyx colours.

This kingdom of baobabs falls within the western centre of endemism in Madagascar (White 1983) with a plant species endemism of 70%. This region comprises mainly dry, deciduous forest and savanna extending inland to approximately the 600 m contour (Cornet 1974). It forms part of the dry savanna biome of Africa – the characteristic ecosystem of the continent. In the southwest this changes to a semi-desert biome, similar to continental Africa's Kalahari (UNEP 2008). In the northwest and north (beyond latitude 14.50°S) deciduous forest intermingles with relicts of the tropical woodland and rainforest that once covered this area. The west is underlain by sedimentary rocks with a limestone plateau in the southwest and limestone outcrops in the mid-west, northwest coast and in the north. Basaltic lava extrusions also occur in the north. A relatively wide sedimentary coastal plain borders on the Mozambique Channel that is heavily dissected by major river systems, many with large deltas (Oldeman 1990). Sandy, calcic soils of recent genesis dominate this coastal plain with sandstone and limestone mainly on the settled substrate. Alluvial soils (fluvisols) are found around rivers, and older lateritic soils (ferralsols) in the north with red ferruginous sandy soils in the southwest (FAO 1977).

The west falls in the lee of the central highlands that form a north–south spine and block the dominant rain-bearing southeastern trade winds. Rainfall comes instead from the northwestern monsoon and the Intertropical Convergence Zone in the austral summer between December and March (Jury 2003). The result is distinct seasonal precipitation with a marked variation between the northern and southern range of *Adansonia za*. Annual rainfall at its northern limit in the northwest

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PLATE 2308.—Opened flower, × 1. Voucher specimen: *Condy 270* in National Herbarium, Pretoria. Artist: Gillian Condy.

PLATE 2308 *Adansonia za*

Sambirano region is 2 156 mm declining to 275 mm at Toliaro in the southwest, near the species' southern limit (based on 30-year records; Oldeman 1990). The length of the dry season varies along this latitudinal gradient from five months in the northwest Sambirano to 10–12 months in the south (Cornet 1974).

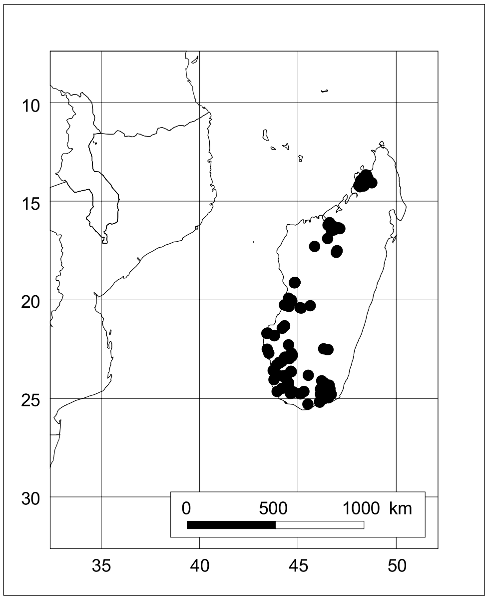

FIGURE 1.—Known distribution of *Adansonia za* in Madagascar.

In addition to being the most widespread of the Malagasy baobabs, Perrier de la Bâthie (1955) recognised three varieties within the species as the various taxonomic synonyms indicate. Baum (1995b) considered *Adansonia za* a possible metaspecies because of differences in features between northern and southern trees, and the possibility that northern trees are more closely related to *A. perrieri* and/or *A. madagascariensis* than they are to southern *A. za*. In the north, there are few clear differences between *A. za* and *A. madagascariensis*, whereas southern *A. za* trees are quite distinct. It was thus flagged as a species for further systematic analysis.

Like *Adansonia madagascariensis*, problems in the identification of *A. za* emerged in historical sources. Baillon (1890) described the species briefly from a specimen collected in the south of Madagascar. His first illustrations in 1893 (Plates 79C, D and I in the *Atlas for Histoire Naturelle des Plantes*) generated years of nomenclatural confusion as to priority and accuracy. Only one of these plates was accurate (Plate D). This illustrated the distinctive fruit from the south with a swollen peduncle. The other two plates showed the species *A. suarezensis* from the far north – ironically the one Malagasy species with no geographical link to *A. za*.

Figure 1 shows the wide distribution of *Adansonia za*; from Andohahela National Park and the Mandrare River in the southeast, through southern and western Madagascar where it is most abundant, to the Sambirano River basin in the northwest where it is rarer and restricted to riverine areas. This range incorporates three different vegetation units: western dry deciduous forest, western sub-humid forest, and southwestern dry spiny forest-thicket (Moat & Smith 2007). It also occurs in the wetter Manongarivo (Nicoll & Langrand 1989) and the semi-evergreen, sub-humid Sambirano.

Disturbed virtually throughout its range by local and commercial cultivation, mining and habitat degradation, scattered trees can be seen growing in large commercial sisal plantations in the arid southeast and, bizarrely for baobabs, sheltering cocoa plants in the cocoa and coffee plantations in the northern Sambirano.

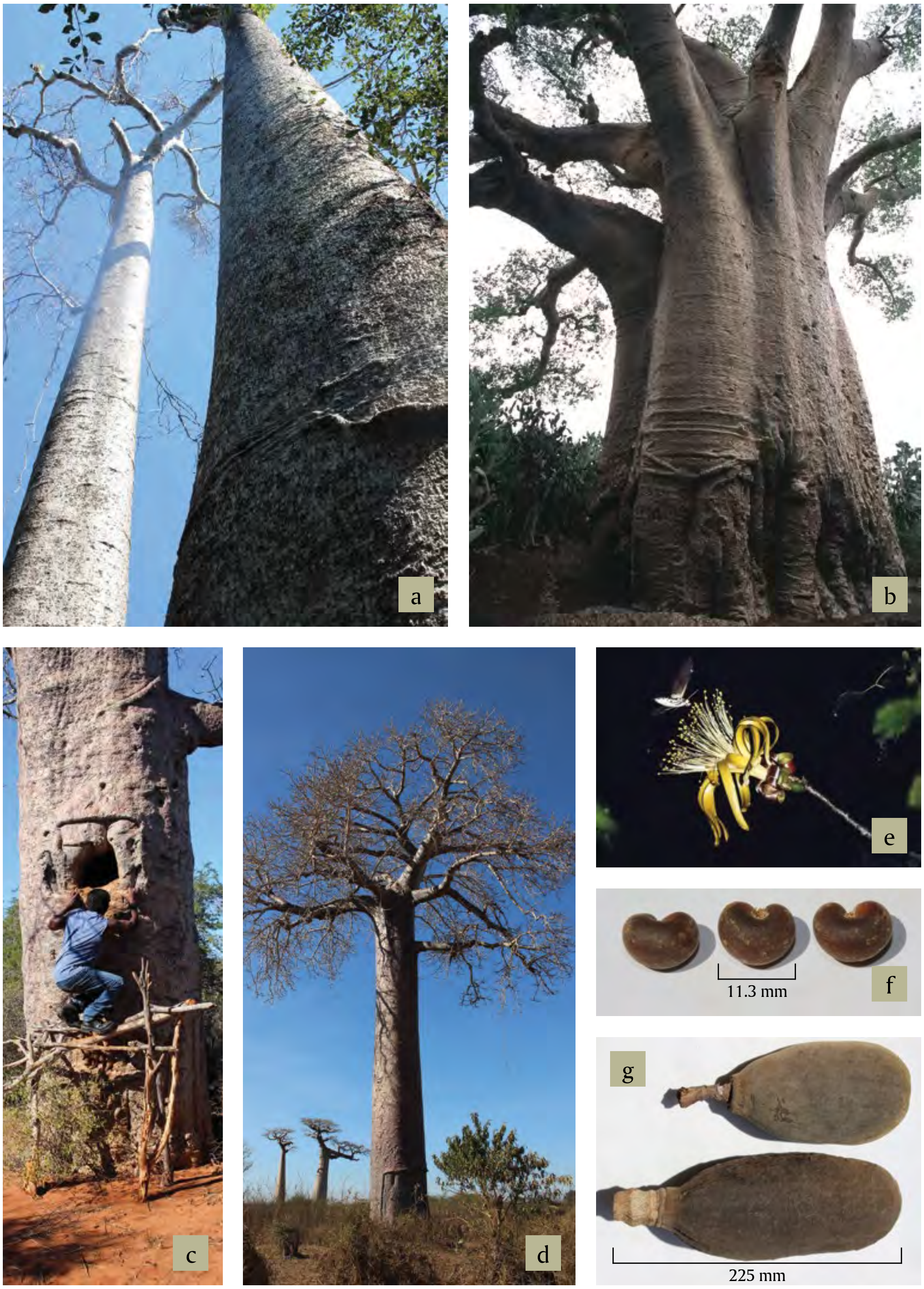

FIGURE 2.—*Adansonia za*: a, tall trees in Ankarafantsika Forest; b, large tree at Reakaly; c, tree at Ampotaka used as a water cistern; d, tree near Morondava; e, hawkmoth pollinator; f, reniform seeds; g, large pod from near Ejeda in the south and a smaller pod from Benavony in the northern Sambirano. Photographs: a–d, f, g, D.H. Mayne; e, D.A. Baum.

However, *Adansonia za* prefers well-drained soils and a dry season of at least seven months of the year (Cornet 1974), hence its greater abundance in the drier south including the arid Didiereaceae forest. It also occurs scattered or in small stands within dense dry forests, for example Kirindy, Southern Mikea and Ankarafantsika.

Surprisingly, despite its wide distribution, recent research finds the species has 'low genetic differentiation' suggesting recent range expansion (Leong Pock Tsy et al. 2013). The use of microsatellite markers to determine variation in the Malagasy baobabs suggest that regional hybridisation with sympatric *Longitubae* species (*Adansonia* species with elongated flower buds; Hochreutiner 1908, Baum 1995b) may have contributed to morphological diversity within *A. za* (Leong Pock Tsy et al. 2013).

With its close relative, *Adansonia perrieri*, *A. za* is the tallest of the Malagasy baobabs, although height varies from 10–31 m. Figure 2a illustrates the tallest trees in Ankarafantsika Forest. In the drier, red, nutrient-poor sandy soils of the south trees are much shorter. The classic columnar morphology of the species is shown in Figure 2d. *Adansonia za* is also the baobab with the widest girth in Madagascar. A unique specimen, and a national monument, at Reakaly in the southwest has a stem diameter of 7.1 m (unchanged in 10 years) and is 25 m tall (Figure 2b). A second very large tree was photographed in 1963 by lemur biologist, Alison Jolly, in the Mandrare River valley in the southeast (Guillaumet 1984). Jolly commented, 'some za baobabs, the species of this corner of Madagascar, are thicker through than the length of a long-wheel-base Land Rover' (Jolly 2004).

Adansonia za flowers at the end of the dry season during leaf flush or soon thereafter. The predominantly yellow-orange petals (Figure 3), sometimes with red streaks, have a length ten times their width and are longer than the style. Anthesis (after dark) is 'spectacularly rapid', taking 1–3 minutes (Baum 1995a). The flower illustrated in the accompanying plate comes from the first flowering in 2013 of a tree planted in the Pretoria National Botanical Garden in the 1970s. Pollinators include the long-tongued hawkmoths (*Coelonia solani*, *Xanthopan morganii* and *Panogena jasmini*) (Figure 2e), (Baum 1995a; Du Puy 1996a; Ryckewaert et al. 2011), the pale fork-marked lemur (*Phaner pallescens*) (Baum 1995a), and the red-tailed sportive lemur (*Lepilemur ruficaudatus*) (S.M. Chapotin, pers. comm). Other observed nectar visitors include butterflies, settling moths and sunbirds (*Nectarinia madagascariensis*) (Baum 1995a).

Significant variation can be seen in the lengths of the staminal tubes in the *Longitubae*. Those of *Adansonia za* vary from 35–112 mm (Ryckewaert et al. 2011). The flower bud varies from 150–290 mm in length (Baum 1995a). Like its closest relatives, *A. madagascariensis* and *A. perrieri*, it has a calyx tube modified as an annular nectar chamber (Baum 1995a,b). The marked annular swelling is illustrated in the drawing of the flower bud (Figure 4). These three species also share the same wood anatomy; their parenchyma tissue is grouped in tangential bands alternating with bands composed primarily of vessels and fibres rather than dispersed through the xylem like the other Malagasy species (S.M. Chapotin, pers. comm.).

In the northern end of the range, leaf flush and flowering begin in late October. Flowering lasts to the end of November. In the south, leaf flush starts in October

FIGURE 3—Colour variation in flowers: a, north of Ejeda in the southwest; b, Ambato Boeny/Betsiboka River in the northwest; c, tree planted in Pretoria National Botanical Garden, seed originally from Amboasary in the southeast; d, Kilimidega, south of Beahitse in the southwest; e, west of Vohitsara in the southwest; f, Bemeraha/Mananbolo River. Photographs: a, c, d, D.H. Mayne; b, e, f, N. Karimi.

with flowering starting generally after leaf flush in late November and continuing into the rainy season until February. Trees are in leaf until the end of the rains in early to mid-April or even May. Fruit is elongated with distinctive swollen peduncles in the south, but more ovoid with normal peduncles in the north (Figures 2g & 5).

Germination is phanerocotylar. The reniform-shaped seeds (Figure 2f) are viable for at least 12 years, including freezing and storage pre-germination. When the first author germinated seeds that had been in storage for over a decade, all of them germinated. Young trees grow relatively fast and adults appear robust; the tree planted on the warmer northern side of the ridge in the Pretoria National Botanical Garden has reportedly withstood occasional frost in winter (L. Ferreira, pers. comm.).

Baobabs are seen as keystone mutualists (Baum 1996). *Adansonia za*'s wide distribution is reflected in the most diverse ecology of the Malagasy baobabs. The fruits and roots provide food for humans (Baum 1996), the seeds provide oil (Jumelle & Perrier de la Bâthie 1914) and the fruits/seeds are food for a variety of mammals and birds. The species is an important food resource for lemurs, especially the leaves in the late dry season (Du Puy 1996a), as well as gum exudates, nectar and flowers (Birkinshaw & Colquhoun 2003). Flowers are also eaten by bats and parrots, and fallen flowers are eaten by tortoises (Wickens & Lowe 2008). Bark is used for rope and cattle leads (Guillaumet 1984). The fruit and leaves of *A. za* are reported to be antidiarrhoeal and a decoction of leaves has been used to reduce fever (Heckel 1903). Various bird species use baobabs, including *A. za*, for nesting sites, often nesting in cavities (Wickens & Lowe 2008). In the southwest it is the main microhabitat and offers a secure refuge for the large day gecko (Cornu & Raxworthy 2010) and also serves as a bat roost.

In the arid southwest where water is a very precious commodity, *Adansonia za* has been utilised for over a century, as a water cistern (Decary 1921). Holes are cut into the stems to collect rainwater running down from the top of trees (Figure 2c). Villagers at Ampotaka, where the trees are protected, told us that a large hole would provide drinking and cooking water for a large family for 6–9 months and a small hole for three months. Trees are reportedly occasionally felled in times of severe drought for water troughs and cattle feed.

Despite its wide distribution, concerns have been raised about the regeneration of *Adansonia za*. Langrand & Goodman (1997) recommended further demographic investigation. The species has suffered dramatic habitat loss from large-scale commercial plantations, mining and gem exploitation, and slash and burn agriculture. The western forests are vulnerable to fire and increased pressure for crops and grazing for livestock has seen the majority of the western forests destroyed (Jenkins 1987). What remains is fragmented, selectively logged (e.g. Kirindy) or burnt – whether intentionally or burnt from uncontrolled burning in adjacent grasslands. This further constrains recruitment as we have noticed that young baobabs are particularly susceptible to fire and seedbanks could be destroyed.

Recruitment is also affected by predation and dispersion. Predators of fruit and seeds include introduced rats, livestock, bushpigs (*Potamochoerus larvatus*), and vari-

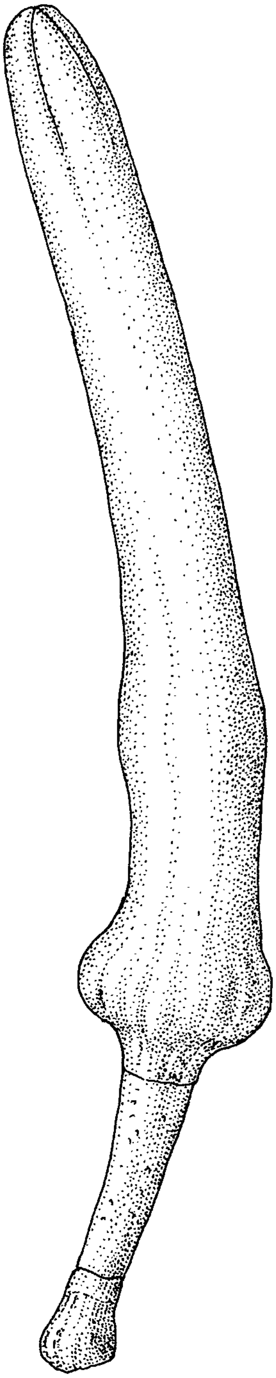

FIGURE 4.—Flower bud; note the marked swelling towards the base where the calyx tube is modified to an annular nectar chamber. Artist: Gillian Condy.

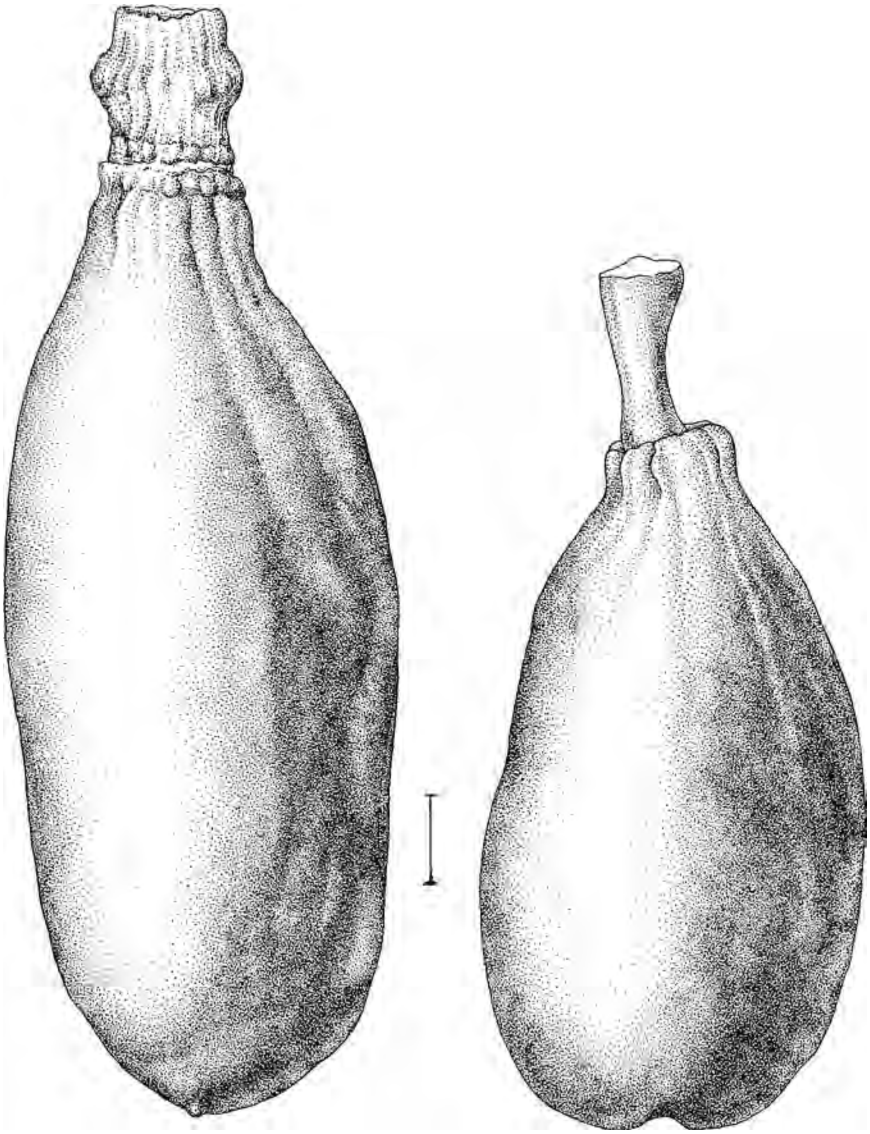

FIGURE 5.—Difference in morphology: fruit is elongated with a distinctive swollen peduncle in the south, whereas fruit is more ovoid with a normal peduncle in the north. Scale bar: 20 mm. Artist: Gillian Condy.

ous invertebrates that generally destroy both the pulp and the seeds and facilitate the dispersion of invasive rather than endemic species (Vavra et al. 2007). According to Du Puy (1996a), the pulp of *Adansonia za* becomes tasteless after three weeks of the fruit falling from the tree and is then destroyed by termites, weevils or the red bugs/cotton stainer (family *Pyrrhocoridae*). However, no extant animals are known to be effective seed dispersers of Malagasy baobabs, which is a major concern. It is possible that *A. za* fruits are waterborne, as beached fruits have been seen after flooding of the Kirindy River (Du Puy 1996b).

Baum (1995b) suggested that the poor regeneration of baobabs could be related to the extinction of the frugivore and possible baobab seed disperser, *Archeolemur* and the inability of the extant fauna to process the seeds within their thick pericarps. Extant lemurs may play a limited role in seed dispersal because *Adansonia za* has some of the smallest baobab seeds, measuring up to 12 × 11 × 8 mm (Baum 1995b), yet only one lemur species in the dry deciduous forest, the common brown lemur (*Eulemur fulvus*), eats seeds this size (Ganzhorn et al. 1999). Recent research on seed dispersal confirms that *Adansonia* species may previously have depended on extinct larger lemurs such as *Archeolemur majori* or *Pachylemur insignis*, each resembling a baboon (*Papio* species) in size, habits and dentition (Crowley et al. 2011). These lemurs were able to eat seeds with hard outer shells (Jernvall et al. 2003). Use of stable isotope biogeochemistry for diet reconstruction found that they fed predominantly on C3 plants like baobabs (Crowley et al. 2011). Andriantsaralaza et al. (2010) has urged the testing of anachronistic dispersion for regeneration and the future survival of the species.

Adansonia za has been listed as Near Threatened since 1998 by the International Union for Conservation of Nature (IUCN 2014), but is being reassessed in an upgraded Red List for 2015. Its vulnerability in the arid south and in dry forest ecosystems where regeneration is slow and populations are likely in decline needs to be examined. Protected areas with *A. za* stands include Andohahela, Tsimanampetsotsa and Zombitse National Parks, Beza-Mahafaly Special Reserve and the PK32-Ranobe New Protected Area in the south, Ankarafantsika National Park in the northwest, Kirindy privately managed forest in the west, and the Ampotake village initiative. Community-based forest biodiversity projects like Sakoantovo and Vohimasio are underway in the south.

Description (modified from Baum 1995b).—Generally tall, deciduous trees with single, cylindrical, straight or slightly tapering stems with rounded crowns, 20–31 m in north, 10–20 m in southern red soils; primary branches usually ascending and tapering. *Bark* grey, ± smooth. *Leaves* 5–8-foliolate; petiole 50–150 × 1–4 mm; stipules caducous; leaflets sessile to long-petiolulate, up to 30 mm, broadly elliptic in north to lanceolate in south, narrowly lanceolate in juvenile trees; margins undulate in south, entire in north; apex usually apiculate, rarely mucronate; medial leaflets up to 200 × 80 mm in north, usually less than 100 × 40 mm in south, 10–20 pairs of regularly spaced secondary veins in south, more in north, usually alternating with prominent intersecondaries, glabrous or somewhat scabrous. *Flowers* emerging simultaneously or soon after leaves; buds erect to horizontal, elongated-cylindrical, 150–240 × 15–25 mm; peduncle 20–30 mm, green. *Calyx* lobes (3–)5, reflexed and twisted at base of flower, 150–220 × 10–12 mm, green and scabrous outside, variable from dusky pink to cerise and red (rare) villous within; calyx tube fitting tightly around petal bases, with marked annular swelling ca. 2 mm wide. *Petals* variable (Figure 3); yellow to orange, sometimes with a diffuse reddish medial streak or red (rare) on the adaxial surface, linear, at least 10 times as long as wide, 140–240 × 10–16 mm, exceeding the style and androecium. *Androecium* pale yellow or yellow, comprising a long cylindrical or tapering staminal tube, 35–112 mm long surmounted by 100–150 free filaments, each up to 120 mm long. *Ovary* conical to ovoid, covered in dense, upward-pointed hairs. *Style* dark red, straight, 160–220 mm, glabrous above, with dense upward-pointing hairs below, usually fitting loosely in staminal tube and persisting after floral abscission but rarely to fruit. *Stigma* red, 3–5 mm diameter with irregular lobes. *Fruit* subglobose, oblong or ovoid, 100–300 × 60–150 mm, rarely curved, usually with longitudinal ridges and distinctly swollen peduncle, swollen peduncle absent in north; pericarp thick, tough with many longitudinal fibres, usually blackish with sparse indumentum. *Seeds* reniform, laterally flattened, variable in size, up to 12 × 11 × 8 mm. *Germination* phanerocotylar. Plate 2308.

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D.H. MAYNE* and GILLIAN CONDY**

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* School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Private Bag X3, Johannesburg, 2050 South Africa.

* Author for correspondence: baobab@icon.co.za

** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

Abutilon grandifolium Malvaceae

South America, Africa, Asia, Australia

Abutilon grandifolium (Willd.) Sweet in Hort. Brit. 1: 53 (1826). *A. mollicomum* (Willd.) Sweet: 54 (1826). *A. molle* Sweet: 65 (1830). *A. molle* var. *grandifolium* (Willd.) Sweet: 65 (1830). *A. tortuosum* Guill. & Perr.: 66 (1831). *A. arnottianum* (Gillies ex Hook. & Arn.) Walp.: 324 (1842). *A. sordidum* K.Schum.: 406 (1891). *A. kauaiense* Hochr.: 238 (1912). *A. mollissimum* var. *sandwicense* Hochr.: 239 (1912). *Sida sericea* Mill.: 15 (1768). *S. mollis* Rich.: 111 (1792). *S. grandifolia* Willd.: 724 (1809). *S. mollicoma* Willd.: 725 (1809).

Abutilon, established by Miller (1754), is a large genus in the Malvaceae family with more than 200 species. The Malvaceae are traditionally placed in the order Malvales, which includes important families such as Tiliaceae, Sterculiaceae and Bombacaceae (Mitchell 1982). The Malvales is a large and important natural order with its members found throughout the world, except in the Arctic regions (Masters 1868). These families are linked together by similarities in floral and pollen morphology, wood anatomy (Metcalfe & Chalk 1950; Manchester & Miller 1978) and leaf structure (Manchester 1992). Recent studies in molecular systematics also confirm these similarities among these four families, although phylogenetic relationship within the families remains unclear (Alverson et al. 1999).

The genus *Abutilon* is pantropic in distribution but also occurs in most subtropical regions including South America, India, Asia, Madeira, Australia, Senegal and Mali (Hutchinson & Dalziel 1958; Meeuse 1961; Robyns 1965; Masters 1868; Dyer 1975). It is one of the largest genera in the Malvaceae family, followed by genus *Hibiscus* (Fryxell 2002). With the current lack of solid taxonomic revision or treatment, it is uncertain how many *Abutilon* species there are. Baker (1893) estimated the genus to include 172 species, while Garcke (1893) described the genus as being large and difficult; other authors, such as Kearney (1958), alluded to *Abutilon* as the most difficult of the Malvaceae family. The genus has received a lot of attention since it was first described. De Candolle (1824) in his *Prodromus* proposed dividing the genus into sections and subsections based on the number of carpels, and recognised 195 species. Baker (1893) in his synopsis of genera and species of Malvaceae recognised 172 species of *Abutilon*, followed by Mattei (1915) who recognised about 100 species, Lemée (1929) recognised about 150 species, and Airy (1966) recognised more than 100 species. More recent studies, for example those of Hutchinson (1967) and Husain & Baquar (1974), recognised more than 400 species, whilst the most recent taxonomic treatment of Fryxell (2002) recognises more than 500 species. In southern Africa, Bredenkamp & Leistner (2003) recognised 21 species in *Abutilon* of which one is not indigenous to the region (*A. theophrastii*). The genus is distinguishable from other Malvaceae genera by its lack of an epicalyx, mericarps that lack wings, the presence of an endoglossum, usually dorsally dehiscent fruit, and by leaves that are subentire to markedly serrate with their principal veins ending at the margins

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PLATE 2309.—1, flowering stem, × 1; 2, fruiting branch, × 1. Voucher specimen: *Jaca & Nkonki 684* in National Herbarium, Pretoria. Artist: Gillian Condy.

PLATE 2309 *Abutilon grandifolium*

(Esteves & Krapovickas 2002). The flowers of African *Abutilon* species generally open in the afternoon, except for *A. fruticosum* which opens in the morning. This is the main character that distinguishes *Abutilon* from *Sida* species, with the latter having flowers that open in the morning (Meeuse, 1961).

Abutilon grandifolium is very similar to two other species: *A. grandiflorum* and *A. theophrastii*. *Abutilon grandifolium* differs from both in its number of mericarps which ranges from 8–10 as opposed to 12–16 in *A. theophrastii* and 18–25 in *A. grandiflorum*. *Abutilon grandifolium* also differs from the other two species by its height as it grows up to 3 m tall compared to 0.75–2.00 m in the other species (Meeuse 1961; Naqshi et al. 1988; Achigan-Dako 2010). However, it is often impossible to use height to identify species, particularly for young plants, and the mericarp characteristics remain the most important factor in distinguishing between species of *Abutilon*.

Abutilon grandifolium has various common names, including hairy abutilon, hairy Indian mallow, abutilon and tall abutilon.

Abutilon grandifolium, illustrated here, is native to South Africa and occurs mainly in the KwaZulu-Natal and Eastern Cape provinces (Bredenkamp & Leistner 2003; Foden & Potter 2005). It is also reported to occur in South America (Hutchinson & Dalziel 1958; Burkill 1997; Achigan-Dako 2010). The species has recently been recorded in Gauteng, South Africa, at the Wonderboom Nature Reserve – this population is, however, outside of its natural range and is the possible result of an escape from cultivation, as the nature reserve is located within an urban area. *Abutilon grandifolium* has also been recorded from Mapungubwe National Park in Limpopo Province, but this is also suspected to be due to an escape from cultivation. Nevertheless, these distributional anomalies require further investigation. *Abutilon grandifolium* has been recorded as naturalised in other parts of the world including New Zealand, some Pacific Ocean islands, tropical Africa, and eastern and western Australia where it is regarded as a potential environmental weed (Achigan-Dako 2010; Global Compendium of Weeds 2014; Environmental Weeds of Australia 2015). The distribution of *Abutilon grandifolium* in Africa, based on the Botanical Research and Herbarium Management System (BRAHMS) and Global Biodiversity Information Facility (GBIF 2014) databases, is illustrated in Figure 1.

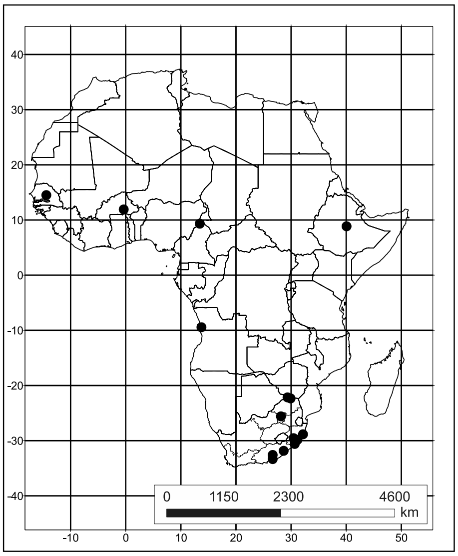

FIGURE 1.—Distribution of *Abutilon grandifolium* in Africa based on herbarium records in the BRAHMS database of the National Herbarium, Pretoria, and the GBIF database.

The strong bast (fibrous material obtained from stems of dicotyledon-

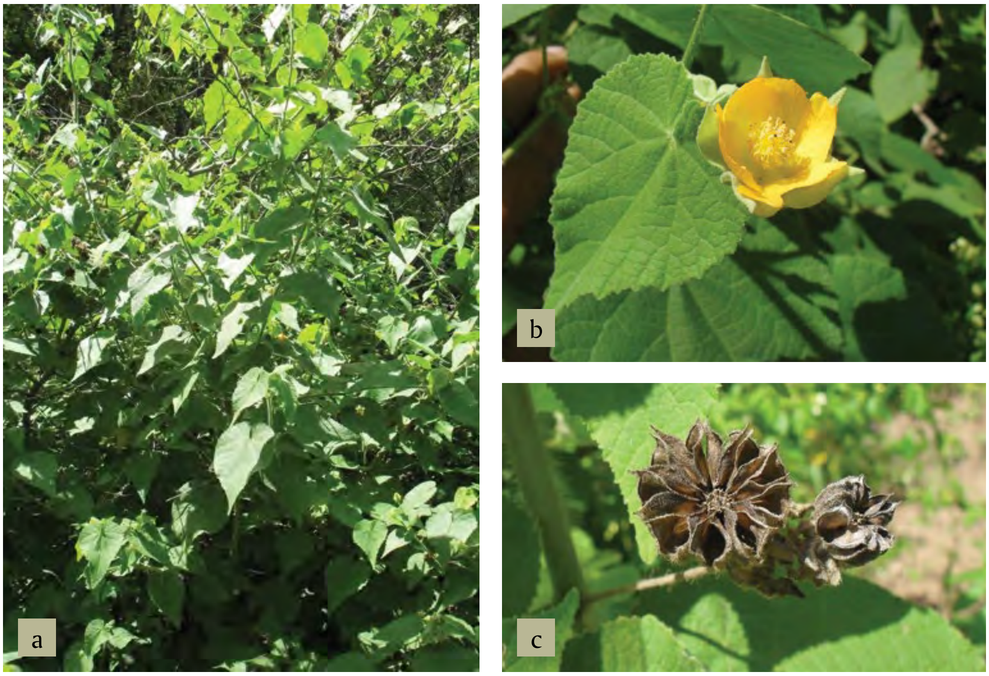

FIGURE 2.—*Abutilon grandifolium* in Wonderboom Nature Reserve, Pretoria: a, in habitat; b, flower; c, fruit. Photographs: T.P. Jaca.

ous plants) from various *Abutilon* species are widely used. Husain & Baquar (1974) reported that the fibre found in the genus could be used as a substitute for jute. Some species are also cultivated for ornamental purposes, as their flowers and seeds are aromatic (Burkill 1997). The seeds of certain species (e.g. *A. pannosum*) are used as a coffee substitute and consumed by some nomadic tribes. A number of species of *Abutilon* are medicinally important and used in the treatment of various diseases, for example: *A. mauritianum* leaves are used to treat diarrhoea, gonorrhoea, are gargled for sore throat, and wood is used to clean teeth; *A. angulatum* leaves are used as remedy for hiccups; in Tanganyika the roots of *A. guineense* are sliced and boiled with millet and sorghum flour to make a *pap* (porridge) that is used to treat sexually transmitted diseases such as syphilis (Burkill 1997). Furthermore, the leaves of *A. mauritianum* and *A. fruticosum* are eaten by grazing animals. In some areas, e.g. in Burkina Faso, *A. grandifolium* leaves and fruiting stems are used to produce a decoction that is applied as an enema for the treatment of measles and for the treatment of insect bites (Meeuse 1961; Dyer 1975; Achigan-Dako 2010; Khadabadi & Bhajipale 2010). Although information on the properties of the fibre remains scant, *A. grandifolium* is cultivated, mostly in Africa and China, as a potential fibre crop and as an ornamental plant. There are no identified toxins present in *A. grandifolium*, or the genus *Abutilon* at large (Khadabadi & Bhajipale 2010; Pingale & Virkar 2011), however, continuous consumption, especially of seed extracts of some species such as *A. glaucum*, has been shown to cause liver and kidney damage if taken for more than two weeks at concentrations of 300 mg/kg/day (Shama et al. 2012).

In South Africa, *Abutilon grandifolium* occurs in riparian areas, riverine forests, wastelands, and along forest margins and roadsides (Figure 2). In some parts of the world the species prefers typical savanna habitats, exposed rocky slopes, disturbed sites, grasslands and rarely in moister habitats such as dense thickets and forests (Meeuse 1961; Achiga-Doko 2010; Environmental Weeds of Australia 2015). In areas where it has been introduced, the species is regarded as a minor weed or potential environmental weed that has escaped cultivation (Environmental Weeds of Australia 2015). The species is pollinated by bees.

Abutilon species can be cultivated in well-drained moderately fertile soil, under light shade or bright sun. In cool climates seedlings must be kept indoors. Leading shoots can be pruned in late winter for a compact form, although some cultivars display their flowers best on long arching branches. Plants can be propagated from tip cuttings in late summer (Kirsten 2004).

Abutilon grandifolium has a Red List conservation status of Least Concern (Foden & Potter 2005).

Description (compiled from specimens examined in the National Herbarium, Pretoria, and based on unpublished notes by Dr O.A. Leistner).—Shrub, 1–3 m high; stems, petioles and pedicels with a dense indumentum of conspicuous, patent, short multicellular, and very short fine stellate to simple hairs, 2–4 mm long. *Leaves* ovate-cordate to suborbicular-cordate, (30–)50–150(–240) × (20–)30–110 (–180) mm; apex acute; margins shallowly serrate or crenate to dentate; upper surface dark green, finely stellate-pubescent; lower surface paler, greyish green, ± softly stellate-tomentose; petioles (15–)30–90(–160) mm. *Flowers* axillary, mostly solitary, yellow or orange; pedicels 10–100 mm. *Epicalyx* absent. *Calyx* 10–15(–18) mm, finely stellate-velutinous, at length glabrescent, 5-lobed, lobes 6–12(–15) mm. *Petals* yellow or orange, 16–22 mm, broadly obovate-cuneate, dense tufts of hairs present on and near margins at base, outer surface glabrous. *Style* branched at tip, branches 6–8 mm, as many as carpels; column 3–4 mm. *Carpels* usually dehiscing at ventral suture. *Mericarps* 9–16, (2–)3–5-seeded, obliquely ovate-rectangular, upper ventral edge curving upwards and outwards and terminating at dorsal angle in a short tooth or awn up to 2 mm long. *Seeds* reddish brown, 2.0–2.5 mm, subreniform, glabrous. *Flowering time*: September–April in South Africa. Plate 2309.

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T.P. JACA[*]§, N. PHEPHU[*] and GILLIAN CONDY[*]

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[*] South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.
§ Author for correspondence: t.jaca@sanbi.org.za

Phaeoptilum spinosum Nyctaginaceae

Southern Africa

Phaeoptilum spinosum *Radl.* in Abhandlungen herausgegeben vom Naturwissenschaftlichen Vereine zu Bremen: 8: 435 (1884). *Nachtigalia protectoratus* Schinz ex Engl.: 133 (1895), *nom. nud* in syn. *Phaeoptilum heimerlii* Engl.: 133 (1895). *Amphoranthus spinosus* S.Moore: 305, 310, fig. 441A (1902).

Phaeoptilum spinosum is a woody plant which, at first glance, has a shrubby growth form and flowers that resemble *Lycium*. It also has 4-winged fruits similar to that of *Combretum*. This member of the Nyctaginaceae might appear bizarre and atypical for its family, but closer scrutiny of the reproductive characters reveals its affinity.

The Nyctaginaceae is a small family of about 30 genera and 400 species worldwide (Douglas & Spellenberg 2010). The family is represented by five genera in southern Africa: *Boerhavia*, *Commicarpus*, *Mirabilis*, *Pisonia* and *Phaeoptilum* (Germishuizen & Meyer 2003). Twenty species are recognised locally of which three are introduced (Struwig 2012; Struwig & Siebert 2013a, b). Unlike the other southern Africa genera, *Phaeoptilum* is a monotypic genus endemic to the arid regions of southern Africa (Jordaan 2000). It occurs in Angola, Botswana, Namibia, and the Free State, Limpopo and Northern Cape provinces of South Africa (Figure 1).

Phaeoptilum spinosum, the only member of the tribe Bougainvilleeae (Douglas & Spellenberg 2010) found in southern Africa, is a spiny shrub of up to three metres high (Figure 2) with linear leaves arranged in fascicles on short spur-shoots. It is distinct from the other four genera in southern African in both vegetative and reproductive characters (Table 1).

In its natural habitat *Phaeoptilum spinosum* is easily confused with *Lycium* species in vegetative growth, as both genera have spiny branches and leaves arranged in fascicles (Coates Palgrave 2002). They differ in that flowers of *Lycium* species are white, purple or mauve, each 8–20 mm long with both a calyx and corolla present (Coates Palgrave 2002), while those of *P. spinosum* are greenish yellow to pale yellow, each 6–8 mm long and consist of a petaloid calyx (Stannard 1988; Coates Palgrave 2002).

The most striking characteristic of *Phaeoptilum spinosum* is its 4-winged anthocarp – a structure consisting of an achene enclosed by the lower part of the perianth (Spellenberg 2004) – that can be mistaken for the samara of *Combretum*. The anthocarp of *P. spinosum* is initially red, pink or purple, but turns brown with age, while the samara of *Combretum* is yellow-green or reddish-brown drying brown (Coates Palgrave 2002).

PLATE 2310.—1, flowering branch. × 1; 2, fruiting branch with winged anthocarps, × 1. Voucher specimen: *Struwig 149* in A.P. Goossens Herbarium, Potchefstroom. Artist: Gillian Condy.

PLATE 2310 *Phaeoptilum spinosum*

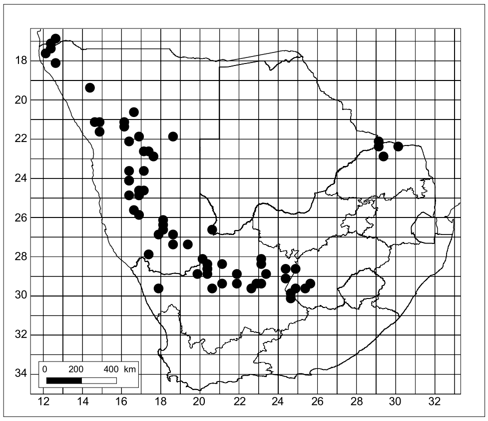

FIGURE 1.—Known distribution of *Phaeoptilum spinosum* based on herbarium specimens.

Phaeoptilum spinosum was first described by Ludwig Adolph Timotheus Radlkofer based on a specimen collected in the Hantam region in 1869. The species commonly occurs in the arid parts of the Savanna and Nama-Karoo biomes of southern Africa, and in drier parts of the Grassland Biome in South Africa. Where encountered, this shrub is always found in full sun within thorny (often in association with *Acacia* or *Rhigozum* species), low, open to closed shrubland. These shrublands occur mainly on plains or in dry riverbeds and are often prone to overgrazing. *Phaeoptilum* is also associated with gentle rocky slopes on ridges and outcrops of hills (*koppies*), and can be found on the rocky upper slopes of mountains on the edge of the Namibian escarpment. Its preferred soil substrate is alluvial sediments, hence its preference for plains and watercourses. Where it is found on rocky outcrops, hills or mountains, the underlying rock is most often dolerite, granite, lime-

TABLE 1.—Differences in the vegetative and reproductive characters of the Nyctaginaceae genera from southern Africa

	Phaeoptilum	*Boerhavia*	*Commicarpus*	*Mirabilis*	*Pisonia*
Habit	Shrub; branches terminate in spines	Annual or perennial herbs; unarmed	Perennial herbs or subshrubs; unarmed	Perennial herbs; unarmed	Scandent shrub or small tree; axillary spines
Leaf base	Subsessile or sessile	Petiolate	Petiolate	Petiolate	Petiolate
Leaf arrangement	Fascicles on short spur-shoots	Solitary, opposite	Solitary, opposite	Solitary, opposite or alternate	Solitary, subopposite or alternate
Leaf shape	Linear	Linear to orbicular	Cordate, deltoid, lanceolate, ovate, orbicular	Ovate, oblong, lanceolate, deltoid	Elliptic to circular
Flower arrangement	Solitary or fascicled	Cyme or umbel	Umbel	Cyme	Cyme
Flower colour	Greenish yellow	Pink, purple, maroon, white	Pink, purple, white	Pink, purple, white, yellow, variegated	Greenish
Flower shape	Campanulate	Distinct lower and upper part. Lower part ovoid to clavate; upper part campanulate	Distinct lower and upper part. Lower part cylindrical or clavate; upper part infundibuliform	Salverform	Infundibuliform or urceolate
Anthocarp	4–5-winged; central portion fusiform	3–5-winged or 5-ribbed; ellipsoid-clavate or clavate	10-ribbed; clavate, cylindrical, elliptic-clavate, fusiform	Subglobose to ellipsoid	4–5-angled; oblong to clavate

stone or quartzite. It is also found on calcrete, chert, gneiss, mica and shale. Its preferred soil is well-drained and structurally coarse, stony (gravel) and sandy. It has also been recorded from red, loam soils.

Phaeoptilum spinosum is commonly known as brittle thorn, *bloudoringbos* or *brosdoring* (Afrikaans), with the latter referring to the branches that break easily. Namibian vernaculars of the plant are *otjinanguruve* (Otjiherero) and ||àri.s (Khoekhoegowab) (Curtis & Mannheimer 2005).

The generic name *Phaeoptilum* (Greek for *phaeos*, meaning dusky, and *ptilum*, meaning feather) probably refers to the brown and wrinkled fruits. The specific epithet, *spinosum*, refers to the branches that end in spiny tips (Glen 2004). It is browsed by wild ungulates such as eland and is visited by a wide variety of insects when in flower (Curtis & Mannheimer 2005). *Phaeoptilum spinosum* is a preferred shrub in the diet of goats in Namibia (Rothauge et al. 2003).

Phaeoptilum spinosum flowers and produces fruit from October to February, but reproductive parts can appear as early as August (late winter) and as late as May (early winter), depending on rainfall.

Description.—Woody shrub up to 3 m high, densely branched, branches terminating in spines, brittle, spreading; bark greyish yellow to greyish brown. *Leaves* simple, in fascicles on short spur-shoots, sessile or subsessile, (9–)10–30 (–40) × 1–4 mm long, linear, apex rounded or emarginate, base attenuate; some-

FIGURE 2.—*Phaeoptilum spinosum* habit in the Kaokoveld, Namibia. Photograph: A.E. van Wyk.

what fleshy, coriaceous, yellow-green to grey-green; glabrous to pubescent. *Flowers* solitary or in fascicles, bisexual or unisexual, usually on leafless branches, scented; bracteate. *Perianth* tube campanulate, 4–8 mm long; 4(5)-lobed, lobes spreading, ovate, rounded to triangular at the tips, greenish yellow to pale yellow, tomentose. *Stamens* 8(9); of two different lengths; longer stamens 6.0–12.5 mm long, slightly exserted; shorter stamens 4–10 mm long; filaments connate into a short sheath around the ovary; reduced in female flowers; anthers oblong-elliptic, 0.5–2.0 mm long. *Gynoecium* reduced in male flowers. *Ovary* stipitate, fusiform-elliptic, 1-ovulate; style asymmetrically inserted at the apex of the ovary, 1.5–3.5 mm long; stigma truncate or penicillate. *Anthocarp* 15–25 × 12–20 mm; broadly 4- or 5-winged, wings semi-circular; central portion fusiform; red, pink or purple turning brown with age; pubescent to glabrescent. *Fruit* an achene, 7–8 mm, oblong-elliptic, brown. Plate 2310.

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M. STRUWIG*, S.J. SIEBERT**, L. ZIETSMAN*** and GILLIAN CONDY****

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* Department of Botany, University of Zululand, Private Bag X1001, KwaDlangezwa, 3880 South Africa.

* Author for correspondence: StruwigM@unizulu.ac.za

** A.P. Goossens Herbarium, Unit for Environmental Sciences and Management, North-West University, Private Bag X6001, Potchefstroom, 2520 South Africa.

*** Department of Botany, National Museum, P.O. Box 266, Bloemfontein, 9300 South Africa.

**** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

Vaccinium exul Ericaceae

Malawi, South Africa, Swaziland

Vaccinium exul *Bolus* in Hook. Ic. Pl. t. 1941 (1890); Brown: 1 (1905); Hutchinson: 351 (1946); Verdoorn: 92 (1954); Palmer & Pitman: 1719 (1973); Compton: 411 (1976); Coates Palgrave: 860 (2002); Braun et al.: 62 (2004); Klopper et al.: 274 (2006). *Vaccinium africanum* Britten: 23, t. 4 (1894). *Vaccinium exul* Bolus var. *africanum* (Britten) Brenan: 496 (1954).

When one thinks of the family Ericaceae in South Africa, the mind immediately pictures the ericas of the Western Cape. There is, however, a lesser known genus, *Vaccinium*, represented by a single species in the subcontinent (Koekemoer et al. 2014). Globally *Vaccinium* is best known for being a fruit source with most species wild harvested and only a few developed into economic crop plants. The genus *Vaccinium* occurs mainly in the northern hemisphere (tropical America and Asia) with the best-known species there the bilberry (*V. myrtillus*), the cowberry (*V. vitis-idaea*), the highbush blueberry (*V. corymbosum*), the lowbush blueberry (*V. angustifolium*) and the cranberry (*V. oxycoccos*) (Vaughan & Geissler 1999). The taxonomy of the genus *Vaccinium* is complex and remains unresolved. A number of the Asian species seem to be more closely related to the genus *Agapetes* than to other *Vaccinium* species, which may explain the divergent number of taxa for the genus from different sources. The number of species ranges between 140 and 500 (Palmer & Pitman 1973; Oliver 2000; Stevens et al. 2004; Fang & Stevens 2005; Beentje 2006; Van der Kloet 2009; Biodiversity Explorer 2014; EOL 2014). Species are globally widely distributed, occurring mainly in Malaysia and the northern temperate zone but extending to the mountains in the tropics, and with two species in Africa and four in Madagascar (Beentje 2006; Phillipson 2008). A classification predating molecular phylogeny divides *Vaccinium* into subgenera and several sections, with *V. exul* in subgenus *Vaccinium* and section *Cinctosandra* (Kron et al. 2002).

Harry Bolus, on one of his many collecting trips, from Lourenço Marques (known as Maputo since independence, Mozambique) to Barberton (South Africa) (Glen & Germishuizen 2010) in 1886 collected a plant that N.E. Brown, when going through his collections, alerted him of the discovery of what was then the first *Vaccinium* known from Africa. This represented the southernmost member for the genus. Bolus (1890) eventually described his new discovery as *V. exul*.

In 1894, a few years after the description of *V. exul*, Britten also saw material of a *Vaccinium* collected from Africa by Whyte. At the time Britten, unaware of the description of Bolus, believed that he had found the first African species of this genus. He aptly named the specimens with their white to pink flowers *V. africanum* and deduced that it should be a 'conspicuous figure in the landscape' (Britten et al.

PLATE 2311.—1, flowering branch, × 1; 2, fruiting branch, × 1; 3, fruit, × 4. Vouchers specimens: 1, *JE Burrows & SM Burrows 12350* in Buffelskloof Nature Reserve Herbarium; 2, 3, *JE Burrows & SM Burrows 14013* in Buffelskloof Nature Reserve Herbarium. Artist: Sandie Burrows.

PLATE 2311 *Vaccinium exul*

TABLE 1.—Comparison between *Vaccinium exul* and *V. stanleyi* (Beentje 2006)

	Vaccinium exul	*Vaccinium stanleyi*
Corolla length	5.0–6.5 mm	2.5–4.0 mm
Corolla diameter	3.0–4.5 mm	4.5–5.5 mm
Anther length	3.0–3.5 mm	1.1–1.2 mm
Anther form	broadly urceolate with parallel horns	narrowly urceolate with divergent horns

1894). The flowers, however, are actually hidden by the foliage which does not make them very visible and in the dense riverine or forest margins where this species grows it would probably not stand out from the surrounding vegetation as alleged by Britten.

Despite the slight differences in hairiness of the stems, the shape and reticulation of the leaves, the length of the inflorescences, coupled with the disjunct distribution between the material of Bolus and Whyte, and with the precedence of the Bolus name, Brown (1905) reduced *Vaccinium africanum* to synonymy under *V. exul*. This decision was upheld by Verdoorn (1954). Despite Brenan's (1954) separation of the Whyte material as a variety of *V. exul*, it is generally accepted as a single taxon by workers on this group.

In continental Africa, the genus is currently represented by two species: *Vaccinium exul* and *V. stanleyi* (Beentjie 2006; Klopper et al. 2006). These are complemented by another four species from Madagascar: *V. fasciculatum*, *V. laevigatum*, *V. madagascariense* and *V. secundiflorum* (Beentje 2006; Klopper et al. 2006; Phillipson 2008; Schatz et al. 2011). In sub-Saharan Africa the presence of *V. madagascariense* still needs to be confirmed as the specimen of *Forbes s.n.* (K) is of doubtful origin (Ross 1983). Of interest is that the latter species has been cited for Mozambique, but Ross (1983) alludes to the possibility that the specimen may have originated from Madagascar rather than Mozambique. The resemblances of *V. stanleyi* to *V. exul* are elaborated on by Beentje (2006) (Table 1). The difference of *gestalt* between our plate and that illustrating *V. stanleyi* (Beentjie 2006) becomes quite apparent when they are compared.

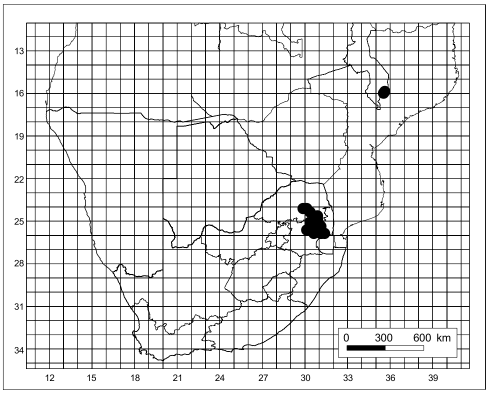

FIGURE 1.—Known distribution of *Vaccinium exul* based on herbarium specimens at PRE and BNRH.

Vaccinium is an old Latin name with uncertain origin (Rehder 1967; Palmer & Pitman 1973). The most plausible explanation for the generic name is that it was used in classical Latin as *vaccinium* indicating a plant (possibly the bilberry) and it was derived from the corruption of the stem of the Latin word *bacca* (berry) which was spelt as *vaccinium* instead of *baccinium* (Coombers 1994; Hyam & Pankhurst

1995; Gledhill 2002). It does, however, not refer to a similar word *vaccinum* that means dun in colour (Stearn 1973) or relating to cows (Glare 1983). The specific epithet of the African blueberry, *exul* (exile), was chosen as this was the first representative from Africa and geographically it was far removed from the centres of diversity for this genus and hence alludes to being the 'exile' or 'outcast' species (Lewis & Short 1933; Gledhill 2002) in relation to the other *Vaccinium* species.

Vaccinium exul is found on the Eastern Escarpment in South Africa and Swaziland, with its northern limit a disjunct distribution on Mount Mulanje in Malawi. In South Africa it is restricted to the high altitude escarpment areas of the Mpumalanga Province and in the Limpopo Province in the Soutpansberg (Schmidt et al. 2002). In comparison, globally most *Vaccinium* species are native to the northern hemisphere, with the greatest centres of diversity in North America and eastern Asia (EOL 2014) where species often also grow in temperate to cold temperate climates.

In South Africa *Vaccinium exul*'s habit is usually that of a shrub or small bush, rather than a tree. However, it does become tree-like especially in its northern distribution limit on Mount Mulanje where plants can grow up to 4 m tall (Palmer & Pitman 1973). Plants are single-stemmed, branched from the base, or frequently coppicing when damaged or burnt in their natural habitat which is prone to frequent fires.

The African blueberry grows in montane areas and along forest and stream margins (here frequently in association with *Myrica* species). The habitat is usually at high altitudes in areas with low winter temperatures, amongst rocky outcrops and steep mountain grassland, in bush clumps and along afromontane forest and riverine margins. The depicted specimen grew in riverine vegetation. Plants have been recorded from altitudes of 1 280–2 438 m in South Africa, and at altitudes of 1 890–2 400 m on Mount Mulanje.

In South Africa the African blueberry is mainly associated with the northeastern Mountain Grassland vegetation type (Bredenkamp et al. 1996) which comprises the grasslands of the northern parts of the great escarpment mountains in Mpumalanga and extends to the north and south. These areas receive a high summer rainfall (700–1 100 mm per annum) and mist contributes substantially to the total precipitation. The temperatures range from -8–39°C (with an average of ± 15°C). The soils on the steep rocky mountainsides where it grows are usually shallow, nutrient poor and acidic. In winter the low temperatures, frost and snow are further important determinants of this vegetation type (Bredenkamp et al. 1996) which produce suitable natural habitat for *Vaccinium exul* to grow in.

Vaccinium exul was assessed as Least Concern (LC) and is currently not considered threatened in either South Africa (Foden & Potter 2005; Raimondo et al. 2009) or Swaziland (Dlamini & Dlamini 2002). However, its natural habitat and vegetation type (mainly Lydenburg Montane Grassland) is considered vulnerable and regarded as of conservation importance (Mucina & Rutherford 2006).

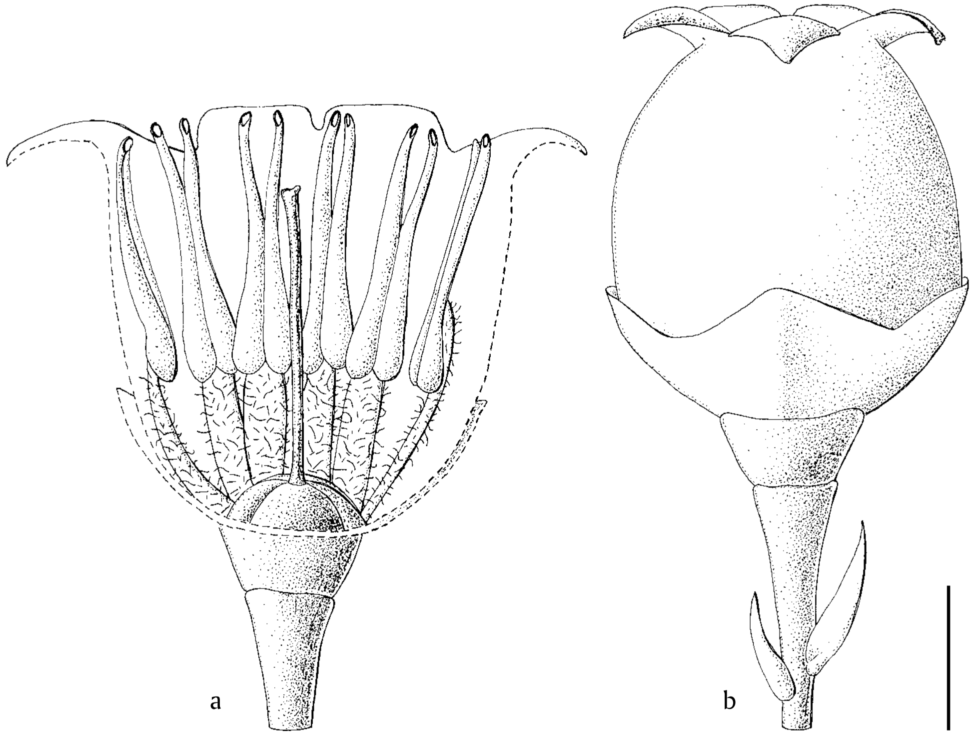

FIGURE 2.—Flower of *Vaccinium exul*: a, flower with section of calyx, corolla and some anthers removed; b, intact flower. Scale bar: 2.5 mm. Artist: S.M. Burrows.

Plants usually flower in early spring and the recorded flowering time is from August to November (specimens in bud recorded for July to September), with successive fruiting from November to May (but mostly in April and May).

Material of *Vaccinium exul* has successfully been cultivated by J.E. Burrows (pers. comm. 2012) but if grown outside natural high altitudinal ranges with its specific environmental conditions, it does not fare well in cultivation. In a study by Meyer & Prinsloo (2003) it was noted that the areas with a suitable climate for the production of commercial blueberries in the Eastern Highveld (South Africa) coincide with the areas of natural distribution of *V. exul*. Here the mean annual temperature of 14.4°C, and mean winter minimum/maximum temperatures of 2.4/18.4°C, is on average low enough to make the cultivation of commercial blueberry crops viable. Additionally the suitable shallow soils with a low clay content and pH of 3.5–4.5 that form in these high rainfall areas may enhance the requirements for supplying early produce for fresh fruit export when markets experience low supplies. *Vaccinium exul* is a ‘crop wild relative’ and should be considered a candidate with potential traits that can enhance commercial crop harvests in the area.

Blueberries have been cultivated for more or less the last two centuries from original stock in North America and Europe, and are now commercially grown in countries other than their origin, for example in central Europe, South Africa, Australia and New Zealand (Biodiversity Explorer 2014). Commercially cultivated blueberries come from a variety of different *Vaccinium* species originating mainly from eastern North America. The main cultivars originated from *V. corymbosum* and *V. australe* and their hybrids. Only a few species are harvested from wild-growing plants. These are encouraged to spread and grow through environmental manipulation like removing competing vegetation and regular burning. The North American species have been most actively selected and improved, and blueberry cultivation has not only become relatively extensive in the USA, but the North American species have also been imported into other temperate countries. The utilisation of the African blueberry or introduction of its genes into commercial varieties should receive serious consideration for future developments.

Cultivated varieties of *Vaccinium* developed only during the last century – making this one of the most recently domesticated fruit crops (EOL 2014). The fruit of *V. exul* is edible, and from personal experience by one of us (SB) compares well in taste and size to commercially cultivated blueberries. The fruits are suitable for desserts (Schmidt et al. 2002) or can be used to produce a pleasant jam (Fox & Norwood Young 1982; Roodt 1994; Coates Palgrave 2002). *Vaccinium* berries are generally utilised as fresh or dried fruit, processed as jam or jellies, preserves used in pastry products, as juice and even in wines, and Christmas decorations (Stevens et al. 2004). The African blueberry cannot be used for any of the aforementioned uses because it is not commercially available and it has a restricted natural distribution range. Unfortunately the fruits of blueberries do not have a very long shelf life, and damage easily in transit. Therefore, the fresh berries will probably always be relatively expensive.

Although information on the indigenous uses of the African blueberry is almost non-existent in literature, various general attributes of *Vaccinium* species are listed on the EOL website (2014). It is a good source of vitamin C, among fruits and vegetables it is the third most antioxidant rich, and it has the highest chemical effectiveness in preventing oxidation in cells (most of the anti-oxidant activity is in the juicy portion). In clinical studies on animals, blueberries have shown a reduction in the build-up of low-density lipoprotein (LDL) cholesterol, which in turn may reduce heart disease, stroke and atherosclerosis. Further benefits include the reversal of some aging effects, including loss of coordination and balance, improved short term memory, and some reverse of a decline in motor skills. Whether blueberries will show the same effect in humans has not yet been tested. None of the aforementioned properties have been tested on *V. exul* which present scope for much further research.

Plants are very decorative. Cultivated plants in a garden will not only be an asset in terms of their structural value and evergreen foliage, but they will surely attract birds with their fruits. Because the plant is adapted to areas with low winter temperatures it will probably not flower or fruit well if planted in areas that do not resemble their natural conditions.

Although not observed in *Vaccinium exul*, in general *Vaccinium* species are used as food plants by the larvae of a number of Lepidoptera (butterfly and moth) species –

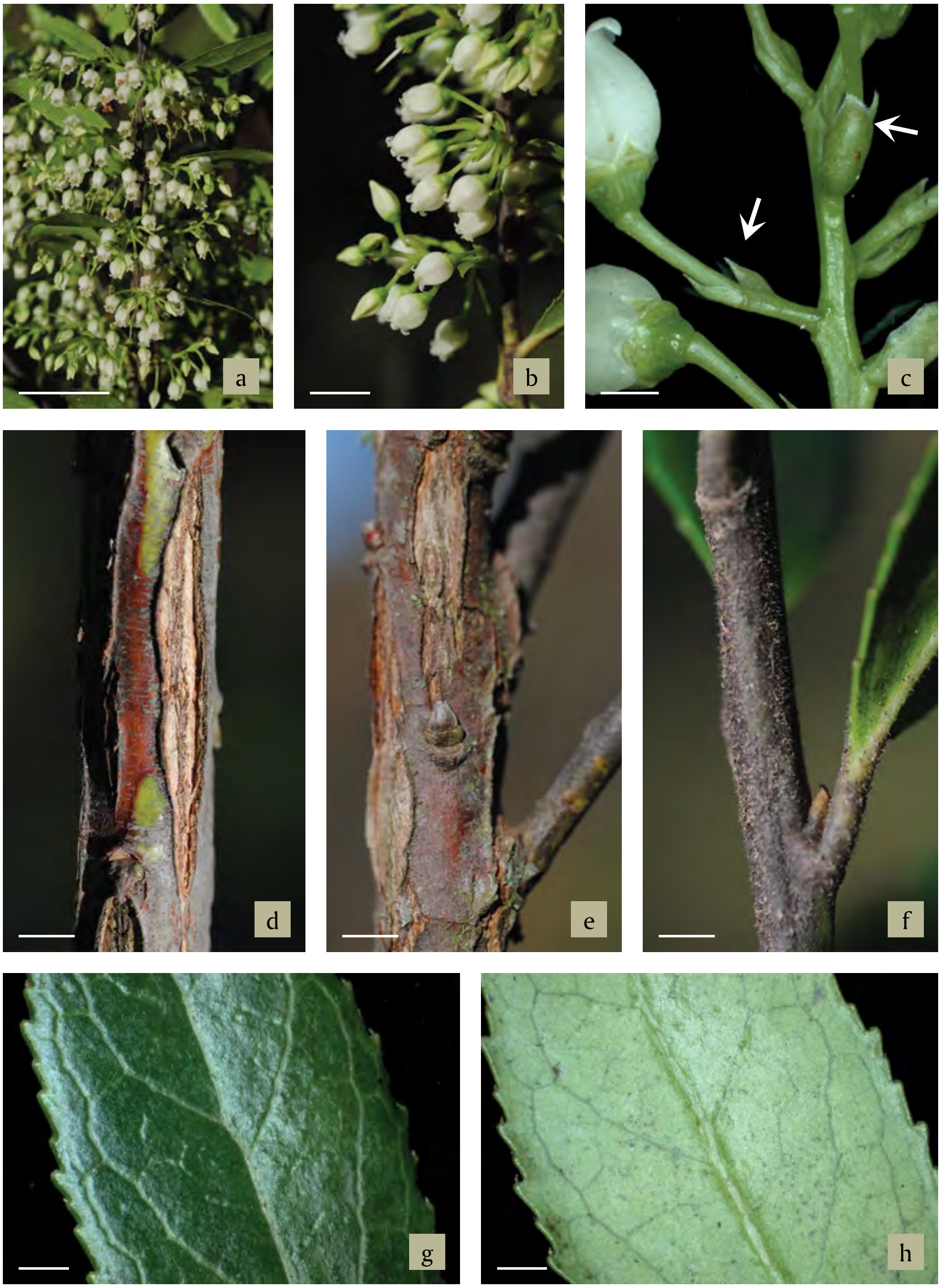

FIGURE 3.—*Vaccinium exul*: a, b, inflorescences; c, part of inflorescence showing bracts and bracteoles; d, e, section of older branches forming characteristic striations; f, hairy young branches; g, adaxial side of leaf showing dentate margin; h, abaxial side of leaf showing prominent venation; g, h, bicolourous leaf. Scale bars: a, 12 mm; b, 6 mm; c, g, h, 2 mm; d–f, 3 mm. Voucher specimen: *Bester 11943* (BNRH, MO, NBG, PRE, PRU, UNIN, WAG). Photographs: S.P. Bester.

see list of Lepidoptera that feed on *Vaccinium* (EOL 2014). It is a generally important food source for numerous species of mammals and birds.

Little is known of the pollination syndromes in the Ericaceae as a whole. The narrow opening of the urceolate corolla in *Vaccinium exul* where the anthers with their porate openings are positioned approximately at the mouth of the corolla and the production of nectar could be indicative of buzz-pollination as in *V. stammineum* (Stevens et al. 2004) despite the unapparent scent that could not be established (SPB, pers. obs.). The baccate fruits are presumably eaten by birds and dispersal is endozoochorous. In *Vaccinium* section *Oxycoccus* the fruit, however, floats and water dispersal seems to be an option (Stevens et al. 2004). Like most *Vaccinium* species, the seeds are dispersed by birds that feed on them.

Description (adapted from Verdoorn [1954] and Beentje [2006] with additional measurements from specimens at PRE).—Shrubs or small trees 0.8–4(–7) m tall, single-stemmed or more usually much-branched from the base; branchlets somewhat sub-angular and thinly pubescent (Figure 3f). *Bark* grey, pale brow or reddish, sometimes striated (Figures 3d, e). *Leaves* alternate, dark green and glossy above (Figure 3g), below light green sometimes blue-green (Figure 3h), leathery, lanceolate to ovate-lanceolate, 30–70 × 9–32 mm, glabrous or pubescent on midrib; margin serrate (Figures 3g, h); apex acute or sometimes tapering; base slightly cuneate or subrounded, shortly petiolate; petiole about 2–5 mm long, frequently tinged pinkish. *Inflorescence* an axillary raceme (Figures 3a, b), shorter than or as long as subtending leaf, to 40 mm long, usually somewhat hidden amongst foliage; pedicels 5–12 mm long, bracteolate; bracts and bracteoles variable in size, usually 2–5 mm long, base broad and semiamplexicaul, tapering into an acute or occasionally sub-obtuse apex, or bracteoles rarely acuminate and ciliate (Figure 3c). *Flowers* (Figure 2) white to cream sometimes pale pink or with a pinkish tinge; calyx tube basally fused to ovary, ± 2 mm long, glabrous; calyx lobes sub-triangular from a broad base, ± 1 × 1.5 mm at base. *Corolla* 6–7 mm long, oblong, urceolate; tube ± 5 mm long, constricted in throat; lobes ± 1.5 mm long, spreading to recurved (Figure 2b), dull- or off-white, cream or white rarely greenish, faintly musky or softly sweetly scented. *Stamens* 10, included to manifest; filaments linear, ± 2.5 mm long, pilose; anthers to 4.5 mm long, cells narrowing to apex and ending in apical pores, apices at level of mouth or slightly exerted from corolla tube (Figure 2a). *Ovary* inferior, 4–5-chambered with 1 to many ovules in each chamber; style ± 5 mm long, straight; stigma small, capitate. *Fruit* fleshy, succulent berry, sub-globose, 5–10 × 5–10 mm in diam. when dry (slightly larger when fresh), with remains of persistent, shrivelled calyx lobe bases encircling it near apex, greenish or yellowish turning red, maroon, bluish or black when ripe. Plate 2311.

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S.P. BESTER* and SANDIE BURROWS**

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* South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa / School of Environmental Sciences and Development, North-West University, Potchefstroom, 2520 South Africa.

* Author for correspondence: s.bester@sanbi.org.za

** Buffelskloof Nature Reserve and Herbarium, P.O. Box 710, Lydenburg, 1120 South Africa.

PLATE 2312 *Schizostephanus gossweileri*

Schizostephanus gossweileri Apocynaceae

Namibia

Schizostephanus gossweileri *(S.Moore) Liede* in Botanical Journal of the Linnean Society 114: 92 (1994). *Cynanchum gossweileri* S.Moore: 363 (1912).

Schizostephanus gossweileri is a twining, succulent-stemmed, deciduous creeper bearing greyish stems 0.7–4.0(–10.0) m long. The side branches are often articulated and swollen at the base, somewhat brittle and will root when detached or touching a substrate. Although *S. gossweileri* is not an obligatory cremnophyte, this vegetative back-up strategy is typical for many cliff-dwelling species (Van Jaarsveld 2011).

This rare species, when not in leaf or flower, superficially resembles *Sarcostemma*. It is only known from four gatherings: one from north-central Angola (type collection from Gossweiler), a collection from southwestern Angola (Bruyns & Klak 2009) and two collections of material from the Kaokoveld in northern Namibia (Figure 1).

The specimen (*Van Jaarsveld & Emms 18876*) of our depicted plant was collected on Sunday 11 July 2004 on top of an exposed, west-facing cliff on the northwestern peak (at 1 836 m) of the high (almost 2 000 m) twin-peaked Otjihipa Mountains in northern Namibia. This conspicuous, high mountain consists of granite and is situated south of the Cunene River, just east of Koos Verwey's Camp Syncro who assisted us during our visit to Kaokoveld. As the crow flies, this peak of the Otjihipa Mountains is about 60 km from the Atlantic Ocean, receiving occasional fog from the coast. The vegetation type where our plant was found is Namib Desert, with open and sparse vegetation and associated species of *Commiphora* prominent (*C. africana*, *C. glaucescens*, *C. virgata*) and other succulent plants include *Cyphostemma currorii*, *Euphorbia eduardoi*, *E. guerichiana*, *E. berotica*, *E. monteiroi*, *Sansevieria pearsonii* and *Tavaresia angolensis*. The plant further shares its habitat with the rare *Othonna huillensis*, which is a relict element of the Cape Flora. The first record for Namibia of *Schizostephanus gossweileri* came quite as a surprise (Bruyns & Klak 2009). The plants are not common, only a few were spotted on the upper sea-facing, granite cliff face and were leafless at the time. The appearance of the cordate, green leaves and flowering time (small inconspicuous yellowish flowers in axillary racemes) coincide with the annual rainfall which is during summer and autumn, ranging between 100–150 mm per annum (Mendelsohn et al. 2002).

The plant has ascending stems becoming spreading and pendent, scrambling down the arid west-facing cliff face (Figure 2). The plants were first spotted by Paul Emms (student botanist at the time) accompanying our expedition to northern

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PLATE 2312.—1, plant showing mature branches (left), and younger branches with flowering racemes (right); 2, cross section of the young stem, × 1; 3, corolla from above × 3; 4, corolla from below, × 5. Voucher specimen: *Van Jaarsveld & Emms 18876* in Compton Herbarium, Cape Town. Artist: Marieta Visagie.

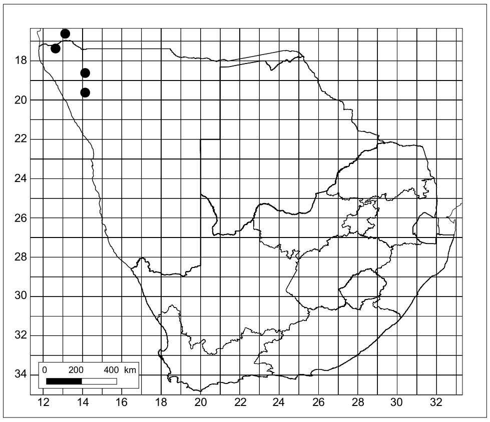

FIGURE 1.—Known distribution of *Schizostephanus gossweileri.*

Namibia in July 2004 through one of us (EvJ) being interested in the cliff-dwelling succulent plants (Van Jaarsveld 2011). Our other aim was to investigate a species of *Pelargonium*, earlier recorded by Pieter Winter (botanist at the South African National Biodiversity Institute) on an expedition arranged by the Thompsons (Van Jaarsveld & Van Wyk 2006). Our party was also accompanied by Mina Daling, Pietie Laubscher, Pierre le Roux, Tielman Haumann, Wessel Swanepoel, Werner Voigt and Louis Wessels. Vegetative material of *Schizostephanus gossweileri* was gathered together with the species of *Pelargonium* (later named *P. vanderwaltii*; Van Jaarsveld & Van Wyk 2006). The question remains, why would a twining succulent plant grow on cliffs? Does its occurrence here point to a prior moist period where vegetation was denser and the plants more common? Another interesting feature of the plant is that, although it easily detaches at the base of side branches (articulated at the base of stems), it has very strong white fibres in its bark and cortex, thus preventing detachment in other areas. With sufficient force it is possible to pull a branch apart to expose the strong white fibres. This phenomenon is also encountered in the genus *Sansevieria* where species have strong fibres in their leaves, but stems or leaves break clean at the base of the subterranean stems when pulled. In *Sansevieria* it is a clear adaptation to surviving grazing by large herbivores, whereas *Schizostephanus gossweileri* uses the same strategy to allow side branches to become detached with little force as a means of vegetative propagation.

Our expedition to the Okahukumune peak of the Otjihipa Mountains also produced other surprises: new species of *Ceraria*, *Commiphora* and *Aloe* (on the upper western slopes). The *Ceraria* and *Commiphora* species were found by Wessel Swanepoel, the one later named *Ceraria kaokoensis* (Swanepoel 2007), is reminiscent of the cerarias of the winter rainfall region. The aloe was named *A. kaokoensis* (Van Jaarsveld et al. 2006). *Ceraria*, *Pelargonium* and *Othonna* are relicts that show a clear affinity to the winter rainfall region, whereas our *Schizostephanus* show an affinity with the northern tropical African flora.

Back at Kirstenbosch the plants were rooted in sand and planted in the succulent house. When it flowered it was identified by Dr Peter Bruyns who, together with Dr Cornelia Klak, was preparing a paper on the species at that time (Bruyns & Klak 2009). When preparing herbarium specimens from the cultivated plants, one of us (EvJ) noticed the tough branches and its distinct fibrous nature. When stems are damaged or cut, our plant bears sap that is only slightly milky (almost clear), unlike many other members of the Apocynaceae that have milky latex.

FIGURE 2.—*Schizostephanus gossweileri* in habitat; scrambling over rocks in the Otjihipa Mountains, northern Namibia. Photograph: E.J. van Jaarsveld.

The second Kaokoveld record of *Schizostephanus gossweileri* was established by Wessel Swanepoel from the Joubertberge, near Ondjombo in December 2012. He reportedly found plants scrambling over and among dark dolomitic rock slabs (*Swanepoel 336*, WIND) at an altitude of 1 600 m.

Our species was first named *Cynanchum gossweileri* S.Moore in 1912 from plants collected by John Gossweiler. *Cynanchum* L. is a large genus with about 250 species (31 in Africa according to Liede, 1996) and a global distribution. Liede (1994) rightfully transferred it to *Schizostephanus* Hochst. with the only other species being *S. alatus* Hochst. ex K.Schum. that occurs in the Mpumalanga and Limpopo provinces, South Africa, and is widespread in tropical Africa as far north as Ethiopia (Liede 1994). She based her decision on the fact that it shares 'the long hairs on the adaxial side of the corolla lobes, stipitate gynostegium and the attachment of the pollinia along the dorsal rim with *S. alatus*' (Liede 1994). *Cynanchum* is usually evergreen, not distinctly succulent (like *Schizostephanus*), with an umbellate inflorescence and a distinct milky latex (Bruyns & Klak 2009).

The Swiss botanist John Gossweiler (1873–1952) collected the type material on the banks of the River Luinha (between Luinha and Canhoca railway station) in north-central Angola (Liede 1994). John Gossweiler made a large contribution to the knowledge of the flora of Angola collecting widely (14 000 numbers) (Figueiredo & Smith 2008). The genus name *Schizostephanus* is derived from the Greek *schizo* (I cut) and *stephanos* (a crown) in reference to the structure of the top of the corona.

Schizostephanus gossweileri is best grown in desert gardens where frost is light or absent (Van Jaarsveld 2010). It thrives as a garden plant but is also easily grown in containers. Grow the plants in a sandy loam soil enriched with compost; plants would benefit from organic fertiliser during spring. The plants are fast-growing in cultivation. Stems twine and does best when supported with a framework. Plants are easily propagated by the short succulent side branches during spring or summer and cuttings root easily. Plants rooted at Kirstenbosch were planted in the Welwitschia bed in the Kirstenbosch succulent nursery. Plants grew rapidly, twining around the construction of the nursery house to a height of 3 m, flowering annually during summer and autumn. It is susceptible to aphid infestation which can be controlled with an insecticide.

Specimens examined: Namibia, Otjihipa Peak, upper west facing cliffs, *Van Jaarsveld & Emms 18876* (NBG).

Description (based partially on Bruyns & Klak 2009).—Succulent shrubs 0.7–10.0 m tall, stems twining, sparingly branched, scrambling or ascending, becoming deciduous from autumn to end of spring. *Roots* fibrous. *Branches* at first green, ± 10 mm diameter, becoming brown and sparsely tomentose, eventually glabrescent and pale grey to greyish brown and longitudinally fissured (with pale green striations); older branches ± 15 mm diameter, side branches articulated at their bases and brittle at point of detachment; main branch to 45 mm diameter (at base), becoming corky; internodes 20–100 mm. *Leaves* decussate, bright green, sparsely pubescent when young, soon becoming glabrescent; ovate-cordate (ovate-lanceolate when very young); petioles 60–90 × 2 mm; blade 60–130 × 55–120 mm, pendent, spreading. *Inflorescence* axillary on young green side branches, ascending, racemose; peduncle 20–30 × 1.5–2.0 mm, the raceme 60–70 mm long, at first whitish tomentose becoming glabrous; bracts small, ovate to lanceolate 1.0–1.5 mm long; pedicels ascending, 5–6(–9) × 1 mm, green. *Sepals* ovate-deltate to oblong 1.5 × 1 mm, green, apex obtuse to acute, adpressed to corolla, glabrous. *Corolla* rotate, 7–8 mm in diameter, divided to almost its base, outside pale green, inside yellow becoming maroon lower down; tube absent; lobes spreading, twisted, linear-lanceolate 2.5–3.5 × 1.5 mm, glabrous, obtuse, margins, recurved. *Corona* with two series of lobes, 2–3 × 2.5–3.5 mm, glabrous; outer lobes fused into an urceolate or bowl-shaped tube 2–3 mm long, emarginate with 10 lobules around mouth; inner lobes to 1 mm long arising behind anthers and touching their bases, keeled and obtusely subulate to shortly rectangular and truncate. *Gynostegium* distinctly narrowed below anthers and sometimes with stripe broadening toward base of outer coronal tube. *Anther appendages* much shorter than style apex but completely covering it; style apex obtuse and slightly bifid. *Fruit* a pair of follicles, 60–90 × 12–20 mm, horizontally spreading, flattened, glabrous, green; seed numerous 6–7 × 2 mm, with coma of fine hairs 25 mm long at micropylar end. Plate 2312.

ACKNOWLEDGEMENTS

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E.J. VAN JAARSVELD* & MARIETA VISAGIE**

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* South African National Biodiversity Institute, Kirstenbosch, Private Bag X7, Claremont, 7735 South Africa / Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville, 7535 South Africa.

* Author for correspondence: e.vanjaarsveld@sanbi.org.za

** 12 Molteno Court, Molteno Drive, Stellenbosch, 7599 South Africa.

Ceropegia terebriformis

Apocynaceae:
Asclepiadoideae–Ceropegieae

Angola

Ceropegia terebriformis *Bester* sp. nov., closely resembles *C. stenantha* in the morphology of the fleshy roots, leaf and corona shape. Leaves are sometimes similarly downwards orientated, but frequently crossed-over. It is separated from the latter in its leaves being more succulent; presence of a distinct peduncle; more strongly expressed five-pocketed outer corona; apical segments that are spirally twisted with pronounced vibratile hairs; and presence of a double-barrelled basal inflation.

TYPE.—Angola, Huila Province, ± 2 km NW of Quihita en route to Chibia, just south of a tributary of the Caculuvar River, Quarter Degree Grid Square 1513BD, altitude 1 315 m, 28 January 2009 (cultivated at Walter Sisulu National Botanical Garden, flowered on 15 November 2012), *Condy 244* (PRE, holotype; K, isotype).

The genus *Ceropegia* has been well represented in this series with at least twenty-five taxa previously covered. The plates show the diversity of the group expressed in the morphology of the corolla, its diverse range of colour forms and pigmentation, and especially fascinating internal structures of the flowers that are adapted to insect pollination (for example Dyer 1969a,b, 1983b, 1985; Dyer & Lavranos 1982; Nicholas 1993; Olleron et al. 2009). Members of the genus have further been utilised by humans for various aspects including as a source of food, for medicine, as tanning agent, some are used in rituals, and for horticultural purposes (Collins 2011) in most cases driven by the wonderfully bizarre expression of the flowers.

The Apocynaceae is the vascular plant family with the sixth highest diversity in Angola. It is represented by 222 taxa of which 17 are endemic to the country (Figueiredo et al. 2009). A total of 15 species of *Ceropegia* (Stopp 1971; Goyder 2008) are represented in Angola.

Ceropegia is one of the larger genera of the tribe *Ceropegiae* (placed in the subfamily Asclepiadoideae and family Apocynaceae). Plants are perennial geophytic herbs and mostly succulent with either fleshy roots or tubers. In others the succulence is situated in the stem or leaves, and a few with the roots tuberous or fleshy and the aerial parts herbaceous, or rarely with fibrous roots only (Dyer 1983a; Victor 2001). The first account of the genus *Ceropegia* was given by Linnaeus (1753) with the last full revision that of Huber (1957) and the most recent comprehensive treatment of the genus by Meve (2002) which covers the 160 more or less succulent species with only about 25 non-succulent ones not covered (Kambale & Yadav 2012). The genus comprises between 160–200 species depending on which classification is followed (Dyer 1983a; Victor et al. 2000; Meve 2002; Bruyns 2003, 2014). The genus

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PLATE 2313.—1, habit (cultivated and trailing on support), × 1; 2, flower, × 2; 3, corona, × 25; 4, pollinium, × 55. Voucher: *Bester 9321b* sub *Condy 244* in National Herbarium, Pretoria. Artist: Gillian Condy.

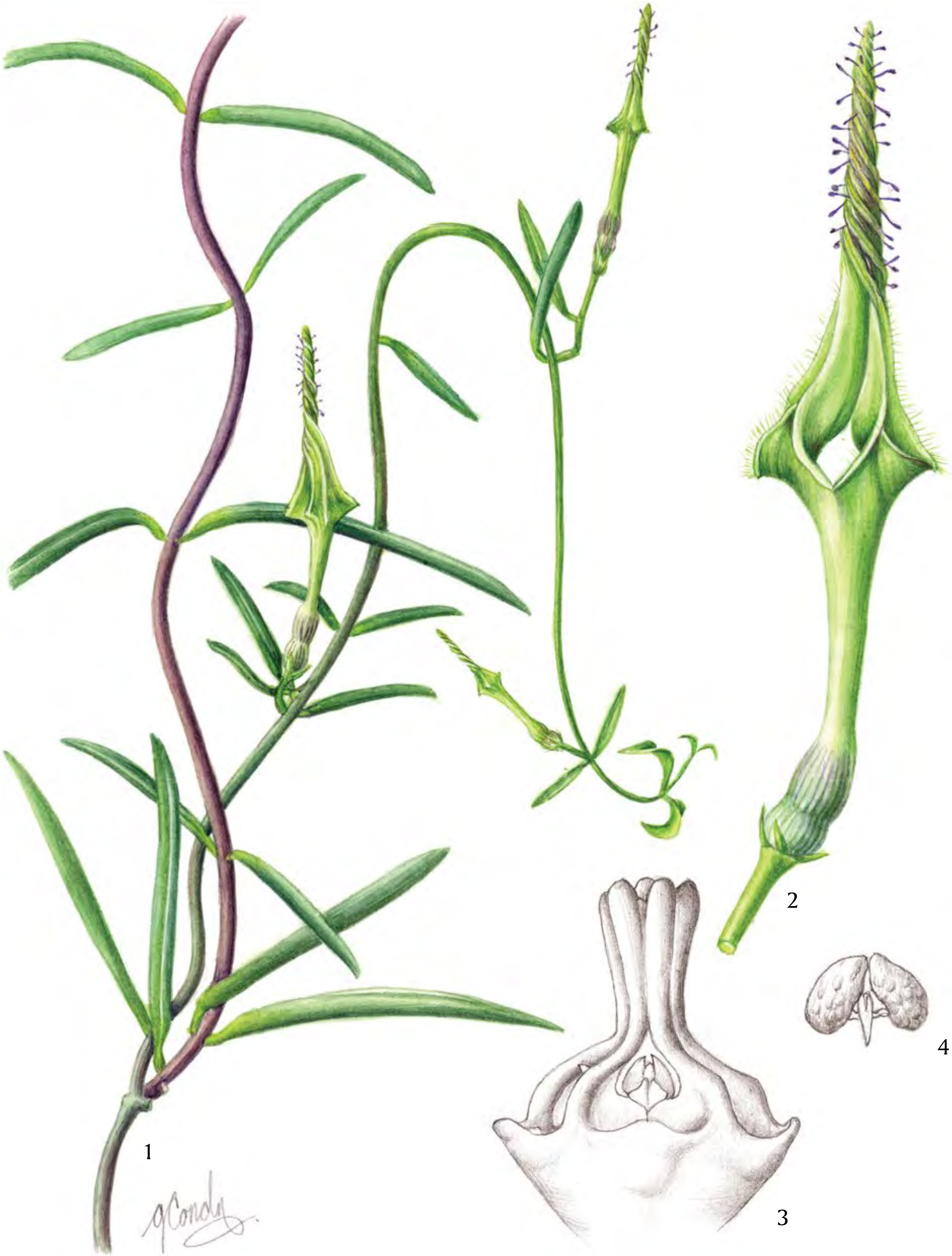

PLATE 2313 *Ceropegia terebriformis*

is widely distributed in Africa and Madagascar, extending in the east to Arabia, India and China, northern parts of Australia and as far as the Canary Islands (Dyer 1983; Victor 2001; Meve 2002; Bruyns 2014). The most diverse centres of diversity for the genus are Africa and India, each containing about a third of the taxa respectively (Kambale & Yadav 2012). In the last ± decade a number of new *Ceropegia* species have been described from various areas: Africa (Gilbert 2002; Bruyns 2003, 2004; Masinde 2004; Dold 2006; Masinde 2012; Goyder 2013), India (Yadav et al. 2006; Kambale & Yadav 2012; Kambale et al. 2012; Soumen 2013; Kullayiswamy et al. 2013) and Thailand (Kidyoo 2014).

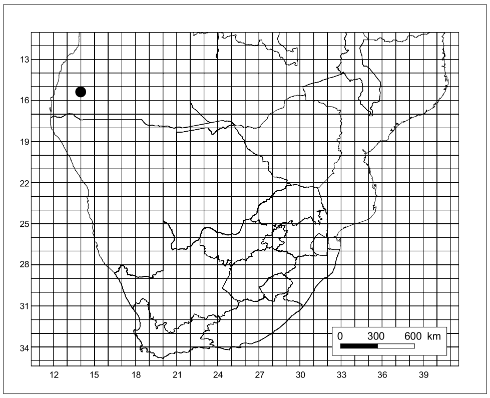

FIGURE 1.—Known distribution of *Ceropegia terebriformis*.

In 2008 an Angolan biodiversity assessment and capacity development project was organised by Brian Huntley between the South African National Biodiversity Institute (SANBI) and the Instituto Superior de Ciências de Educação (ISCED – Huíla) in Lubango, with the primary objective to develop Angolan biodiversity professionals (Huntley 2009). As part of this project, the first fieldwork was conducted in January 2009 by a number of biodiversity workers from various disciplines (Van Jaarsveld 2009). During this endeavour a plant growing in the black turf soils was collected in the undergrowth of acacia savanna, close to Quihita on the expedition's return journey from Lubango towards the Namibian border (Figure 1). When it eventually flowered in Pretoria, herbarium material and relevant literature were consulted in an attempt to identify the specimen. It did not match any of the Angolan species (Goyder 2008), or any of those listed for northern Namibia (Bruyns 1984, 2014) and hence is here described as a species new to science. In Huber's monograph (1957) he indicated that some characters (e.g. leaf shape) may be very variable, whereas others (e.g. pubescence), according to Dyer, can be relatively constant (Dyer 1983a). *Ceropegia* species in Angola and the northern parts of Namibia that have a similar expression of the corona include *C. floribunda* and *C. linearis* subsp. *linearis*, and the twisted corolla segments closely resemble *C. campanulata* (Huber 1957, 1967), but in this account the closest relative seems to be *C. stenantha* against which it is diagnosed. Resulting from the 2009 collections in Angola, a number of new species have been encountered, with at least the following already published: *Aloe mocamedensis* (Van Jaarsveld 2012), *Drimia intricata* var. *visagieae* (Van Jaarsveld 2014) and *Psednotrichia perennis* (Bergh & Nordenstam 2010).

The epithet *terebriformis* (drill-shaped) was selected in reference to the tightly, spirally-twisted segments of the corolla that resemble the shape of a drill-bit (Figure 2b).

FIGURE 2.—*Ceropegia terebriformis*: a, solitary flower; b, succulent leaves; c, base of corolla tube showing band of purple-maroon on inside and papillate surface; d, segments of corolla showing vibratile hairs and long white patent hairs on margins of lobes. Scale bars: a, 9 mm; b, d, 12 mm; c, 4 mm. Photographs: S.P. Bester.

The original material collected in January 2009 was a single live specimen, sterile at the time that it was brought back to Pretoria where it was subsequently cultivated. No specimen was made of the sterile material. The live plant flowered in March 2010, November 2011 and November 2012 respectively. From this it is assumed that the plant could flower from November to March in the wild, and this time should be targeted when searching for more wild specimens. In cultivation the fusiform roots sprout new stems early in October. Once the flower buds became visible, it took about 2–3 weeks for the flowers to fully develop and open. Plants went into dormancy towards late April with the aerial parts dying back fully.

The single living plant that was collected originated from a wooded plain in well-drained black turf soil in partial shade. The vegetation consisted of intermingled acacia and mopane woodland. The plant was grown, first at the Pretoria National Botanical Garden where it flowered in 2010. It was then moved to the nursery at the Walter Sisulu National Botanical Garden where it flowered again in 2011 and 2012. During the last flowering the plate was painted and the type specimens pressed. Unfortunately, although both the mother-plant and cuttings made from it initially survived and seemed well-adapted to cultivation based on the 2012 growth, all material eventually died. The original habitat was exposed to extensive grazing. *Ceropegia teberiformis* is only known from the type location in Angola (Figure 1) and until more material is found no conservation assessment is possible. Its current Red List status would thus be DD (Data Deficient, IUCN 2001) or DDD (Data Deficient – Insufficient Information, Raimondo et al. 2009).

Following are some guidelines on the cultivation of *Ceropegia* species in general. One of the easiest ways to propagate ceropegias is to grow them from seeds. As seed are so rarely available, other methods of propagation have become increasingly important. The method of layering is very successful. This is where a stem is secured on the soil in order to root where the stem comes into contact with the soil, while still attached to the mother-plant. Once its roots have formed, it is severed from the mother-plant. Cuttings can also be made from succulent stems by letting the tips dry for a couple of days, then dipping the severed ends into rooting powder and placing in peat-based compost without letting them further dry out (Shirley 1995). A high humidity will assist in prevention of drying out. The temperature should be kept between 24–25°C and roots will be produced within two weeks. After a month these roots will be strong enough to transplant the new plants. Continual taking of cuttings and winter temperature of ±15°C may assure that plants survive in collections. *Ceropegia* species grow well in warm conditions and watering should only be done during the growth phase and discontinued, or watered only very sparingly, when temperatures drop. The roots are usually very shallow in leaf litter or wedged in crevices between rocks. A potting mix of one part sand, one part peat-less potting mix and one part small stones or perlite is a good mix. *Ceropegia* species are usually very sensitive to frost. The grafting of stems on a variety of other asclepiads (Oliver 1998) is another method of propagating *Ceropegia*.

The reproductive success of *Ceropegia* species is usually limited by the complex, highly specialised flower structure. Natural pollination is mainly done by flies (myo-

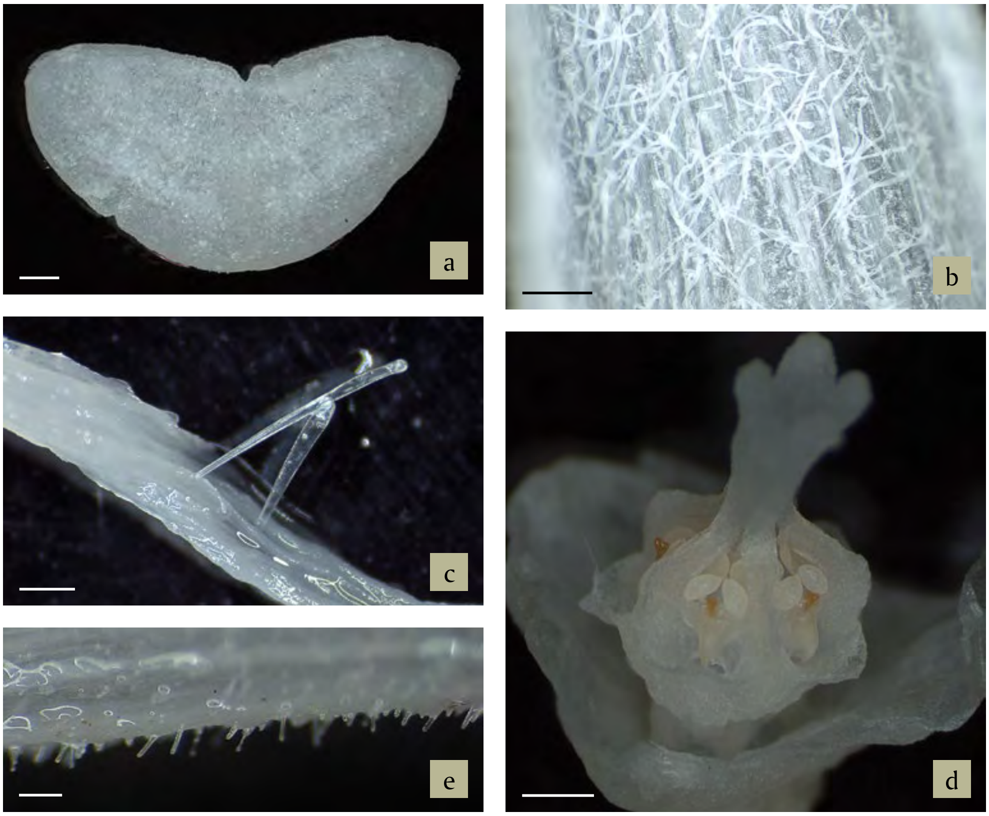

FIGURE 3.—*Ceropegia terebriformis*: a, leaf in cross-section; b. collapsed hairs on inside of corolla tube at place of purple-maroon band (at basal double-barrelled inflation); c, vibratile hairs on apical segments; d, corona with upper part of corolla tube cut away; e, papillate hairs on outside of corolla tube. Scale bars: a–c, e, 0.5 mm; d, 0.2 mm. Photographs: S.P. Bester.

phily) (Coombs et al. 2011). No fruits were formed from the flowers of *C. terebriformis* that was cultivated from 2009–2012. This was possibly because the natural pollinator was not present, which could indicate that the species relies on a very specific pollinator rather than generalists. In *C. terebriformis* the hairs that carpet the inner corolla tube are orientated towards the base of the flower acting as a guide for the pollinator to direct it towards the pollinia. These hairs are denser in the constriction between the basal inflations, therefore, returning in the direction of the segments will be very difficult for a pollinator. In this way the plant ensures that a possible pollinator is kept captive for some time in order to facilitate successful removal of pollinia from the flower. Initially the hairs are straight but after some time they collapse (Figure 3b) in order to release the pollinator (Coombs et al. 2011). The flowers did not produce any discernible scent to the human nose.

Description.—Succulent climber. *Rootstock* producing a cluster of succulent, fusiform roots to ± 6 mm in diam., ± 85 mm long. *Stems* annual, 1–6 from apex of rootstock, up to ± 1.2 m long, twining, sparingly branched, glabrous. *Leaves* succulent (Figure 2a), opposite; petiole to 4 mm long, narrowly lanceolate to lanceolate, 18–74 × 2.0–11.5 mm; base attenuate; apex apiculate; margins smooth, 3.07–3.17 mm thick, only very slightly conduplicate adaxially, rounded abaxially (Figure 3a). *Inflorescence* axillary, flowers developing in succession having one in anthesis at a time. *Flowers* pedunculate, extra-axillary, 1–3 develop successively from upper leaves; peduncle 4.7–12.1 mm long; pedicels 3.90–9.66 mm long. *Calyx* narrowly triangular, 1.5–2.0 × 0.3–0.4 mm. *Corolla* 45–78 mm long, 4–6 mm in diam. at base, slightly narrowing to ± 3 mm in diam. above basal inflations, then gradually widening along tube and abruptly becoming flabellate at base of segments to 12–15 mm diam. just below segments; shortly papillate (Figure 3e), papillae 0.05–0.16 mm long on tube outside; hairs inside corolla 1–2 mm long, flattened, straight when fresh, swirly when collapsed (Figure 3b). *Corolla tube* 32–35 mm long with maroon band on lower third on inside, basal inflation double-barrelled, 9.0–10.5 × 4.0–5.5 mm (Figure 2c); segments 35–36 mm long with apical half spirally entwined with purple vibratile hairs on their margins; hairs to 3 mm long, clavate becoming broader towards apex, apex rounded (Figures 2b, d, 3c). *Corona* (Figure 3d) united at base, stipitate, stype 0.13–0.37 mm high; outer lobes cupular, forming 5 pockets, 0.3–0.6 mm high, 0.7–0.8 mm broad, 0.2–0.6 mm in diam.; inner lobes linear bending over gynostegial column, upper part erect forming a cylindrical column ± in centre above gynostegial column, double the length of gynostegial column, 0.8–3.5 × 0.2–0.5 mm, slightly expanding and rounded at apex, sometimes slightly divergent at tip (Figure 3d). *Pollinarium*: pollinia 153–320 × 105–180 μm, ovate; carrier 130–170 × 47–90 μm, oblanceolate to ovate, apex rounded, base acute; caudicels 40–87 μm long, triangular-winged, wing 60–69 μm at broadest, caudicels attached medial to carrier and sub-apical to pollinia; guide rail 160–210 μm extended from central column, ± 0.3 × 0.1 mm. *Fruit* and *seed* not seen. Plate 2313.

SPECIMENS EXAMINED

ANGOLA, Huila Province, ± 2 km NW of Quihita en route to Chibia, just S of a tributary of the Caculuvar River, Quarter Degree Grid Square 1513BD, alt. 1 315 m, 28 Jan.; fl. in cult. 9 Mar. 2010, Pretoria National Botanical Garden, *Bester 9321b* (PRE); fl. in cult. 3 Nov. 2011, Walter Sisulu National Botanical Garden, *Hankey 2995* (PRE); fl. in cult. 15 Nov. 2012, Walter Sisulu National Botanical Garden, *Condy 244* (PRE, K).

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S.P. BESTER* and GILLIAN CONDY**

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* South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa / School of Environmental Sciences and Development, North-West University, Potchefstroom, 2520 South Africa.

* Author for correspondence: s.bester@sanbi.org.za

** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

Acanthopsis disperma Acanthaceae

Namibia, South Africa

Acanthopsis disperma *Nees* in Prodromus systematis naturalis regni vegetabilis 11: 278 (1847); Anderson: 36 (1864); Clarke: 34 (1901); Balkwill & Welman: 36 (2000); Mannheimer et al.: 218 (2008); Balkwill: 257 (2012); Snijman: 163 (2013). *Acanthodium dispermum* E.Mey., *nom. nud*., Drège: 2 (1837). *Acanthodium dipsaceum* E.Mey., *nom. nud*., Drège: 92 (1843).

Representatives of the genus *Acanthopsis* are readily recognised by a combination of four characters: a one-lipped corolla; spinous bracts terminating in 3–5 spines or compound spines (lobes); outer stamen filaments without an appendage at the tip (in contrast to all southern African representatives of the genus *Blepharis*) (Vollesen 2000); and a simple, unbranched filiform style with a single-lobed stigma (in contrast to a bilobed stigma in *Blepharis*) (Vollesen 2000). The plants range from annual, acaulescent herbs to perennial, branched shrublets and shrubs. *Acanthopsis* species can be found from the southern Namib Desert, through the coastal plains in Namaqualand, to mountain slopes in the Western Cape. The corolla is usually purple or lilac with a white or lemon throat, but some species include plants with yellowish or white flowers with purple markings.

Depending on the authority, the genus *Acanthopsis* is currently considered to include seven (Balkwill 2012) or eight (Welman 2003) species restricted to the southern parts of Namibia, and the Northern and Western Cape provinces, South Africa. The genus is severely under-collected and taxonomically poorly understood. The online *Red List of South African Plants* (version 2014.1) list two of the eight species as data deficient: *Acanthopsis glauca* (Data Deficient – insufficient information; Kamundi 2008) and *Acanthopsis trispina* (Data Deficient – taxonomically problematic; Kamundi & Raimondo 2006). Due to a lack of knowledge and taxonomic expertise on this genus, the conservation status of most species may prove to be incorrect. The first author has embarked on a taxonomic revision of the genus which will include an updated conservation status for each taxon.

In 1842 Harvey established the new genus *Acanthopsis* with *Acanthodium dispermum* (based on a herbarium specimen in Drège's herbarium) as the type species. The name *Acanthodium dispermum* was first applied by E.H.F. Meyer (in Drège 1837) to a Drège collection (*Drège s.n.*), but was published without a description, hence it is invalid. Although Harvey (1842) referred to Meyer's name, he did not definitely associate the epithet *disperma* with the name of the new genus, therefore he cannot be attributed as the validating author for the name *Acanthopsis disperma* (Art. 35.2 in McNeill et al. 2012). The latter name was only validly published by Nees in 1847.

PLATE 2314.—1, habit, × 1; 2, bract, × 2; 3, bracteoles, × 2; 4, lateral sepals, × 2; 5, ventral and dorsal sepals, × 2; 6, corolla, × 2. Voucher specimen: *Koekemoer 4183* in National Herbarium, Pretoria. Artist: Gillian Condy.

PLATE 2314 *Acanthopsis disperma*

FIGURE 1.—Annotations on duplicate *Acanthopsis disperma* specimens (*Drège s.n.*) from various herbaria: a, British Museum (BM); b, c, Kew (K); d, e, Paris (P); f, Stockholm (S). Specimen images from various websites.

Although most of the duplicates of this collection by Drège are labelled *Acanthodium dispermum* (Herbarium specimens: BM000810291, K000394340, K000394341, P04426151, S-G-40), one duplicate (P04426149) carries the name *Acanthodium dipsaceum* (Figure 1). It is not clear why there is a difference in the species names between duplicates of *Drège s.n.*, as all these annotations are in Meyer's handwriting. What appears to be Drège's collecting number (2438) appears on one of the duplicates in the Paris Herbarium (P04426149), while the number 1827 appears on a duplicate in Kew (K000394340). However, until the status of these numbers can be confirmed, the particular collection by Drège is here given as without a number (*s.n.*). *Acanthodium dipsaceum* is also the name used by Meyer in Drège (1843: 92) for this collection from 'Zwischen Natvoet und Garip, 1000–1500 ft', made in September 1830. According to Drège's map, the specimens were collected in the Richtersveld, probably in grid 2816D. The Natvoet locality could not be traced on subsequent maps of the region, but Clarke (1901) interpreted it as Holgat River in the northern Richtersveld. The epithet *dipsaceum* most probably refers to the dense inflorescences resembling the flower heads of teasel (*Dipsacus* spp.). The epithet *disperma* means 'having two seeds' and although it is an apt specific name, *dipsaceum* would have been more descriptive. Because Nees (1847) was the first to validly publish the name *Acanthopsis disperma*, based on Meyer's invalid name in Drège (1837), and considering the fact that *Acanthodium dipsaceum* of Meyer in Drège (1843) is also invalid, the epithet *disperma* enjoys priority and was subsequently used.

There has been considerable uncertainty regarding the species concept of *Acanthopsis disperma* and a morphologically diverse range of specimens with, amongst others, different life forms, as well as leaf and bract characters, were included in this species. For the purpose of the present contribution, *A. disperma* is defined in a narrow sense as an annual, acaulescent plant with dense, sessile inflorescences (Figure 2a) without viscid glandular hairs on the bracts. Although the hairiness of leaves and bracts is fairly variable, the plants always retain their annual habit and show a distributional confinement to the arid parts of southwestern Namibia and into the Richtersveld in the Northern Cape Province of South Africa (Figure 3). It is noteworthy that many authors subsequent to Harvey (1842) have applied the name *A. disperma* in a much broader sense, often including plants ranging from southern Namibia to the Western Cape (Balkwill & Welman 2000; Mannheimer et al. 2008; Balkwill 2012; Snijman 2013). Furthermore, the taxon in the Little Karoo (Western Cape) referred to as this species by Vlok & Schutte-Vlok (2010), is here excluded from the concept of *A. disperma*.

As here defined, *Acanthopsis disperma* is centred in the eastern parts of the Gariep Centre of Endemism (Van Wyk & Smith 2001). It occurs in the Succulent Karoo and Nama-Karoo biomes (Rutherford & Westfall 1994; Low & Rebelo 1996), and partly in the Desert Biome based on a different biome boundary mapping method by Mucina & Rutherford (2006). In the Succulent Karoo and Nama-Karoo biomes it is found in the transitional zone between winter- and summer-rainfall regions with rain either falling in early winter or late summer. The plants prefer weathered granite and quartzite, and grow in sandy and gravelly soils on plains and hill slopes (Figure 2e). *Acanthopsis disperma* is a terophyte – an ephemeral that completes its entire life cycle within a year (Rutherford & Westfall 1994) – and flowers mainly between June and September, depending on the time of rainfall.

Acanthopsis disperma displays conspicuous variation in leaf and bract indumentum, however, its taxonomic significance is not clear at this stage. Although the extremes are exceedingly different, there are specimens representing intermediate states and the different forms are currently included within *A. disperma*. It is possible that further study and fieldwork could lead to the recognition of infraspecific taxa. The leaf indumentum does not seem to correlate with any obvious environmental variables and varies from short, appressed hairs, to longer strigose to spreading hairs. The bract lobes can vary from being glabrous/glabrescent (often with a margin of long, rigid hairs) to hairy (villose) (Figure 2b–d). The bract indumentum types correspond with the species' geographical distribution: plants with glabrous/glabrescent bracts are found in the winter-rainfall areas where rainfall usually coincides with lower temperatures, while plants with hairy bracts are predominantly found in the eastern parts of the range in the late summer-rainfall area of the Nama-Karoo (warm temperatures in the rainy season). If glandular hairs are present on bract lobes, they are sessile or short and non-viscid, as opposed to *A. hoffmannseggiana* with its long, viscid glandular hairs.

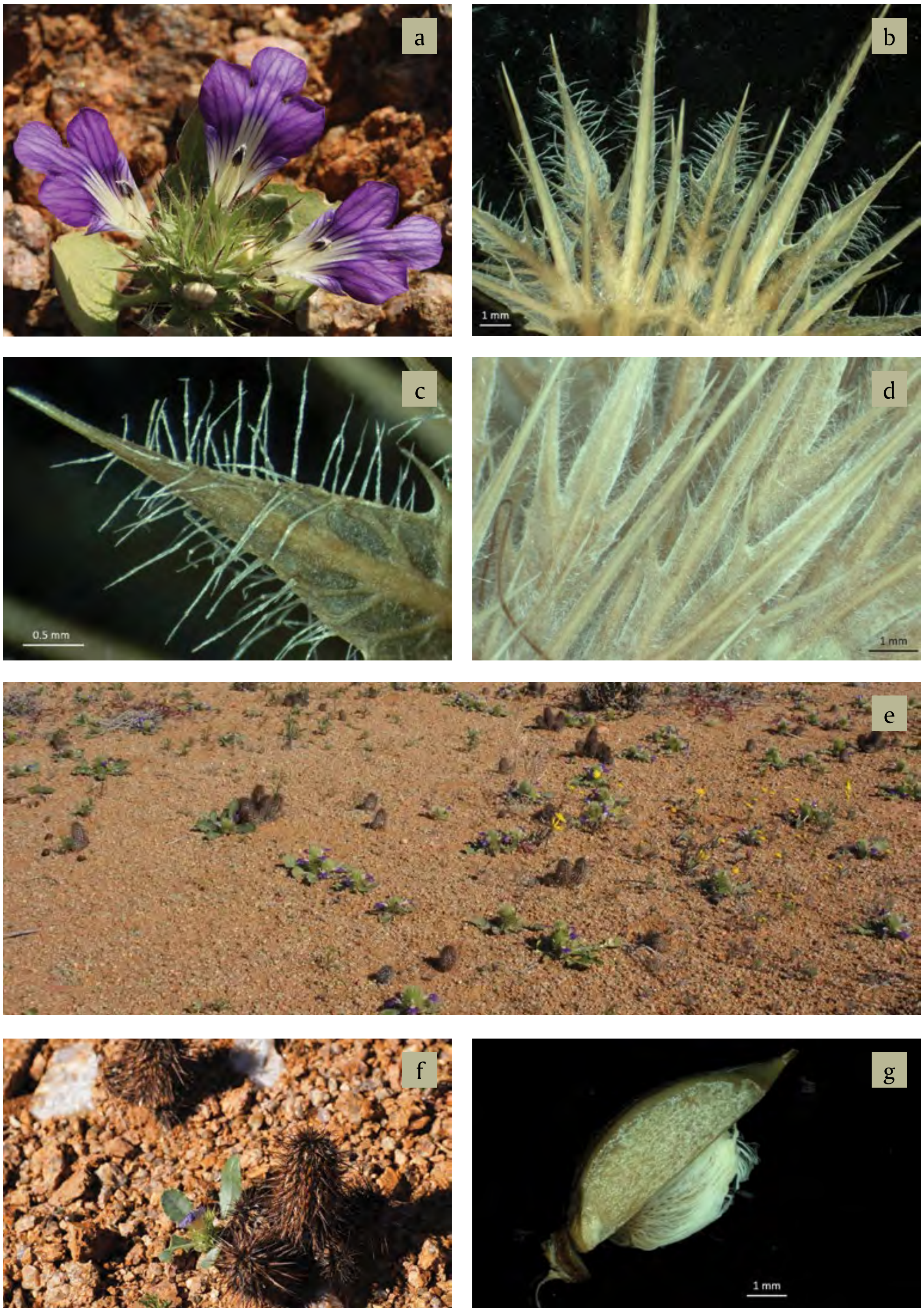

FIGURE 2.—*Acanthopsis disperma*: a, habit; b, bract; c, glabrescent bract showing margin of long silky hairs; d, hairy bracts; e, typical habitat; f, persistent inflorescences; g, capsule (opened) with seed. Photographs: a, e, f, M. Koekemoer; b–d, g, H.M. Steyn.

In Afrikaans *Acanthopsis disperma* is known as *verneukhalfmensie*, in reference to its spent inflorescences' somewhat vague resemblance (Figure 2f) to a miniature *halfmens* (*Pachypodium namaquanum*). During fieldwork it was noted that some *Acanthopsis* species were heavily browsed by livestock (mainly sheep and goats), despite their spiny inflorescences. According to Vollesen (2000) the capsules and especially the seeds in members of the related *Blepharis* are rich in protein, and they have been indicated as a source of fodder for cattle and game. In tropical Africa some species of *Blepharis* are used medicinally (Vollesen 2000), but no similar information on possible medicinal use of *Acanthopsis* could be found.

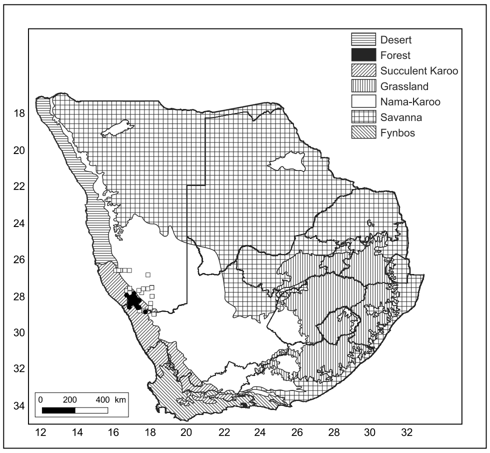

FIGURE 3.—Known distribution of *Acanthopsis disperma*: ●, form with glabrescent bracts; □, form with hairy bracts. Biomes according to Rutherford & Westfall (1994).

The specimen illustrated (*Koekemoer 4183*) was collected near Hakiesdoring Camp on a quartzite ridge (2817AC) in the |Ai-|Ais/Richtersveld Transfrontier Park.

Description.—Spiny, acaulescent herb up to 100 mm tall. *Leaves* tufted, arranged in a rosette, obovate to oblanceolate, (30–)40–60(–150) × 10–20 mm, with appressed, strigose or spreading hairs; leaf margins flat or undulate, spinose, spines fine, up to 2(3) mm long; apex rounded to acute; base attenuate; petiole 3–10 mm long; cotyledons in seedlings reniform (strikingly different from ordinary leaves). *Inflorescences* sessile, spikes erect, dense, 1–5 per plant, (20–)50–70 (–100) mm long, (12–)13–15(–20) mm in diameter, persist after plant has died; each flower supported by a single bract and two bracteoles. *Bracts* fan-shaped, 15–20 mm long, base 4–5 mm long; middle and upper bracts ending in 5 spine-tipped lobes (primary spines), each lobe with 2 or 3 pairs of secondary spines; spine tips often tinged purple-brown; spines spreading to recurved in fruit; bract base hirsute; lobes glabrescent with margin of rigid, multi-cellular white hairs and sessile/subsessile glands, or villose (long, silky hairs interspersed with short glands and short, deflexed hairs). *Bracteoles* linear-lanceolate with bony midrib ending in spinous tip; 7–9 mm long. *Calyx* 4-partite, dorsal sepal longer and wider than ventral one, both much wider than lateral sepals; basal part and veins thickened and bony; green or with tips tinged purplish; dorsal sepal envelops other 3 sepals, cuspidate, (10–)11 (–14) mm long, densely silky hairy, especially on inside, 7–9-veined from base; ventral sepal bifid, ending in spinous tip, 9–11 mm long, densely silky hairy, especially on inside, 5–7-veined from base; lateral sepals lanceolate, broader at base, 7–8 mm long, densely silky hairy inside and outside, ending in spinous tip. *Flowers* 1-lipped, 5-lobed with outer lobes reduced, blue-purple with white throat, pubescent to villose, 19–22(–28) × 7–9(–12) mm, tube (5–)6–9(–11) mm long, corolla limb obovatespathulate, central lobe longer than wide or equal, slightly constricted at base, truncate to emarginate. *Stamens* 4; anthers purple-black, densely bearded; filaments 4–5 mm long, hard and bony, sparsely glandular, hairy towards base. *Style* filiform, with patch or ring of glandular hairs at base; stigma a single flattened lobe. *Capsules* ovate, flattened, glabrous, shiny, 5–7 × 3–4 mm, 2-seeded. *Seeds* (3–)5 × 3 mm, covered with long white hygroscopic hairs (Figure 2g). Plate 2314.

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H.M. STEYN*§ and GILLIAN CONDY*

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* South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.
§ Author for correspondence: h.steyn@sanbi.org.za

PLATE 2315 *Sclerochiton odoratissimus*

Sclerochiton odoratissimus Acanthaceae

South Africa

Sclerochiton odoratissimus *Hilliard* in Notes from the Royal Botanic Garden Edinburgh 30: 109–112 (1970); Vollesen: 13–16 (1991). *S. harveyanus auct.* Clarke: 36–37 (1901) *pro parte*.

For nearly 70 years *Sclerochiton odoratissimus* was formally considered conspecific with *S. harveyanus*, a more widespread shrubby element of moist forests along the eastern seaboard of southern Africa, extending from the Eastern Cape of South Africa northwards to Zimbabwe and Mozambique. This confusion is reflected in an account by Clarke (1901) who, in *Flora Capensis*, considered *S. harveyanus* to bear flowers either 'purplish-blue or white': specimens cited by him confirm that he indeed considered material of both taxa in working up his description. In the course of later circumscribing *S. odoratissimus*, Hilliard & Burtt (1970) acknowledged that the distinctness of this species had earlier been recognised, and referred to annotations to this effect on a Kew sheet (*McKen 5*), the handwriting of which they attributed to Harry Bolus. These two species sometimes co-occur and, although similar in general appearance, should be readily separated on vegetative form alone: *S. harveyanus* plants are always more spreading and drooping with glossy leaves, while *S. odoratissimus* plants are generally more dense and woody with leaves somewhat duller. *Sclerochiton harveyanus* plants are usually found in more shady situations. When in flower, the two species are unmistakable, not least for *S. harveyanus* being far less floriferous as it carries fewer flowering shoots. The flowers of *S. odoratissimus* are very strongly scented and possess ivory-white corollas with deflexed limbs and tubes rarely longer than 5 mm. By comparison, the scentless flowers of *S. harveyanus* have violet-blue corolla limbs that are generally presented flat and directed forwards, i.e. in the same plane as the corolla tube; the floral tubes are also at least 7 mm long. Accordingly – based on flower colour – these taxa have assumed the English common names blue-lips and white-lips. At the northern extent of its range (Figure 1), in the vicinity of the type locality in the Vryheid District, *S. odoratissimus* plants are somewhat more lax and less compact in habit, with larger, broader leaves than specimens found to the south (Hilliard & Burtt 1970). Plants from Mt Gilboa certainly represent a fine selection for horticulture, with their distinctly erect and compact form, and densely floriferous character. Such is their robustness that branches are seldom found arching and touching the ground, although when they do, they exhibit a vegetative propagation characteristic shared by many sclerochitons – that of natural tip layering whereby apices in contact with the soil strike root to form daughter plants. These shrubby plants grow to a height of about 2 m, in midsummer bearing a profusion of ivory-white flowers, each with a series of purplish-brown nectar guides leading into the russet-brown throat of the tube. It is not on scale or floral structure, but rather on scent and colour combinations that one is reminded by *S. odoratissimus*

PLATE 2315.—1, flowering branch, flowers axillary, terminating side shoots, × 1; 2, fruit, a bivalve woody capsule, × 2. Voucher specimen: *Condy 233* in National Herbarium, Pretoria. Artist: Gillian Condy.

of the flowers of both *Rothmannia capensis* (wild gardenia) and *R. globosa* (September bells), rubiaceous species long valued as indigenous horticultural subjects. The pollinators of *S. odoratissimus* are unknown to us, but the diurnally scented white flowers lead us to speculate that xylocopids (carpenter bees) are involved, as has been observed with *Rothmannia* species in the neotropics (Kato et al. 2008). Diurnal moths and butterflies likely also pollinate this species, and in this regard we have noted the Dark Elfin (*Sarangesa seineri seineri*, Hesperiidae) visiting flowers of cultivated *S. harveyanus* in Pretoria.

Although trends in domestic and amenity gardening come and go, few fashions achieve near-mythical status and remain ever-popular. One of the best known and enduring of these is the attempt by some gardeners to establish entirely white gardens, or at least sections within (Clifton 1990). Many gardeners accept both bluish green and creamy-white as 'white', with shades of this colour being introduced into gardens through either foliage or flowers, or both. In the case of selecting white-flowered plants there is still a strong and lingering reliance on the tried and tested gardening stalwarts such as species and cultivars of *Rosa* (roses), *Agapanthus* (African lilies), *Petunia* (petunias) and *Clematis* (traveller's joy). However, for those gardeners and horticulturalists on the lookout for new South African material to include in their white gardens, *Sclerochiton odoratissimus* comes as a pleasant addition to the range of available material. An added advantage of this species is that the creamy white, summer-borne flowers are perfectly offset against the dense, mid-green foliage of this robust shrub, with light leaf veins adding a further attractive element. In this regard our species easily rivals the indigenous species of *Carissa* and the exotic *Viburnum odoratissimum* for sheer beauty.

It is not certain who the discoverer of this showy shrub was, for it has proven rather difficult to identify the first plant collector to have made a pressing. We have traced three gatherings to the middle 19th century, by Mark Johnston McKen (1823–1872), Mary Elizabeth Barber (1818–1899) and Peter MacOwan (1830–1909), all of which are undated. Based on their respective documented travels and sites of abode it appears that both the Barber 'Kaffraria' and McKen 'Natal' specimens do not predate 1860. MacOwan, who arrived from the United Kingdom and took up employment in Grahamstown in 1862, moved to Somerset East in 1869 (Gunn & Codd 1981), but evidently collected in the vicinity of that town some years before – indeed, his collector's notebook reveals that his *Sclerochiton odoratissimus* specimen from the Boschberg (*MacOwan 538* [PRE and SAM]) was pressed in 1864. From 1855 until

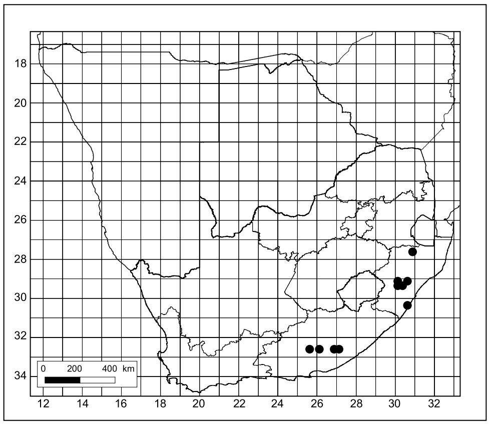

FIGURE 1.—Known distribution of *Sclerochiton odoratissimus*.

1875, Harry Bolus, the well-known South African amateur botanist, orchidologist and a contemporary of MacOwan, was based in Graaff-Reinet, not far from Somerset East, and they soon collaborated on matters botanical. For a period of eight years, from 1884 to 1892, MacOwan, who was by then director of the Cape Town Botanic Garden, worked with Bolus, at the time also based in Cape Town, on distributing what was referred to as centuriae of exsiccata – pressed plant specimens in sets of 100 (Gunn & Codd 1981). These sets were issued under a joint label 'Herbarium Normale Austro-Africanum' to ten herbaria in the UK, continental Europe, and the USA, while MacOwan and Bolus each retained a set for themselves. One of the primary purposes of exchanging their duplicates – as well as those of other collectors including Glass, Flanagan and Medley Wood – with prominent international herbaria (Kew, Paris and Berlin amongst them) was to strengthen the holdings of the Cape Government Herbarium. This herbarium became the core of the historically significant South African Museum (SAM) collection, which since 1956 has been housed in the Compton Herbarium of the South African National Biodiversity Institute in Cape Town (Smith & Willis 1999).

Plants of *Sclerochiton odoratissimus* are known mainly from higher altitudes (above 1 200 m) along the northeastern seaboard. Subpopulations are localised at sites where mean annual temperatures are less that 15°C, frost occurs for 26 days on average each year, and precipitation is high, at nearly 900 mm. This species forms dense stands on stream banks in grassland, on forest margins, or in forest openings (Figure 2). As with many other Afromontane taxa this species does drop in altitude to Pondoland (Van Wyk 1994), where it has been recorded growing near Umzinto at an altitude of 550 m. Although Van Wyk & Smith (2001) noted the ability of these Afromontane plants to thrive across a fairly wide altitudinal range, this phenomenon remains largely unexplained. Interestingly, plants grown at much the same low altitude in Kloof (KwaZulu-Natal) for two years have not performed optimally, showing poor growth rates. They are yet to flower, suggesting that this site is too warm for white-lips. At the Kloof site the mean annual temperature is about 5°C higher than at Mt Gilboa, and the mean annual precipitation close to 1 000 mm. No frost is experienced. This species will likely best perform in situations where it receives a high precipitation and enjoys the partial shade of surrounding shrubs of equal size. It is likely to be quite tolerant of frosts and even exposure to snow for short periods.

Vollesen (1991) placed *Sclerochiton odoratissimus* in *Sclerochiton* subg. *Sclerochiton*, along with *S. harveyanus*: this section was considered by this author to be primitive relative to *Sclerochiton* subgen. *Isacanthus*, which accommodates all other representatives of this African genus of c. 20 taxa. The genus *Sclerochiton* is classified in the Acantheae, a basal lineage of the Acanthaceae, with c. 500 species and 20 genera (McDade et al. 2005; McDade & Kiel 2006). These authors grouped *Sclerochiton* with *Streptosiphon* and *Crossandrella*, a notion strongly supported by molecular data but with unclear morphological evidence.

The plant figured here was gathered from the slopes of Mt Gilboa near the Karkloof, growing at an altitude of 1 600 m on the wooded margin of a streamside in grassland. The associated vegetation unit at that site was Drakensberg Foothill Moist

Grassland (Gs10) (Mucina et al. 2006), within which it was found growing on soils derived from underlying dolerite intrusions. Plants growing alongside included other small trees, such as *Rapanea melanophloeos*, *Halleria lucida*, *Buddleja salviifolia* and *Kiggelaria africana*. Notably, plants were not seen in the dense shade of a neighbouring forest patch, indicating their preference for brightly lit ecotone situations. This species is seldom encountered in KwaZulu-Natal and evidently too in the Eastern Cape Province, for relatively few vouchers have been made to date. Across its range white-lips flowers between December and February, with fruit maturing only two to three months later such that flowers and fruits are not to be found on the same plant at any given time.

The generic name *Sclerochiton* is derived from the Greek *skleros* for 'hard' and *chiton*, 'covering', in reference to the woody capsule. The specific epithet *odoratissimus* refers to the strong odour of the flowers.

Description.—Shrub to 2 m tall, perennial. *Stems* erect to spreading, rooting at apex when in contact with ground, subterete, woody, green becoming brown, young branches puberulous to pubescent. *Leaves* opposite, membranous, slightly anisophyllous, mid-green; petiole 3–6(–9) mm long; lamina elliptic, base attenuate to cuneate,

FIGURE 2.—Mistbelt forest patch margins at Mt Gilboa, typical habitat for *Sclerochiton odoratissimus*. Photograph: N.R. Crouch.

apex obtuse, rounded, 15–45 × 7–20 mm, subglabrous to pubescent-ciliate along midrib and sometimes also larger veins below, subglabrous to puberulous along midrib above or sparsely puberulous to pubescent all over, midrib raised below, with 3–5 distinct lateral pairs of veins, margins entire, subrevolute. *Flowers* strongly scented, axillary, supported by ordinary, typically cauline leaves, single or 2–9-clustered, widely scattered, terminating the branches and short side-shoots, pedicels to 1.5 mm long, puberulous, winged. *Bracteoles* 2, oblong or broadly oblong, firm, about 5–9 × 5 mm, truncate with small central tooth or subacute, sparsely puberulous to pubescent (rarely densely so), mid-green, margins not scarious, not frayed. *Sepals* 5, subequal, ovate to oblong, 7–11 mm long, 3–5-nerved, glabrous to puberulous or pubescent and finely ciliate. *Corolla* 1-lipped, 20–25 mm long; tube 5(–7) mm long and c. 2.5 mm broad, with a band of hairs immediately below insertion of stamens and spreading into tube, russet-green within; limb 5-lobed, cuneiform, deflexed, 13–20 mm long, ivory-white (very rarely tinged pink) with red or purple lines into throat, margin ciliate; lobes subequal obovate-oblong, rounded at the apex, 5–6 mm long. *Stamens* 4, exserted, filaments attached at the top of tube, flattened, 8–10 mm long, dorsal pair slightly longer, glabrous; anthers 1-thecous, elliptic, c. 2 mm long, purple-brown, glabrous or shortly bearded near middle, without basal tuft of hairs but sometimes hairy near tip, ventral thorn absent. *Ovary* ellipsoid, bilocular; style c. 10 mm long, linear, exserted, deflexed towards apex; stigma minute and obscurely bifid. *Fruit* an oblong, bivalved, woody capsule with distinct dorsal furrow, 15–17 mm long, glabrous, 4-seeded. *Seed* elliptic, about 6 × 4 mm, brown, with low ridges but no pectinate scales. Plate 2315.

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N.R. CROUCH*, G.F. SMITH**, E. FIGUEIREDO*** and GILLIAN CONDY****

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* Biodiversity Research, Monitoring and Assessment, South African National Biodiversity Institute, P.O. Box 52099, Berea Road, 4007 South Africa / School of Chemistry & Physics, University of KwaZulu-Natal, Durban, 4041 South Africa.

* Author for correspondence: n.crouch@sanbi.org.za

** Office of the Chief Directorate: Biosystematics Research and Biodiversity Collections Division, South African National Biodiversity Institute, Private Bag X101, 0001 Pretoria / Department of Botany, P.O. Box 77000, Nelson Mandela Metropolitan University, Port Elizabeth, 6031 South Africa / Centre for Functional Ecology, Departamento de Ciências da Vida, Universidade de Coimbra, 3001-455 Coimbra, Portugal.

*** Department of Botany, P.O. Box 77000, Nelson Mandela Metropolitan University, Port Elizabeth, 6031 South Africa / Centre for Functional Ecology, Departamento de Ciências da Vida, Universidade de Coimbra, 3001-455 Coimbra, Portugal.

**** South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.

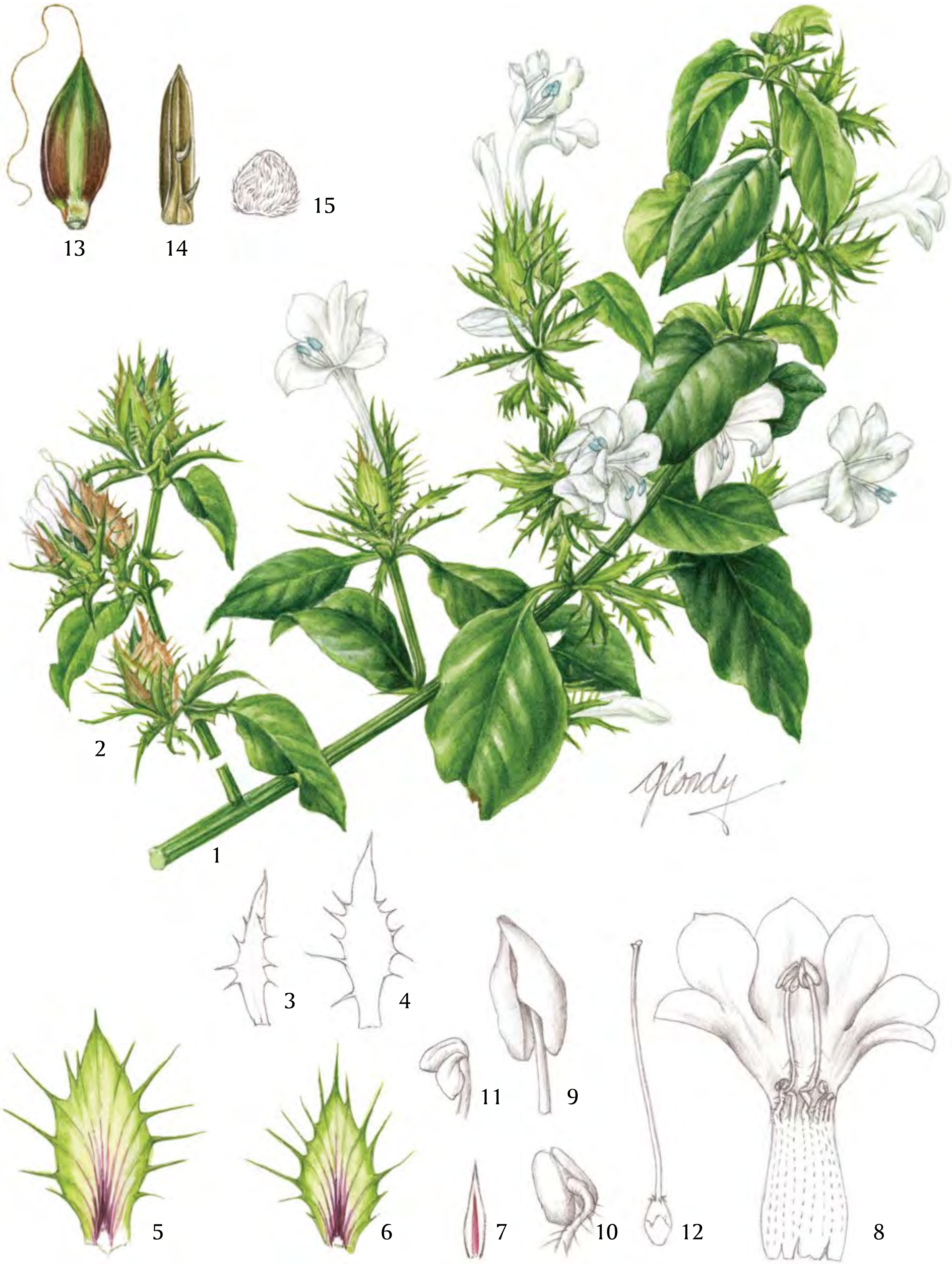

PLATE 2316 *Barleria elegans*

Barleria elegans Acanthaceae

Angola, Mozambique, Namibia, South Africa, Swaziland, Zimbabwe

Barleria elegans *S.Moore ex C.B.Clarke* in Flora of Tropical Africa 5: 154 (1899); Clarke: 49 (1901); Obermeijer: 154 (1933); Meyer: 16 (1968); Bandeira et al.: 160, 191 (2007). *Barleria pungens* L. var. *macrophylla* Nees: 237, non *B. pungens* L. *sensu stricto* (1847).

Barleria is a genus of ± 300 species and this makes it the third largest genus in the Acanthaceae following *Justicia* and *Strobilanthes* (Mabberley 2008). It is essentially an Old World genus, occurring in tropical and subtropical regions of Africa, Madagascar, Arabia, India, southern Asia and the Far East. Only one species, *B. oenotheroides*, extends to the New World tropics (Mexico, Central America and northern South America) and also occurs in West Africa (Daniel 1995). Balkwill & Balkwill (1997) provided an infra-generic classification of *Barleria*, and this was followed by an account of the biogeography of the genus (Balkwill & Balkwill 1998). There have been considerable recent advances in the taxonomy of *Barleria* in tropical Africa and Madagascar, and these include the works of Hedrén (2006a,b), Kelbessa (2006), Darbyshire (2008, 2009), Darbyshire & Ndangalasi (2008), Malombe & Darbyshire (2010), Champluvier (2011) and Darbyshire et al. (2012, 2014). These treatments infer that the highest number of species in *Barleria* (216) is found in Africa, excluding Madagascar. Close to 60 species occur in southern Africa of which 59% are endemic to the region (African Plants Database).

Barleria is easily distinguished from other genera in the Acanthaceae by a combination of three characters: the calyx is four-partite with two large outer segments (anterior and posterior lobes) and two smaller inner ones (lateral lobes), the pollen grains are spheroidal and honeycombed, and the predominant presence of double cystoliths (calcium oxalate crystals) in the epidermal cells (Shendage & Yadav 2010). Balkwill & Balkwill (1997) noted that each of these characters occurs in other acanthaceous genera, however, their regular co-occurrence is restricted to *Barleria*. The genus has been classified by Balkwill & Balkwill (1997) into two subgenera, *Barleria* and *Prionitis*, and seven sections. Subgenus *Barleria* consists of two sections, *Barleria* and *Chrysothrix*, while subgenus *Prionitis* consists of five sections, *Prionitis*, *Somalia*, *Cavirostrata*, *Fissimura* and *Stellatohirta*. Subgenus *Barleria* produces four-seeded capsules without prominent apical beaks, whereas subgenus *Prionitis* produces two-seeded capsules with or without prominent apical beaks, except in section *Cavirostrata* where the combination is four-seeded capsules with prominent beaks. Seven species of *Barleria* were featured in *Flowering Plants of Africa* from 1943 to 2011

PLATE 2316.—1, flowering branch, × 1; 2, fruiting twig, × 1; 3, outer bracteole, × 2; 4, inner bracteole, × 2; 5, posterior calyx lobe, × 2; 6, anterior calyx lobe, × 2; 7, lateral calyx lobe (one of two), × 2; 8, open flower slit along lower corolla lobe, × 2; 9, anther of large stamen (one of two), × 8; 10, anther of short stamen (one of two), × 8; 11, anther of rudimentary stamen, × 8; 12, gynoecium with disc, × 2; 13, unopened capsule, × 2; 14, interior view of valve of capsule, × 2; 15, seed, × 2. Voucher specimen: *Baijnath 2550* in Ward Herbarium, University of KwaZulu-Natal. Artist: Gillian Condy.

FIGURE 1.—*Barleria elegans*: a, in typical habitat; b, close-up of flowers. Photographs: H. Baijnath.

representing four sections: *Barleria* (*B. bremekampii*, *B. greenii*, *B. macrostegia* and *B. obtusa*), *Prionitis* (*B. rotundifolia*), *Somalia* (*B. pretoriensis*) and *Stellatohirta* (*B. albostellata*).

Species falling in all sections (except *Cavirostrata*) occur in southern Africa, the largest number of these belong to section *Barleria*. Within the genus, section *Barleria* is most widespread, being prominent along the eastern part of Africa (Balkwill & Balkwill 1998). It is also the largest section in the Flora Zambesiaca region (Balkwill & Balkwill 1998) declining northwards where section *Somalia* becomes more prominent (Darbyshire & Ndagalasi 2008). In southern Africa, section *Barleria* is represented by 32 species of which ± 25 are endemic to the region, most of them with colourful flowers. Section *Barleria* is recognised by plants that are usually prickly (non-prickly in species like *B. obtusa* and *B. repens*) with axillary inflorescences based on scorpioid cymes (inflorescences successively branching on one side to form axillary shoots after the shoot at each branch develops into a flower), having noticeably scarious calyces, and flowers that are white, blue or red. Our featured *B. elegans* (Figure 1) is grouped in subgenus *Barleria*, section *Barleria*.

The genus name *Barleria* is derived from Jacques Barrelier (1606–1673), a French biologist and Dominican monk who devoted his spare time to botany. The species name *elegans* (Latin) refers to the graceful flowers. In South Africa, *B. elegans* is commonly referred to as the white bushveld barleria or *wit bosviooltjie* in Afrikaans, where populations produce white (less often blue) flowers from February to July, most profusely from March to May. Among the specimens (± 140) of *B. elegans* in the South African National Biodiversity Institute's herbaria, five specimens (*Gerstner s.n.*, NH22862 [NH], *Siebert 1969* [PRE], *Van Rooyen & Bredenkamp 493* [PRE], *Vahrmeijer 1406* [PRE] and *Wood 11870* [PRE]) from northern KwaZulu-Natal and Mpumalanga indicate blue flowers on the labels for the species.

In 1847, Nees described *Barleria pungens* var. *macropylla* based on a specimen collected by John Forbes (1798–1823) in Delagoa Bay (Maputo, Mozambique) in 1822. Nees reported the variety differs from typical *B. pungens* in having oval to oblong leaves that are 50 to 60 mm long. Moore (1880) provided a detailed description for

Barleria pungens var. *macrophylla* with a comment, '*B. elegans*, mihi in schedis' meaning '*B. elegans*, to me [own name], on [herbarium] sheets'. Presumably, he was referring to *Welwitsch 5068* (K, K000394523) and *Welwitsch 5187* (K, K000394522) which both have the pencil inscription 'type specimen of *B. elegans* S. Moore'. Moore applied the name *B. elegans* to the Angolan specimens and later realised that this taxon was the same as that named *B. pungens* var. *macrophylla* by Nees. He cited Welwitsch specimen numbers *5034*, *5068*, *5114*, *5122* and *5187* to represent *B. pungens* var. *macrophylla*.

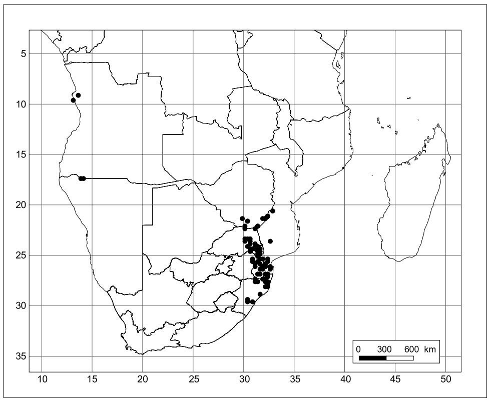

FIGURE 2.—Known geographical distribution of *Barleria elegans*.

In 1899, Clarke in his account of *Barleria* in the Flora of Tropical Africa, validly published *B. elegans* with *Barleria pungens* var. *macrophylla* as a synonym. He remarked, 'It was not easy to understand how Nees supposed it could be a variety of the Cape, *B. pungens* Linn., which has small toothed leaves with a different indumentum, and bears no superficial resemblance to *B. elegans*.' In his 1901 treatment of the Acanthaceae in *Flora Capensis*, Clarke cited the *Forbes s.n.* specimen from Delagoa Bay that represents Nees' *B. pungens* var. *macrophylla* under *B. elegans*. In his notes under *B. elegans* he cautioned, 'It must not be inferred from Nees' synonym that the plant bears the slightest resemblance to *B. pungens*.' Clarke (1899) listed eight specimens in his account of *B. elegans* and under the rules of the International Code of Botanical Nomenclature these are today recognised as syntypes of this name. In 2012 Florence Nyirenda, working on the morphological variation in five species of *Barleria* (Acanthaceae) for her MSc. study, selected *Welwitsch 5068* as the lectotype of *B. elegans*. *Barleria elegans* is to be formally lectotypified by Dr Iain Darbyshire of Kew in his treatment of the group in *Flora Zambesiaca* with the BM sheet of *Welwitsch 5068*, with isolectotypes at C, K, LISU and P (I. Darbyshire, pers. comm.). This forms part of his taxonomic treatment of the genus for the Flora Zambesiaca region and for a revision of the genus in Namibia and Angola. These treatments will clarify placement of the tropical and southern African populations of *B. elegans*. For the purpose of the present contribution, *B. elegans* is defined according to the broader concept as used by Clarke (1899, 1901).

Barleria elegans occurs in Angola, Namibia, Zimbabwe, South Africa, Swaziland and Mozambique. The Quarter Degree Square data used in Figure 2 were extracted from BRAHMS (PRE, NH, NBG and WIND) for Angola, South Africa, Swaziland and Namibia, and localities for Mozambique and Zimbabwe were provided by Dr Darbyshire. In South Africa, the species is restricted to the summer rainfall areas where it extends from Durban (KwaZulu-Natal) northwards to Nelspruit (Mpumalanga), and westwards and northwards to Musina (Limpopo Province). It grows at altitudes ranging from 20–750 m above sea level, in well-drained soils. The species occurs on rocky slopes in full sun where it forms low-growing, dense bushes, or along forest margins in semi-shade where it has a more scrambling habit with plants reaching heights of 7 m. Along the KwaZulu-Natal coast, the species is common on river banks, scrambling among vegetation.

Flowering, pollination and seed dispersal in *Barleria elegans* were observed during May and June 2014 and it was found that bud break occurs around 04:00, by which time the anthers are dehisced, and by 06:30 flowers are fully open. Once flowers are fully open, pollen adheres to the stigmatic area if introduced by hand. The short and rudimentary stamens with abortive anthers also carry well-formed pollen grains. The flowers produce rewards in the way of nectar and pollen, the former taken by butterflies and the latter by honeybees. By the end of the day (± 18:00) the corolla tube abscises and slides along the style, stopping at the point where the stigma comes into contact with the pollen of the short stamens. In controlled experiments in the laboratory, the anthers of two long filaments of several flowers were removed before bud break. It confirmed that the stigma picks up pollen from the reduced anthers of the short and rudimentary stamens as the corolla tube slides through. This infers that self-pollination is possible if cross-pollination by insects is not successful during the day. During the flowering and fruiting season of 2013 and 2014, apical twigs (about 0.5 m long) of *B. elegans* with ripe capsules were placed upright in a container in a controlled environment. Seeds were cast up to a distance of 10 metres away from the twigs, indicating forceful ballistic expulsion triggered by the drying of capsules. This distance would be affected in the wild by surrounding vegetation.

Barleria elegans forms bushy clumps and is an excellent low shrub for urban coastal gardens. Many flowers on a single plant open at the same time, making for a floriferous display in autumn when little else is in bloom. As a genus, *Barleria* produces several flower colour forms, some species displaying more than one colour. The profusion of flowering may be exploited to attract pollinators. Carvalheiro et al. (2012) reported that planting *Barleria* species in cultivated fields increased pollinator visits and could assist in enhancing crop pollination and fruit set. Like many *Barleria* species (Nichols 2005), *B. elegans* is easily propagated from tip cuttings or through seed germination.

Barleria elegans is most closely related to *B. saxatilis*, also a member of section *Barleria* with white and blue flowers that is widespread in South Africa and Swaziland. It differs from *B. saxatilis* in its larger leaves of 20–70(–100) × 15–25(–40) mm and the presence of non-glandular hairs on margins and spines of the calyx. *Barleria saxatilis* has leaves of 20–30 × 10–20 mm and glandular hairs on calyx margins and spines. *Barleria elegans* furthermore occurs mainly in humid areas, whereas *B. saxatilis* inhabits dry hot areas in KwaZulu-Natal, Mpumalanga, Limpopo and Swaziland (Makholela et al. 2004).

Description.—Prickly shrub, bushy or straggling, erect, 0.5–7.0 m high. *Stems* square in outline turning circular with age, sparsely hairy, glabrous with age, hairs curved. *Leaves* opposite, dark green above, pale below, elliptic, 20–70(–100) × 15–25(–40) mm; base attenuate or cuneate; apex mucronate; margins entire; lateral veins 3–9 pairs; hairs mainly present on margins and veins, directed upwards, white; petioles 5–14 mm long. *Inflorescence* axillary, scorpioid cymes with 2–20 flowers. *Bracteoles* 2, spinescent, 10–20 × 1.5–4.0 mm, green, elliptic; margins with 4–10 spines; apex spiny. *Calyx* 4 lobes, 1 anterior, 1 posterior, 2 lateral; anterior and posterior lobes elliptic or ovate, subequal, 13–22 × 4–9 mm, pale green with purple stripe from base to midway, margin spinescent, spines 4–20, 0.4–7.0 mm long, mucronate-spinescent at apex; lateral lobes linear or lanceolate, whitish with central purple stripe, 4–9 × ca. 1 mm, spinescent at apex. *Corolla* cylindrical, 26–40 mm long, white or blue, outer surface hairy, glabrous towards base; tube 18–25 mm long; upper lip of 4 subequal lobes, obovate, 2 adaxial lobes, 9–11 × 6–8 mm, slightly shorter than 2 lateral lobes, 10–13 × 7–8 mm; lower lip with single lobe, obovate, 11–12 × 8–9 mm. *Stamens* 5, attached to corolla tube, 2 long, exserted by 3–5 mm above corolla tube, 2 short included, one rudimentary; long filaments 13–20 × 0.5 mm, sparsely hairy, anthers 2–3 × 1.0–1.5 mm; short and rudimentary filaments 1.5–5.0 × 0.2–0.4 mm, densely hairy; anthers 0.1–1.3 × 0.2–0.7 mm, white, all producing pollen, pollen powder blue, dehiscence introrse. *Disc* cupular, white, covering ovary. *Ovary* smooth, glabrous, 2.5–3.5 × 1.5 mm; ovules 2 per locule; style 28–32 mm long; stigma shortly bilobed, finely papillate, ca. 1 mm long. *Fruit* a capsule, flattened, elliptic in face view, 13–14 × 5 mm, 1.7 mm thick, glabrous, 4-seeded, black when mature, dehiscing explosively. *Seeds* dark brown, 3–5 mm in diameter, appressed-hairy, hairs hygroscopic ca. 1 mm long, woolly and tapering finely towards apex when wet. *Flowering time*: February–July, most profuse from March–May. Plate 2316.

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Y. SINGH*, H. BAIJNATH** and GILLIAN CONDY***

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* KwaZulu-Natal Herbarium, South African National Biodiversity Institute, P.O. Box 52099, Berea Road, 4007 South Africa.

* Author for correspondence: y.singh@sanbi.org.za

** Ward Herbarium, School of Life Sciences, University of KwaZulu-Natal, Private Bag X54001, Durban, 4000 South Africa.

*** South African National Biodiversity Institute, Private Bag X101, Brummeria, 0001 South Africa.

PLATE 2317 *Curio muirii*

Curio muirii Asteraceae: Senecioneae

South Africa

Curio muirii (*L.Bolus*) *Van Jaarsv*., *comb. nov. Senecio muirii* L.Bolus in Annals of the Bolus Herbarium 1: 192, 193 (1915).

Curio muirii is a succulent shrublet endemic to shale cliffs along the Gouritz River and its tributaries, where it is mainly confined to the south-facing cliff faces. Although it is established in some succulent plant collections, its cliff habitat is rarely visited. The plant has drooping leafy branches, up to a metre long, hanging from cliffs or sprawling on steep slopes (Figure 1).

Louisa Bolus, one of South Africa's most productive botanists and a mesemb specialist, named her new species after John Muir (1874–1974), Scottish physician and self-trained naturalist who settled in the Cape in 1892. Muir practised at various places in South Africa but finally settled at Riversdale (Gunn & Codd 1981), where he made a large contribution to our knowledge of the local flora. His thesis *Flora of Riversdale*, later published as *Memoirs of the Botanical Survey of South Africa* 13 in 1929, earned him a D.Sc. from Edinburgh University. He is commemorated in several other plant species, including *Conophytum truncatum* subsp. *viridicatum*, *Leucospermum muirii* and *Erica muirii* (Gunn & Codd 1981). *Muiria hortenseae*, a monotypic genus in the Aizoaceae, was named for his daughter. Muir gathered the type of *Curio muirii* from cliffs along the Gourtiz River south of the Langeberg Mountains, and the species was named for him as *Senecio muirii* by Louisa Bolus in 1915.

Modern classification of *Senecio* L. begins with Linnaeus (1753), who recognised 26 species in the genus in his *Species Plantarum*. Asteraceae are one of the world's largest plant families (about 1 300 genera and 21 000 species) with a cosmopolitan distribution (Willis 2012). Of these species, just over 120 are recognised as succulent (Eggli 2002) belonging to 15 genera, many of them members of the tribe Senecioneae. The genus *Senecio* is by far the largest at present with more than 1 000 species, of which more than 50 have succulent features. The genus *Senecio* is in the process of being fragmented into several smaller genera following the application of DNA techniques (Nordenstam et al. 2009). In *The list of southern African succulent plants* (Herman et al. 1997), 44 succulent species are listed as belonging to *Senecio*. The genus *Caputia* was separated from *Senecio* by Nordenstam & Pelser (2012) to accommodate plants with terete leaves covered in dense cobwebby hairs and large flowers with conspicuous ray florets, all endemic to South Africa. These include *C. medley-woodii*, *C. pyramidata*, *C. oribiensis*, *C. scaposa* and *C. tomentosa*. The genus *Curio* was recognised by P.V. Heath (1997) to accommodate species with fusiform succu-

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PLATE 2317.—1, plant with branch and inflorescence, × 1; 2, cross section and dorsal and ventral view of detached leaves, × 1; 3, capitulum, × 3; 4, detached floret, × 20; 5, achene, × 4; 6, longitudinal cross-section of flowering capitulum, × 4; 7, mature capitulum releasing its seed, × 4. Voucher specimen: *Van Jaarsveld 7593* in Compton Herbarium, Cape Town. Artist: Marieta Visagie.

FIGURE 1.—*Curio muirii* in habitat: a, plant sprawling over cliff face at Meiringspoort, Little Karoo; b, close-up of plant; stems root where they touch rock ledges or ground. Photographs: E.J. van Jaarsveld.

lent leaves and uniform disc florets, lacking ray florets (Heath 1997, 1999; Manning 2013). The genus *Curio* is currently under revision by the University of the Orange Free State. Floral and vegetative features of *Senecio muirii* indicate that it should be transferred to the genus *Curio* and we do so here.

Curio muirii is one of five related species often confined to sheer cliff faces. The others includes *Curio talinoides*, *C. ficoides*, *C. serpens* and *C. pondoensis*. From these it is immediately separated by its ascending, pruinose, dorsiventrally compressed succulent and sparingly toothed leaves.

Curio muirii has been found mainly in the Klein Karoo, from Meiringspoort on the Olifants River (a tributary of the Gouritz River) in the northeast, from the Huisrivier Pass in the northwest (on the Gamka River), and then further south at various sites along the lower Gouritz River (Figure 2). Plants are typically found on quartzitic sandstone of the Peninsula Formation but also on Bokkeveld shale (Cape Supergroup). Although the species has been listed by Raimondo et al. (2009) in the *Red List of South African Plants* as being rare, it is locally abundant and well protected by its vertical rock-face habitat.

The plant depicted here (*Van Jaarsveld 7593*, NBG 1336/84) was collected south of Calitzdorp close to the Calitzdorp Spa in 1984. It was growing on sheer sandstone cliffs not far from the Gouritz River. Another population from cliffs near the top of Huisrivier Pass (at about 800 m above sea level) was found growing together with *Crassula rupestris* subsp. *marnieriana*. The species was also later found at Badspoort (*Van Jaarsveld 16106*, NBG 202/2003) on shady, south-facing cliffs. Here the plants were observed growing with other cremnophytes such as *Albuca thermarum*, *Bulbine ramosa*, *Cotyledon tomentosa* subsp. *tomentosa*, *Crassula badspoortense*, *Tromotriche choanantha* and *Tylecodon leucothrix*. We also found the species on cliffs south of the Langeberg at Groote Heuvel (*Van Jaarsveld 13920*, NBG 90/94) and Valsriviermond (*Van Jaarsveld 19264*, NBG 486/2004) close to the Gouritz Bridge, along the N2 motorway.

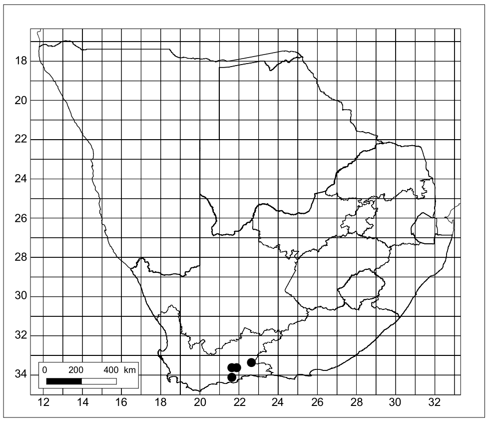

FIGURE 2.—Known distribution of *Curio muirii*.

The plants usually grow on south-facing cliffs (altitude 300–800 m), often sprawling down the cliff-face and bearing long, pendent branches. Detached pieces landing in crevices or on ledges will root, a method of vegetative propagation aiding survival and colonisation. The leaves are always oriented vertically. Windows on the leaves allow for light penetration (Rowley 1994; Van Jaarsveld 2011). The leaves of *Curio muirii* have three prominent veins that are translucent on the abaxial side. This can be clearly seen when a leaf is held up against a light source. The pruinose surface covering is easily rubbed off when a leaf is touched. The vegetation along the Gouritz River consist of Albany Thicket and Gamka Thicket in the Klein Karoo, and Southern Cape Valley Thicket further south (Mucina & Rutherford 2006).

Rainfall occurs mainly in winter and summer from thundershowers and cyclonic winter rain, ranging from 300–400 mm per annum. The average daily maximum temperature is 23°C and average daily minimum is 11°C. The summers are hot with temperatures frequently above 30°C. The winters are mild with cold nights but frost is usually absent from the cliff-face habitat.

Pollinators have not been observed in this species but the flower architecture suggests an insect with an extended proboscis. The plants flower from spring to autumn, often depending on rainfall. The seeds are dispersed by wind. Vegetative reproduction is also associated with other succulent plants growing on cliffs. The branches of *Curio muirii* grow aerial roots where they touch a ledge or crevice, thus readily forming new colonies.

Curio muirii has been grown at Kirstenbosch National Botanical Garden since 1984. It is easily propagated by stem cuttings rooted in moist sand. When grown in a container, the plant soon grows long branches that become pendent. Plants were also established with success in hanging baskets in front of the Botanical Society Conservatory. Some of the branches have reached almost 1 metre in length. Short aerial roots often develop at the branch ends. Plants are evergreen, but the leaves often wither from the base, resulting in crowded leaves at the apices. The leaves become turgid after rain but survive in a semi-desiccated state during dry periods. *Curio muirii* thrives in cultivation and does best in thicket gardens, subtropical gardens and also succulent karoo gardens in regions where frost is not severe. It is best grown on embankments, dry stone wall gabions or in hanging baskets (Van Jaarsveld 2010). A spontaneous hybrid between *C. muirii* and *C. pondoensis*, which germinated in the cliff plant house, corroborates their close relationship. The hybrid has leaves much broader that *C. pondoensis* with single large windows on adaxial surfaces.

Specimen examined: South Africa, Western Cape, *Van Jaarsveld 18876* (NBG).

Description.—Spreading, moderately branched succulent shrublet. *Stems* decumbent and becoming pendent on cliffs, rooting where touching rock ledges or ground, all parts glabrous; branches terete, 5–6 mm diam., at first softly succulent (flaccid), becoming purplish grey and slightly woody, internodes 4–8 mm, branch tips often with aerial roots, rooting in crevices. *Leaves* obovate to oblong-obovate, subsecund, vertically oriented, succulent, bluish or glaucous green, pruinose, crowded towards branch tips, lower surface with 3 prominent translucent veins, margin entire or with 1–3 pairs of shallow teeth, often becoming purplish, apex obtuse to subacute, mucronate, base cuneate; petiole short, up to 2 mm long; older leaves deciduous from base. *Inflorescence* a spreading to drooping, terminal, sparsely branched, lax corymb, up to 150–250 mm long, peduncle long and slender. *Capitula* discoid, oblong, 10 × 5 mm, with up to 8 phyllaries. *Cypsela* 3 × 0.8 mm; pappus 5–6 mm long. Plate 2317.

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E.J. VAN JAARSVELD* & MARIETA VISAGIE**

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* South African National Biodiversity Institute, Kirstenbosch, Private Bag X7, Claremont, 7735 South Africa / Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville, 7535 South Africa.

* Author for correspondence: e.vanjaarsveld@sanbi.org.za

** 12 Molteno Court, Molteno Drive, Stellenbosch, 7599 South Africa.

Othonna globosa Asteraceae: Senecioneae

South Africa

Othonna globosa *Koekemoer* sp. nov., distinguished from other species by its large, globose succulent stem, thin, long, flexible, trailing branches, leathery, brown to blackened bark, pealing with age; leaves simple, undivided, somewhat fleshy, margins entire, apex rounded or apiculate; capitula radiate, ray florets 5, lamina shorter than involucral bracts. Distribution restricted to the South African West Coast, Northern Cape.

TYPE.—South Africa, Northern Cape, Namakwa National Park, along coastal 4×4 route at Koringkorrelbaai, amongst rocks just S of bay, 3017CB, 30°39'20"S 17°27'50"E, altitude 17 m, 5 September 2010, *Koekemoer 3917* (PRE, holotype; NBG, isotype).

The specific epithet was chosen to describe the globe-shaped, spherical caudex of this plant.

The genus *Othonna* is largely endemic to southern Africa, with most species distributed in the western parts of the country. Currently, after the recent separation of *Crassothonna* (Nordenstam 2012), 86 species of *Othonna* are recognised in southern Africa. Members of the genus display a variety of growth forms: from underground tubers with perennial or annual branches and leaves, aboveground bonsai-like stem succulents, small stunted dwarf trees, to large woody shrubs.

Othonna globosa is distributed in a narrow band of probably not more than 100 m wide along the shores of the West Coast of South Africa, roughly between Hondeklipbaai and Groenriviersmond (Figure 1). When the type material was collected it was already past the flowering time and therefore representative herbarium specimens were not collected. Sight records of many plants were recorded in all suitable habitats along the stretch of coastline where it was quite common. It is likely that more plants will be found in suitable habitats further north and south of this area. The distribution area falls within the Namaqualand Coastal Duneveld vegetation type (Mucina & Rutherford 2006), which extends much further north of Hondeklipbaai and an effort should be made to search for specimens as far north as Kleinsee.

Most of the known localities are in rocky coastline habitat. *Othonna globosa* grows in shallow soil pockets and in crevices on rocky outcrops along the coast, where it is subjected to mist and salt spray from the sea (Figure 2). This is a rather harsh environment where rainfall is low and mainly falls during the winter months. Moisture in the form of fog from the sea and sea spray probably provides enough water for the plants to grow.

PLATE 2318.—1, caudex, × 1; 2, flowering stem, × 1. Voucher specimen: *Koekemoer 3917* in National Herbarium, Pretoria; duplicate in Compton Herbarium, Cape Town. Artist: Gillian Condy.

PLATE 2318 *Othonna globosa*

The specimen illustrated (*Koekemoer 3917*) was collected at Koringkorrelbaai (3017CB) in the Namakwa National Park.

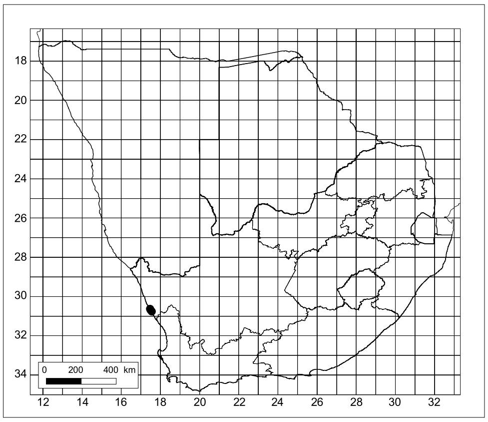

FIGURE 1.—Known distribution of *Othonna globosa.*

In searching through herbarium collections for more material, only one specimen, *Marloth 6485* in PRE, was found to be similar to our illustrated species. This specimen was made by Marloth from a plant grown in his garden from a caudex originally sent to him by Rev. Meyer. This caudex flowered in July 1926. He gave the district locality for the caudex as Steinkopf, with no further locality notes, and added the common name *knolrapuis* to the label. The caudex and leaves are similar to *Othonna globosa* but the capitula are discoid and have broader involucral bracts that are connate at the base for about a quarter of the length. Without more accurate locality details it is difficult to determine if this specimen should be included in the concept of *O. globosa*.

The Marloth specimen does, however, cause one to ponder the value of radiate versus discoid capitula as a distinguishing character between species. It is known that some typically radiate species of *Senecio* can be with or without ray florets, but this characteristic is not known for *Othonna*.

A specimen without locality, similar to *Othonna globosa* but with discoid capitula, was observed in the conservatory of Kirstenbosch National Botanical Garden. Similar plants, without voucher specimens, with discoid capitula have also been photographed in the Namaqualand area (A. le Roux, pers. comm.). It therefore remains to be seen if the discoid form should be incorporated into *O. globosa* and substantially extend its distribution range, or be described as a distinct species.

Rowley (1994) features an image of a similar-looking plant, which is not in flower, from an unknown locality near Vredendal. He did not name the plant but stated that it might perhaps be *Othonna macrosperma*. However, from the isotype specimens on ALUKA and the description in De Candolle's *Prodromus* (1838), it is unclear if the image depicted by Rowley is that of *O. macrosperma*. The type specimen of *O. macrosperma* has short flowering stems with radiate capitula and it is described as succulent shrubs with no mention of a caudex. The locality is given as the Olifants River, which runs past Vredendal. The plant in the image may depict *O. globosa* if it has radiate capitula, or it may be undescribed if the capitula are discoid.

We are grateful for advice of Dr H.F. Glen on the name, and to H.M. Steyn for producing the distribution map.

FIGURE 2.—*Othonna globosa*: a, typical habitat where *O. globosa* can be found; b, *O. globosa* in its natural habitat; c, a very old caudex of *O. globosa*; d, a single capitulum; e, a flowering branch; f, a young plant in cultivation.

FIGURE 3.—Achene and pappus of the ray floret.

Description.—Succulent plants, up to 0.3 m tall. *Caudex* round, generally about the size of a tennis ball, 20–90 (–160) mm diameter, shallowly rooted in soil pockets, roots often spreading horizontally to reach cracks between rocks to anchor plant; stems seasonal, develop from several growth points from upper part of caudex, die back in dry season to leave protective remains which develop into large tubercles and stem-like protrusions with age, 2–80 mm long; stems and caudex covered with thick brown leathery bark, peels off in flakes as plant grows, coppery-brown with green undertone in young plants, blackened by sun in old plants. *Branches* short-lived, few to many, up to 0.4 m long, often spreading horizontally, slender, with sparse terminal branching, brittle, leafy at tips. *Leaves* alternate, sessile, often in terminal clusters, simple, oblanceolate, 30–62 × 7–16 mm, flat, somewhat fleshy in fresh material, glaucous, indistinctly veined when fresh but with clear midrib when dry, apex rounded or minutely apiculate, tapering at base, silky hairs in axils. *Flowering stems* with 1–4 capitula slightly overtopping leaves. *Involucre* narrow, with 5 bracts, bracts uniseriate, 6.8–7.2 × 1.5 mm, glaucous, smooth, connate at base only. *Capitula* radiate, florets yellow. *Ray florets* 5, female, fertile, shorter than involucre; tube 3 mm long; lamina 6.5 × 2 mm; style divided with two slender arms, ± 2 mm long; ovaries 1.5 × 1 mm; pappus in multiple rows, as long as tube. *Disc florets* 25–35, male; tube 4.3–4.7 mm long, widening abruptly in upper half; lobes 1 mm long; style undivided; ovaries 3 mm long, narrow, cylindric, sterile; pappus in single row of barbed bristles. *Achenes* very densely villous (Figure 3). *Flowering time*: June and July. Plate 2318.

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M. KOEKEMOER*§ and GILLIAN CONDY*

---

* South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa
§ Author for correspondence: m.koekemoer@sanbi.org.za

Othonna pumilio Asteraceae: Senecioneae

South Africa

Othonna pumilio *Koekemoer* sp. nov. is distinguished from other species by its bonsai-like growth form with succulent stem, leathery bark and short, stout branches; leaves toothed, clustered at tips of young branches; capitula radiate, ray florets 5, lamina of ray florets longer than involucral bracts. Distribution restricted to Swartruggens and Cederberg mountains in the Western Cape, South Africa.

TYPE.—South Africa, Kagga Kamma Nature Reserve, Swartruggens Mountains, in shallow soil in rock crevice, mostly on large open rock slabs with small soil pockets, 3219DA, 32°42’18”S 19°33’10”E, altitude 955 m, 10 August 2012, *Koekemoer 4301* (PRE, holotype; NBG, isotype).

The specific epithet *pumilio* is in reference to the distinctive dwarf-like growth form of this species.

The Swartruggens and Cederberg mountains are relatively rich in *Othonna* species. The species vary from stem and tuberous succulents to woody shrubs. Thirteen and nine species are currently known from the two areas respectively, which makes the grid square including the Swartruggens Mountains one of the grids with the highest density of *Othonna* species.

The geology and climatic conditions of the Swartruggens Mountains are very similar to those of the Cederberg. The known distribution of *Othonna pumilio* (Figure 1) falls within the Swartruggens Quartzite Fynbos vegetation type (Mucina & Rutherford 2006) and the landscape in the Swartruggens Mountains strongly resembles the localities where *O. pumilio* occur in the Cederberg range. Plants are found on rocky plateaus among magnificent and characteristic sandstone formations.

The three known collections in the Compton Herbarium have previously been identified (with reservations indicated on the sheets) as *Othonna quercifolia*, but this species is separated from *O. pumilio* by its longer peduncles, clusters of capitula and deeply incised leaves. Robert H. Compton originally identified *Wagener 155* as ‘indet.’ and later added ‘quercifolia’ with a note stating, ‘not matched in H.Bolus’. A note on *I. Jardine & C. Jardine 316* indicate uncertainty about the identity.

The specimen *Cowell, Bennett & Pekeur 3445*, collected in the Bushmanskloof Private Nature Reserve and housed in the Compton Herbarium, is regarded as a good match for *Othonna quercifolia*.

In general the identification of succulent *Othonna* collections remains problematic if one has incomplete specimens. The leaves vary considerably from the seedling

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PLATE 2319.—1, caudex, × 1; 2, capitulum, × 2; 3, involucre, × 2; 4, ray floret, × 4; 5, tubular floret, × 4. Voucher specimen: *Koekemoer 4301* in National Herbarium, Pretoria; duplicate in Compton Herbarium, Cape Town. Artist: Gillian Condy.

G Condy

PLATE 2319 *Othonna pumilio*

to mature stages and also between mature plants. Leaves of cultivated plants are often very different from those in nature. The capitulum structure seems to be more stable but provide very few diagnostic characters. In an attempt to identify herbarium specimens consisting of short leafy twigs on a sheet, one has to create an imaginary reconstruction of the plant. This exercise becomes almost impossible if plants have not been studied in the wild.

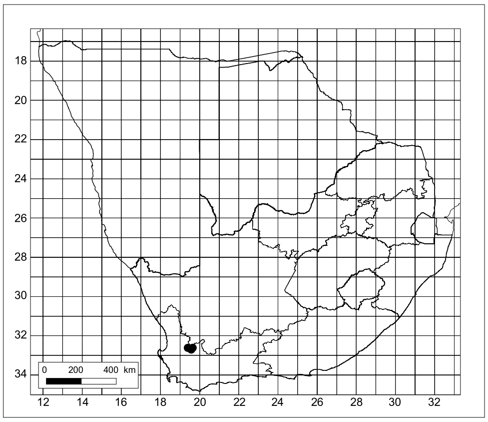

FIGURE 1.—Known distribution of *Othonna pumilio*.

The specimen illustrated (*Koekemoer 4301*; Figures 2a & b) was part of the type collection and has been cultivated for two years. In cultivation the leaves are much larger in dimension and the indentations much deeper (Figure 2c). The capitula consistently produced five ray florets with the lamina of these florets much longer than the length of the involucral bracts (Figure 2d).

We are grateful for advice of Dr H.F. Glen on the name, and to H.M. Steyn for producing the distribution map.

Description.—Succulent plants, up to 0.25 m tall. *Caudex* cylindric, generally about 200 × 60 mm, slightly swollen near base with shallow roots; surface covered with thick, leathery bark, pealing with age; branches confined to upper parts, short, stout, short-lived, 10–50 mm long. *Leaves* oblanceolate, 20–45 × 8–17 mm, shallowly incised, with 2–5 pairs of teeth, clustered on young branches, alternate, sessile or tapering into a short petiole, fleshy, midrib often tinged purple. *Flowering stems* mostly solitary, occasionally branching into up to 4 peduncles, each with a single capitulum; peduncles overtopping leaves slightly. *Involucre* narrow with 5 bracts; bracts uniseriate, 10–11 × 4 mm, glaucous, smooth, each tightly clasping the fertile achene of a ray floret, connate at base only. *Capitula* radiate, florets yellow. *Ray florets* 5, female, fertile; tube 6 mm long; lamina 11–12 × 4 mm, revolute in low light; pappus 4 mm long, shorter than tube, multiple rows of barbed bristles; style divided, arms 1.5 mm long; ovary 3 × 2 mm, very densely hairy. *Disc florets* 55–65, male; tube 5–6 mm long, widening gradually upwards; lobes 1 mm long; style club-shaped; pappus ± 3 mm long, single row of barbed bristles; ovary 3–4 mm long, slender cylindric, smooth, sterile. *Flowering time*: June to September. Plate 2319.

SPECIMENS EXAMINED

Western Cape: 3219. (–CB): Cederberg, Gonnafontein. Rocky outcrop E of Pond's house, 16 June 2000, *Pond 81* (NBG); Matjiesrivier, Cederberg, September 1943, *Wagener 155* (NBG). (–DC): Knolfontein, Swartruggens, 60 km NE of Ceres, 1194 m, 32°52'59"S, 19°38'21"E, 19 June 2006, *I. Jardine & C. Jardine 316* (NBG).

FIGURE 2.—*Othonna pumilio*: a, the type specimen before it was pressed; b, leaves and capitula of the live type specimen; c, a plant in cultivation two years after collection; d, capitula of cultivated plant.

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M. KOEKEMOER*§ and GILLIAN CONDY*

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* South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.
§ Author for correspondence: m.koekemoer@sanbi.org.za

Zoutpansbergia caerulea Asteraceae: Inuleae

South Africa

Zoutpansbergia caerulea *Hutch*., A botanist in southern Africa: 350 (1946); Venter: 20 (1995); Hahn: 122 (2002).

During his travels in the interior of South Africa, Hutchinson collected a shrubby Compositae plant on the farm Crewe at the western end of the Soutpansberg. He recognised it as a new genus and named it *Zoutpansbergia*, after the mountain range where it was collected for the first time. He described it as a shrub with solitary heads and blue ray florets, hence the species name *caerulea*. Hahn (1994) said the species name *caerulea* refers to the blue tubular florets. Venter (1995) described the ray florets as white and the disc florets as blue. However, 25 herbarium specimens from PRE and PRU were examined. Of these, the flower colour was recorded on 17 labels: one reported purple flowers, 15 reported white ray florets or, in general, flowers white; two labels mentioned white disc florets and five recorded the colour of the disc florets as purple, light purple or tinged lilac. Only two collectors described the white ray and disc florets with light purple or purple red anthers, which is more realistic. The accompanying plate, prepared from a live specimen, shows the white ray and disc florets and the rose-pink anthers and styles – no sky blue colour whatsoever. The illustration in Hahn (2002: 126) also clearly depicts the protruding rose-pink styles and anthers.

The tribal position of this genus in the family Asteraceae is still unresolved. Hutchinson (1946) put it in the tribe Inuloideae. Leins (1971a, b) reduced *Zoutpansbergia* to a synonym under *Callilepis* and made the new combination *Callilepis caerulea* (Hutch.) Leins. His reasoning for doing this was the similarities in the styles, style branches and stigmatic areas, cypselae and pappus morphology, paleae, corollas, the anther tails as well as the pollen. He put *Callilepis*, including *Zoutpansbergia*, in the tribe Inulinae. In more recent publications Anderberg (1991), Bayer et al. (2007) and Ward et al. (2009) followed Leins by including *Zoutpansbergia* in *Callilepis* but placed them in the tribe Gnaphalieae. Anderberg (2009) put them in the tribe Inuleae, with the Athroismeae and Heliantheae as sister groups.

The inclusion of *Zoutpansbergia* in *Callilepis* was not favourably accepted by South African botanists and plant enthusiasts. In the *List of species of southern African plants* published in 1984 by Gibbs Russell et al., and the second edition, part 2, published in 1987, *Callilepis* and *Zoutpansbergia* were treated as two independent taxa, as was the case in Herman (1993). Hahn (1994) also listed *Zoutpansbergia* as an independent genus. In Retief & Herman (1997), Herman et al. (2000) and Herman et al. (2003) the synonymy was accepted but *Zoutpansbergia* was resurrected in Herman et al.

PLATE 2320.—1, flowering branch, × 1; 2, capitulum, × 3; 3, ray floret, × 5; 4, disc floret with palea, × 5. Voucher specimen: *Kremer-Köhne 896* in National Herbarium, Pretoria. Artist: Gillian Condy.

PLATE 2320 *Zoutpansbergia caerulea*

(2006). Recent publications and documentation on plants of South Africa still accept *Zoutpansbergia* as a separate taxon (Coates Palgrave 2002, Hahn 2002, Van Wyk et al. 2011).

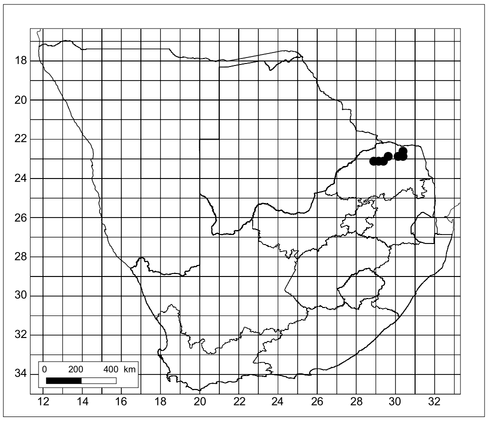

FIGURE 1.—Known distribution of *Zoutpansbergia caerulea* in southern Africa.

Zoutpansbergia caerulea is a shrub or small tree endemic to the Soutpansberg and Blouberg (Blaauwberg) areas in the Limpopo Province of South Africa (Figure 1) (altitude 1 160–1 750 m) where it is usually found growing on open sunny ridges covered with sparse vegetation (Venter 1995). It is commonly known as the Soutpansberg marguerite, *soutpansbergmadeliefiebos* (Afrikaans) and *Nyatsi* (Venda) (Van Wyk et al. 2011). According to Raimondo et al. (2009) the Red List status of *Callilepis caerulea* (= *Zoutpansbergia caerulea*) is LC (least concern). A poster paper which was displayed at the congress of the South African Association of Botanists in January 2011, by R. Rambau & N.A. Masevhe, titled *An inventory of indigenous medicinal plants used in the treatment of tuberculosis in Vhembe district municipality, Limpopo Province, South Africa*, described the use of dried and ground leaves of *Zoutpansbergia caerulea* of which half a teaspoon is sniffed thrice a day as a treatment for tuberculosis.

Description.—Shrub or small tree up to 4 m high. *Leaves* alternate, ± subsessile, obovate to narrowly obovate to rarely very narrowly obovate, 25–75 × 5–15 mm, apex obtuse to acute, base cuneate, margins serrate in upper half, glabrous, with 2 faint veins parallel to main vein from base, petiole ± 2 mm long. *Capitula* heterogamous, radiate, solitary or up to 5 terminally in axils of upper leaves, shortly pedunculate. *Involucre* campanulate to urceolate, 7–14 mm in diameter. *Involucral bracts* in 5 or 6 rows, imbricate, outer shortest, glabrous, straw coloured, with dark or purplish elliptic to obovate resin blotch at apex; outer row consisting of 2–4 bracts, ovate, acute, 5.0–5.5 × 2.5–4.0 mm, gibbous and keeled in middle at base, margin narrowly membranous; second row ovate, 6.0–7.5 × 4–6 mm, apex acute to obtuse, margin narrowly membranous; third row ovate, acute to sub-acute, 8.0–8.5 × 4.0–5.5 mm, margin narrowly membranous; fourth row ovate to elliptic, 8.5–9.5 × 3.5–5.0 mm, apex acute to sub-acute, margin narrowly membranous; fifth row narrowly ovate to elliptic, 9–10 × 3.0–4.5 mm, apex acute, margin membranous, fimbriate at apex; sixth row narrowly elliptic to oblong, 9–10 × 2.5–3.5 mm, apex acute, margin membranous, fimbriate at apex. *Receptacle* paleate, paleae straw coloured, conduplicate (boat-shaped), 9.0–10.5 × 2.0–2.4 mm, apex acute, purplish, margins membranous, fimbriate at apex, keeled, keel with membranous wing and fimbriate towards apex, enveloping ray and disc florets, paleae of ray florets transition between inner involucral bracts and disc paleae, not so strongly keeled. *Ray florets* female, fertile, tube 3–5 mm long, with 4 or 5 staminodes, ± 1 mm long, limb 7–12 × 2.5–5.0 mm, elliptic, apex 3-dentate, corolla white, glabrous. *Style* 4–5 mm long, bifurcate, style branches linear, 1.0–1.5 mm, apex obtuse, stigmatic areas covering inside of branches, rose-pink. *Ray cypselae* brownish to straw coloured, cuneate to narrowly oblong, 4–5 × 1 mm, triquetrous, margins long hairy, hairs multicellular. *Pappus* dimorphic, consisting of 3 long awns interspersed with small scales; awns from cypsela margins, inner awn (opposite ray limb) longest, 3.0–4.5 mm long, other 2 awns shorter, 2.5–3.5 mm long; scales oblong, up to 1 × 0.2 mm, apices lacerated. *Disc florets* regular, bisexual, fertile, tube cylindric, 5.0–6.5 mm long, slightly widening towards lobes, lobes 5, up to 1.8 mm long, corolla white, glabrous. *Anthers* rose-pink, 2 mm long, with ovate apical appendages, 0.5–1.0 mm long, bases calcarate and caudate, tails 0.5–1.0 mm long, hairy. *Style* 5.0–6.5 mm long, bifurcate, style branches 1.0–1.7 mm long, oblong, apex obtuse or conical, papillate on outside, stigmatic areas covering inside of branches, rose-pink. *Disc cypselae* brownish to straw coloured, cuneate to narrowly oblong, laterally compressed or sometimes faintly triangular, 4.5–6.0 × 1.0–1.2 mm, hairy along margins, hairs multicellular. *Pappus* dimorphic, consisting of 2, rarely 3, awns interspersed with small scales; awns from margins of cypselae, 1 awn, 4–5 mm long, other awn 3–4 mm long; scales oblong, up to 1 × 0.5 mm, apices lacerated. *Flowering time*: recorded from February–December, but with a peak from April–July. Plate 2320.

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P.P.J. HERMAN*§ and GILLIAN CONDY*

---

* South African National Biodiversity Institute, Private Bag X101, Pretoria, 0001 South Africa.
§ Author for correspondence: P.Herman@sanbi.org.za

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. 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, several completed plates awaiting publication in *FPA*. Authors intending to have plants illustrated and written up for *FPA* are therefore advised to contact the editor to establish whether a plant has not already been figured for *FPA*.

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

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

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

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

1. ***Synopsis***. The correct name of the plant together with its author/s and relevant literature (name of publication written out in full) is cited. Put a comma after the author's name if the publication that follows is his/her own; write the word 'in' after the author's name if the publication that follows is a journal or other work edited/compiled by someone else. Following this, are synonyms (listed chronologically) plus their author/s and relevant literature reference/s reflecting only author, page and year of publication, e.g. Boris et al.: 14 (1966). The whole synopsis is in one paragraph. If there are many synonyms and literature references, restrict yourself to the most important ones. References should be arranged in chronological sequence; where two or more references by the same author are listed in succession, the author's name is repeated with every reference. Author citations of plant names should follow Brummitt

& Powell (1992, *Authors of plant names*); for other authors, give full surnames followed by a colon, page number/s and date.

2. ***Literature references in the text***. Should be cited as follows: 'Jones & Smith (1999) stated …' or '… (Jones & Smith 1999)' when giving a reference simply as authority for a statement. When more than two authors are involved, use the name of the first author followed by 'et al.' Personal communications are given only in the text, not in the list of references; please include full initials to identify the person more positively. Referencing websites are generally discouraged unless their content is based on reviewed scientific research (e.g. databases of plant names, online Floras, specimen images, Red Lists, etc.) or are otherwise trustworthy and reputable.

3. ***List of references***. All publications referred to in the synopsis and the text, but no others, are listed at the end of the manuscript under the heading 'References'. The references are arranged alphabetically according to authors and chronologically under each author, with a, b, c, etc. added to the year if the author has published more than one work in a year. If an author has published both on his/her own and as senior author with others, the solo publications are listed first and after that, in strict alphabetical sequence, those published with one or more other authors. Author names are typed in capitals. Titles of books and journals are written out in full, in italics. In the case of books, the name of the publisher is followed by a comma and the place of publication. For websites, provide full website name, address and the date when it was accessed in square brackets.

4. ***Text proper***. It should be written in language and style acceptable to both the scientist and informed lay person. The following features should, as far as possible, be described and discussed in the text:
   - Main diagnostic characters for a brief pen picture of the plant.
   - Affinities: how the taxon differs from its nearest allies; if necessary keys may be used to distinguish closely related taxa.
   - History of the taxon, where and when first collected and by whom.
   - Geographical distribution in Africa: a distribution map, which will be handled as a figure, is essential; authors should submit a list of Quarter Degree Grid Cells, or GPS coordinates in decimal degrees in two columns (first column for latitude, second column for its corresponding longitude), from which the editor's office will produce the distribution map.
   - Ecology: habitat preferences etc. It is highly recommended that authors submit a photograph of the plant in habitat or a general habitat image.
   - Phenology: time of flowering, fruiting, etc.
   - Economic importance, edibility, medicinal use, toxicity, etc.
   - Cultivation potential and hints on cultivation.
   - Origin of the scientific names.
   - Common names in various languages.
   - Any other facts of interest to the scientist or lay person.

5. ***Description***. This is a formal description of the taxon and not merely of the specimen illustrated. For measurements, use only units of the International System of Units (SI). Use only mm and/or m.

6. ***Captions***. Supply a caption for the colour plate, indicating the relevant magnifications and/or reductions, and citing the voucher specimen used for the illustration, i.e. collector + number + herbarium (full name, not acronym) where the specimen is

housed. The caption ends with the name of the artist. Also supply captions for the distribution map and any other figures you want to include (please use scale bars where relevant), making sure all figures are mentioned in the text.

ARTISTS

1. ***Supervision***. All illustrations should be executed under the supervision of the botanist writing the text to ensure botanical accuracy and that details considered important by the botanist are adequately depicted.

2. ***Dimensions***. The dimensions to work to are 160 × 210 mm (width × height of image) or slightly smaller. Illustrations are printed as is, i.e. the same size. Only in exceptional cases are illustrations reduced or enlarged.

3. ***Paper***. The paper must be of good quality and as white as possible. Arches or Saunders Waterford (hot-press, 300 gsm) is recommended. The use of board should be avoided.

4. ***Watercolours***. The use of good-quality watercolours, e.g. Winsor & Newton (certain pigments fade with time) or Schmincke (colourfast), is essential. The use of black paint is not recommended as it is too harsh and tends to kill colour. Similarly, white paint must be used with caution since it tends to dull adjoining colours and sometimes reproduces as a bluish colour. Its use should be limited to white hairs and certain highlights only. To reflect whiteness, endeavour to use the paper colour itself.

5. ***Subject material, composition etc***. For obvious reasons, the subject material should be representative of the species being illustrated and should be in excellent condition. Drawing from photographs is not recommended: it is impossible to obtain the same detail from a photograph as from the living plant.

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

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

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

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

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

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