

Flowering Plants of Africa

Volume 66

June 2019



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 179.

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(note Afrikaans translation and changes in title)

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The Flowering Plants of South Africa

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Flowering Plants of Africa

Cover illustration: *Aloidendron barberae* (Plate 2342)

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Flowering Plants of Africa

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

Edited by

Alicia Grobler

with assistance of

Gillian Condry

Volume 66

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This volume is dedicated to

GILLIAN [GILL] CONDY



Recently retired, Gill Condry was the resident botanical artist of the South African National Biodiversity Institute, stationed at the National Herbarium, Pretoria, for 34 years. She is passionate about botanical art and active as a freelance artist and inspirational teacher. Her paintings have delighted readers with more than 400 of them having graced the pages of *Flowering Plants of Africa* over the years. One of the founding members of the Botanical Artists Association of Southern Africa, she has been awarded several local and international medals, including from the Linnaean Society of London, the Royal Horticultural Society, the Botanical Society of South Africa and the South African Association of Botanists' Merit Certificate. Gill has curated and contributed to various prestigious events and exhibitions locally and around the world, including the Highgrove and Transylvanian Florilegiums, under the auspices of the Prince's Trust, and features in the Sydney Florilegium. Her zest for documenting indigenous flora is unsurpassed.



PLATE 2341 *Moraea spathulata*

Moraea spathulata

Iridaceae

Southern Africa

Moraea spathulata (L.f.) Klatt in Durant & Schinz, *Conspectus Florae Africae* 5: 152 (1894). *Iris spathulata* L.f.: 99 (1781). *Iris spathacea* Thunb.: 17 (1782). *Moraea spathacea* (Thunb.) Ker Gawl., sub tab. 1103 (1808). *Moraea longispatha* Klatt: 560 (1866). *Moraea spathulata* subsp. *autumnalis* Goldblatt: 265 (1977); *Moraea spathulata* subsp. *saxosa* Goldblatt: 265 (1977); *Moraea spathulata* subsp. *transvaalensis* Goldblatt: 265 (1977).

Moraea Mill. is a large genus in the Iridaceae with individuals that can, at first glance, easily be mistaken for *Iris* L. species (Goldblatt 1976). The Iridaceae are geophytic perennials, many with attractive and colourful flowers, several of which are well known as ornamentals and cut flowers (Koekemoer et al. 2013). In South Africa, the family is represented by 33 genera and 1 204 species and is most diverse in the winter-rainfall zone and along the eastern escarpment (Koekemoer et al. 2013).

Moraea is closely related to *Iris*, *Dietes* Salisb. ex Klatt and *Ferraria* Burm. ex Mill. (Goldblatt et al. 2002) and includes formerly recognised genera *Barnadiella* Goldblatt, *Galaxia* Thunb., *Gynandriris* Parl., *Hexaglottis* Vent., *Homeria* Vent., and *Roggeveldia* Goldblatt. It consists of approximately 230 species (Goldblatt et al. 2013; Goldblatt & Manning 2013, 2014a,b; Goldblatt et al. 2014) divided into 11 subgenera, 15 sections and three series (Goldblatt et al. 2013). The genus is distributed throughout sub-Saharan Africa (also present in the Mediterranean and the Middle East), but it is most diverse in the winter-rainfall region of South Africa (Goldblatt et al. 2002).

Moraea spathulata is one of the most common and widespread *Moraea* species that occur in the summer-rainfall area of southern Africa (Goldblatt 1986). It extends from its southernmost distribution around George through eastern South Africa, Lesotho, Swaziland and Mozambique into eastern Zimbabwe (Goldblatt & Manning 2009) (Figure 1). In the south, the species occurs in both montane and coastal areas, but to the north it is restricted to mountainous areas in rocky grassland or at the edges of forest or thicket, often among rocks (Goldblatt 1986, 1993).

Moraea spathulata is classified in subgenus *Grandiflorae* Goldblatt (Goldblatt et al. 2013). It is distinguished by its clump-forming habit, tall stems, broad and dorsiventrally flattened to channelled basal leaves that exceed the stems, and large yellow flowers (Goldblatt 1973, 1986). The species is morphologically variable and flowering time differs across its range, which in the past led to the recognition of four subspecies (Goldblatt 1973, 1986).

The well-known Swedish botanist and pupil of Carolus Linnaeus, Carl Peter Thunberg (1743–1828), collected *Moraea spathulata* for the first time in the Outeniqua Mountains and

from the Langkloof near Keurboomsrivier in 1772 during his first expedition through the southern Cape (Goldblatt 1986). It was described by Linnaeus' son in 1782 as *Iris spathulata* (although the book cover indicates that it was published in 1781, it was in fact published in April 1782). Thunberg redescribed the species in the same year as *Iris spathacea* where it remained until it was transferred to *Moraea* in 1808 by J.B. Ker Gawler. In 1894 F.W. Klatt corrected the name to *spathulata*.

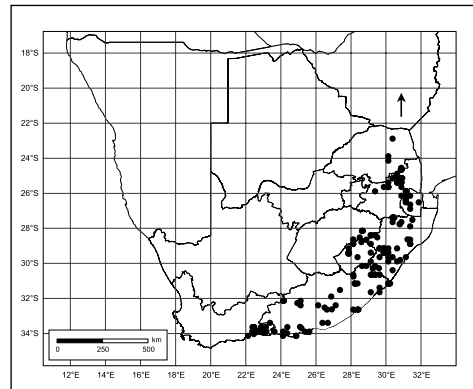


FIGURE 1.—Known distribution of *Moraea spathulata* in the FSA region based on specimens in the National Herbarium, Pretoria.

The generic name honours Dr Johan Moraeus, the father of Linnaeus' wife, Sara Elizabeth (Moraea) Linnaeus (1716–1806) (Quattrocchi 1999). The specific epithet, *spathulata*, refers to the spoon-shaped inner tepals (Goldblatt 1986). The species is known as the large yellow tulip, large yellow moraea, yellow tulip or mountain moraea, and in Afrikaans as *bergmoraea*, *geeltulp*, *grootgeeltulp* or *tulp*. In Zulu the species is known as *ihlamvu*, *ihlamvu elincane*, *ihlamvu lentaba*, *indlolothi* and *ingqunda*, and in South Sotho as *lelele* (Von Staden 2014).

Moraea spathulata is traditionally used by South African women to treat infertility (Hulme 1954; Steenkamp 2003). It is also used as a protective charm (Long 2005). The Basotho of Lesotho and the Free State Province use the leaves to make rope to bind mats (Jacot Guillarmod 1971; Moffett 2010). The species, however, causes tulip poisoning in cattle, sheep, goats and donkeys (Naude & Potgieter 1971; Van Wyk et al. 2002). Naude and Potgieter (1971) also reported human deaths after the corms were mistaken for edible *uintjies* (Afrikaans name for the edible corms of some *Moraea* species).

Moraea spathulata flowers from May to November in the south and November to February in eastern southern Africa, while in Zimbabwe and Mozambique flowering is from November to early April (Goldblatt 1986).

Moraea spathulata can easily be grown in gardens and prefers a sunny position, open ground and ample water in summer and autumn. The flowering season lasts for six weeks and each flower lasts for three days (Goldblatt 1986).

Description (adapted from Goldblatt 1973, 1977, 1993).—Perennial herbs up to 1 m high, grow in small clumps, rarely solitary. *Corm* up to 20 mm in diameter, covered by brown, fibrous remains of old tunics and leaf bases. *Prophylls* prominent, brown to pale straw-coloured, membranous to firm, entire or irregularly broken or frayed at apex. *Foliage* leaves basal, solitary, flat or channelled, up to 15 mm wide, arching toward the ground. *Stem* solitary, unbranched; bearing 2–5 sheathing leaves, 90–180 mm long, green becoming dry and brown at the tips, often overlapping. *Inflorescence* a ripidium enclosed by paired spathes, solitary; spathes green becoming dry and brown from apex, attenuate;

inner spathe 100–140 mm long; outer $\pm \frac{3}{4}$ as long. Flower deep to pale yellow, nectar guides on outer tepal limb bases pale to deep yellow; outer tepals 35–75 mm long, limbs 20–40 $\times$ $\pm$ 25 mm, spreading or reflexed; inner tepals erect, spatulate, 30–60 mm long, less than 20 mm wide. Filaments 8–15 mm long, united in lower $\frac{2}{3}$; anthers 8–12 mm long. Ovary 20–30 mm long; style branched, branches 12–18 mm long, appressed to outer tepal limbs; crests 10 mm long; exserted. Capsules 35–55 mm long, oblong-cylindric in outline, three-lobed. Seeds large, flattened. Plate 2341.

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PLATE 2342 *Aloidendron barberae*

Aloidendron barberae

Asphodelaceae: Alooideae

South Africa, Swaziland (and possibly Mozambique)

Aloidendron barberae (Dyer) Klopper & Gideon F.Sm. in Phytotaxa 76: 9 (2013); Van Jaarsveld & Judd: 36, t. 1 (2015); Smith et al.: 157 (2017). *Aloe barberae* Dyer: 568 (1874a); Dyer: 91 (1874b); Dyer: 720 (1874c); Smith et al.: 35 (1994); Van Wyk & Smith: 30 (1996); Glen & Hardy: 143 (2000); Carter: 98 (2001); Newton: 44 (2001a); Newton: 112 (2001b); Van Wyk & Smith: 34 (2003); Smith & Van Wyk: 73 (2008); Carter et al.: 695 (2011); Grace et al.: 18 (2011); Van Wyk & Smith: 38 (2014); Klopper: 577 (2015). *Aloe bainesii* Dyer: 568 (1874a); Baker: 178 (1880); Baker: t. 6848 (1885); Baker: 326 (1896); Schönland: 44 (1903); Berger: 319 (1908); Marloth: 91 (1915); Christian: 1, t. [1] (1933); Groenewald: 47 (1941); Reynolds: 498, t. 58 (1950); Jacobsen: 149 (1960); Reynolds: 384 (1966); Judd: 1, t. 1 (1967); Jeppe: 59 (1969); Bornman & Hardy: 281, t. 141 (1971); Jacobsen: 71 (1974); Jeppe: 5 (1974); Schedler: 102 (2014). *Aloe bainesii* var. *barberae* (Dyer) Baker: 326 (1896).

The genus *Aloidendron* (A.Berger) Klopper & Gideon F.Sm. was established in 2013 to accommodate *Aloe* sect. *Aloidendron* A.Berger and *A.* sect. *Dracoaloë* A.Berger (1905: 56), as part of a revised generic classification for *Aloe* L. *sensu lato*, based on results from molecular phylogenetic research (Grace et al. 2013). The name is derived from the Greek word *dendron* (a tree) and the generic name *Aloe*, hence indicating that these are tree aloes. As published, this genus comprised six species ranging from southern Namibia (*Aloidendron dichotomum* (Masson) Klopper & Gideon F.Sm., *A. pillansii* (L.Guthrie) Klopper & Gideon F.Sm. and *A. ramosissimum* (Pillans) Klopper & Gideon F.Sm.) in the west, to Mozambique (*A. barberae* and *A. tongaense* (Van Jaarsv.) Klopper & Gideon F.Sm.) in the east. There is then a large disjunction in the distribution of the genus northwards to Somalia (*A. eminens* (A.Berger) Klopper & Gideon F.Sm.). A year later the genus was expanded to include *A. sabaeum* (Schweinf.) Boatwr. & J.C.Manning from the Yemen and Saudi Arabia (Manning et al. 2014) from *Aloe* sect. *Sabaealoë* A.Berger (1905: 56), bringing the species total to seven tree aloes.

Members of *Aloidendron* are dichotomously branched (apart from *A. sabaeum* which is unique in the genus in having simple stems), large-shrubby (*A. ramosissimum*) to arborescent, sub-woody, succulent perennials, with bark smooth to longitudinally fissured. The leaves are rosulate, often narrowly canaliculate, lanceolate or ensiform, unspotted and with somewhat cartilaginous margins with small, but conspicuous teeth. Their inflorescence is a panicle with cylindrical racemes bearing cylindrical to cigar-shaped flowers, ranging from yellow through orange to red-brown (Carter et al. 2011; Grace et al. 2013). Tree aloes occur in both winter- and summer-rainfall areas in a variety of habitats ranging from humid subtropical conditions (*A. tongaense*) through to extremely arid environments (*A. pillansii* and *A. sabaeum*). Surprisingly, the only other tree aloe that has been illustrated in this series is *A. dichotomum* as *Aloe dichotoma* (Phillips 1938: t. 709).

Aloidendron barberae was first described simultaneously as both *Aloe barberae* Dyer and *Aloe bainesii* Dyer by William Turner Thiselton-Dyer (Dyer 1874a), who in the following year was appointed assistant director of the Royal Botanic Gardens, Kew. This was a seminal paper on the tree aloes of South Africa, dealing principally with the longer-known and more familiar western species, *Aloe dichotoma* Masson, now known as *Aloidendron dichotomum*.

Joseph Dalton Hooker, then director at Kew, for many years corresponded with John Thomas Baines, the intrepid explorer, artist and adventurer. Baines rose to fame following his employ by David Livingstone as artist and storekeeper on his celebrated Zambezi expedition (1857–1859). He subsequently joined James Chapman's expedition through what is now Namibia to the Victoria Falls (1861–1863) during which trip he became the first artist to paint one of the most bizarre and iconic plants of southern Africa, for a while known as *Tumboa bainesii*, and later as *Welwitschia bainesii* (Gunn & Codd 1981). For nomenclatural reasons, this fascinating gnetophyte is now correctly known as *Welwitschia mirabilis* subsp. *namibiana* Leuenb. (Rowley 1997). As the *International Code of Nomenclature for algae, fungi, and plants* required and as we shall relate, this *Welwitschia* was not the only spectacular plant painted by Baines for which he was commemorated in name, to later lose the honour to the shadow-realm of synonymy.

Baines wrote to Hooker in a letter dated 15 July 1873 (Dyer 1874a): 'I have the pleasure of sending you, by the kindness of my friend Mr. Jameson, a specimen and two sketches of an arborescent *Aloe*, from the slope of a rugged hill overlooking the sources of the Inada or Inandu rivulet, a tributary of the Tugela river, and perhaps nineteen or twenty miles north-east of Greytown. On Thursday, June 5, while proceeding to examine a hill near the Tugela reported to be auriferous, I first noticed these arborescent Aloes, and remarked their similarity to the great Tree *Aloe* of Damaraland ... On July 2, as we were returning from the Inyemba hill, where we had been prospecting with just sufficient success to ascertain that gold was actually there, we again crossed the rugged slope, and this being the only place on which I had observed the *Aloe* in question I let the men go on, and halted to make a sketch ... I should think the tree sketched was 20 feet high, and the spread of its crown about 15 feet. The trunk seemed about 2 feet thick, and at 5 or 6 feet from the ground divided into half a dozen branches, and these again were subdivided into many more. The bark was white and smooth, as in the Tree *Aloe* of Damaraland, but the leaves were long and slender, with small hooked thorns along the edges, and curved downwards. The flower, I believe, was scarlet and orange, but I cannot say certainly ... In these points it differs from the Damara species, the leaves of which curl upward, while the flowers are of a bright yellow ... Since my arrival in Durban, I am told that Aloes similar, or nearly so, have been found in the Noodsberg.' On stopping to sketch the tree on 2 July, Baines instructed one of his men to climb an aloe to collect the branch that accompanied the letter to Kew, and to look for flowering material, although none could then be found. Baines knew what flowers to expect, recalling to Hooker that on 21 June, '... I saw a flower of a bright scarlet or orange colour on one of the trees'. Despite Kew receiving only sterile material, Dyer (1874a) shortly thereafter commemorated Baines in his new species *Aloe bainesii* Dyer, the article accompanied by illustrations based on two of Baines's sketches, one of which is reproduced here (Figure 2). The smaller of the figures is a sketch of a rather tatty branch revealing snapped leaves, the condition of which was apologetically explained by Baines: 'I am

sorry the specimen branch is much broken but a [porter] already loaded had to carry it through a bushy country and 90 miles more of carriage by Wagon and Bus has not improved it.' On his mediocre illustration he ruefully remarked. 'The sketch also had to be made on the march when we were all pretty well tired and coloured when halted at Mr Hill's the nearest farm house ...'. The larger figure was published in *The Gardener's Chronicle* as a woodcut (Figure 2), produced from a drawing by an unknown artist, but based on a watercolour painting (reproduced in Van Jaarsveld & Judd 2015: Figure 16). This image depicts the type locality near Greytown, with the aforementioned expedition member climbing a tree to secure material. This represents a fascinating translation of the original Baines watercolour (220 × 350 mm) sent to Hooker, in which Baines – as was his wont – included himself within the very scene. A black and white reproduction of the original painting is also reproduced by Wallis (1976:



FIGURE 1.—*Aloe barberae* (now *Aloidendron barberae*), from the plant growing at Kew (from Dyer 1874a: Fig. 117).



FIGURE 2.—*Aloe bainesii* (now *Aloidendron barberae*) growing on rocky hills near Greytown in the Thukela River Basin, KwaZulu-Natal. Woodcut based on a watercolour by J.T. Baines 2 July 1873 (from Dyer 1874a: Fig. 120).

122), showing Baines the artist at work, yet the woodcut commissioned for Dyer (1874a) (Figure 2) depicts Baines engaged quite differently, as a disinterested bystander holding a bedroll!

The Greytown aloe was not the first tree aloe to have been painted by Thomas Baines, for in May 1866 he painted *Aloidendron dichotomum* whilst in Namibia. This is thought to be the first illustration of that species in its natural setting and was published in *Nature and Art* under the title 'The Great Tree Aloe of Damara land' (Palmer & Pitman 1972; see black and white reproduction on p. 28). Based on comments in Baines' letter to Hooker in July 1873, the original painting should be at Kew.

Material of the second tree aloe species that Dyer (1874a) simultaneously published was sourced from the Eastern Cape of South Africa from Mrs Frederick William Barber (née Mary Elizabeth Bowker, 1818–4 September 1899), based then near Grahamstown (Gunn & Codd 1981). Barber, like Baines, was a keen naturalist and artist and is credited with the discovery of a number of South African succulents (Rowley 1997). She had similarly sent a cutting of a tree aloe to Kew a little prior to Baines doing so, and this was grown on and illustrated (Dyer 1874a: 566). In her reflections on the genus *Aloe* (Barber 1870), Mrs Barber recounted 'the gigantic Aloe of the Transkeian territory (*A. zeyheri*) which attains the height of sixty feet ...'. The reference made by Barber (1870) to '*A. zeyheri*' is somewhat perplexing – Dyer (1874a) also mentioned that he was 'unable to ascertain who is responsible for attaching the name Aloe zeyheri to the Transkeian species' – as the name *Aloe zeyheri* Salm-Dyck was published earlier (Salm-Reifferscheid-Dyck 1863) for a species of *Gasteria*; the name *Aloe zeyheri* Salm-Dyck is widely treated as belonging in the synonymy of *G. bicolor* Haw. The way Barber (1870) cited the name makes it hard to believe that she formally proposed a name for the tree aloe. It rather seems that she was unaware of the pre-existence of the name *Aloe zeyheri*, or misapplied the name. Baker (1880) was, however, prompted to mention the designation '*Aloe zeyheri*, Hort.' in synonymy under his treatment of *A. bainesii* Dyer.

One expects that news of this incredible-sounding tree aloe species prompted Kew to spur Barber to forward material post haste. Shortly after she finally delivered a branch, a letter was sent by the Reverend Leopold Richard Baur to Professor Peter MacOwan of Gill College, Somerset East, and forwarded to Kew, saying: 'But the most curious thing is the Aloe tree, growing in the forests close to Shawbury [Tsitsa River], amongst the other forest trees, up to the height of 40 feet. Mr. Davis and I measured the trunk of one, 3 feet above the ground, and found it 16 feet in circumference. It is a most wonderful sight. This Aloe tree was for long considered a sort of botanical Münchausiade, and I heard that many botanists would not believe in it; but I think now it is known in Europe ... I enclose you a slight pen-and-ink sketch of the Aloe tree, that you may form some idea about it. Now it has not been in flower, but the seed-pods were still on.' Baur also mentioned in his letter that the locals 'call it Nomawen (if I [Baur] were to give you the proper sound in German I should write it Nomawühn)'. This second eastern tree aloe was named *Aloe barberae* in honour of Mrs Barber. Dyer (1874a) stated that '*Aloe barberae* differs from *A. bainesii* in the leaves being apparently longer, not glaucous, and not so completely crowded into a terminal tuft. Fig. 117 [here reproduced as Figure 1] is drawn from a plant in the succulent-house at Kew'. It was thus that in the spring of 1874 two new species of tree aloe were described

in the same paper (Dyer 1874a). Notably, Kew had heard as early as August 1866 of a giant tree aloe along the east coast of South Africa, this prior even to Mrs Barber's communications. This was through Mark McKen, then director of the Durban Botanic Gardens, who described one 30 feet tall, growing on the banks of the Mdloti River. Sir James Hulett also sent in a report of plants from Verulam (McCracken & McCracken 1990).

However, only seven months later in December of the same year, Dyer (1874b) wrote, 'The appearance of the branch of the Natal plant was so different from that of the Kaffrarian, that I ventured to characterize it as a new species under the name of *Aloe Bainesii*, on the ground that the leaves were longer, not glaucous, and not so completely crowded into a terminal tuft. The fact of the leaves being crowded into a terminal rosette, or spaced down the stem, is found to afford a character of even sectional value among the species. I was therefore rather astonished to find that when the Natal plant had fairly established itself, its rosette of leaves began to grow out. It is apparently only in old plants that the leaves are crowded into rosettes. I do not now doubt that the Kew plant of the Natal *Aloe* will eventually assume quite the same appearance as plants of the Kaffrarian one, with which I am now disposed to believe it to be identical. The name *A. Bainesii* must therefore be merged as a synonym in *A. Barberae*.' Only two days later Dyer (1874c) repeated his preference for the name *A. barberae*, as opposed to *A. bainesii*, but again he stated no reason for his choice. In expressing his preference, Dyer was to determine which epithet could be applied and our subject would become known as *A. barberae* in consequence, with the name *A. bainesii* relegated to synonymy. This then represented the second example of an iconic southern African plant named initially to honour J.T. Baines, but then later lost to his memory. However, Dyer's preference (Dyer 1874b, 1874c) was overlooked in most subsequent *Aloe* literature, most surprisingly by Baker (1885, 1896), the *Aloe* specialist at Kew, but also by many others who followed in Baker's misleading footsteps, including Berger (1908), Marloth (1915), Reynolds (1950), Jeppe (1969) and Bornman & Hardy (1971).

It was not until Smith et al. (1994) rectified this nomenclatural error that the name of the eastern tree aloe again became *Aloe barberae* in line with its author's stated preference and decision. Despite this, the name *Aloe bainesii* is still occasionally found in the literature, for example in Schedler (2014). More recently, *Aloe barberae* was transferred to *Aloidendron* with the combination *Aloidendron barberae*, as outlined above (Grace et al. 2013).

Undoubtedly the most significant feature of *Aloidendron barberae* is its height and the girth of its trunk: at a maximum of 18 m tall and a trunk diameter of up to 3 m, this is the world's tallest and largest aloe with little close competition (Figure 3). It is accordingly remarkable that such a gigantic aloe was only described as late as 1874, especially given the extensive botanising in 'Natal' at that time (McCracken & McCracken 1990). Historical accounts such as those of Barber and Baur above emphasise the unexpected scale of size of *A. barberae* relative to other aloes. In similar vein, when Marianne North, the globe-trotting artist-adventurer travelled to then Victorian Natal, she too was awed on encountering a flowering specimen at Verulam in May of 1883, writing in correspondence reported in *The European Mail*, 'I had a great treat; a botanical butcher took me in his gig to see one of the biggest aloes in the world, perhaps, and I have painted it so well that tears came into his eyes when he looked at it. There are three trees standing together on a high bank over the [Mdloti] River, and they make a fine subject. They are 40 feet high, with hundreds of heads



FIGURE 3.—*Aloidendron barberae* in cultivation in Hayfields, Pietermaritzburg. Photograph: N.R. Crouch.



FIGURE 4.—Typically reaching a height of up to 8 m at full maturity, *Aloidendron tongaense* trees, here photographed on the outskirts of Maputo, Mozambique, usually do not grow as tall as those of *A. barberae*. Photograph: E. Figueiredo.

on the ends of their branches, which keep forking into two, like the dome [douw] palm. The trunk, a yard above the ground, is quite two feet through. When in bloom, every head has a bunch of “red-hot poker flowers” coming out of it, and the mass of scarlet can be seen 30 miles off, Mr. Hill says’ (Saunders 1979). North’s excellent painting of the *Verulam* plants hangs in the Marianne North Gallery at Kew as painting number 383 (Anon. 1914) and was reproduced in Anon. (1980: 215).

The phylogenetic tree of Daru et al. (2013) included five of the seven species of *Aloidendron*: *A. sabaeum* and *A. tongaense* were omitted from this study. The study indicated *A. barberae* to be sister to the Somalian species *A. eminens*, whilst the relationship among *A. dichotomum*, *A. pillansii* and *A. ramosissimum* was unresolved. Interestingly, Van Jaarsveld (2010), when describing *A. tongaense*, placed *A. barberae* next to *A. eminens* in his dichotomous key, with *A. tongaense* being slightly further removed. Although *A. sabaeum* was not included in the molecular phylogeny of Manning et al. (2014), they included this species in *Aloidendron* based on its historical association with other tree aloes (Reynolds 1966), due mainly to morphological similarities and an erroneous height (as pointed out by Wood 1983) of 9 m given in the original description that was repeated by subsequent authors such as Reynolds (1966). More molecular data, including for *A. sabaeum* and *A. tongaense*, are needed to allow for the resolution of the phylogenetic relationships within *Aloidendron*.

On the basis of vegetative morphological features, *Aloidendron barberae* appears to be closest to *A. tongaense*, a long-known species referenced by Van Wyk & Smith (2001: 93). The most significant difference is that *A. tongaense* is a smaller tree, only 4–8 m tall (Figure 4), compared to *A. barberae* that can grow up to 18 m in height. Van Jaarsveld (2010) records other more significant differences for the reproductive characters in which there is greater divergence between these two putative sister species: *A. barberae* has a panicle of 400–600 mm long (compared to 350 mm long for *A. tongaense*); the perianth for *A. barberae* is 33–37 mm long, rose-pink and green-tipped (Figure 5) (compared to 47–50 mm long and yellowish orange for *A. tongaense*) (Figure 6); stamens are exserted to ca. 15 mm at anthesis in *A. barberae* (cf. 3–5 mm in *A. tongaense*). Notably, both species exhibit some variation in the length of exsertion of their stamens at anthesis. *Aloidendron barberae* also flowers slightly later in the year (June, in the southern hemisphere) than *A. tongaense* (April–May).

Aloidendron barberae is recorded from South Africa, Swaziland and the southern parts of Mozambique (Reynolds 1950; Reynolds 1966; Glen & Hardy 2000; Carter 2001; Van Jaarsveld & Judd 2015) (Figure 7). Within South Africa it occurs from East London in the Eastern Cape Province through to southern Mpumalanga Province, in forests and on the hillsides above major rivers such as the Mkomazi, Mngeni and Tugela. Specifically for Mozambique, Carter (2001) records it from the Districts of Cheringoma, Zavala and Namaacha ‘on rocky slopes of wooded valleys 20–600 m’. Glen & Hardy (2000) report that ‘The tallest specimens occur in the Lebombo foothills near the KwaZulu-Natal–Mozambique–Swaziland border; those with the greatest diameter occur near Grahamstown’.

Apart from Van Jaarsveld & Judd (2015), these references all predate the publication of the name *Aloe tongaensis* (Van Jaarsveld 2010), which was considered by these authors as a coastal form of *A. barberae*. Van Jaarsveld & Judd (2015) report that *A. barberae* is present in ‘the southern portion of Mozambique’, but provide no supporting evidence. We could not trace any herbarium specimens from Mozambique that represent *A. barberae* as the available specimens held at COI, K, LISC and PRE (including those cited by Carter 2001 and others seen by her for the *Flora zambesiaca*



FIGURE 5.—Close-up of the rose-pink, green-tipped flowers of *Aloidendron barberae*. In the case of this species the stamens are usually well-exserted to 15 mm at anthesis. Photograph: G.F. Smith.



FIGURE 6.—The flowers of *Aloidendron tongaense* are yellowish orange and, in contrast to *A. barberae*, the stamens are only shortly exserted, for up to 5 mm. Photograph: G.F. Smith.

treatment) are all identified as *A. tongaense*. Besides herbarium specimens, sight records by one of us (EF) (Figure 4) vouch for the occurrence of *A. tongaense* in southern Mozambique. The latest publication on the trees and shrubs of Mozambique (Burrows et al. 2018) also treats only *A. tongaense*. It seems as though *A. barberae* is not actually present in Mozambique, but further fieldwork would be useful to confirm this. We suggest initially exploring the southern Lebombos of Mozambique to the immediate southeast of Abercorn (Swaziland); large specimens of *A. barberae* have been observed by one of us (NC) (Figure 8) near Border Cave, 23 km southwest of Abercorn.

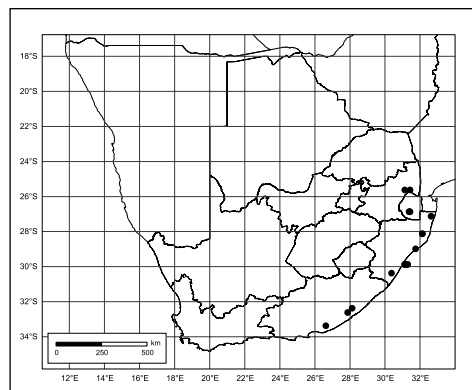


FIGURE 7.—Known geographical distribution range of *Aloidendron barberae* in southern Africa.

There is little information available on the pollination syndrome of *Aloidendron barberae*, apart from the fact that it is ornithophilous. Main pollinators are thought to include short billed weaver birds and white-eyes (Van Jaarsveld & Judd 2015), while several species of sunbird have also been observed to visit flowering plants.

Reynolds (1950) records the isiZulu common name as *inKalane enkubu* [variously spelled *inkalane unkulu* or *inkalane-enkulu*; cf. Grace et al. 2011: 19] meaning ‘the big one’, which is highly appropriate. Amongst several other common names catalogued, Grace et al. (2011: 19) also listed the Afrikaans names *boomaalwyn* (= tree aloe) and *mikaalwyn* (= forked aloe) (Jeppe 1969).

As recently as the early 1990s *Aloidendron barberae* was comparatively uncommon in cultivation in domestic and large-scale, corporate gardens in South Africa. However, that changed as waterwise gardening became more firmly established during the past 20 years. Today, *A. barberae* is a common sight in gardens both large and small, in open beds, as a specimen plant, or in large, or even small, containers. Of all the *Aloidendron* species, it is the easiest to cultivate and does well in a diverse range of climatic zones, excluding very cold areas where subzero temperatures are regularly recorded. It is an essentially summer-rainfall species, but also grows very well in the winter-rainfall regions of South Africa, for example in the Kirstenbosch National Botanical Garden in Cape Town (Figure 9). While Bornman & Hardy (1971) note that *A. barberae* is a very slow grower that will attain maximum height in 40 to 50 years, plants will nonetheless grow into impressive specimens in a far shorter period of time.

Propagation is through stem cuttings or truncheons – such is their ease of rooting



FIGURE 8.—Trees growing on rhyolitic soils near Border Cave on the South Africa–Swaziland border, southeastern Lebombo Mountains, South Africa. Photograph: N.R. Crouch.



FIGURE 9.—A magnificent specimen of *Aloidendron barberae* growing on the Matthew's Rockery at Kirstenbosch, illustrating the architectural nature of its branching pattern. Photograph: C.C. Walker.



FIGURE 10.—The inflorescences of *Aloidendron barberae* are particularly prone to infestations by aloe cancer mites. Photograph: G.F. Smith.

that production using seed is rare. Cuttings can be taken at any time of year, left to dry for a few days, and then placed in a coarse, sandy soil mixture; roots will soon develop. In production and wholesale nurseries, the terminal sections of branches are sometimes removed to break apical dominance and stimulate the formation of small, rosulate shoots that can easily be excised with a sharp knife. However, it is considerably more difficult to relocate mature trees. Such plants weigh several tons and moving them presents extensive logistical challenges, the solutions to which may involve cranes and flatbed trucks. Once the root systems of such trees have been severely damaged, plants often die an inexorably slow death as they are starved of water and nutrients. However, if such mature trees have been successfully established in enormous, industrial-scale planting bags, trees can be more easily transported and will flourish once well-rooted in a new spot.

Plants are reasonably pest-resistant, but leaves can be prone to infestations of white leaf-scale. These leaf sap-sucking insects are, however, easy to control if the infestation has not spread much; they can be simply washed off the leaves with a strong jet of water. Severe infestations may require treatment with a systemic insecticide. More difficult to control are aloe cancer mites that preferentially infect developing inflorescences (Figure 10) rather than the rosettes (see also Thackray 2017: 10). If possible to reach, inflorescences so infected should ideally be removed using secateurs that must afterwards be sterilised.

Description.—Arborescent plant, up to 20 m high. *Stem* 10–18 m high, trunk 1–3 m diameter at ground level, narrowing upwards, copiously dichotomously branched and rebranched from about middle, erect, without persistent dried leaves. *Leaves* densely rosulate, recurved, dull green, without spots, ensiform, deeply channelled, 600–900 × 70–90 mm at base; sheath with greenish white marginal border; margin narrow, white, cartilaginous, with firm, horny, brownish tipped, dull white, deltoid teeth, 2–3 mm long, 10–25 mm apart. *Inflorescences* 0.4–0.6 m high, erect, dichotomously 3-branched from below middle, branches erect. *Peduncle* up to 100 mm long, ± 30 mm wide, flattened, biconvex at base, without sterile bracts below branches. *Racemes* cylindric, slightly acuminate, 200–300 × 80–100 mm, erect, dense; buds erect to spreading, flowers spreading to nodding when open. *Floral bracts* linear-acuminate, 8–10 mm long, ± 1 mm wide, hair-like and coiled backwards, scarious. *Pedicels* 7–10 mm long, rose to rose-pink. *Flowers*: perianth rose to rose-pink, greenish tipped, 33–37 mm long, ± 9 mm across ovary, not narrowed above ovary, widening to ± 12–13 mm towards middle, narrowing somewhat to ± 10 mm towards slightly upturned mouth, cylindric-ventricose; outer segments free almost to base, tips spreading; stamens with rather thick, much flattened filaments, lemon-coloured, exserted portion turning brownish orange, exserted to 15 mm; ovary 8 mm long, 6 mm diameter, pale olive-green; style pale lemon-coloured, almost white, exserted 15–20 mm. *Fruit* a capsule, oblong-ovoid, brown, ± 40 × 17 mm. *Seed* pale brown, 6–8 × 20–24 mm, flat, with very broad, pale brown wings. *Chromosome number*: $2n = 14$ (Resende 1937). Plate 2342.

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Cyrtanthus pondoensis

Amaryllidaceae

South Africa

Cyrtanthus pondoensis Van Jaarsv. sp. nov. differs from *C. brachysiphon* Hilliard & B.L.Burt by its stoloniferous nature; ascending, spreading, funnel-shaped perianth, 45 mm long, of which the lobes close at dusk for the night.

TYPE.—South Africa, Eastern Cape Province, 3129 (Bizana): On rocky, quartzitic, sandstone banks of the Msikaba River (159 m) together with *Aloe arborescence*, *Ficus bizanae*, *Crassula pellucida* subsp. *marginalis*, *C. lactea* and *Bulbine natalensis*, (–BD), Van Jaarsveld & Nell 24359 (NBC, holo.).

Cyrtanthus pondoensis is named from the rocky, quartzitic sandstone sides of the Msikaba River (Figure 1). This region, known as the Pondoland Centre of Endemism (Van Wyk & Smith 2001), has several endemic species. Our species appears to belong to a group of orange to red-flowering species, which are clearly sunbird pollinated, immediately distinguished from closely related taxa by its stoloniferous nature (Figure 2) and a perianth, 45 mm in length (Figure 3), of which the lobes are closed during the night.

The genus *Cyrtanthus* Aiton belongs to the Amaryllidaceae, a cosmopolitan family which is well represented in South Africa (Duncan et al. 2016). The family consists of 77 genera with 2 140 species. Chase et al. (2009) divided the Amaryllidaceae into three subfamilies, namely Amaryllidoideae, Allioideae and Agapanthoideae. *Cyrtanthus* belongs to the subfamily Amaryllidoideae with 56 species (Duncan et al. 2016). *Cyrtanthus* was established by William Aiton in 1789 in volume 1 of *Hortus Kewensis* with *C. angustifolius* as the type species. The name *Cyrtanthus* is derived from the Greek *kyrtos*, meaning ‘curved’ and is in reference to the curved perianth tube (Clarke & Charters 2016). *Cyrtanthus* is widespread in southern Africa and has a clear centre of diversity in the southeastern parts of South Africa (Eastern Cape and KwaZulu-Natal provinces) (Snijman & Meerow 2010).

There are 23 tubular orange to red-flowering, mainly summer-rainfall, *Cyrtanthus* species from the eastern parts of South Africa. These species are pollinated by sunbirds and most have curved, funnel-shaped flowers with sturdy scapes from where birds perch to feed (Snijman & Meerow 2010). They include *C. angustifolius* (L.f.) Aiton, *C. bicolor* R.A.Dyer, *C. brachysiphon*, *C. brachyscyphus* Baker, *C. collinus* Ker Gawl., *C. contractus* N.E.Br., *C. epiphyticus* J.M.Wood, *C. eucallus* R.A.Dyer, *C. huttonii* Baker, *C. inaequalis* O’Brien, *C. junodii* P. Beauv., *C. labiatus* R.A.Dyer, *C. macmasteri* Snijman, *C. macowanii* Baker, *C. obrienii* Baker, *C. rhododactylus* Stapf, *C. rotundilobus* N.E.Br., *C. sanguineus* (Lindl) Walp. subsp. *sanguineus*, *C. spiralis* Burch. ex Ker Gawl., *C. staadensis* Schönland, *C. suaveolens* Schönland, *C. tuckii* Baker and *C. wellandii* Snijman (Duncan et al. 2016). The habitats of these species vary from rocky ridges to grassy slopes and from dry river valleys to sheer cliff faces. Of these species, only *C. brachysiphon* and *C. pondoensis* (Figure 4)

PLATE 2343.—1, bulb, × 1; 2, bulb with leaves, × 0.5; 3, inflorescence, × 1; 4, perianth, × 1; 5, longitudinal section through flower, × 1.5. Voucher specimen: Van Jaarsveld & Nell 24359 in Compton Herbarium, Cape Town. Artist: Lisa Strachan.



PLATE 2343 *Cyrtanthus pondoensis*

have more or less straight tubes, all other species have distinctly curved tubes. *Cyrtanthus brachysiphon* has curved pedicles and clearly pendent or nodding bright red, wide, funnel-shaped flowers with a tube of 10 mm in length and tepals of 16–18 mm in length that do not close at night. It is only known from cliffs on the Louwsburg plateau in northern KwaZulu-Natal growing at 1 300 m (Duncan et al. 2016).

Not only does the combination of characteristics make this species unique, but it also has some unique autapomorphies. *Cyrtanthus pondoensis* is at once distinguished by its funnel-shaped, orange to orange-red flowers (Figure 3 and 4) of 45 mm in length, carried on an arched peduncle up to 400 mm long, during late winter or early spring (August to September in the southern hemisphere). The 6–9, straight-tubed flowers are ascending spreading and carried on pedicels of various lengths, from short to long (15–35 mm). In bud, flowers are covered by two protective, linear-lanceolate acuminate bracts, which become dry as the flowers develop fully. Flowers are

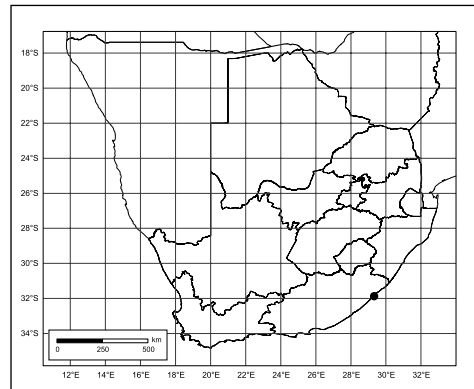


FIGURE 1.—Distribution of *Cyrtanthus pondoensis*.



FIGURE 2.—*Cyrtanthus pondoensis* showing the stolon and young bulb. Photograph: E.J. van Jaarsveld.



FIGURE 3.—Close-up of the perianth of *Cyrtanthus pondoensis*. The lobes close at dusk for the night. Photograph: E.J. van Jaarsveld.

presented secundly (arranged on one side only). The spreading tepals close at night – a unique feature within this red-flowering tubular group. The stamens are included and in two series, with the style, when fully mature, just protruding beyond the anthers.

The dry river valleys along the eastern coast of South Africa are often difficult to reach by foot or vehicle, especially those in the Eastern Cape. For the past 20 years one of us (EJvJ) and colleagues have investigated some of these river valleys by rubber canoe. *Cyrtanthus pondoensis* was collected on such an expedition. From 21–29 April 2012 Ernst van Jaarsveld, together with Philip Nell, Adam Harrower and Paul Emms explored the coastal portion of the Msikaba River in the Eastern Cape as part of a study on obligatory cliff-dwelling succulent and bulbous plants (Van Jaarsveld 2011). The vegetation of the first part of the river consists of Eastern Valley Bushveld (Mucina & Rutherford 2006), rich in succulents. The

shale-derived soils in this portion is mineral-rich, however, closer to the coast the geology is abruptly replaced by mineral-poor quartzitic sandstones of the Natal Group (Johnson et al. 2006). The rainfall also increases towards the coast and, as a consequence, the vegetation changes to Scarp Forest and Pondoland-Ugi Sandstone Coastal Sourveld (Mucina & Rutherford 2006). The collecting party camped for five nights at various points and it was at Donkergat (altitude about 159 m) where the bulb was collected in crevices of sandstone rocks above the river.

The river here, and a little further down at Donkerpoort, has, over time, created a deep gorge in the Natal Group quartzitic sandstone, with high cliffs and a nesting site for Cape Vultures. Rowing was difficult at times due to boulders and other obstacles, but fortunately the river was not in flood. Many rare species were found on the cliffs in this centre of diversity (Van Wyk & Smith 2001). Trees and shrubs on the wider rock clefts and crevices included *Ficus ingens* (Miq.) Miq., *F. burkei* (Miq.) Miq., and among the moss in shaded areas grew numerous endemics such as the recently named *Streptocarpus aylae* T.J. Edwards, as well as *Gasteria croucheri* (Hook.f.) Baker subsp. *pondoensis* N.R.Crouch, Gideon F.Sm. & D.G.A.Styles, *Crassula streyi* Toelken, *Plectranthus ernstii* Codd, *Rhipsalis baccifera* (J.S.Mill.) Stearn subsp. *mauritiana* (DC.) Barthlott, *Delosperma abbottii* Van Jaarsv., *Crassula lactea* Sol., *C. rupestris* Thunb., *Caputia medley-woodii* (Hutch.) B.Nord. & Pelsner, *Ornithogalum juncifolium* Jacq., *Albuca bracteata* (Thunb.) J.C.Manning & Goldblatt, *Chlorophytum comosum* (Thunb.) Jacques, *Gerrardanthus macrorhizus* Harv. ex Hook.f., *Peperomia blanda* (Jacq.) Kunth, *Cyrtanthus sanguineus* (Lindl.) Walp., *Aeollanthus parvifolius* Benth. and *Plectranthus madagascariensis* (Pers.) Benth.



FIGURE 4.—Close-up of the inflorescence of *Cyrtanthus pondoensis*; note the funnel-shaped flowers and pedicels of various lengths. Photograph: E.J. van Jaarsveld.

The climate in this part of the southeastern Cape is subtropical and although cooler during winters, the nights are usually frost free. The average daily maximum is $\pm 23^{\circ}\text{C}$ and the average daily minimum $\pm 15^{\circ}\text{C}$. Rainfall occurs mainly from spring to autumn and averages at about 900 mm per annum, with occasional cold fronts during the winter months (Mucina & Rutherford 2006).

Cyrtanthus pondoensis can be cultivated and grown in full sun or light, dappled shade in sandy acidic quartzitic sandstone soil. Plants flower readily during winter and early spring (July to September) and they increase rapidly by means of stolons, soon filling containers. They can also be propagated from bulbils. *Cyrtanthus pondoensis* grows well in subtropical coastal gardens. It soon settles down in containers with a sandy, well-drained soil mixture, and plants are not shy to flower. Water throughout the year but more sparingly during winters.

Description.—Hypogeous bulbous plants, stoloniferous from base, stolons spreading forming new bulbs some distance from mother bulb. Roots white up to 2 mm in diameter. Bulb ovate to broadly ovate $25\text{--}28 \times 17\text{--}24$ mm; outer tunics dark brown, papery, forming a short indistinct neck of about 10 mm long; inner tunics white, fleshy. Leaf solitary,

ascending spreading, linear-lanceolate 200–260 × 3.5–5.0 mm, green, lower portion terete, densely maroon-spotted, V-shaped when open, bearing thickened keel, slightly channelled at base; apex acute. *Inflorescence* 370–400 mm long, 5–7 mm in diam. at base and tapering to 3–4 mm wide just below umbel, densely purple-spotted in lower third. *Umbel* with 6–9 outward spreading flowers (secund). *Scape bracts* 2, opposite, linear-lanceolate, 30–50 × 3–8 mm, acuminate. *Pedicles* variable, 15–35 mm long, ±1.5 mm wide, dull brown. *Flowers* 45 mm long; tube straight or becoming slightly curved; tepals free for 15 mm, ±20 mm long, ovate-lanceolate; anthers yellow, oblong, 5 × 1 mm; ovary orange-red, 4 mm in diam. expanding to 6 mm (petals diverging) and 15 mm ultimately, triquetrous, oblong 8 × 3 mm; style 17 mm long, whitish, trilobate, style branches 1.0–1.2 mm long, spreading. *Capsule* and *seed* not seen. *Flowering time*: during August and September, opening during the day and closing at dusk for the night. Plate 2343.

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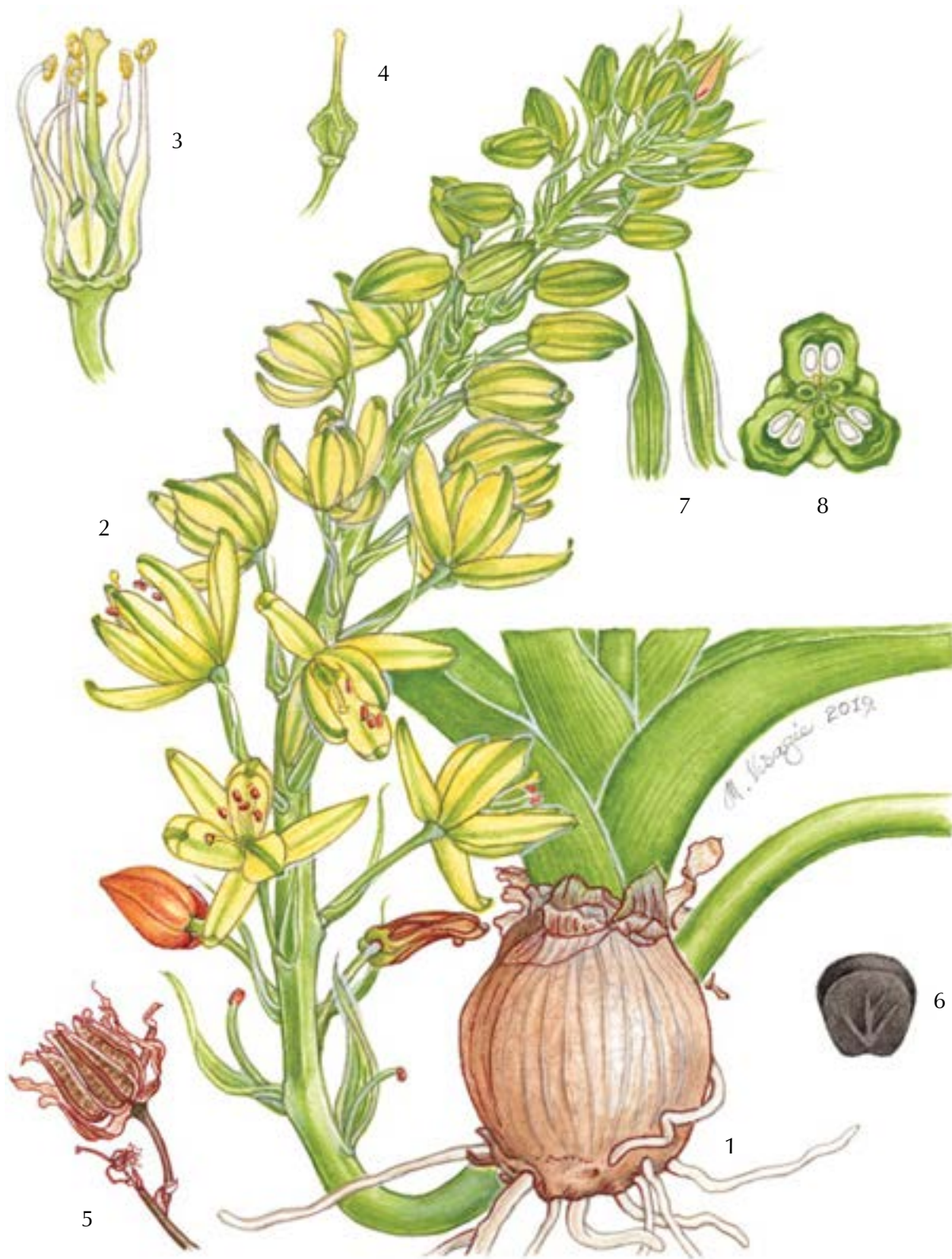


PLATE 2344 *Albuca heydenrychii*

Albuca heydenrychii

Hyacinthaceae

South Africa

Albuca heydenrychii Van Jaarsv. sp. nov. differs from *A. abyssinica* Jacq. by its flaccid, drooping to spreading, glabrous leaves, 1 000–1 200 × 60–80 mm, with up to 35 striations; distinctly curved inflorescence and perianth, 18–20 mm in diameter.

TYPE.—South Africa, Limpopo Province, 2430 (Mafefe): 2.5 km north of Magokolo Peak along the main watershed of the northern Drakensberg (Thabakgolo) Escarpment, upper south-facing sandstone cliffs, 1 400 m, (–AB), *Heydenrych* 1336 (NBC, holo.).

Albuca heydenrychii, a cremnophilous species from the eastern scarp cliffs in the Limpopo Province, South Africa, is named. It is closely related to *A. abyssinica*, which is a widespread species in the northern parts of South Africa, through Namibia and further north into tropical Africa. *Albuca heydenrychii* is at once recognised by its spreading to drooping, obscurely striate leaves, and spreading curved inflorescence with yellow flowers. *Albuca abyssinica* has an erect growth form, bearing firm, ascending leaves, 600–1 000 mm long, and an ascending raceme, 200–300 mm long. This characteristic is also retained in cultivation.

The Ornithogaloid genera to which our *Albuca* L. belongs, were revised by Manning et al. (2009) using molecular data (plastid DNA sequences). *Albuca* was subsequently redefined to include the subgenera *Osmyne* and *Urophyllon* of the genus *Ornithogalum*. This enlarged arrangement by Manning et al. (2009) recognises five subgenera within *Albuca*: subgenus *Albuca* (70 species), *Osmyne* (Salisb.) J.C.Manning & Goldblatt (30 species), *Urophyllon* (Salisb.) J.C.Manning & Goldblatt (4 species), *Monarchos* (U.Müll.-Doblies & D.Müll.-Doblies) J.C.Manning & Goldblatt (10 species) and *Namibiogalum* (U.Müll.-Doblies & D.Müll.-Doblies) J.C.Manning & Goldblatt (10 species).

Albuca was established by Linnaeus in his second edition of *Species Plantarum* in 1762. In its current circumscription, it can be readily distinguished from other Ornithogaloid genera by its fleshy, oblong tepals bearing a dark green to brownish line on its adaxial surface (Manning et al. 2009). The genus currently contains more than a 100 species (Manning & Condy 2011). The last comprehensive revision was by Baker in *Flora capensis* (1897). The genus name, *Albuca*, is derived from the Latin word *albus*, meaning ‘white’, in reference to the white flowers of the majority of species within the genus (Clarke & Charters 2016).

Albuca has a predominantly African distribution, extending into Arabia (Baker 1897). Most species, however, are confined to parts of southern Africa where there is a clear

PLATE 2344.—1, bulb, roots and leaves, × 1; 2, partially curved scape and raceme, × 1; 3, flower with tepals removed, × 2; 4, gynoecium showing the distinctive three paraseptal crests, × 1; 5, the dry fruiting capsule, × 1; 6, seed, × 4; 7, floral bracts, × 1; 8, dissection through the three paraseptal crests of the ovary, × 16.5. Voucher specimen: *Heydenrych* 1336 in Compton Herbarium, Cape Town. Artist: Marieta Visagie.



FIGURE 1.—*Albuca heydenrychii* in habitat with Reuben Heydenrych, who first discovered the new species and in whose honour it was named. Photograph: E.J. van Jaarsveld.

centre of endemism spanning the summer-dry Succulent Karoo and Fynbos biomes (Müller-Doblies 1995). In these biomes *Albuca* is certainly summer-deciduous, but some species (of the winter-rainfall, summer-dry region) are known to be evergreen. *Albuca* is also well represented in the Grassland and Thicket biomes and their habitat varies from flat to mountainous. Throughout its range, *Albuca* plants vary in size – the smallest, *A. unifoliata* G.D.Rowley from the semi-arid winter-rainfall Succulent Karoo Biome, with a solitary succulent leaf of only a few millimetres high, to the large robust *A. nelsonii* N.E.Br. of the Grassland Biome with leaves up to 0.6 m high, and *A. clanwilliamsaegloria* U.Müll.-Doblies from the Fynbos Biome in the Clanwilliam district, Western Cape Province, with an inflorescence of 2 m and taller (Manning et al. 2009).

Albuca heydenrychii belongs to the section *Pallastema* (Salisb.) J.C.Manning & Goldblatt, subgenus *Albuca* (Manning et al. 2009), members of which are immediately recognised by their unspecialised, spreading (relative to the peduncle), weakly zygomorphic flowers, ovaries with distinctly paraseptal crests bearing slender styles. *Pallastema* was established by Baker in 1873. Three *Albuca* species in southern Africa belongs to *Pallastema*, namely *A. abyssinica* Jacq., *A. amboensis* (Schinz) Oberm., and our new species, *A. heydenrychii* Van Jaarsv. These three species are all from summer-rainfall regions of South Africa and Namibia and become deciduous during winter. The floral presentation, shape and yellow colour is similar in all species. Of these three species, *A. heydenrychii*

and the widespread *A. abyssinica* are closest related. The latter has firmly erect, narrow leaves and erect inflorescence and are mainly from dry savanna parts of Africa. *Albuca heydenrychii* differs in habit and morphology: it grows isolated on the northern Drakensberg Escarpment cliffs, its leaves are flaccid, pendent to spreading 1 000–1 200 × 60–80 mm, distinctly striate, and its inflorescence has a distinct curve, initially drooping with the raceme always curving upwards. These characteristics are maintained in cultivation.

The habitat of *Albuca heydenrychii* consist of sheer, south-facing cliffs of the east-facing escarpment (Figure 1). The surrounding area is characterised by a mosaic of Northern Misbelt Forest (Mucina & Geldenhuys 2006) and Northern Escarpment Quartzite Sourveld (Mucina & Rutherford 2006). The plants grow on the upper cliff faces at an altitude of about 1 400 m with frequent mist (Figure 2) and high summer rainfall.



FIGURE 2.—*Albuca heydenrychii* in habitat, growing on a sandstone cliff face together with *Agapanthus inapertus* and *Tulbaghia simmleri*. Note the mist which ensures extra precipitation. Photograph: E.J. van Jaarsveld.

Of the southern African species, 12 *Albuca* species are confined to cliff faces or grow on steep slopes; plants known as obligatory cremnophytes (Figure 3). They include *A. batteniana* Hilliard & B.L.Burt., *A. buffelspoortensis* Van Jaarsv., *A. cremnophila* Van Jaarsv. & A.E.van Wyk, *A. crudenii* Archibald, *A. deaconii* Van Jaarsv., *A. fastigiata* Dryand., *A. heydenrychii*, *A. kirstenii* (J.C.Manning & Goldblatt) J.C.Manning & Goldblatt, *A. lebaensis* (Van Jaarsv.) J.C.Manning & Goldblatt, *A. tenuifolia* Baker, *A. thermarum* Van Jaarsv., and *A. tenuifolia* Baker. *Albuca shawii* Baker is widespread in the summer-rainfall regions (Grassland and Savanna biomes), but not an obligatory cremnophyte. Like *A. heydenrychii*, it has yellow flowers, but here the resemblance ends. The flowers are much smaller and it belongs to section *Falconera* (Salisb.) J.C.Manning & Goldblatt. Most of these obligatory cremnophytes have restricted distributions. *Albuca thermarum*, with its firm leaves bearing yellowish flowers, is confined to Badspoort near Calitzdorp (Succulent Karoo); *A. crudenii*, with its solitary soft flaccid leaf (rarely two) and yellow flowers, from Grahamstown (Albany Thicket); *A. kirstenii* is confined to shale cliffs of the Gourits and Breede rivers (Albany Thicket); *A. buffelspoortensis* is confined to the Buffelspoort, part of the Gourits River System (Van Jaarsveld 2016); *A. batteniana* is confined to dry river valleys between the Kei and Bashee rivers (Valley Bushveld); *A. deaconii* is confined to the Groot Winterberg of the southeastern Drakensberg. In southwestern Angola, the recently named *A. lebaensis* grows on cliffs of the escarpment margin (Van Jaarsveld 2010) – although originally named as an *Ornithogalum* (following Obermeyer 1978), Manning & Goldblatt (2011) transferred it to *Albuca*. *Albuca tenuifolia* has been rediscovered from several sites in the Eastern Cape Drakensberg (Sneeuberg and Stormberg mountains) and recently also from the Steenkampsberg in Mpumalanga (Martinez-Azorin et al. 2011).



FIGURE 3.—Close-up of obligatory cremnophyte, *Albuca heydenrychii*, in habitat. Photograph: E.J. van Jaarsveld.

Albuca heydenrychii was first collected by Reuben Heydenrych on 11 January 2008 (Figure 1). Reuben is an ecologist and keen hiker from Pretoria, Gauteng, and has recently authored a book on the Magaliesberg trees (Heydenrych 2018). He accompanied one of us (EJv) to the plants, 2.5 km north of Magokolo Peak along the main watershed of the northern Drakensberg (Figure 4), while they were in flower in January 2019. These plants grow in quartzitic sandstone (Black Reef Group, Transvaal Supergroup) on south-facing cliffs. They are locally common and grow among other geophytes and succulent such as *Agapanthus inapertus* P.Beauv., *Albuca bracteata* (Thunb.) J.C.Manning & Goldblatt, *Aloe arborescens* Mill., *Aloe spicata* L.f., *Crassula sarcocaulis* Eckl. & Zeyh. and *Crassula pellucida* L. The habitat is partially shaded by Afrotemperate forest. Trees and shrubs observed in the habitat include *Combretum kraussii* Hochst., *Faurea rochetiana* (A.Rich.) Chiov. ex Pic.Serm., *Hemizygia rugosifolia* Ashby, *Maesa lanceolata* Forssk., *Protorhus longifolia* (Bernh.) Engl., *Rapanea melanophloeos* (L.) Mez, *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb., *Psychotria capensis* (Eckl.) Vatke, *Schefflera umbellifera* (Sond.) Baill. and *Vaccinium exul* Bolus. Other plants in the same community are *Helichrysum wilmsii* Moeser, *Plectranthus rubropunctatus* Codd, *Rabdosiella calycina* (Benth.) Codd, *Streptocarpus cyaneus* S.Moore and *Tulbaghia simmleri* P.Beauv.

Albuca heydenrychii has only been found on cliffs (given that it is an obligatory cremnophyte). Plants consist of drooping to spreading rosettes (solitary or dividing and forming clusters of up to three rosettes) of long, slightly channelled, pendent, flaccid leaves, up

to 80 mm wide and more than a metre in length. The climate in its nutrient-poor quartzitic sandstone habitat is warm temperate with cool, but frost-free, winters (Mucina & Rutherford 2006). Temperatures are mild during summer (an average daily maximum of 24–27°C) with rain generally occurring during the summer months (mainly convectional), ranging from 700–1 000 mm with frequent mist in the same season, ensuring extra precipitation.

Albuca heydenrychii flowers mainly during midsummer (late December to January). The seeds are normally released during late summer or autumn and are wind dispersed.

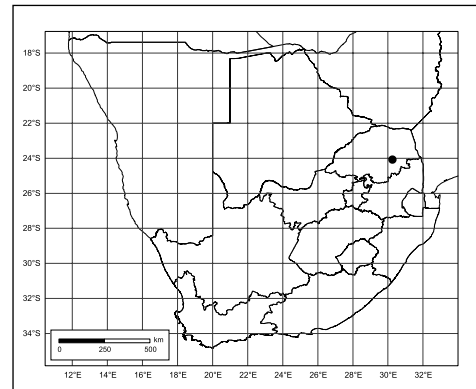


FIGURE 4.—The distribution of *Albuca heydenrychii* in Limpopo Province, South Africa.

Description.—Winter deciduous, hypogeous, solitary bulbous plant, or dividing to form small groups of up to 3 rosettes. *Bulb* broadly ovoid 40–50 × 45–55 mm; basal plate 20 mm in diameter; tunics fleshy, withering and becoming grey, leaf remnants deciduous. *Roots* fleshy, white, up to 1.0–1.5 mm in diameter. *Leaves* 2 to 5 per bulb, 1 000–1 200 × 60–80 mm, in an apical rosette, drooping to spreading, green, slightly fleshy, flaccid, linear, flat becoming subterete at apex and with an subacute end, shallowly channelled at base, semi-translucent, with up to 35 striations each 1–3 mm apart, glabrous; margin entire, whitish, translucent for 0.3 mm. *Inflorescence* spreading, medially pendent, 370–400 mm long; scape often with s-bend; peduncle 5–8 mm in diameter at base; raceme ascending, 50–300 mm long; bracts triangular acuminate, clasping, membranaceous, greenish-white to translucent, bearing a green centric stripe soon turning brownish; lower bracts 47 × 10 mm, gradually becoming smaller upwards; upper bracts 18 × 4 mm; pedicels spreading, 8–20 mm long. *Flowers* spreading; perianth 18–20 mm long, yellow. *Outer tepals* linear-ovate 16–18 × 5 mm; yellow with green centric portion; apex obscurely hooded. *Inner tepals* ovate, 17–18 × 9 mm; apex hooded. *Stamens* with filaments white tapering to translucent, 15 mm long, 2 mm in diameter at base; inner filaments with a constriction in lower third; anthers of inner filaments 2 × 1 mm; anthers of outer filaments 4–5 × 1.5 mm; pollen yellow. *Ovary* green, with 3 distinctly paraseptal crests, 4 mm long, 3.5 mm in diameter, stipitate for 1.5 mm; style yellow, linear-trigonous, 11–16 × 1.2 mm; stigma 0.5 mm long, yellow, obscurely 3-angular, bearing translucent papillae. *Capsule* ovoid, acute 15 × 16 mm. *Seed* 7 × 3 mm, black, flattened, somewhat half lunar in shape. Plate 2344.

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We are grateful to Pieter Winter who informed one of us (EJV) and facilitated contact with Reuben Heydenrych, the collector of the new species, and who accompanied the author to the plants in habitat on 3 January 2019. Thanks also goes to Paul Kruger and Jaco Lategan for accompanying the author to the site. Anton Cilliers is thanked for providing the dry fruiting capsules and seeds collected earlier by Reuben.

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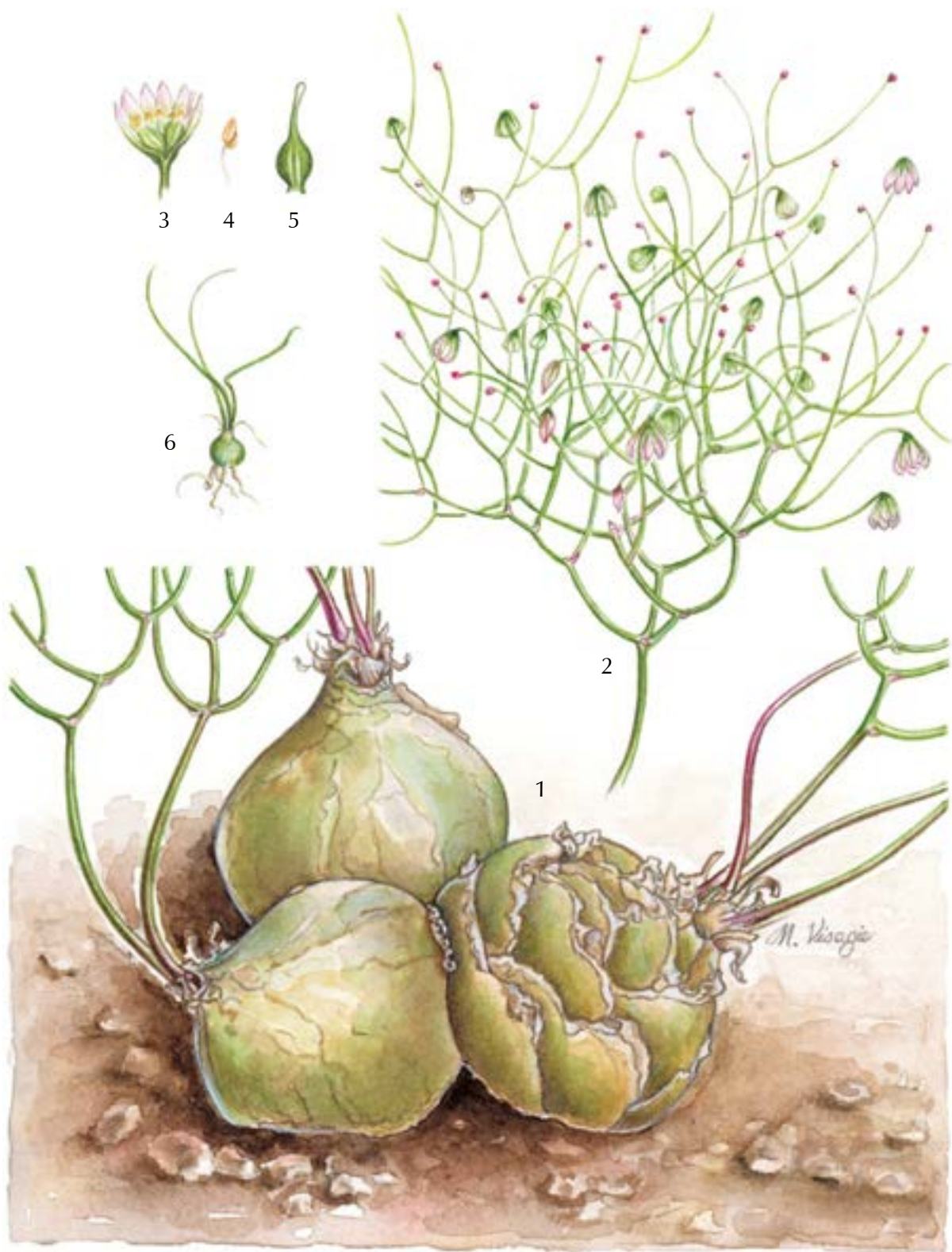


PLATE 2345 *Drimia intricata* var. *visagieae*

Drimia intricata* var. *visagieae

Hyacinthaceae

Angola

Drimia intricata* var. *visagieae Van Jaarsv. in *Bradleya* 32: 78 (2014).

Drimia intricata var. *visagieae* van Jaarsv. is a rare, cliff-hugging bulbous taxon endemic to the sheer cliffs of the upper escarpment margin near Lubango in southwestern Angola.

The rugged escarpment margin of southwestern Angola remains botanically underexplored due to the recent civil war. On a visit to Angola in July 2010, the escarpment margin at Tundavala near Lubango was briefly visited and the cliffs (Figure 1) were inspected as part of a general study of cliff-dwelling plants (Van Jaarsveld 2011). This part of the escarpment reaches 2 000 m above sea level and supports grassland and Afro-temperate forests. The sheer cliffs of this region harbour a number of endemic species, including *Aloe mendesii* Reynolds *Aloe vallis* L.C. Leach (Asphodelaceae) and *Albuca lebaensis* (Van Jaarsv.) Manning (Hyacinthaceae), all of which are obligatory cliff-hangers. Cliff-hangers (cremnochloids) are plants that have adapted to grow on sheer rock faces and three categories have been identified: cliff-huggers, cliff-squatters and cliff-hangers (Van Jaarsveld 2011). The cliff-hangers have stems or leaves that droop or hang from cliffs (surrender to gravity). Cliff-huggers are usually plants growing in tight clusters on cliff faces. Cliff-squatters are solitary plants with ascending stems. On one of the Tundavala ledges a group of epigeous greenish-yellow bulbs was spotted and collected (Figure 2). These plants were grown in the succulent section of Kirstenbosch National Botanical Garden where they subsequently flowered and could be identified as belonging to the *Schizobasis* group within the genus *Drimia* Jacq.

Manning et al. (2014) recently revised the *Schizobasis* group, recognising only two species, *Drimia intricata* (Baker) J.C. Manning & Goldblatt and *D. sigmoidea* J.C. Manning & J.M.J. Deacon from sub-Saharan Africa. Recently a third species, *D. schizobasoides* J.C. Manning & J.M.J. Deacon, was described from the Springbok region in the Northern Cape Province of South Africa and included in this group (Manning & Goldblatt 2018). This group consists of plants with bulbs, which are often epigeous, producing a solitary leaf when young that is soon deciduous, and an ascending, branched, wiry inflorescence that acts as the assimilating organ. Superficially it is reminiscent of the genus *Bowiea* Harv. ex Hook.f., but the latter differs by its soft climbing or scrambling succulent inflorescence (Van Jaarsveld 1983, 1992). Manning et al. (2014) supports this association by molecular analysis, therefore confirming *Bowiea* as sister to *Schizobasis* Baker and all other Urgineoideae.

Drimia intricata is widespread in sub-Saharan Africa, from the Eastern Cape Province in South Africa to Zambia in the north (Figueiredo & Smith 2008; Manning et al. 2014). *Drimia sigmoidea* from the winter-rainfall Robertson Karoo is a recently described species

PLATE 2345.—1, cluster of epigeal bulbs, × 1; 2, inflorescence, × 1; 3, opened flower, × 3; 4, stamen, × 5; 5, ovary, × 6; 6, seedling of *Albuca bracteata*, which germinated in the container of our species, × 1. Voucher: Van Jaarsveld & Harrower 23119 in Compton Herbarium, Cape Town. Artist: Marieta Visagie.



FIGURE 1.—The cliff face habitat of *Drimia intricata* var. *visagieae* at Tundavala near Lubango, Angola. Photograph: E.J. van Jaarsveld.

distinguished from *D. intricata* by its flowering pedicles deflexed from the base, sigmoid in fruit (as opposed to being suberect or spreading, geniculate in fruit) and with a conspicuous anther connective, ± 0.3 mm long (as opposed to a minute anther connective, 0.1 mm long). These species differ from *D. schizobasoides* in having obvious paniculate inflorescences, weakly to extensively branched with lowest nodes subopposite or $\pm$ ternate and bearing multi-flowered branches; plants are widespread but not known from the Richtersveld. In contrast, *D. schizobasoides* has simple raceme inflorescences, the lowest one or two nodes with a short spreading branch resembling a pedicel bearing one or two accessory flowers; only known to occur in the Richtersveld.

Drimia intricata var. *visagieae* was named in *Bradleya* in 2014 as a new variety on the grounds of its pendent, semi-terete, succulent, minutely tuberculate leaves, firm yellowish green bulbs and larger pendent white flowers. The bulb remains firm, unlike some other distinct forms that bear soft bulb scales. The young bulb with ascending leaves in the upper left-hand side of the plate (number 6) represent a seedling of *Albuca bracteata* (Thunb.) J.C.Manning & Goldblatt, which germinated in the container of our species and was mistakenly illustrated as belonging to *D. intricata* var. *visagieae*. It was named after Marieta Visagie in recognition for her botanical artwork through the years.



FIGURE 2.—*Drimia intricata* var. *visagieae* plants in habitat at Tundavala, southwestern Angola. Photograph: E.J. van Jaarsveld.

Drimia intricata var. *intricata* is widespread from the Eastern Cape Province, South Africa, in the south to Angola and Zambia in the north, and includes several distinct entities which were formerly recognised at species level, viz. *Schizobasis buchbergensis* Dinter, *S. cuscutooides* (Burch. ex Baker) Benth. & Hook.f., *S. gracilis* R.E.Fr., *S. angolensis* Baker and *S. schlechteri* Baker. In the opinion of one of us (EJV), *Schizobasis* Baker represents a distinct genus of several species and is in need of thorough investigation. The genus *Schizobasis* was established by Baker (1874) on the grounds of its firm, wiry, non-succulent persistent paniculate inflorescence (Obermeyer 1978). The flowering branches often have a characteristic zigzag growth. The genus is currently included in a broadly circumscribed *Drimia* (Manning & Goldblatt 2003, 2018; Manning et al. 2014)

Drimia intricata var. *visagieae* is only known from the Serra da Chela Mountains growing on sheer cliffs at Tundavala (Figure 3). This range forms part of the western escarpment mountains consisting of slightly acidic quartzitic sandstone formations. The plants were observed growing in shallow soil, in rock crevices, with up to three bulbs clustered together. The inflorescence is an ascending panicle, bearing pendent flowers. It is distinguished from other taxa in the *Schizobasis* group by its attractive, drooping, white, cup-shaped flowers of 10 mm in diameter. The plants continue to produce two to five succulent, subterete, minutely tuberculate, drooping leaves, 100–210 mm long after reaching flowering size, these appearing before the inflorescence. In the other known taxa in the group, including

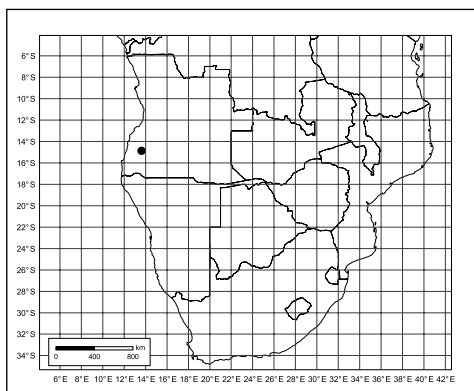


FIGURE 3.—The known distribution of *Drimia intricata* var. *visagieae*, at Tundavala near Lubango, southwestern Angola.

D. angolensis, the flowers are consistently smaller and leaves only present in the juvenile stage.

The vegetation types where *Drimia intricata* var. *visagieae* (Figure 2) are found consist of grassland (upper slopes), miombo woodland (dense savanna, rich in *Brachystegia* species) and Afromontane forests along the escarpment margin and in sheltered kloofs. *Drimia intricata* var. *visagieae* grows on cliffs below the spectacular look-out point at Tundavala at an altitude of about 2 000 m (Figure 1). The plants share their immediate habitat with other cliff-dwelling species such as *Albuca* species, *Aloe mendesii* Reynolds, *Crassula lanceolata*

(Eckl. & Zeyh.) Endl. ex Walp. and *Kalanchoe lanceolata* (Forssk.) Pers. The habitat lies well within the tropics and at this altitude the climate is warm-temperate, with mild, frost free winters. Plants experience shady conditions early in the day but are fully exposed during the latter half of the day (western aspect). Precipitation occurs during summer and ranges from $\pm 1\,000$ – $1\,500$ mm per annum. The drooping white flowers suggest an insect as



FIGURE 4.—Close-up of the bulbs in cultivation at Kirstenbosch National Botanical Garden. Photograph: E.J. van Jaarsveld.

pollinator. The flowers are the largest in the *Schizobasis* group and an example of rich flowering so often associated with obligatory cremnophilous plants (Van Jaarsveld & Van Wyk 2003). Cremnophilous plants are compelled to make themselves visible during flowering so as to maximise their chances of attracting pollinators. Snogerup (1971) studied cremnophytes in the Mediterranean and found an increase in flower size compared to the level-ground relatives. He refers to the phenomenon as 'rich flowering'. In the study of southern African cremnophytes (Van Jaarsveld 2011), 28 (13%) of the obligatory cliff-dwelling plants examined have rich or near-rich flowering. *Drimia intricata* var. *visagieae* flowers during late spring, in October.

The *Schizobasis* group of *Drimia* species are occasionally cultivated by succulent plant enthusiasts for their exposed green bulbs and wiry green inflorescence (Figures 4 & 5). The plants can be increased by division or by growing them from seed. *Drimia intricata* var. *visagieae* grows well in containers but should be grown in a sandy gravel mixture with ample compost added, and kept completely dry during winter.



FIGURE 5.—*Drimia intricata* var. *visagieae* in flower at Kirstenbosch National Botanical Garden. Photograph: E.J. van Jaarsveld.

Description (after original description, Van Jaarsveld 2014).—Plants bulbous, epigeous, solitary or dividing and forming small clusters of up to 5 bulbs, 120 mm in diameter. *Bulbs* globose-ovoid, up to 35–50 × 45–55 mm; tunics firm, yellowish-green drying whitish; roots whitish, less than 1 mm in diameter. *Leaves* 2 to 5, linear, succulent, subterete, 100–210 mm long, 1–2 mm broad at base, shallowly channelled, minutely tuberculate, dark green, flaccid, soon deciduous. *Inflorescence* (the assimilating organ) ascending, 1 or 2 per plant, paniculate, 100–140 mm long; panicle 50–100 × 60–120 mm; scape terete, 50–70 mm long, ± 1 mm in diameter at base, dark purplish below; lower bracts filiform, 2 mm long, becoming smaller upwards; pedicels 25–27 × 0.7 mm. *Flowers* laxly arranged, 25–35, pendent, cup-shaped, 10 mm in diameter, white to slightly translucent and bearing a purplish median band at base; outer tepals ovate-lanceolate, 8 × 3 mm; inner tepals ovate, 6 × 3 mm. *Stamens* 3 mm long; filaments white, linear; anthers 1 mm long; pollen yellowish. *Ovary* ovoid, 2.5 × 2 mm, ridged, green; style 3 mm long, white, slightly club-shaped; stigma minute. *Capsule* and seed not seen. Plate 2345.

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PLATE 2346 *Eucomis sonnetteana*

Eucomis sonnetteana

Hyacinthaceae

South Africa

Eucomis sonnetteana N.R.Crouch, Mart.-Azorín & J.E.Burrows sp. nov. differs from *E. zambesiaca* Baker in its extremely short peduncle, shorter and fewer-flowered raceme, shorter leaves, and its unpleasant rather than sweet floral scent.

TYPE.—South Africa, Mpumalanga: Pilgrim's Rest District, Morgenzon Reserve (2430DC), 2106 m, 17 November 2012, J.E. Burrows & Turpin 13172 (BNRH, holo.; NH, iso.).

The Hyacinthaceae are a widespread family of ca. 1 000 taxa that remains in contentious taxonomic flux. However, recent molecular analyses coupled to morphological and phytogeographical studies (Martínez-Azorín et al. 2011) have resolved generic boundaries in one large subfamily, and work is ongoing in the rest of the family. South Africa is one of two main centres of global Hyacinthaceae diversity, harbouring approximately half of the overall diversity in three of the four subfamilies. The fourth subfamily, the Oziroëoideae, is restricted to South America. Within the Flora of Southern Africa (FSA) region the subfamily Hyacinthoideae is represented by two tribes, the small and recently delimited Pseudoprosopereae, and the much larger and long-established Massonieae to which *Eucomis* L'Hér. is assigned. The circumscription of *Eucomis* is not contested, and has been relatively stable since last revised by Reyneke (1972) for his unpublished M.Sc. study. Accordingly, the genus size and nomenclature have not altered substantially in recent years, save for the description of two new species, *E. schijffii* Reyneke and *E. grimshawii* G.D.Duncan & Zonn., the reinstatement of *E. amaryllidifolia* Baker to species level, and the recognition of *E. pole-evansii* N.E.Br. as a larger, more northerly subspecies of *E. pallidiflora* Baker (Reyneke 1976; Zonneveld & Duncan 2009; Duncan 2013). Reyneke published most of his findings by 1980, with an adaptation of his key to the species appearing only 30 years later (Crouch 2010).

Members of the genus *Eucomis* are readily recognisable in the field with their prominent tuft of leafy bracts (coma) that tops the many-flowered cylindrical racemes, a character that has led to their common name, pineapple lilies. At the base of the inflorescence, several synanthous leaves are present in a rosette which may be either flattened or semi-erect. As deciduous perennials, they possess subterranean bulbs that are broadly ovoid in shape, with papery outer scales. Although representatives of the tribe Massonieae are distributed widely in both summer- and winter-rainfall regions, *Eucomis* is found primarily in the summer-rainfall zone where it is a typical component of moist grasslands in mostly montane and Afro-alpine areas. Only *E. regia* (L.) L'Hér. is localised in the winter-rainfall region, where it inhabits arid, shady sites from western Namaqualand through to the southern Cape. When not hybridising, as they so often do, plants of *Eucomis* are usually easily identifiable in the field. As noted by Zonneveld & Duncan (2009) the flowers of *Eucomis* are very similar, and the species are best separated on the basis of plant size, leaf colour and flower fragrance. Habitat

PLATE 2346.—1, habit (in flower), × 1; 2, basally-fused anthers, × 2; 3, ovary, × 1; 4, incurved filament, × 1; 5, flower, × 1. Voucher specimen: Burrows & Turpin 13172 in Buffelskloof Herbarium (BNRH), Lydenburg. Artist: Gillian Condy.

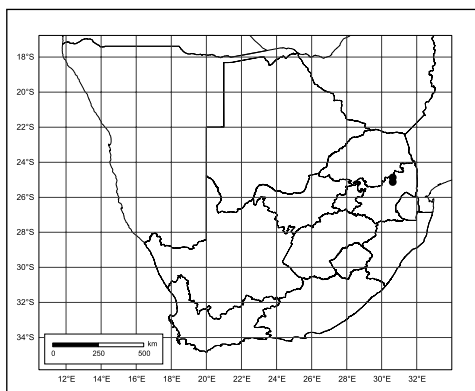


FIGURE 1.—Known geographical distribution range of *Eucomis sonnetteana* in southern Africa.

preferences, maculation patterns and the colour of floral parts are also useful taxonomically. Nine of the 12 *Eucomis* species (16 accepted taxa) are found only in southern Africa, with *E. zambesiaca* Baker and the nominate subspecies of *E. autumnalis* (Mill.) Chitt. also occurring north of the Limpopo River in south tropical Africa (Reyneke 1980; Compton 1990; Winter & Condry 2009). This last-mentioned species was the first to be figured (as *E. undulata* Aiton) in *The Flowering Plants of Africa* (Pole Evans 1926). Other genus representatives featured in this series include *E. zambesiaca* (Winter & Condry 2009), *E. humilis* Baker (Verdoorn 1944a) and *E. vandermerwei* I. Verd. (Verdoorn 1944b).

The material illustrated here (Plate 2346) was first encountered and collected during mid-November of 2012 during a trip by the Mpumalanga Plant Specialist Group to the Forest Nature Reserve known as Morgenzon, near Pilgrim's Rest in Mpumalanga (Figure 1). The following year the site was formally gazetted as 'Morgenzon Reserve'. Live material was that same evening presented to Gill Condry, an artist with a group from the Botanical Artists Association of South Africa (BAASA), who was staying at Buffelskloof Private Nature Reserve near Lydenburg. After painting this miniature species for several hours she reported having to physically distance herself from the specimen on account of the repulsive 'smelly sock' scent of its flowers. In common with both *Eucomis zambesiaca* and *E. autumnalis*, the leaves and other organs of *E. sonnetteana* are immaculate. This feature allows for its distinction within the Mpumalanga Highveld from the purple-spotted *E. montana* Compton and *E. vandermerwei*. The immaculate *E. autumnalis* var. *clavata* (Baker) Reyneke has been observed to grow with *E. sonnetteana*. It is substantially larger in most respects (Reyneke 1980), with plants at the Morgenzon site producing more expansive leaves (ca. 220 × 65 mm) with undulate margins, peduncles to 70 mm tall, and racemes with a greater number of larger flowers that are green rather than white.

This highly distinct *Eucomis* was an unexpected find, but one that will be eagerly sought by plant breeders as a hybrid parent in their cultivar development programmes. This is on account of its small stature, bright white campanulate flowers, erect inflorescence, and its short but spreading leaves, all attributes that allude to its stock value in new alpine garden or potted plant cultivars. The inflorescence size of *E. sonnetteana* in relation to its leaf rosette is aesthetically proportional (Figure 2), unlike the overly leafy dwarf species *E. grimshawii* (see e.g. Figure 2 in Zonneveld & Duncan 2009). Another small member with unpleasantly scented flowers is *E. vandermerwei* (Crouch & Krynanuw 1999), which is similarly endemic to the broader Lydenburg Centre of Endemism (Lötter & Burrows 2012). Despite its malodorous character *E. vandermerwei* has been developed as a long-lasting summer-flowering container subject and rock garden plant (Duncan 2011), even receiving an RHS Garden Merit Award. The cultivar 'Octopus' has been especially well received



FIGURE 2.—*Eucomis sonnetteana* plants in flower at the type locality, Morgenzon Reserve, Mpumalanga. The erect inflorescences are dense and few-flowered, with barely discernible peduncles and remarkably short racemes. Photograph: J.E. Burrows.

by the horticultural community in the northern hemisphere. We have no doubt that the subject of this report will also find a valued place in European gardens and as a flowering potted plant.

In habitat at Morgenzon Reserve, plants form concentrated stands comprising individuals and small clumps of plants (Figure 3), which are particularly obvious in mid-summer when they bloom. The population comprises several hundred individuals or small clumps, and occurs within Long Tom Pass Montane Grassland (Gm 31) (Lötter & Burrows 2012) in the Lydenburg Centre of Endemism (Lötter et al. 2002), at one of the highest points along the escarpment. During late autumn the above-ground parts senesce such that by mid-winter only the below-ground bulbs remain, making plants difficult to locate. The soil at the site, derived from the surrounding Klapperkop Quartzites, is remarkably sandy, indicating a preference by this species for well-drained media. As with such soils derived from the Blackreef Quartzites in the neighbouring Wolkberg Centre of Endemism (Van Wyk & Smith 2001), those quartzitic soils of the Lydenburg Centre are acidic, nutrient-poor and highly leached. At the type locality (Figure 4) the plants occur on level areas in very sparse grassland where they are fully exposed at an altitude of approximately 2 000 m. This vegetation unit receives an average of 25 frost days each year (Schulze 1997), and based on a 2018 high-resolution rainfall model developed by the Mpumalanga Tourism & Parks Agency, an expected mean annual precipitation of 933 mm, augmented by frequent mists. The plants co-occur with a number of other bulbous species including a profusion of *Drimia sphaerocephala* Baker plants, along with a lesser number of individuals of *Ledebouria* Roth and



FIGURE 3.—A flowering colony of *Eucomis sonnetteana* at Morgenzon Reserve, Mpumalanga. Plants grow exposed within the very sparse grassland, with their inflorescences reaching only 70 mm in height, and the small leaf rosettes presented almost flat on the ground. Photograph: J.E. Burrows.

Nicipe Raf. The closely related *Eucomis autumnalis* subsp. *clavata* is sympatric at the site, and presents its characteristically larger habit, and flowers with green rather than white perigones. Mature plants of this more robust species are clearly distinguishable, even in the vegetative state. *Eucomis sonnetteana* is one of about 50 plant species that are endemic on the shale- or quartz-derived substrates of the Lydenburg Centre, and like most quartzitic ones is an inhabitant of the grasslands (Lötter et al. 2002). Although only 60% of the Long Tom Montane Grassland is still natural and untransformed (MTPA 2014), both the known populations of *E. sonnetteana* occur within forest nature reserves where they are protected. Threats to this vegetation unit are primarily from expanding alien tree plantations, with 39% of this unit already afforested. A further threat is gold mining from both organised and illegal artisanal activities (Lötter & Burrows 2012).

Eucomis sonnetteana is most closely related to the diploid *E. zambesiaca* which is currently thought to occur from northern South Africa, through eastern Zimbabwe to southern Malawi, from where this species was first described (Baker 1886). The closest known population of *E. zambesiaca* is in the Blouberg range some 250 km to the northwest of Morgenzon Reserve. Winter & Condry (2009) detailed the history, distribution, circumscription and typification of *E. zambesiaca*, and raised questions about the precise identity and form of this rather uncommon species. They noted the possibility, which we also entertain,

that Baker described this species based on a mixed concept. Kativu (2006) lectotypified the name *Eucomis zambesiaca*, and although his type differs somewhat from South African material linked to this epithet, our consideration of images of the lectotype (Kirk s.n., K) and both syntypes (Lynch s.n., K; Strickland s.n., K) has confirmed that *E. zambesiaca* is not conspecific with the Morgenzon plants. Besides differing in respect of the characters detailed in the above diagnosis, the tepals of *E. sonnetteana* are bright white immediately after anthesis whereas Baker (1886) described the perigone [perianth] of *E. zambesiaca* as 'green'. Flower colour has not been emphasised as a distinguishing feature in the current account as there is neither consensus regarding the colour of the perigone of *Eucomis* species from north of the Limpopo River, nor of the names that should be applied, even at country level. Such contention is well exemplified by illustrated accounts of the Zimbabwean flora (e.g. Martineau & Pear 1953; Linley & Baker 1972; Plowes & Drummond 1990). Resolution of the identity of *Eucomis* plants from the *Flora zambesiaca* (FZ) region has not much improved with the lectotypification of *E. zambesiaca* by Kativu (2006). This author considered the three specimens cited by Baker in the protologue of *E. zambesiaca* and selected the lectotype on the basis that 'Kirk's specimen containing leaf, inflorescence, flowers and capsule, together with details of locality and date of collection was the most ample'. However, consideration of this specimen (Alap.specimen.k00257391) reveals that Kirk's material is only of an infructescence with capsules in various stages of development. Kativu appears to have mistakenly interpreted the leaf and mature inflorescences of other *Eucomis* material mounted on the same sheet (Alap.specimen.k00257390, 5 July 1889, from Hort Gumbleton) to be part of the gathering by Kirk.



FIGURE 4.—Typical montane grassland habitat of *Eucomis sonnetteana*, Morgenzon Reserve, Mpumalanga, South Africa. Photograph: N.R. Crouch.



FIGURE 5.—Flowers of *Eucomis sonnetteana* have bright white perigones, and produce copious clear nectar that concentrates on the outer ovary wall as honey-coloured droplets. Calliphorid (blowfly) visitors are attracted by the unpleasant floral fragrance. Photograph: N.R. Crouch.

An annotation on a specimen of *Eucomis zambesiaca* gathered from the Blouberg [Blauwberg] in northwest Limpopo Province (Codd & Dyer 9167, PRE) records the ‘coconut-like smell’ of the flowers, confirmed by Zonneveld & Duncan (2009) as ‘sweet’. This contrasts with the scent of our novelty from Morgenzon Reserve which is distinctly unpleasant to the nose. This points to its pollination-based reproductive isolation from not only *E. zambesiaca* but also from the sympatric and sweet-scented *E. autumnalis*. Shuttleworth & Johnson (2010) have shown that colour plays little role in pollinator discrimination in *Eucomis*, and that the production or otherwise of sulphur compounds in the fragrance bouquet can induce a shift between specialised carrion-fly and pompilid-wasp pollination systems. As the nectar of *E. sonnetteana* seems to include malodorous sulphur compounds it is likely that the species exhibits a myophilous pollination system, a view strengthened by the observation of blowfly (calliphorid) visitors to the flowers of cultivated plants (Figure 5). However, we do not discount the possibility of pollination also by rodents (therophily), an observation documented for two other members of the Massonieae; by Wester et al. (2009) for the pagoda lily (*Whiteheadia bifolia* (Jacq.) Baker), and by Johnson et al. (2001) for *Massonia depressa* Houtt. *Eucomis sonnetteana* exhibits several characters associated with a rodent pollination syndrome, including dull colouration, robust bowl-shaped flowers presented close to the ground (geoflory), and easily accessible, sometimes viscous nectar (Wester et al. 2009). The flower scent too might attract rodents. It may be of evolutionary

and phylogenetic significance that of the 12 species of *Eucomis*, three with foul scents (*E. vandermerwei*, *E. montana* and *E. sonnetteana*) are located in the uplands of Mpumalanga. A southern suite of similarly unpleasant-scented species (*E. humilis*, *E. schijffii* and *E. bicolor* Baker) are known from the central Drakensberg to the south. Both of these clusters represent a mixture of known diploid and tetraploid species (Zonneveld & Duncan 2009). The ploidy of *E. sonnetteana* has not yet been established, although it is likely diploid in view of its miniature habit.

Although *Eucomis* has attracted horticultural interest in Europe for almost three centuries (Duncan 2011), their popularity in Britain and the Netherlands has increased markedly in recent decades, especially of forms of larger species such as *E. comosa* (Houtt.) H.R.Wehrh., *E. autumnalis* and *E. pallidiflora* (Duncan 2007). This is due to the release of several well-received cultivars, and further to a realisation that the genus' hardiness in north temperate climes is greater than earlier supposed. As mostly summer-rainfall taxa, they conveniently retreat during winter to their subterranean bulbs and in so doing avoid exposure of tender green growth to frost (Mathew 1989). Bulbs in cultivation should be kept relatively dry when dormant over winter, and in temperate climates with wet winters they should either be lifted or provided with good drainage to ensure healthy air movement around them. The new season's leaves appear in late spring prior to the inflorescences and are well developed by the time the plants flower from November to February (in the southern hemisphere). In his excellent treatment of the dwarf species Duncan (2007) related the need for regular watering during the growing period, and heavy feeding. He recommended the use of potassium-rich, rather than nitrogen-rich, fertilisers in order to avoid excessive leaf growth in the subjects. Whilst division of offsets is also feasible, and best undertaken during the early spring prior to active growth, seed propagation has not yet been attempted. Propagation from leaf cuttings has been found straightforward, and even when these organs are excised from the parent plant during late autumn they root readily in a well-drained medium, forming small bulbils at their base within six weeks. Plants so produced have already been released into local horticulture in anticipation of demand. Although the global population of this species (of <1 000 mature individuals within an area of occurrence of <20 km²) is at two locations within protected areas, our concern about potential illegal extraction for horticultural purposes is such that we propose an IUCN (2001) 3.1 Red List status of Vulnerable D1+2.

Eucomis sonnetteana is named in honour of Sonnette Krynauw (1962–2010), who as an employee of the Transvaal Provincial Authority's (TPA) Department of Nature Conservation and afterwards with Mpumalanga Tourism & Parks Agency, dedicated her life to protecting the flora of northeastern South Africa. She was an active field member of the former TPA Threatened Species Unit, then later curator of the Lydenburg Herbarium (LYD) before moving in 2005 to the Larry Leach Herbarium (UNIN) as its curator. She had a particular appreciation of grassland geophytes, including *Eucomis*, and Sonnette's interest in their conservation reflects in her account of one such member (Crouch & Krynauw 1999). The generic name *Eucomis* is derived from the Greek *eu* (good or true) and *komos* (tuft), implying 'beautiful-haired', with reference to the prominent coma of leafy bracts that overtops the raceme.

Description.—Dwarf geophyte, deciduous, immaculate, summer-growing, 50–65 mm high. *Bulb* ovoid, widest near base, 35–40 × 35–45 mm, with distinct truncate basal plate, solitary or offset-forming, scales cream, apices obtuse; tunic to 5-layered, membranous, dark

brown; cataphyll broadly triangular, $5\text{--}13 \times 10\text{--}25$ mm, translucent white, subterranean, adhering to leaf bases, apex obtuse. *Leaves* 7–9, narrowly ovate to oblanceolate, shallowly canaliculated, $55\text{--}70 \times 20\text{--}32$ mm, contemporary with flowers, spreading to suberect; apex acute to subobtuse, pale green, flattened, imbricate; midrib prominent on lower surface, median stripe yellowish green; margins entire to weakly undulate, hyaline, minutely crispate. *Peduncle* cylindrical, very short, $3\text{--}5 \times 3\text{--}5$ mm, erect, pale green. *Raceme* cylindrical, $35\text{--}40 \times 25\text{--}35$ mm, erect, dense, 25–30 flowered; rachis pale green; pedicels erectopatent, to 4 mm long; flower bracts narrowly triangular, slightly canaliculate, lengthening towards inflorescence apex, $5\text{--}11 \times 1.5\text{--}3.5$ mm. *Coma* seldom overtopping, 10–20 sterile coma bracts; bracts ovate to lanceolate, $12\text{--}17 \times 3\text{--}10$ mm, pale green, margins hyaline, suberect to spreading or weakly deflexed, not obscuring upper flowers. *Perigone* campanulate, white, greenish basally, pungently scented; tepals oblong-oblanceolate, $6.5\text{--}12.0 \times 2.5\text{--}3.5$ mm, apex cucullate above, spreading to recurved, soft, short-lived. *Stamens* included; filaments narrowly triangular $4.5\text{--}6.5 \times 1.2\text{--}1.4$ mm, bases fused for 1.5–2.0 mm, green basally, white in distal third, curved inwards; anthers oblong, $1.0\text{--}1.2 \times 0.6\text{--}0.8$ mm, blue-grey, pollen yellowish-cream. *Ovary* trilocular, ovoid, $2.8\text{--}3.0 \times 1.8\text{--}2.5$ mm, not strongly inflated, white tinged green, nectariferous above, ovules ovoid, 1×0.5 mm; style tapering, 2.5–4.5 mm long, weakly decurved, white; stigma penicillate. *Capsule* not seen. Plate 2346.

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Protea parvula

Proteaceae: Proteoideae

*South Africa, Swaziland, Angola****Protea parvula* Beard**, in *Bothalia* 7(1): 54 (1958); Rourke: 26 (1980); Rebelo: 30, t. 3 (1995).

Protea parvula is one of the lesser known species of dwarf *Protea* from the summer-rainfall region of southern Africa. It is rarely seen and infrequently collected. Aptly named *parvula*, meaning ‘very small’, this sparsely branched procumbent to prostrate shrublet seldom exceeds 150 mm in height and tends to be well concealed in the short mountain grassland of its natural habitat.

The earliest recorded collection of our species was made by Dr E.P. Phillips at Kaapsehoop in December 1928, but strangely he did not seem to recognise it as a distinct species, despite having been one of the principal authors of the Proteaceae account in the *Flora capensis* (Hutchinson et al. 1912). It was only formally described by Dr J.S. Beard in 1958, based on a collection made by E.E. Galpin at Suikerboskop near Dullstroom. However, the taxonomy of *Protea parvula* is by no means straightforward. It belongs to a suite of several dwarf, prostrate, lignotuberous grassland proteas, all of which are similar in general morphology, with glabrous stems, glabrous secund leaves, widely splayed patent involucre bracts and perianths everted at anthesis. *Protea enervis* Wild, endemic to the quartzitic summits of the Chimanimani Mountains around an altitude of 2 000 m on both the Zimbabwean and Mozambican sides of the border is the most easily recognised element in this complex of vicariads, distinguishable by its very narrow, linear leaves.

As originally construed, *Protea parvula* was regarded as a southern African endemic. However, a collection made near the Estacao Zootechnica at Humpata on the Bimbe plateau in the Huíla Province of southwestern Angola (*Williams 1490* in NBC), is morphologically indistinguishable from the southern African populations. Moreover, this particular collection is from a site ecologically very similar to the southern African populations of *P. parvula*; namely, a temperate habitat in short montane grassland on quartzitic sandstone at an altitude of 2 300 m where it is locally frequent. Like *P. parvula* it is also lignotuberous with secund leaves. It is our (JPR) opinion that the Bimbe plateau populations are conspecific with *P. parvula*, making this a significant range extension (Figure 1). Another Angolan species, *P. minima* Hauman is also morphologically similar, but occupies a very different habitat at considerably lower elevations on the margins of damboes (shallow wetlands) in *Brachystegia* woodland on Kalahari sands. It too appears to be very closely related to a South African species, *P. simplex* Phillips and may be conspecific.

In Beard’s revision of *Protea* in tropical Africa, he did not cite any material of a dwarf prostrate *Protea* from the Bimbe plateau matching *Williams 1490*, and was presumably unaware of this population (Beard 1963). The most recent review of *Protea* in tropical Africa



PLATE 2347 *Protea parvula*

concentrated on taxa from the *Flora Zambesiaca* and *Flora of Tropical East Africa* areas and similarly did not cite any material of dwarf prostrate taxa from the Angolan highlands (Chisumpa & Brummit 1987). The taxonomic conclusion reached here is based on morphological evidence, yet it is possible that advanced genetic analysis may prove to the contrary. Plant distributions follow ecological rather than political boundaries, so resolving the taxonomy of *Protea* in the summer-rainfall region of southern and tropical Africa – such as in this case – will require much trans-frontier fieldwork and more rigorous analytical methods than vegetative and floral morphology.

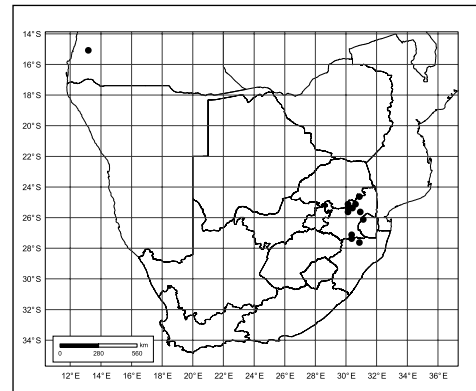


FIGURE 1.—Known distribution of *Protea parvula*.

The specimen illustrated here is a rather narrow-leaved form in the post pollination phase. On opening, the involucre bracts bend outwards becoming patent and widely spread, like a *Nymphaea*, with the floral parts prominently everted. Later, the involucre bracts fold inward to close over the perianths as illustrated in the accompanying plate. The bracts vary in colour, from ivory white through creamy green to pink and deep carmine, even within a single population.

No reliable observations on the pollination of this species have been recorded, although sunbirds (*Nectarinia* species) are known to occasionally descend to ground level to visit other ground-hugging proteas. Scarab beetles and other Coleoptera are more probable pollinators. They are attracted to proteas with shallow bowl-shaped inflorescences with everted floral parts which allow easy access to the nectar-secreting bases of the perianths. While this is well documented in the larger tree-like, widely opening species of *Protea*, no factual data is available for *P. parvula*. These suggestions are offered as a challenge to local field observers to gather some definitive data for *P. parvula*.

After pollination the involucre bracts fold inward, enclosing the perianths again. Flowering takes place in summer, mainly between December and February, depending on locality.

In South Africa the typical habitat of this species is Lydenburg Mountain Grassland, among small rocks, almost invariably on shale- or quartzite-derived soils at elevations of between 1 200 and 2 100 m; in Swaziland it occurs in a similar vegetation type, KaNgwane Montane Grassland (Mucina & Rutherford 2006). The specimen illustrated was collected by the artist in the Verloren Vallei Nature Reserve on the Steenkampsberg plateau near Dullstroom in the province of Mpumalanga. Here summers are moist, mesic and often misty; winters cold, dry and harsh with anything of up to 20 days of frost. The result is that although a shrublet, *Protea parvula* behaves almost like an herbaceous perennial with some of the old stems becoming woody and senescent, occasionally even dying back after winter while in spring new stems sprout from the rootstock on which the next season's

inflorescences are borne. Wild fires in winter have a beneficial effect on flowering, by removing old woody stems and simultaneously stimulating the growth of new flowering shoots from the rootstock.

Description.—A low, procumbent shrublet 80–160 mm in height with numerous simple to sparsely branched stems up to 1 m in length, arising from a large subterranean rootstock. *Branches* procumbent, trailing, very rarely suberect or erect, glabrous, 2–4 mm in diameter. *Leaves* sessile to subsessile, closely ranked, secund to subsecund, only occasionally ascending to patent, linear, lanceolate, elliptic, oblanceolate, occasionally subfalcate, 60–140 × 5–20 mm, acute or obtuse, glabrous, slightly glaucous, margins and petioles flushed red. *Inflorescences* globose in bud, becoming shallowly crateriform on opening, later assuming a flattened everted position, 35–60 mm in diameter; sessile to stipitate, stipe up to 25 mm long. *Receptacle* conic-depressed, acute, 10–15 mm in diameter. *Involucral bracts* 4–5 seriate; outer series broadly ovate, acute, 5–8 × 7–10 mm, glabrous; inner series oblong, concave, apices rounded to obtuse, 25–30 × 5–15 mm, whitish green to pink or carmine, glabrous but margins occasionally minutely ciliate. *Perianth* straight to slightly adaxially arcuate, 25–35 mm long, glabrous but usually ferruginously villous on proximal surface of perianth sheath; limbs 8–10 mm long, glabrous to ferruginously villous at apices; apices acute to uncinated; tube region 5–7 mm long, perianth segments considerably broadened. *Style* straight to slightly adaxially arcuate, 30–35 mm long. *Pollen presenter* 5 mm long, linear-filiform, scarcely differentiated from style. *Anthers* 4, sessile, 8 mm long. *Hypogynous scales* ovate acute, 2 mm long. *Ovary* obconic, 5 mm long, covered with long silky ferruginous hairs. Plate 2347.

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PLATE 2348 *Kalanchoe winteri*

Kalanchoe winteri

Crassulaceae

South Africa

Kalanchoe winteri Gideon F.Sm., N.R.Crouch & Mich.Walters in Crouch et al. in *Bradleya* 34: 219 (2016a). Smith et al.: 308 (2017).

With over ca. 1 500 species in about 35 genera, the Crassulaceae J.St.-Hil. are one of the largest families of succulent plants globally, with only the predominantly southern African Aizoaceae Martinov and New World Cactaceae Juss. known to be more speciose. The Crassulaceae are near-cosmopolitan, with present-day centres of diversity and endemism in South Africa, Mexico, Madagascar, East Asia and Macaronesia. They are though poorly represented in the wet tropics, South America and Australia (Thiede & Eggli 2007). Some 250 Crassulaceae taxa are recognised in the *Flora of Southern Africa* (FSA) region (Smith et al. 1997; Van Jaarsveld & Koutnik 2004), the majority of which belongs to *Crassula* L., with over 150 taxa. The name for the nominate genus *Crassula* is appropriately derived from ‘crassus’ meaning ‘thick’, in reference to the almost invariably and distinctly succulent leaves of its members. This same leaf succulence is common to all five genera native to southern Africa, including *Kalanchoe* Adans. to which the subject of this account belongs. Along with *Kalanchoe*, three other genera in Crassulaceae subfam. Kalanchooideae (Berger 1930) are richly represented in southern Africa: *Adromischus* Lem., *Cotyledon* L., and *Tylecodon* Toelken.

Kalanchoe is an essentially African–Madagascan–Asian leaf-succulent genus and consists of about 150 species globally (Descoings 2003). These range from small prostrate herbs, such as *K. rotundifolia* (Haw.) Haw. (Figure 1), to medium-sized, but prominent trees such as the Madagascan *K. beharensis* Drake (Figure 2). In the treatment of the genus *Kalanchoe* in the *Flora of Southern Africa* (FSA) region (Namibia, Botswana, Swaziland, Lesotho, South Africa), Tölken (1985: 61–71) recognised 14 taxa – 13 species and one subspecies, with *K. montana* Compton at the time regarded as *K. luciae* Raym.-Hamet subsp. *montana* (Compton) Toelken, and *K. hirta* Harv. included in the synonymy of *K. crenata* (Andrews) Haw. With *K. montana* (Smith et al. 2016) and *K. hirta* (Smith et al. 2018) reinstated at species rank, *K. leblanciae* Raym.-Hamet newly recorded for the FSA region (Crouch et al. 2016b), and *K. winteri* Gideon F.Sm., N.R.Crouch & Mich.Walters (Crouch et al. 2016a) and *K. waterbergensis* Van Jaarsv. (Van Jaarsveld 2017) recently described, contemporary taxonomic studies in southern Africa have increased the number of indigenous FSA species by over one quarter, to 18. In southern Africa, *Kalanchoe* is accordingly reasonably diverse at the species rank, with more than 10% of the globally-known species occurring in the subcontinent. These occur almost exclusively in the summer-rainfall, savanna region (Smith et al. 2003).

Kalanchoe winteri, a thick-leaved succulent (Figure 3), is allied to *K. thyrsoiflora* Harv. (treated 90 years ago in *The Flowering Plants of South Africa*, under the editorship of Pole

PLATE 2348.—1, inflorescence, × 1; 2, inflorescence, middle section, × 1; 3, plantlets on mature peduncle, × 1. Voucher specimen: G.F. Smith & E. Figueiredo 50 in the H.G.W.J. Schweickerdt Herbarium, Pretoria. Artist: Gillian Condy.



FIGURE 1.—*Kalanchoe rotundifolia*, which has a distribution range that stretches from near Port Elizabeth in South Africa's Eastern Cape Province northwards through eastern Africa to the Indian Ocean island of Socotra, is one of the smaller-growing species of this genus. Photograph: G.F. Smith.

Evans [1929]), *K. luciae* and *K. montana*, three long-known and rather similar-looking species. Characters common to all four taxa in this group are thick, cylindrical to club-shaped, densely flowered inflorescences, and large, soup plate- to paddle-shaped leaves. These are often conspicuously covered with an almost ghostly white epicuticular wax, or fine hairs. Of these four related species, the newly described *K. winteri* has by far the quickest growth rate, followed by *K. luciae*. Remarkably, *K. winteri* will reach flowering maturity within a single season, while in the process accumulating significant biomass in its loosely packed leaves. The spectacular growth rate is achieved when plants are propagated from small, perfectly-formed plantlets arising on the long peduncle (Figure 4).

Kalanchoe winteri can be easily separated from *K. luciae* and *K. thyrsiflora*, from



FIGURE 2.—The Madagascan *Kalanchoe beharensis*, commonly known as donkey's ears, attains tree-like dimensions and is one of the few truly arborescent species included in *Kalanchoe*. Photograph: G.F. Smith.



FIGURE 3.—*Kalanchoe winteri* has thick, paddle-shaped, succulent leaves. Photograph: G.F. Smith.

which it differs in several vegetative and reproductive respects. It contrasts with *K. luciae* in consistently presenting golden-yellow (Figure 5) instead of whitish corolla lobes, corolla tubes that are ellipsoid rather than urceolate, and leaf blades only occasionally red-infused on their margins rather than frequently so. *Kalanchoe winteri* differs from *K. thyrsiflora* in having ellipsoid corolla tubes instead of cylindrical ones, filaments inserted lower in the corolla tube, and all eight anthers exerted instead of only four (Crouch et al. 2016a). *Kalanchoe winteri* differs from both *K. luciae* and *K. thyrsiflora* in having often basally auriculate, mainly wide-spreading, somewhat floppy rather than erect leaves, and ovaries that are broadest above their middle. *Kalanchoe winteri* is separated from *K. montana* by lacking a tomentum, which to a varying degree is present in the latter species, one that tends also to be smaller-growing and less prone to clump.

Kalanchoe winteri provides further evidence for the uniqueness of the flora of the Wolkberg Centre of Endemism (Figure 6) in the Limpopo Province in northern South Africa, a recognised area of remarkably high species diversity in northern South Africa in which it occurs (Van Wyk & Smith 2001). Although the area in which *K. winteri* was found has been reasonably well botanised, the species had escaped detection until the 21st century, when it was discovered by Pieter Winter who at that time was curator of the L.C. Leach Herbarium at the University of Limpopo. He gathered the type at Sedibeng sa Lebesse Mountain to the West of Strasburg. Although novelties often hide in plain sight, whether in the field or as an accessible herbarium specimen, this seems not to be the case with *K. winteri*. Rather, this uncommonly encountered species has a comparatively small geographical distribution



FIGURE 4.—Lateral shooting is commonly observed in *Kalanchoe winteri*, particularly after release from apical dominance. Photograph: N.R. Crouch.



FIGURE 5.—The 4-angled corolla tubes of *Kalanchoe winteri* are subtended by relatively short, bright yellow calyx lobes. Photograph: N.R. Crouch.

range spanning about 50 km (Figure 7), and is at present known from only three localities, none of which were known before the fieldwork of Winter. It occurs in Northern Escarpment Quartzite Sourveld (Mucina et al. 2006) growing on quartzite in grassland vegetation, always in fire protected microhabitats on or near rocks. It may be encountered at altitudes of 1 370–1 750 m above sea level on north, northeastern, eastern, and southwestern aspects, usually in full sun, although at times in the partial shade of shrubs. Plants flower between May and September, peaking in July.

Kalanchoe winteri is very easy in cultivation. The non-flowering leafy shoots and short branches that develop in the axils on the peduncle can be removed and placed in a well-drained soil mixture where they will root easily. The fine, almost dust-like seeds can be sowed in a seedling tray, or directly in the spot in a garden where plants are intended to grow. The species is remarkably pest- and disease resistant, and apart from slugs and snails that will devour virtually any plant material, no maladies have been recorded for the species.

With over 47% of the succulents of the world indigenous and in many instances endemic to southern Africa, the region has by far the highest global diversity of this growth form (Smith et al. 1997). The recent discovery and description of *Kalanchoe winteri* emphasise that there are still many succulents to be discovered and recorded from this part of the



FIGURE 6.—Northern Escarpment Quartzite Sourveld habitat of *Kalanchoe winteri*, Wolkberg, Limpopo Province. Photograph: M. Lötter.

world. With the Crassulaceae being the second largest succulent plant family in our region (Smith et al. 1997), it will likely yield many more novelties, especially in the most speciose and widespread genus *Crassula*.

Description.—Perennial, many-leaved, 1–3 rosettes, sparsely to profusely branched from near the base and higher up, glabrous, waxy, robust succulent, 0.5(–0.9) m tall in bloom. *Stems* erect to leaning and curved upwards, smooth, waxy especially at internodes, light green. *Leaves* opposite, erect to mostly spreading to variously floppy, succulent, sessile, flattened above and below, glabrous, waxy, light green to bluish-green; petiole absent; blade 140–160 × 80–140 mm, obovate to somewhat oblong, not folded lengthwise, occasionally infused with light red; axils often carrying small leafy shoots and short branches that produce flowers in season; base narrow, often distinctly auriculate; apex rounded-obtuse or truncate, usually indented at the tip; margins smooth, slightly lighter green than blade, sometimes infused with red. *Inflorescence* a slender, erect, densely flowered, cylindrical thyse

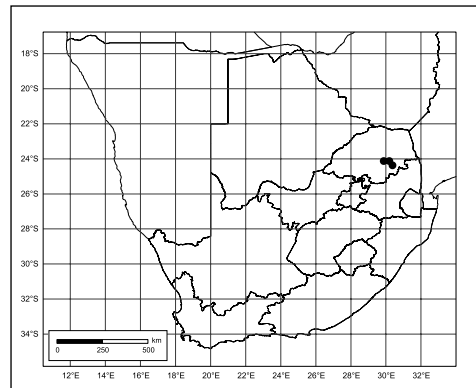


FIGURE 7.—Known geographical distribution range of *Kalanchoe winteri* in South Africa.

consisting of several dichasia terminating in monochasia, 0.5–(0.9) m tall. *Flowers* 13–15 mm long, erect to slanted horizontally, pale yellowish green to greenish white (tube) and yellow (lobes), all parts excepting tepal lobes above covered with a substantial white waxy bloom, highly scented, resinous to the touch; pedicels 9–10 mm long. *Calyx* mid-green, contrasting against lighter green corolla tube; sepals 4, 3–4 mm long, elongated-triangular, acute (sharp-tipped). *Corolla* light greenish yellow; tube 11–12 mm long, more or less quadrangular, ellipsoid (cigar-shaped enlarged in the middle), distinctly 4-angled; lobes 6–8 × 3.5–4.0 mm, triangular, margins slightly to distinctly inrolled, truncated, bright yellow. *Stamens* 8, inserted just below or in the middle of the corolla tube, 1–2 mm exerted; filaments 3.0–5.5 mm long, thin, light greenish white; anthers 1.4–1.6 mm long, yellow. *Pistil* pyriform, consisting of 4 carpels; ovaries, 9–10 mm long, broadest above the middle, light green; styles ± 4 mm long; stigmas very slightly capitate, light yellow, exerted as far as or slightly less than anthers; scales 2.3–2.5 × 1.8–2.1 mm, narrowing at the base, truncate, repand. *Follicles* brittle, grass spikelet-like, light to dark brown when dry, enveloped in dry, light whitish brown remains of corolla, 6–7 mm long. *Seeds* 0.75–1.25 mm long, dark brown. *Chromosome number*: unknown. Plate 2348.

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Agathosma adenandriflora

Rutaceae: Rutioideae: Diosmeae

South Africa

Agathosma adenandriflora Schltr. in Engler Botanisch Jahrbücher xxvii: 160 (1900); Dümmer: 334 (1912). *Agathosma formosissima* Dümmer: 58 (1920); Pillans: 77 (1950).

Agathosma adenandriflora was first described in by Rudolf Schlechter, a German botanist who collected prolifically in South Africa in the years 1891–1898 (Schlechter 1900). The name was published by Schlechter from one of his own collections (*Schlechter 8903*), of which the type specimen (the specimen used to describe the species with that name for the first time) is housed in the Bolus Herbarium. Richard Dümmer, a South African-born horticulturalist and botanist, subsequently described a more robust form of this species as *A. formosissima* Dümmer, mentioning that it is the largest-flowered of all the *Agathosma* species (Dümmer 1912). Pillans, in his 1950 revision of the genus, however, synonymised this name with *A. adenandriflora* (Pillans 1950).

The word *Agathosma* is a combination of two Greek words (*agathos* meaning ‘good’ and *osme* meaning ‘scent’) (Trinder-Smith 2003). The specific epithet *adenandriflora* refers to the fact that this species has flowers resembling that of the larger-flowered genus in the tribe, *Adenandra*. The name *formosissima*, given to the species described by Dümmer, stems from the Latin word *formosus*, meaning ‘finely formed, handsome or beautiful’, which is most appropriate for the species (Stearn 1990).

Agathosma belongs to the Diosmeae in the Rutaceae family, a tribe that is almost wholly confined to the Cape Floristic Region (CFR) (Manning & Goldblatt 2012). The genus has 134 described species and can be most readily distinguished by: conspicuously gland-dotted leaves, particularly visible on the undersides; reproductive structures being five-merous, often with a reduced number of carpels forming the ovary; prominent staminodes (infertile stamens) which vary from being conspicuous and non-petal-like in appearance, to being narrow and petal-like; and a variable disc on which the ovary is borne that also produces nectar for pollinators (in *A. adenandriflora* this is cup-shaped). With such a large number of species in the genus, and a substantial number still requiring formal description, this genus is regarded as being one of the major Cape clades of plants in the CFR (Linder 2003). Only six of the known species have distributions that extend beyond the CFR. One species, *A. namaquensis* Pillans, occurs exclusively on the mountains near Kamieskroon (regarded as an outlying zone of the CFR) in the Northern Cape Province; other species with outlying

PLATE 2349.—1, flowering branch, $\times 1$; 2, section through flower, $\times 6$; 3, petal, $\times 6$; 4, sepal, $\times 6$; 5 and 6, staminodes, $\times 8$; 7, stamen, $\times 8$; 8, ovary, $\times 12$; 9, bract, $\times 12$; 10, bracteole, $\times 12$; 11, underside of leaf showing glands embedded in the margins and scattered around the nerve, $\times 6$; 12, sectioned leaf showing upper surface with slightly revolute margins, $\times 6$; 13, ovary, $\times 3$; 14, split loculicidal capsule, $\times 3$; 15, detached inner leathery wall of carpel, $\times 5$; 16, frontal view of seed, $\times 5$; 17, side view of seed with elaiosome (note, the seeds of this specimen are particularly under-formed and are usually appreciably ‘fatter’), $\times 5$. Voucher specimen: Bean & Trinder-Smith 2687a in Bolus Herbarium, Cape Town. Artist: Ellaphie Ward-Hilhorst.

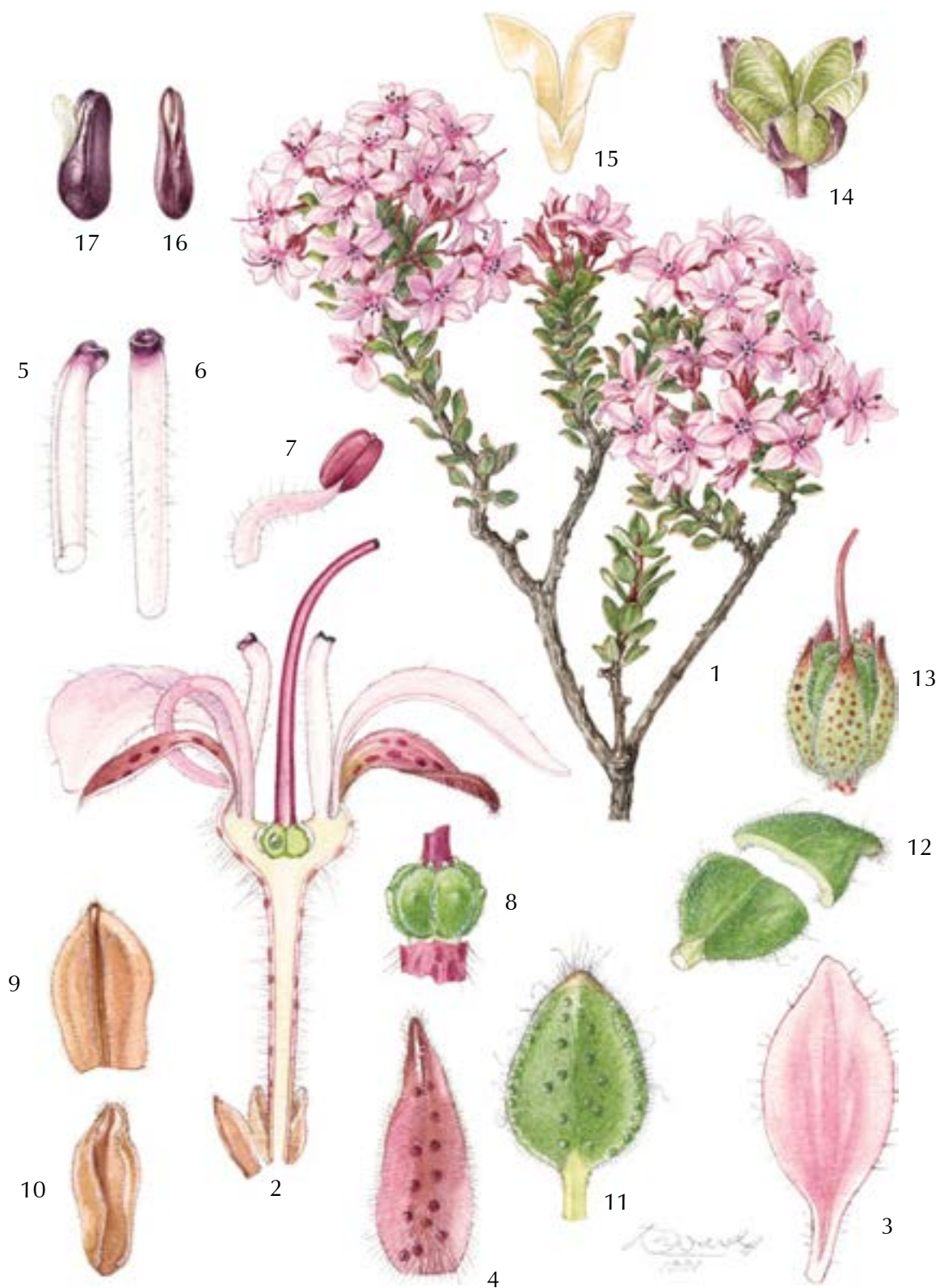


PLATE 2349 *Agathosma adenandriiflora*



FIGURE 1.—Close-up of an inflorescence showing the densely pilose pedicels, silky-villous sepals with acute tips, widely oblanceolate petals with pubescent vestiture underneath and villous margins, and comparatively large pale to dark pink flowers. Photograph: D. Gwynn-Evans.

populations in the Northern Cape are: *A. capensis* (L.) Dümmer, *A. ovata* (Thunb.) Pillans and *A. marifolia* Eckl. & Zeyh. *Agathosma venusta* (Eckl. & Zeyh.) Pillans has been recorded from the Great Escarpment near Graaff-Reinet and *A. peglerae* Dümmer along the Eastern Cape coast in the vicinity of East London. The rather widespread *A. ovata* extends from the Western Cape into the Eastern Cape and as far as the grasslands of KwaZulu-Natal, always on sandstone-derived soils, where it has become a re-sprouter as an adaptation to more frequent fires that occur in grasslands. It is the only species found outside of South African borders, occurring in Lesotho. One of the undescribed species can only be found growing on the Great Escarpment near Sutherland.

Agathosma adenandriiflora can be recognised by its comparatively large flowers (whitish to pale- to dark pink; Figure 1) and large, gland-tipped staminodes (Figure 2), the glands being deeper coloured, almost cherry-red (a character which likens it to one of the other genera in the Diosmeae, *Adenandra*). The flowers are borne in loose terminal clusters of three to four. The leaves are also relatively long and broad, up to 12×5 mm wide, flattened, and with a prominent margin that houses immersed glands. Glands also appear scattered on the undersides of the leaves. The calyx lobes are maroon-red in colour, the lower parts, becoming green with age and covered in long silky hairs, has maroon-coloured glands on the outer (under surface) and these can often be stalked. When not observed in



FIGURE 2.—Close-up of a flower and leaves clearly showing the five staminodes with darker, cherry-red tips in the flower and distinctly scabrid leaves with obtuse tips. Photograph: D. Gwynn-Evans.

its natural growing environment, *A. adenandriiflora* can possibly be confused with *A. acocksii* Pillans – the latter being more compact in stature with smaller morphological features overall. The most pertinent difference, however, is in the staminodes, with those of *A. acocksii* being 2 mm long, more or less oblong in shape, with short dense hairs on the lower part and a stalked apical gland, as opposed to *A. adenandriiflora* where the staminodes are 4.5–5.0 mm long, linear in shape, with the hairs on the lower section sparser and longer and an unstalked, large somewhat bowl-shaped apical gland. Seeds are released explosively from the capsule when ripe, which project the seeds to a distance of up to ± 2 m from the plant (pers. obs.). The inner wall of the carpel, which becomes leathery and can become detached, is responsible for this action. The seeds are black, smooth, leathery and bear an elaiosome that attract ants. Seed dispersal is thus by explosive expulsion and then, often, further by ants (myrmecochory). The latter carry the seeds into their nests where they are protected from the ravages of ultraviolet radiation and the heat of the sun. The stored seeds are also protected from the heat of fires and from predation. In the nest the elaiosome gets eaten by the ants, after which the slippery seed coats disallow the ants to get a purchase on the seeds to expel them from the nest, so they remain buried, which in turn advances germination success.

A characteristic of the flowers of many *Agathosma* species is that the filaments bend downwards, between the petals, once the pollen is shed from the anthers. This is believed to promote better transfer of pollen onto the stigma (the latter becomes receptive after

pollen has been shed) from pollinators when arriving to gather the nectar produced by nectaries embedded in the disk which surrounds the ovary.

The surface sculpturing of pollen grains in the subtribe Diosminae (tribe Diosmeae), have been shown to be very variable both between and within genera (Victor & Van Wyk 1998, 1999a, b, 2000, 2001). In *Agathosma* this also appears to be the case with the surface of *A. adenandriiflora* resembling that of *Adenandra obtusata* Sond., *Coleonema juniperinum* Sond. and *C. nubigenum* Esterh., as well as *Phyllosma capensis* Bolus in having a striate exine sculpture (Victor & Van Wyk 1999a, b, 2000; Trinder-Smith & Dreyer, unpublished data), thus seeming to indicate a relatively close phylogenetic relationship between these species or, alternatively, indicating that this trait has evolved independently several times. Further investigation is, however, necessary before a clear statement can be made regarding intergeneric evolutionary relationships.

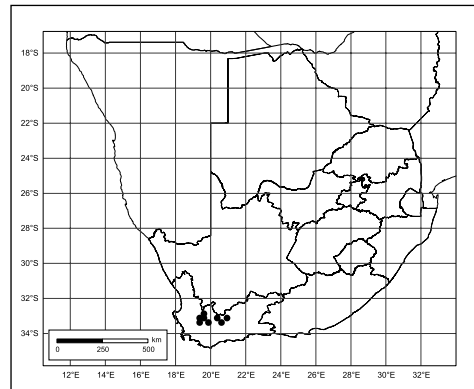


FIGURE 3.—Known distribution of *Agathosma adenandriiflora* in South Africa.

A study using molecular techniques (three chloroplast DNA regions: *psbA-trnH*, *atpB-rbcL* and *rpl16*) showed that *Agathosma adenandriiflora* is not closely related to the other group of large-flowered agathosmas (e.g. *A. bathii* (Dümmer) Pillans) (Trinder-Smith et al. 2007), which would seem to indicate that large flowers arose independently for this species. In fact *A. adenandriiflora* appears to be altogether odd in its placement within the genus, as confirmed by a further molecular analysis (Trinder-Smith & Verboom, unpublished data).

Agathosma adenandriiflora occurs in arid fynbos in the Clanwilliam, Ceres, Worcester and Laingsburg districts (Figure 3), above 850 m (in the Laingsburg district but mostly above 1 000 m elsewhere) and predominantly on east, southeastern and south-facing aspects, but has also been recorded from dry north and north-north-east-facing slopes. Its preferred habitat is where horizontal bedrock is associated with vertical rock walls, forming sheltered, fire-protected refugia where it is associated with other plants, which seem to be vulnerable to damage by fire, such as *Heliophila hurkana* Al-Shehbaz & Mumm. It can be a plant of cushion-like habit to sprawling to shrubs of up to 2 m high. It grows in rock cracks or on rocky, sandy soil derived from Table Mountain Sandstone, but has, unusually, also been found on shale-derived soils. Where plants grow they are rather localised and uncommon, but where conditions seem to be favourable it can be locally frequent. The flowers vary from white to dull- to bright pink with bright pink staminodes (anthers which have become sterile). The leaves are variously sized and shaped, but are generally flat and, when crushed, have a diesel-garlic scent, while the crushed flowers emit a lemon-scented fragrance. This species has been recorded as having flowers throughout the year, but appears to peak in the spring and early summer (September–January).

Historic records show this species to once have been more abundant and widespread, however, it now proves quite elusive to find. It occurs predominantly in non-arable, drier,

rocky regions and is thus not much threatened by ploughing. It is, however, a highly palatable species and a number of subpopulations have been heavily grazed in the Klein-Spreufontein, Witteberg Mountains and Katbakkies Pass areas (J.H. Vlok, pers. com.). The species is regarded as Near Threatened (Raimondo et al. 2009).

Description.—A single-stemmed, dwarf to tall, prostrate shrub, 0.2–2.0 m high with rigid, wiry puberulous or pilose branchlets, multi-branched from base. *Leaves* 7–12 mm long, alternate, ovate, obovate, ovate-lanceolate or occasionally subrotund in outline; tips obtuse; base rounded; slightly convex above; margins coriaceous with submerged glands, somewhat revolute, often pilose; minutely scabrid beneath and above, sometimes minutely puberulous above; younger leaves mostly villous above and below. *Flowers* in terminal clusters, 2- to 4-flowered. *Pedicels* 8–12 mm long, densely pilose, often bearing stalked glands, subtended basally by a widely obovate bract and two bracteoles. *Sepals* 4–8 mm long, keel angled $<90^\circ$, oblong, lanceolate-oblong or ovate-lanceolate; tips acute or subacute, densely silky-villous, often bearing stalked glands. *Petals* 9–11 mm long, obtuse, widely oblanceolate, pubescent beneath, sometimes pubescent above; margins mostly villous. *Stamens* with glabrous anthers with an apical gland; filaments pilose. *Staminodes* white to pale pink, 4.5–5.0 mm long, not petal-like, linear, furrowed above, conspicuously nerved and pilose beneath, with a large crateriform apical gland. *Style* glabrous or puberulous towards the base, deep red, erect, becoming 6 mm long; stigma subcapitate, obscurely 5-lobed, crimson, apex green becoming maroon, crateriform. *Ovary* with 5 carpels forming a loculicidal capsule, tubercled, setose or glabrous with stalked glands on apex. *Carpels* furrowed and with a small projection (horn) at the tip of each (umbonate), opens explosively. *Fruit* a capsule. *Seeds* black, glossy, 4×1.75 mm, with elaiosome. Plate 2349.

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Triumfetta welwitschii

Malvaceae: Grewioideae

Angola, Burundi, Democratic Republic of Congo, Malawi,
Mozambique, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe

Triumfetta welwitschii Mast. in Flora of Tropical Africa 1: 255 (1868); Wilczek 10: 64 (1963); Wild 2: 68 (1963); Wild 21: 21 (1984); Whitehouse et al.: 74 (2001).

With about 102 species (The Plant List 2018), *Triumfetta* L. is the largest genus of subfamily Grewioideae (named after *Grewia* Willd., the type genus) in the hibiscus or mallow family, Malvaceae. The genus is distributed through the tropical and subtropical regions of the world, and is found in warmer parts of all continents except Europe. It occurs in North America (± 6 species), South America (± 9 species), Africa (± 56 species), Asia (± 40 species) and Australia (± 61 species; a large number listed as unresolved on The Plant List 2018). Many species of *Triumfetta* have a wide distribution on a single continent and a few species have become weedy across continents, obscuring their place of origin (Halford 1997). In southern Africa, nine species are recognised namely, *T. angolensis* Sprague & Hutch., *T. annua* L., *T. dekindtiana* Engl., *T. obtusicornis* Sprague & Hutch., *T. pentandra* A.Rich., *T. pilosa* Roth, *T. rhomboidea* Jacq., *T. sonderi* Ficalho & Hiern and *T. welwitschii*, with only *T. obtusicornis* endemic to the region (South African National Biodiversity Institute 2018). The remaining taxa also occur in tropical Africa and the three species, *T. annua*, *T. pentandra* and *T. pilosa* are also found in Madagascar (African Plant Database 2018). *Triumfetta pentandra*, *T. pilosa* and *T. rhomboidea* are noted as introduced in the floras of North America and Western Australia (Halford 1997).

Plumier (1703) named the genus *Triumfetta* in honour of Giovanni Battista Triumfetti (1658–1708), director of the Rome Botanical Garden and professor at Sapienza University of Rome. In various classifications (De Candolle 1824; Bentham & Hooker 1862; Hutchinson 1967; Cronquist 1981; Dahlgren 1983; Takhtajan 1997; Thorne 1983, 1992) *Triumfetta* was placed in the family Tiliaceae. Judd & Manchester (1997) redefined the Malvaceae to include the Tiliaceae as well as the Sterculiaceae and Bombacaceae following their analyses of morphological, anatomical, palynological and chemical characters of the families. These authors drew attention to a special character in the expanded Malvaceae, namely that of floral nectaries. In the family, nectaries consist of densely packed, multicellular, glandular hairs (Judd & Manchester 1997) (Figure 1) and are present on the sepals, less often on the petals (e.g. *Grewia*) or androgynophore (e.g. *Heliocarpus* L. and *Triumfetta*) (Figure 1), and may be absent in some species of *Corchorus* L. Based on molecular findings in the expanded Malvaceae, Bayer et al. (1999) reassigned most genera in the Tiliaceae, including *Triumfetta*, to subfamily Grewioideae, and transferred genera not closely related to Grewioideae to subfamilies Brownlowioideae, Dombeyoideae and Tilioideae, and to other families within the Malvales.

In a comprehensive revision of the Tiliaceae, Burret (1926) used the characters, presence of an androgynophore (the stalk bearing the androecium and gynoecium together



PLATE 2350 *Triumfetta welwitschii*

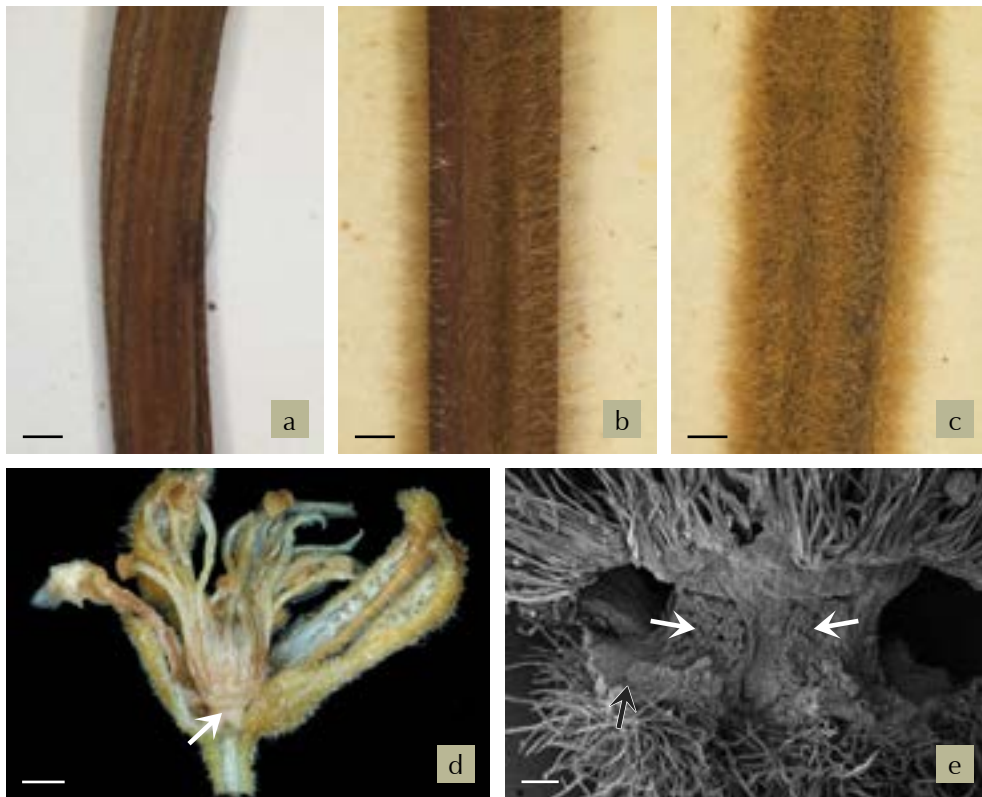


FIGURE 1.—*Triumfetta welwitschii*: a, base of stem, almost hairless, $\times 6$; b, base of stem with simple long hairs, $\times 6$; c, upper part of stem with dense stellate hairs (tomentose), $\times 6$; d, flower with sepals and petals removed showing position of androgynophore (arrow) and free stamens, $\times 10$; e, two of five nectar glands (white arrows) on androgynophore opposite base of petals (black arrow), $\times 90$. Voucher specimens: a, d, e from Condé 248 (PRE); b, c, from Codd 5654 (PRE). Photographs: S. Sharma.

above the level of petal attachment [Figure 1]), staminal tubes and floral nectaries to designate four subfamilies and 16 tribes in the family. Within the Malvaceae, the Grewioideae are characterised by sepals without nectaries, nectaries either on petal bases or androgynophores, and numerous, often free, stamens with dithecal anthers (Brunken & Muellner 2012). Combining the characters of Brunken & Muellner (2012) with easily observable characters, such as plant habit (trees, shrubs or rarely herbs), stems and leaves pubescent, leaves alternate (rarely opposite), deciduous (rarely evergreen) and stipules present and deciduous, members in the Grewioideae can be recognised more readily.

Triumfetta is distinguished within the Grewioideae by its yellow flowers, its free, 4–5-parted sepals, all fertile stamens, distinct nectaries on the androgynophore (Figure 1) opposite the base of petals (Bayer & Kubitzki 2003), and its fruit which is a round capsule covered in bristles bearing hooks (burrs). Due to the bristly fruits, members in the genus are referred to as bur weed or burbark. In its morphology, *Triumfetta* closely resembles *Helio-carpus* L. in being pubescent with stellate hairs, and having alternate, palmately reticulate leaves with long slender petioles (Lay 1949). The genera can be separated with certainty

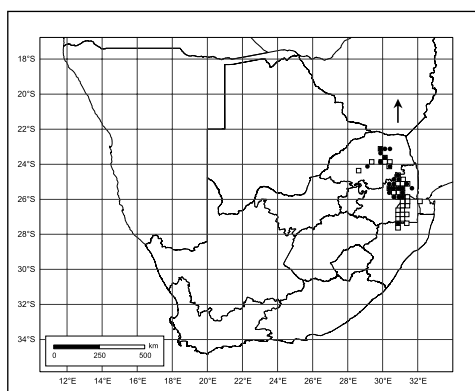


FIGURE 2.—Known distribution of *Triumfetta welwitschii* varieties in southern Africa. White squares represent var. *hirsuta*, black circles represent var. *welwitschii*.

when plants reach the fruiting stage (Lay 1949; Bayer & Kubitzki 2003). In *Triumfetta*, the entire fruit is covered in pink-red hairy bristles giving it a round shape. This distinguishes it from *Heliocarpus* in which the fruit is compressed and fringed by two rows of bristles, like the rays of the sun – a character Linnaeus (1742) used in naming the genus.

In dealing with the diversity of triumphettas from Africa that reached Kew, Sprague & Hutchinson (1909) proposed a subgeneric classification for the genus. They also reviewed in detail the classifications of *Triumfetta* by Linnaeus (1742), Gaertner (1791), De Candolle (1824), Endlicher (1840), Masters (1868), Baillon (1873) and Schumann

(1886), all of whom recognised two sections in the genus, *Triumfetta* and *Bartramia* L. Characters used in defining sections included presence or absence of petals, presence of an androgynophore with five glands, fruit divided or undivided and fruit dehiscent or indehiscent. In their classification, Sprague & Hutchinson (1909) added three new sections namely *Lasiotrix*, *Lepidocalyx* and *Porpa*, in addition to the two widely accepted sections *Triumfetta* and *Bartramia* and De Candolle's (1824) section *Lappula*. They used habit, stem and leaf indumentum, leaf lobes, shape of flower buds, scales on the calyx, length of androgynophore, stamen number, locule number, and fruit type and texture to delimit the sections in *Triumfetta* as reviewed by Halford (1997).

Triumfetta welwitschii was named in honour of Friedrich Martin Josef Welwitsch (1806–1872), an Austrian botanist who made the first collection of the species in Angola in 1857. The species is recognised by its erect stems arising from a vertical rootstock, mostly leafless at flowering, flowers yellow and fruit globose covered in hairy bristles. It is recorded as being very variable in stem and leaf pubescence, leaf shape, stipule width and distribution in various treatments of the Tiliaceae in Africa (Wild 1963, 1984; Brummitt & Seyani 1978; Whitehouse et al. 2001). Brummitt & Seyani (1978) assessed the species and varieties grouped in the *T. welwitschii* complex, reducing them to three varieties (Table 1), namely var. *welwitschii*, var. *lanata* Brummitt & Seyani and var. *rogersii* Brummitt & Seyani. The authors placed specimens with a combination of few short stellate hairs and long simple hairs scattered on the entire stem to the base (characteristic of var. *hirsuta*) into a group of intermediates between var. *welwitschii* and var. *lanata* (referring to woolly pubescence). They further remarked that the name *hirsuta* is not suitable for the intermediates as the type specimen (*Junod 605*, lectotype in Kew Herbarium) lacks long simple hairs on the lower part of the stem (Table 1). The authors of the current paper chose to uphold var. *hirsuta* until sampling of populations confirms the stability of the distribution of long simple hairs along the length of stems, and specimens of var. *hirsuta* in southern Africa are considered against characters that define the intermediates recognised by Brummitt & Seyani (1978).

Table 1.—Summary of key characters in varieties of *Triumfetta welwitschii*. Data extracted from Wild (1963, 1984), Brummitt & Seyani (1978) and Whitehouse et al. (2001)

	var. <i>welwitschii</i>	var. <i>hirsuta</i>	var. <i>lanata</i>	var. <i>rogersii</i>
Stems	Up to 400(–500) mm long	200–450 mm long	Up to 400(–500) mm long	Up to 180 mm long
Stem pubescence	Glabrous in lower third, subglabrous to densely tomentose in the upper two-thirds	Subglabrous, hairs scattered	Densely villous (woolly) throughout	Pubescent throughout
Hair type	Stellate, occasionally long simple hairs	Long simple hairs, few stellate hairs	Long simple hairs	Stellate hairs
Leaf shape and size	Linear to linear-oblong or oblong-elliptic 20–110 × 2–30 mm	Linear, linear-lanceolate 30–110 × 4–20 mm	Elliptic to broadly elliptic 20–115 × 7–50 mm	Linear 20–50 × 3 mm
Leaf pubescence	Sparsely pubescent to shortly tomentose with stellate hairs, hairless with age but retaining some vestiges of tomentum	Scattered simple or stellate hairs	Subglabrous to densely pubescent above, densely pubescent to tomentose with stellate or simple hairs beneath	Sparsely pubescent with short stellate hairs, sometimes hairless with age
Distribution	Democratic Republic of Congo, Tanzania, Angola, Zambia, Malawi, Mozambique, Zimbabwe, Swaziland and South Africa (Mpumalanga)	Zambia (Victoria Falls), Zimbabwe, Swaziland and South Africa (Mpumalanga, KwaZulu-Natal)	Democratic Republic of Congo, Zambia, possibly Tanzania	Democratic Republic of Congo (Shaba Province)

Triumfetta welwitschii is concentrated in the *Flora zambesiaca* region (Angola, Malawi, Mozambique, Zambia and Zimbabwe), and extends northwards into Tanzania, Democratic Republic of Congo and Burundi, and southwards into South Africa and Swaziland. In South Africa, the species extends from the Limpopo Province southwards into Mpumalanga and marginally enters KwaZulu-Natal at Vryheid and Paulpietersburg (Figure 2). *Triumfetta welwitschii* grows in the Grassland Biome where it is found in open areas, hill slopes, along stream banks and occasionally along forest margins. In tropical Africa, it also grows in open woodlands. Its thick perennial rootstock is protected by soil during periods of cold, drought and fires, and plants re-sprout from the rootstock each year in the spring when conditions are favourable. After a fire, *T. welwitschii* sends up many shoots and, while the leaves are emerging, the flowers open offering a flurry of yellow (Figure 3).

Flowers in *Triumfetta welwitschii* open in the afternoon (Sprague & Hutchinson 1909) similar to *T. flavescens* Hochst. ex A.Rich. (Schimper 1891), *T. semitriloba* Jacq. (Collevatti et al. 1998) and *T. rhomboidea* (Raju & Rani 2017). Volkens (1887) recorded flowers in *T. brachyceras* K.Schum. (= *T. macrophylla* K.Schum.) open in the evening. He also observed sunbirds (*Nectarinia* spp.) collecting nectar from flowers of *T. brachyceras* and *T. tomentosa* Bojer ex Bouton. Observations by Schimper (1891) showed bees and small beetles visited *T. flavescens*. Bees and wasps were reported as regular visitors to



FIGURE 3.—*Triumfetta welwitschii* in Mpumalanga: a, habit; b, many annual shoots bearing inflorescences before leafing; c, close-up of shoots with inflorescences at start of growing season and after fire; d, flower showing numerous free stamens; e, fruits with pink-red bristles. Photographs: M. Koekemoer.

T. rhomboidea, and are the likely pollinators of the species (Raju & Rani 2017). Different insects (beetles, butterflies and honeybees) visit *T. sonderi* flowers, feeding on pollen and thereby assisting in pollination (Malatji 2016). Collevatti et al. (1998) recorded 63 species of insects which visited flowers of *T. semitriloba* and found the pollinators were mainly solitary and subsocial species of bees.

Fruits of *Triumfetta welwitschii* have bristles with hooks adapted to grasp onto the hair of animals and are thus carried around and dispersed. Similarly, the fruits adhere to clothing and are so disseminated by humans. Due to their nature, the fruits of *Triumfetta* spread with ease and this may contribute to the reason why some species become weedy. Watt &

Breyer-Brandwijk (1962) report the fruit in the genus to be troublesome to the South African wool farmer.

The low growth form and many shoots with flowers in spring attract insect visitors and sunbirds, making *Triumfetta welwitschii* a good choice for garden beds. However, the species has not gained any interest for cultivation. It holds more promise as a medicinal remedy than a garden ornamental. In African medicine, the tuberous roots of *T. welwitschii* are crushed and applied to the hands of the midwife before she stretches the birth canal of a woman in labour (Fowler 2002). The species has also been reported as a remedy for fever (Gelfand 1985) and diarrhoea (Long 2005). In Zambia, Clarkson et al. (2004) reported *T. welwitschii* as one of 20 indigenous species in southern Africa to have high antiplasmodium activity and as a potential source of antimalarial drugs. Leaf extracts of *T. welwitschii* were found to be effective against cancer cells and a potential source of lead compounds for cancer drugs (Moyo & Mukanganyama 2015).

Description.—Perennial herb, with woody rootstock, 5–20 mm thick, blood-red when cut, developing 1 to many annual stems; usually flowers develop before leaves on the first shoots with vegetative leafy shoots appearing later in the growing season, after anthesis. *Stems* 200–350(–500) mm tall, base covered in grey triangular scale-leaves ($\pm 2 \times 0.1$ –1.0 mm), glabrous, or tomentose (short stellate matted hairs) and/or with long simple hairs, upper two-thirds subglabrous to densely tomentose, occasionally with long simple hairs. *Leaves* variable in shape, linear, elliptic, lanceolate, sometimes oblanceolate, 35–120 $\times$ 5–20 mm, apex acute or obtuse, base cuneate (wedge-shaped), margins finely serrate, sometimes more pronounced towards the apex, leathery in texture, tomentose or with long simple hairs, more so on lower surface, dense on young leaves; petiole 2(–5) mm long, hairy; 2 pairs of glands at sides towards apex, glands globose to shortly cylindrical, 0.5–0.7 mm long, inconspicuous in young leaves; 2 pairs of stipules, filiform to linear, lanceolate, 5–11 $\times$ 0.5(–2.0) mm, glabrous, brown, membranous. *Inflorescence* terminal, produced before the leaves expand, highly branched, branches up to 110 mm long, each bearing 1 to many 1–5-flowered cymes, internodes becoming elongate in fruit, closely covered with a yellowish or golden velvety tomentum, bracts, linear 5–6 $\times$ ± 2 –5 mm broad, silky-pubescent on dorsal side. *Flowers* actinomorphic, bright yellow. *Pedicels* 1–6 mm long, tomentellous (dense stellate hairs). *Sepals* 5, linear or oblong, 8–10 $\times$ 1.0–1.5(–2.5) mm, yellow to grey, densely stellate-hairy (hairs long or short), with an apical spine 0.25–0.50 mm long, glabrous. *Petals* 5, spatulate-oblong to obovate, 7–8 $\times$ 3.5–5.0 mm wide, apex rounded or slightly emarginate, yellow, base lightly hairy. *Androgynophore* ± 0.5 mm long; annulus with a hairy ring. *Stamens* 20–34; 5–10 mm long; free filaments bearing dorsifixed anthers. *Ovary* globular in shape, covered in hairs, 2–5-locular with 2 ovules per locule. *Fruit* indehiscent capsule, globose, 20–30 mm in diameter including bristles, bristles numerous, 8–14 mm long, pink-red, plumose. *Flowering time*: September–February, peaking in November. Plate 2350.

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Mussaenda arcuata

Rubiaceae

Tropical Africa

***Mussaenda arcuata* Poir.** in Tableau encyclopédique et méthodique des trois règnes de la nature. Botanique. 4: 392 (1797); Hiern: 68 (1877); Wernham: 274 (1913); Petit: 157 (1955); Codd: t.1231 (1956); Bridson & Verdcourt: 434 (2003).

With about 13 200 species in just over 610 genera, Rubiaceae are the fourth largest plant family, after Orchidaceae, Asteraceae and Leguminosae, in the world. This family has a cosmopolitan distribution, however, most species are concentrated in tropical and sub-tropical habitats with species richness and diversity much lower in temperate and sub-polar regions of the world. Nearly all plant growth forms are found in this family, including trees, herbaceous plants, epiphytes, lianas, suffrutices and (rarely) succulent or aquatic species. Plants are generally easy to recognise by the presence of simple, opposite or whorled, entire leaves with interpetiolar stipules and an inferior ovary (Davis et al. 2009).

The genus *Mussaenda* L. is an important source of pharmacologically active compounds such as iridiodides, triterpenes and flavonoids (Gunasekaran et al. 2015) and it is the thirteenth largest genus in Rubiaceae with 200 species (Davis et al. 2009). The first collection of the genus was made between 1672 and 1677 by Paul Hermann, who worked in a Dutch East Indian company in Ceylon as a medical officer. He gave the plant the vernacular name ‘mussaenda’, which was later adopted by Linnaeus when he named the type species for the genus, *Mussaenda frondosa* L. (Jayaweera 1963).

Mussaenda arcuata was first named by Poiret in *Encyclopédie Méthodique Botanique* (1797), with the description based on a plant collected by Commerson in Mauritius. The species occurs throughout tropical Africa, and it is also indigenous to Madagascar, Mauritius and Réunion (Figure 1). It is a shrub, often scrambling, reaching up to 14 m in height. Its leaves are elliptic to round, glossy dark green above, and paler and sparsely pubescent below. Flowers are yellow with a striking dark orange to red star of hairs in the centre. Its fruits are pale green to yellow berries. The preferred habitats for *M. arcuata* include shaded riverine areas, rocky outcrops, in evergreen and woodland forests. It also occurs in savanna and grassland where it grows in well-drained, clayey or gravelly, humus-rich soils, and flourishes at altitudes of 350–1 800 m (Bridson & Verdcourt 2003). The sweet-scented flowers attract butterflies and bees which feed on the nectar and pollinate the plant. The fruits are eaten by birds which act as important dispersal agents (Alejandro et al. 2016).

Within the genus of medicinally important species, *Mussaenda arcuata*, is one of the most vital plants in Africa with various plant parts used for different ailments (Ssegwa & Kasenene 2007; Gunasekaran et al. 2015; Göhre et al. 2016). In Angola, the crushed leaves



PLATE 2351 *Mussaenda arcuata*

are used to treat hepatitis and skin disease (Göhre et al. 2016). In Uganda, a decoction of the roots is administered orally to treat jaundice and it is applied externally for the treatment of skin rashes in babies (Ssegwa & Kasenene 2007; Gunasekaran et al. 2015). In Réunion, different plant parts are used to treat various ailments, including asthma, albuminuria, conjunctivitis, dermatosis and gastroenteritis. The plant is also used to reduce fever and as a laxative (Poulain et al. 2004). Pharmaceutical research has shown that this plant has antibacterial (Aro et al. 2015), anti-oxidant and free radical scavenging activities (Astalakshmi 2017), thus validating the ethnomedicinal use of the species.

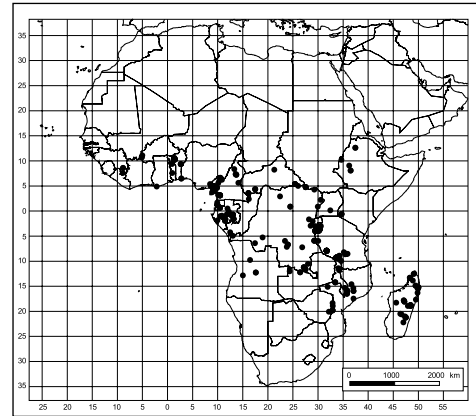


FIGURE 1.—Known distribution of *Mussaenda arcuata* based on specimens in the National Herbarium, Pretoria.

This magnificent plant is propagated in many homesteads, parks, and botanical gardens around the world due to its resilience to pests and diseases, and also for its long blooming period that last for almost an entire year (Jayaweera 1963; Gunasekaran et al. 2015; Alejandro et al. 2016). Many Rubiaceae species, to which *Mussaenda* species are no exception, are best propagated from seeds. To propagate *M. arcuata* plants from seeds, fruits are collected when ripe and cut in half to separate the seeds from the pulp. Separating seeds from pulp is usually rather challenging, however, best results can be achieved by rubbing the inside of the fruit against a strainer and rinsing them with water. During the rinsing process, parasitized seeds should be removed and healthy seeds can be sown into pots containing potting soil mix. Seeds usually take 14 days to germinate. Once the seeds have germinated, seedlings should be transplanted into pots that contain a good nitrogen-based fertiliser. The fertiliser should be applied weekly as a soluble mixture diluted to half the recommended dosage to prevent necrosis (Nichols 2005).

Description (as per Bridson & Verdcourt 2003).—Shrub, often scrambling, 0.6–7.0(–14.0) m high; branches usually smooth, often covered with short spreading hairs, said to exude a watery to milky or sticky latex. *Leaves* 30–163(200) × 13–85(108) mm, elliptic to almost circular, acuminate to caudate at tip, cuneate, acute or rounded at base, with 5–7 pairs of adjacent nerves, coriaceous, glabrous above, glabrous or sparsely pubescent below with nerves densely hairy; petiole 3–22 mm long. *Stipules* 3–12 mm long, lobe entire or divided almost to base, reflexing, soon caducous revealing a line of red to brown hairs above scar. *Flowers* sweetly fragranced, in dense, lax or few-flowered panicles, terminal on short lateral branches (in climbing specimens); peduncles 8–40 mm long; secondary peduncles often present; pedicels to 5.3(7.0) mm long. *Bracts* and *bracteoles* entire or rarely 2–3-lobed, 2–27 mm long, up to 2 mm wide. *Calyx* tube 2–4 mm long, turbinate to ellipsoid, usually glabrous but occasionally sparsely hairy; lobes 0.7–1.5 × 0.25–2.50 mm, dentate, linear or slightly spatulate, curving outwards when mature, usually caducous. *Corolla* with greenish-yellow tube, pale to bright yellow lobes with dark orange to red star of hairs in centre, often turning brown with age; tube 13–27 × 2.5–5.0 mm at top,

0.75–1.50 mm wide at base, glabrous, hairy all over or with hairs concentrated into 5 vertical streaks outside, with flattened yellow hairs at throat and between anthers, becoming glabrous towards the base within; lobes 4–19 × 2.5–11.0 mm, lanceolate to broadly ovate, acute to apiculate at apex, shortly connate for (0)1.5–3.0 mm. *Isostylous flowers*: distance from throat to top of anthers 0–1.6 mm (both stigma and anthers near the throat); style 12–21 mm long; arms 0(1.3–2.0) mm long; stigma entirely exerted or included; lobes 2.2–5.2 mm long. *Heterostylous flowers*: distance from throat to top of anthers 0–3 mm in short-styled flowers and 4–6 mm in long-styled flowers; style 12–21 mm long in long-styled flowers and 7.5–10.0 mm long in short-styled flowers; arms 0(1.3–2.0) mm long; stigma entirely exerted or included; lobes 2.2–5.2 mm long. *Fruit* pale green to yellow, (8)11–25 × (6)8–18 mm, ellipsoid or subglobose, with a round whitish scar at apex. *Seeds* 1.0–1.3 mm long, beige to pale brown, ± rectangular or triangular, slightly thickened, clearly reticulated. Plate 2351.

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Chironia baccifera

Gentianaceae

South Africa

***Chironia baccifera* L.** in *Species Plantarum* 1: 190 (1753); Marais & Verdoorn 26: 215 (1963).

Chironia L. is a genus of about 24 species in the Gentianaceae or gentian family. The family contains 87 genera and over 1 600 species (Struwe et al. 2002) in tropical and southern Africa and comprises small trees, shrubs with stout stems, or herbs with ascending, erect or straggling stems. Their leaves are opposite and closely spaced, rarely alternate or whorled, and lack stipules but often with ochreas – structures that sheath the stems formed by fused stipules. Inflorescences in the family are cymose and flower form and colour are variable. Flowers are usually 4- or 5-parted, although the corollas of some northern hemisphere plants, like *Gentiana* L., and *Blackstonia perfoliata* (L.) Huds. are more than 5-parted. Members of *Gentiana* have plicae (small lobes) between the main flower lobes, these are often tiny, being noticeable in *Gentiana verna* L. Both the sepal and the petal whorls are fused, with the corolla lobes contorted in the bud. Pinkish-mauve flowers are common in the family, but pure blue flowers are well known in *Gentiana*, which also has yellow- and bright red-flowered members. Gentian (crystal) violet, a renowned 19th century over-the-counter synthetic antiseptic for skin infections (Maley & Arbiser 2013), though not derived from the Gentianaceae, got its name from its resemblance to the violet colours of flowers in the family (Cooksey 2017). The fruit is a capsule splitting into halves, or rarely a berry (*Anthocleista* R.Br. of Africa, *Fagraea* Thunb. of Malesia and Papuaia, *Potalia* Aubl. of south and Central America, and *Chironia baccifera* of South Africa). Many species in the family, including *Gentiana lutea* L., *Gentianella alborosea* (Gilg) Fabris, and *Swertia chirayita* (Roxb.) Buch.-Ham. ex C.B. Clarke yield bitter compounds used in medicine (Singh 2008; Mungole et al. 2010; Kumar & Van Staden 2016).

Chironia is named after the centaur Chiron, in Greek mythology the father of medicinal art, well known for his wisdom and skill in using medicinal herbs and teaching the art of healing. Centaurs are mythological half-man, half-horse creatures. According to legend, when Chiron died, the god Zeus elevated him to the southern sky as Alpha and Beta Centauri, the two pointers to the Southern Cross (March 1998). Another genus of the same family named after Centaur Chiron is *Centaurium* Hill, known as centaury. *Centaurium* occurs in Europe and Asia and *Centaurium erythraea* Rafn is known for its long-standing use as a herbal remedy for gastrointestinal disorders (European Medicines Agency 2015, PDR for Herbal Medicines 2000). It has been shown to have sedative, anti-inflammatory, antipyretic (Berkan et al. 1991), diuretic (Haloui et al. 2000) and antidiabetic properties (Newall et al. 1996). More recently, extracts of *C. erythraea* have been shown to protect red blood cells from oxidative damage in diabetic animals, supporting use of the species in managing diabetes (Đorđević et al. 2017). The species is also used in beverages and soft drinks (Newall et al. 1996).



PLATE 2352 *Chironia baccifera*

Chironia and *Centaurium* belong to tribe Chironieae, which has 23 genera and about 159 species (Struwe et al. 2002), found mainly in temperate and subtropical climates. They are placed in the Chironieae based on their unilocular ovaries and anthers without appendages. The character that differentiates *Chironia* from *Centaurium* is the length of corolla tube relative to the lobes. In *Chironia* the tube is shorter than the lobes and the corolla is rotate to funnel-shaped, whereas in *Centaurium* the tube is longer than the lobes and the corolla is salverform. *Chironia*'s closest relative is the monotypic genus *Orphium* E.Mey. (*O. frutescens* (L.) E.Mey.), endemic to the Western Cape, South Africa. *Chironia* and *Orphium* share a number of characters, namely, plants are herbs or suffrutices; flowers are arranged in terminal, simple or compound cymes; floral parts are 4- or 5-merous, corolla lobes are without nectaries; and their ovaries are unilocular. *Chironia* differs from *Orphium* in being glabrous and having a keeled calyx, whereas in *Orphium* plants are hairy and the calyx is without a keel (Marais & Verdoorn 1963). *Orphium* overlaps in its distribution with *Chironia baccifera* in the southwestern Cape. *Exacum* L. with only two species in Africa, one of them *Exacum oldenlandioides* (S.Moore) Klack. occurs in southern Africa (Limpopo and Mpumalanga provinces). It differs from *Chironia* and *Orphium* in having terminal and axillary cymes, and a bilocular ovary, which is rare in the family (Struwe et al. 2002).

Linnaeus established the genus *Chironia* in 1753 with seven species. Of these, *C. angularis* L., *C. campanulata* L. and *C. dodecandra* L. are now placed in the genus *Sabatia* Adans., and *C. frutescens* L. and *C. trinervia* L., are included in *Orphium* and *Exacum* respectively. Only two of the original species included by Linnaeus (1753), namely *C. baccifera* L. and *C. linoides* L., remain in *Chironia*. Until 1986, three species, *C. lancifolia* Baker, *C. madagascariensis* Baker and *C. pubescens* Baker were recorded as occurring in Madagascar, all endemic to the island. These were recognised by Klackenberg (1986) as differing from *Chironia* in that their ovaries are bilocular with axile placentation and their anthers open by longitudinal slits (see key below). Klackenberg (1986) placed these in a new genus, *Ornichia* Klack. (tribe Exaceae), the name being an anagram of *Chironia*.

Key to tribes and genera; characters obtained from Marais & Verdoorn (1963), Klackenberg (1986), Struwe et al. (2002) and Mansion (2004):

- 1a Ovary bilocular with axile placentation; anthers often with apical or basal appendage 2 (Exaceae)
- 2a Plants glabrous; anthers opening with apical pores. *Exacum*
- 2b Plants hairy; anthers opening by longitudinal slits. *Ornichia*
- 1b Ovary unilocular with parietal placentation, or pseudo-bilocular (i.e. two locules formed by parietal placentas intruding into centre of ovary); anthers without appendage 3 (Chironieae)
- 3a Corolla salverform, tube longer than the lobes; ovary pseudo-bilocular *Centaurium*
- 3b Corolla rotate to funnel-shaped, tube shorter than the lobes; ovary unilocular 4
- 4a Stamens inserted between the corolla lobes near the sinuses *Sabatia*
- 4b Stamens inserted in the corolla tube 5
- 5a Plants glabrous; calyx keeled *Chironia*
- 5b Plants hairy; calyx not keeled. *Orphium*

Sixteen species of *Chironia* occur in southern Africa and 13 species in tropical Africa. Only *C. palustris* Burch. and *C. purpurascens* (E.Mey.) Benth. & Hook.f. occur in both regions. *Chironia baccifera* is a South African endemic. It occurs from Kamiesberg in the

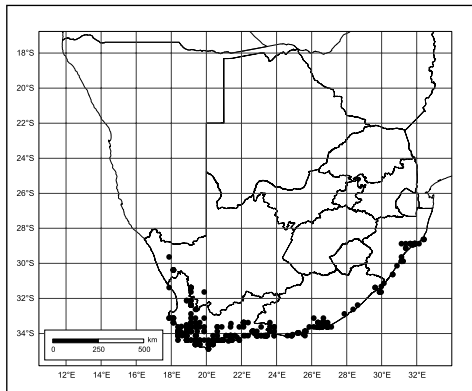


FIGURE 1.—Known geographical distribution of *Chironia baccifera*.

Northern Cape, southwards along the coast of the Western Cape and eastwards through the Eastern Cape to Zululand in KwaZulu-Natal. From the collections in SANBI herbaria (PRE, NBC and NH), the species appears to be prominent in the Western Cape and the Eastern Cape provinces (Figure 1). It grows from sea level to altitudes of up to 1 500 m. *Chironia baccifera* occurs in a variety of habitats (Figure 2a), including sand dunes, fynbos, savanna, grassy hill slopes, mountain slopes and forest margins. Plants grow in dry, sandy or loam soil in full sun, or in light shade of surrounding vegetation (Marais & Verdoorn 1963).

Chironia comprises herbs with woody stems. In general, flowers are shades of pink, e.g. rose-pink and magenta, or rarely white, as in *C. albiflora* Hilliard (Hilliard 1983), contrasting with the vivid yellow anthers. Both pink and white flowers occur in *C. linoides* and *C. melampyrifolia* Lam. Flower colour is most variable in *C. krebsii* Griseb. where the flowers range from various shades of pink to red with ‘occasionally a white flowered plant’ (Paiva & Noguiera 1990). *Chironia baccifera* offers a decorative display of flowers and berries (Figure 2b, c) when planted in groups as a hedge, as border plants in flowerbeds, at the edge of ponds and in rockeries (Pienaar 1985; Joffe 1993). Plants are fast-growing from cuttings as well as seeds and can be placed in full sun or lightly shaded spots in the garden.

The epithet *baccifera* is derived from the Latin word *bacca*, meaning berry-bearing (Stearn 1995), which is unique to this species in the genus. Members of the Gentianaceae usually have dry capsules that split in halves. As early as 1790, Necker (1790) excluded *Chironia baccifera* from *Chironia* and suggested it be accorded separate generic status because it produces berries. Just over a decade later, Moench (1802) transferred *C. baccifera* to *Roeslinia* Moench. Thereafter, Prain (1908) reduced *Roeslinia* to a subgenus of *Chironia* with *C. baccifera* as the only species. Prain (1908) recognised four varieties within *C. baccifera* based on differences in leaf shapes and length of corolla lobes. Modern treatments (Marais & Verdoorn 1963) retain *C. baccifera* in *Chironia* with no varieties.

The berries in *Chironia baccifera* change from green to yellow to bright red, thereafter drying black and the species has aptly come to be known as Christmas berry because the fruits are red from December. In Afrikaans the species is known as *Aambeibossie* (literally, haemorrhoid or pile bush) and *bitterbos* (meaning bitter bush) (Smith 1966). Preparations of *C. baccifera* are reported to be bitter and induce sleepiness and perspiration (Watt & Breyer-Brandwijk 1962). A decoction drunk as a tea (Roberts 1990) reportedly works as a cleanser for skin problems and haemorrhoids. The species is toxic to small stock and proved fatal when administered experimentally to sheep and rabbits (Wolfender et al. 1993). Other species of *Chironia* are used for colic, diarrhoea and stomach complaints (Hutchings et al. 1996).



FIGURE 2.—*Chironia baccifera*: a, in habitat, Bokbaai; b, flowers, Fernkloof Nature Reserve, Hermanus; c, fruit, Kogelberg Biosphere Reserve, Pringle Bay. Photographs: a, J.C. Manning; b, c, A.E. van Wyk.

Chironia baccifera is also an ingredient of the Italian aperitif Campari, an alcoholic beverage developed in 1860 by Gaspare Campari in Novara, northern Italy near Milan. The product is the outcome of an infusion of sixty herbs, fruit skins, spices and plant bark and is a closely guarded secret family recipe (Schwegler 2003). Natural product chemists have established that the species is characterised by secoiridoids known to stimulate the appetite (Van der Sluis & Labadie 1978). Spivak (2012) encourages its intake: ‘Drink some Campari after dinner to settle your stomach. Have a nice *aperitivo* of Campari before you eat; it will cleanse the system and ward off illness and evil spirits.’

Description.—Perennial, much-branched herb with stems woody at base, 200–400 mm high, branches sprawling, up to 1 m high, leafy to apex. Leaves opposite, sessile, thin to slightly fleshy, linear, $5\text{--}20\text{--}(25) \times 1\text{--}2\text{--}(4)$ mm, spreading widely to reflexed from base; margins rolled back often minutely papillose; midrib prominent on lower surface; lower surface minutely papillose; apex broadly rounded or acute, tips hooked. Flowers solitary or 1–3 in lax cymes, borne terminally or in axils of upper leaves, ± 20 mm in diameter. Pedicels varying in length, 2.0–2.5 mm long, with several longitudinal ridges. Calyx shorter than or about equal to corolla tube length; tube, short, keeled, up to 1 mm long; lobes ovate-oblong 1.5–4.0 mm long, subacute to acute, apex usually hooked. Corolla funnel-shaped, various shades of pink or rarely white; tube cylindrical, 3–5 mm long; lobes contorted in bud, obovate-oblong, $5\text{--}10 \times 2\text{--}4$ mm, broadly rounded at apex, persistent in fruit development. Stamens inserted in corolla tube where it narrows above ovary; filaments

2.5–4.5 mm long; anthers straight, erect, oblong, bright yellow, 2.4–5.0 mm long, strongly twisted in a helix after dehiscence. Ovary globose, $\pm$ 5 mm long, ovules numerous with parietal placentation. Style 5–9 mm long; stigma rounded. Fruit globose or subglobose berry, glossy red when mature, drying black, 5–10 $\times$ 5–7 mm, splitting irregularly; seeds many, black. Flowering time: October–May, peaking in December and January. Plate 2352.

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Strophanthus amboensis

Apocynaceae: Apocynoideae

Angola, Cabinda, Democratic Republic of the Congo and Namibia

Strophanthus amboensis (Schinz) Engl. & Pax in Bot. Jahrb. Syst. 15: 376 (1892); Franchet: 289, pl.14 (1893); Stapf: 185 (1902); Gilg: 33 (1903); Hess: 91 (1952); Codd: 293 (1963); Merxmüller: 7 (1967); Beentje: 35, fig.6 (1982); Curtis & Mannheimer: 554 (2005); De Ruijter: 542 (2008); Bruyns: 14, t.17, 18 (2014). *S. petersianus* Klotzsch var. *amboensis* Schinz in Verhandl. Bot. Ver. Brandenb. 30: 259 (1888). *S. intermedius* Pax: 375 (1892); Franchet: 287 (1893); Stapf: 185 (1902); Gilg: 31, fig.3 (1903); Staner & Michotte: 54 (1934); Hess: 89, t.4 (1952); Watt & Breyer-Brandwijk: fig.103 (1962). *S. schuchardtii* Pax: 371 (1892); Franchet: 276 (1893); Stapf: 184 (1902); Gilg: 10, pl.1 (1903); Hess: 85, t.1 (1952). *S. demeusei* Dewèvre: 431 (1894); Stapf: 184 (1902); Gilg: 32, fig. 4 (1903). *S. gossweileri* H.E. Hess: 94, t. 6 (1952). *S. hirsutus* H.E. Hess: 88, t. 3 (1952). *S. longicalyx* H.E. Hess: 92, t. 5 (1952). *S. paxii* H.E. Hess: 86, t. 2 (1952). *S. gossweileri* × *schuchardtii* Pax ex H.E. Hess: 98, t. 9 (1952). *S. hirsutus* H.E. Hess × *intermedius* Pax ex H.E. Hess: 97, t. 8 (1952). *S. intermedius* Pax × *paxii* H.E. Hess: 96, t. 7 (1952).

The genus *Strophanthus* DC. is distributed in the tropics of the Old World in Africa, Madagascar and Asia (Beentje 1985). None of the species are, however, shared between Africa and Asia (Beentje 1982). The bulk of the ±42 species (POWO 2018) in *Strophanthus* is found in Africa (79%) with only nine species widely distributed in Asia (21%) and only *S. boivinii* Baill. in Madagascar (Victor et al. 2000; Klopper et al. 2006; POWO 2018). In southern Africa there are six species (Codd 1963; Victor et al. 2000) with only two listed for Namibia (Craven et al. 1999) and ten for Angola (Figueiredo & Smith 2008). Of the southern African species, only *S. amboensis* is geographically isolated with a natural range from central Namibia, northwards through Angola to the southwestern parts of the Democratic Republic of the Congo (DRC) and Cabinda (Beentje 1982; De Ruijter 2008; Bruyns 2014; WCSP 2018) (Figure 1). *Strophanthus amboensis* is one of the six *Strophanthus* species that are widely distributed, the other African species are *S. eminii* Asch. ex Pax, *S. hispidus* DC. and *S. sarmentosus* DC. (Beentje 1982).

The ten-lobed corona with partly fused pairs of lobes is diagnostic for *Strophanthus* (Beentje 1982). Most workers considered the genus to be allied to *Nerium* L. (Beentje 1982), but Beentje further considered it to be closely related to *Adenium* Roem. & Schult., *Wrightia* R.Br. and *Pleioceras* Baill. due to the presence of the corona, the absence of a disc at the base of the pistil, and the morphology of the clavuncula (an enlarged stigma of which the sides and lower surfaces are the receptive zones, usually coherent with the anthers (Beentje 2016)). Based on molecular data, recent studies rather result in its placement in a subtribe, separate from *Nerium* and *Adenium*, and more associated with *Alafia* Thouars, *Isonema* R.Br. and *Farquharia* Stapf (Livshultz et al. 2007; Endress et al. 2014).

In the most recent revision of *Strophanthus* by Beentje (1982), six names and three intermediate hybrids between *S. amboensis* in the strict sense and other taxa were

PLATE 2353.—1, flowering branches, × 1; 2, mature fruit splitting open, × 1; 3, seed with coma released from fruit, × 1. Voucher specimens: Condý 285a (flowering), Condý 285b (fruiting) in National Herbarium, Pretoria. Artist: Gillian Condý.



PLATE 2353 *Strophanthus amboensis*

synonymised. This may perhaps hint at the variability of the species. Beentje (1982) noted that not only does the leaf size decrease across its distribution range from north to south, but that the leaves also vary from being glabrous in the north to puberulous or densely pubescent in the centre of its distribution and glabrous or puberulous in the southern areas.

Strophanthus amboensis is closely related to *S. vanderijstii* Staner but is distinguished by a number of characters. *Strophanthus vanderijstii* has narrower leaves with inconspicuous tertiary venation; a very short beak (maximum 2 mm long) of the seed; a geophytophytic habit and shrublet of less than 0.3 m high; anthers that are only 4.2–4.4 mm long; and lastly with a restricted distribution in north-central Angola (Malanje) to just across the border into the DRC (Bandundu). In comparison, *S. amboensis* is a shrub or liana, more than 1 m tall; the tertiary venation on the leaves is very conspicuous; the anthers are larger (6.0–9.5 mm long); the seed has a glabrous beak of 22–50 mm long; and the species exhibit a much wider distribution range (Beentje 1982). Further outstanding diagnostic characters of *S. amboensis* that are listed by Beentje (1982) are: (1) the acumen of the anthers is intermediate between a group with long and another group with short acumen; (2) the ovary may be either glabrous or puberulous to pubescent; and (3) the corolla lobes are slender. Other characters that could further be used to identify *S. amboensis* are a corolla that is puberulous on the outside (at least near the mouth); older branches without protuberances; sparsely lenticillate follicles with broad obtuse apices (not tapering); seed with glabrous beaks for 22–50 mm and a coma of 22–70 mm long; and the leaves that are pale green beneath.

Four species of *Strophanthus* have previously been featured in this series and are listed by Bester & Condy (2011). The illustrated material for this contribution was obtained from the old poisonous plants section in the Pretoria National Botanical Garden (PNBG) (Figure 2). The original material was collected by Johann Wilhelm Heinrich Giess on 31 October 1962 in Ameib, Erongo in Namibia. Through the strong collaboration between the Windhoek (WIND) and Pretoria herbaria (PRE), a specimen and some seeds were presented to PRE. Originally when WIND was established in Namibia in 1953, Giess attended to the herbarium by working there once a week. In August 1957 he was appointed to a full-time position in the herbarium where he worked until his retirement in February 1975. After his retirement he continued to work in a temporary capacity. He started the first Namibian botanical journal, *Dinteria*, and contributed a large number of herbarium specimens. Of these $\pm 10\,000$ were personal collections and many others ($\pm 5\,000$) were made in conjunction with especially Herman Merxmüller, Bernard de Winter, Anna Bleissner (later Giess), Otto-Heinrich Volk and Daniel Rudolph Janse van Vuuren (Gunn & Codd 1981). These

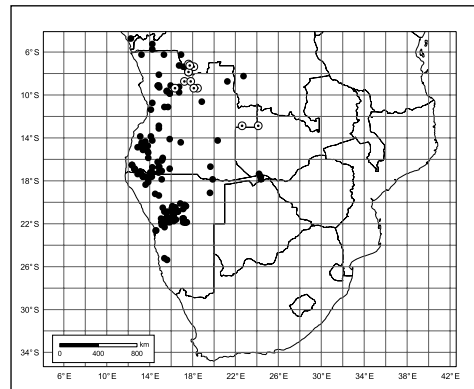


FIGURE 1.—Known distribution of *Strophanthus amboensis* (●) based on records in the National Herbarium, Pretoria; GBIF distribution records, records from Lebrun & Stork (1997) and cited specimens from Beentje (1982); and *S. vanderijstii* (○) from Beentje (1982) and Beentje & Crawford (2015).



FIGURE 2.—*Strophanthus amboensis*: a, habit in former poisonous plants section of the Pretoria National Botanical Garden (note the whip-like or sarmentose branches etched off against the sky); b, multi-stemmed branches from the base; c, close-up of flower showing the pink and white corona, corolla that is white on the inside at the base becoming yellow towards the tips and orange on the outside; d, paired follicles from one flower, usually bending backwards from the attachment to the pedicel exposing the groove where it will dehisce upwards; e, original name-tag of plant in the Pretoria National Botanical Garden. Scale bars: a, 340 mm; b, 30 mm; c, 4 mm; d, 25 mm. Voucher: a–d, Bester 11946 (PRE). Photographs: S.P. Bester.

collections made an enormous contribution of material towards the account in *Prodromus einer Flora von Südwestafrika*. The seeds of *Strophanthus amboensis* were grown in the nursery at PNBG and a specimen was planted in the garden as a small shrub in 1986. It has since grown into a shrubby tree of about 3.2 m tall, branching profusely from the base, with the larger stems about 120 mm thick. The plant flowers profusely each year. If the previous winter was cold enough, flowering starts in early to mid-spring towards the end of the dry and the beginning of wet season (August–October), before the leaves appear, when the plants are generally covered with maturing follicles. Flowers are intermittently produced until about April. Pollinated flowers develop fertile follicles, which grow slowly throughout the summer and mature during late winter. In spring the follicles burst open to disperse hundreds of seeds. Due to the sporadic flowering of the depicted plant, fruit may be present on the plant all year round. Our plant has pairs of follicles that diverge at between 40–175°; they are 120–160 mm long before winter, maturing to 140–180 mm just before dehiscing. The follicles are held with the slit along which they dehisce facing up. When the follicles open, the decrease in humidity causes the coma fibres that are attached to the seeds to unfold and they are carried off by the slightest breeze. No juvenile plants have been located in the vicinity of the mother plant, but the seeds are fertile – some were collected and germinated easily, however, it is difficult to retain them to juvenile plants, as they died before establishment. Despite being planted far from its natural distribution, the plant produces many follicles each year. No pollinators have been observed and very little is known of the pollination biology of *Strophanthus*. Curtis & Mannheimer (2005) observed the plants in Namibia to be dormant (without any leaves) only from July–September. Flowering recorded from tropical specimens at PRE range from August–January with its peak in September and October.

The only species of *Strophanthus* that grow in very dry areas are *S. amboensis* and *S. mirabilis* Gilg. From specimen labels it seems that *S. amboensis* prefers a range of habitats, including areas amongst stones and boulders on granitic hills or outcrops, rock fissures, kloofs and cliffs, mostly in savanna or dry bushveld vegetation; also along forest margins, woodland and thorn scrub; and even in sandy plains (Beentje 1982; Curtis & Mannheimer 2005; Bruyns 2014). Specimens have been recorded from altitudes ranging from 450–2 000 m above sea level. Most individuals grow as lianoid shrubs, with bushy trees – as our plant depicted here (Figure 2a) – rather uncommon.

As with almost all species in *Strophanthus*, almost no information exists on the pollination and very little on the biology of this group as a whole. The fragrance reported for many species, predominant colour-patterns and streaks leading from the corona lobes to the cone of the anthers on the inside of the tube, might hint at butterfly pollination. Movement of especially the corolla-tails in the wind could also perhaps be attractive to pollinators (Faegri & Van der Pijl 1979).

The seed and latex of *Strophanthus* species have been used in Africa and Asia in the preparation of arrow poison (Beentje 1982). The poison apparently acts quickly with small quantities being lethal. The usual practise was to pulp a single seed, mix it with saliva or other additives to form a paste, and to smear the resulting pulp on the tips of arrows (Beentje 1982) which were then left in the sun for several hours before they were used. The arrow was launched by a bow and when the poison entered the bloodstream, death was said to occur within 15 minutes in humans and within 20 minutes in average-sized

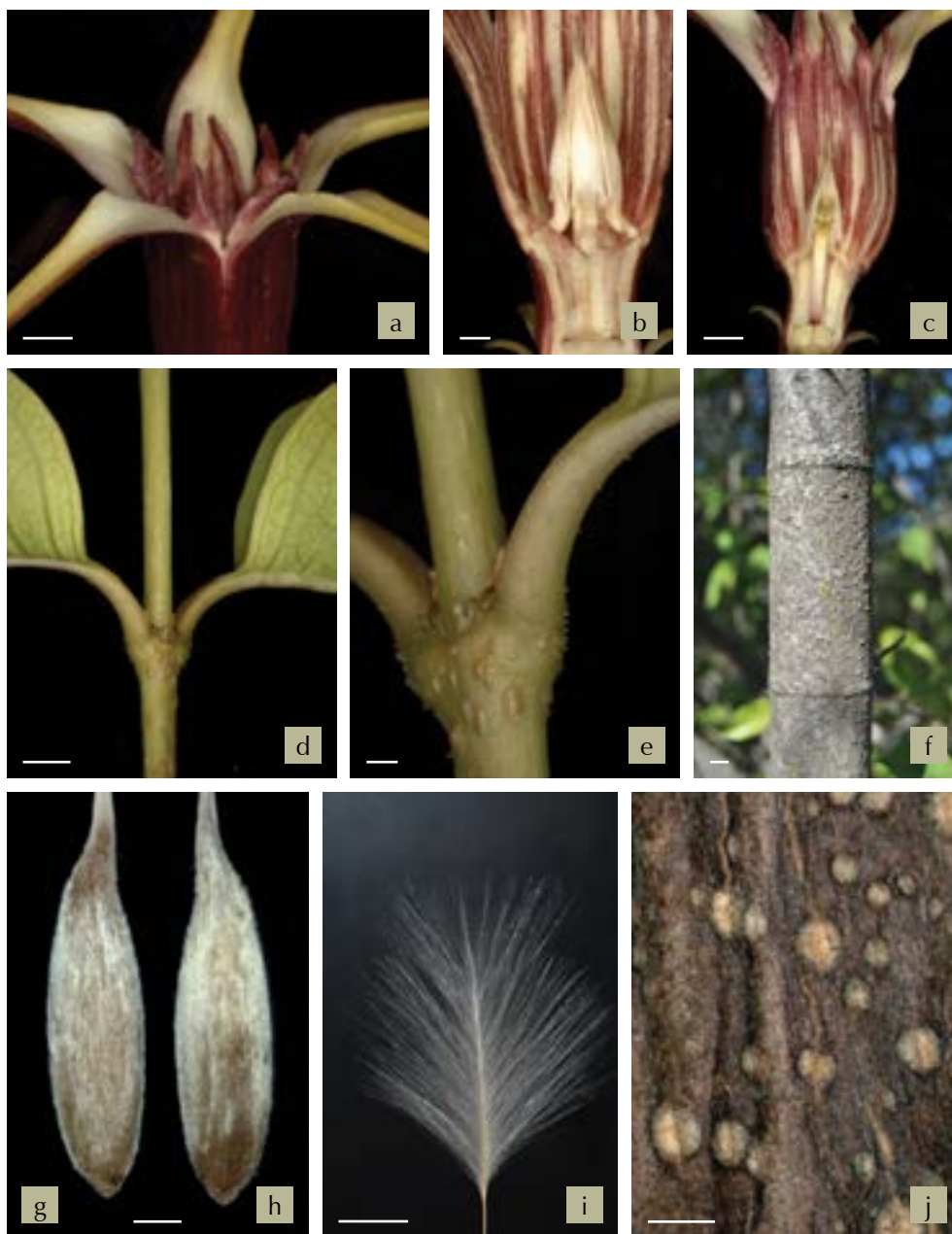


FIGURE 3.—*Strophanthus amboensis*: a, close-up of mouth of flower showing corona, tube and segments; b, dissected basal part of flower showing the anther cone of arrowhead-shaped anthers tips; c, dissected basal part of flowers with front anther removed to show caruncula, ovary, style and stigma; d, twig showing opposite leaves; e, close-up of base of petioles showing immature lenticels between petioles and edge of colleters between petiole and node on either side; f, bark; g, dorsal side of grain of the seed; h, ventral side of grain of the seed, shallowly concave; i, part of beak and coma of seed; j, old bark with mature lenticels. Vouchers: a–i, *Bester 11946* (PRE); j, *Winter 7737* (PRE). Scale bars: a, c, d, g, h, 2 mm; b, j, 1 mm; e, 0.5 mm; f, 5 mm; i, 14 mm. Photographs: S.P. Bester.

game or longer in large animals like elephants. When an animal was killed in this way for consumption as food, the affected area around the point of penetration was cut away and discarded (Beentje 1982). The species most used for their poison are *S. kombe* Oliv. (Zambezi tail flower or poison rope) in central and east Africa, *S. amboensis* in southern Angola and northern Namibia, *S. hispidus* in western Africa and *S. speciosus* (Ward & Harv.) Reber (common poison rope) in South Africa (Salmon et al. 1952). The possible use of these glycosides for arrow poison was accidentally discovered by John Kirk who kept seeds of *S. kombe* in the same pocket as his toothbrush (Livingstone & Livingstone 1865). He noticed that every time that he had a slight fever and then brushed his teeth, his heartbeat slowed down and his temperature lowered. From the bitter aftertaste in his mouth, he concluded that it must be due to the seeds (Beentje 1982).

Beentje (1982) list the active component of the poison to be one of a group of glycosides: ouabain, sarmentogenin, strophantidin and divaricoside. Numerous chemical studies have been done on the cardiac glycosides present in the seed in *Strophanthus* (Bisset 1953, 1955; Heftmann et al. 1954; Watt & Breyer-Brandwijk 1962; Martindale 1967; Oliver-Bever 1986; Moll & Moll 1989) and based on the results, *S. amboensis* falls in one of the four groups that contain sarmentogenin or sarverogenins (Beentje 1982). These glycosides are highly toxic (De Ruijter 2008) and plants are also lethal if browsed (Curtis & Mannheimer 2005). The glycosides affect muscle fibres (especially those of the heart) causing the heartbeat to slow down, followed by convulsions until the heart eventually stops (Hutchings 1996). As an antidote, tannic acid, vinegar or a decoction of the bark of the baobab (*Adansonia digitata* L.) may be employed by smearing it into the wound – presumably any strong acid will serve as an antidote (Beentje 1982). Despite the seed containing these very poisonous glycosides, Wink & Van Wyk (2008) note that very few cases of poisoning have been reported and due to the low rate of absorption it would only be lethal if taken in large quantities, in which case it would rather induce vomiting.

Strophanthus amboensis is used medicinally for the treatment of rheumatism (a decoction of the roots or leaves are used), venereal diseases (using an infusion of the roots as an enema) and scabies (use pounded root mixed with oil as a topical ointment) (Watt & Breyer-Brandwijk 1962; Beentje 1982; De Ruijter 2008; PROTA 2018) and even as a charm against evil (Palmer & Pitman 1972). De Ruijter (2008) further states that the medicinal use of this plant will be limited to local use in its area of distribution, unless further studies on the chemical constituents reveal new possibilities.

The generic name is derived from the Greek words *strophos* meaning ‘twisted cord’ and *anthos* meaning ‘flower’, in reference to the outstanding characteristic of many species – the twisted corolla lobes. In most cases plants are lianas, but under certain conditions they may develop into tree-like forms (Palmer & Pitman 1972). The label of the type specimen of *Strophanthus amboensis* (Schinz 222), on which the description was based, indicated the location of the collection as ‘Amboland’. From this locality information the specific epithet, *amboensis*, was derived – a phonetic version of Ovamboland, the former region at the northern border of Namibia with Angola. It was pointed out by Dr P.V. Bruyns (pers. comm.) that it is highly likely that the type rather originated from Angola than Namibia, based on his knowledge of the region and the habitat of the species, as well as information provided from the travel journal of Schinz (1891).

The vernacular names for *Strophanthus amboensis* are elephant-vine in Namibia (Curtis & Mannheimer 2005) or knob-stemmed poisonrope in South Africa; *knopstamgiftou* (Afrikaans) and *omhundure* (Otjiherero) (Van Wyk et al. 2011). In Angola it is known under a range of names including *mangala-ndumbu* (Lunyaneka, Muila and Muquilenge languages) and *muzua(-nganga)* (Kimbundu) or more generally as (o-)mulembelembe, which is a collective name for various *Strophanthus* species (Beentje 1982).

Strophanthus amboensis has been cultivated in Uganda (Omino 2002), Indonesia and South Africa, but never on commercial scale and rather as an oddity, particularly by collectors. The plant has attractive flowers and, as an architectural plant, changes in facet through the seasons. As it is long-lived, it may well be considered for development as an ornamental.

The IUCN conservation status of this species has not been evaluated in Namibia (Curtis & Mannheimer 2005) or Angola, but it will possibly be classified as of Least Concern, due to its wide distribution range spanning three countries and, therefore, probably in no danger of genetic erosion.

Description (adapted from Codd (1963) and Beentje (1982) with additional measurements from specimens at PRE).—Perennial and deciduous, densely intertwined, sarmentose shrub, 1–4 m high, much branched from base, or liana up to 20 m high; young branches pubescent with short dense hairs, soon becoming glabrous, branches pale brown to reddish brown or purple brown, turning grey with age, sparsely or densely lenticellate, to 200 mm in diameter, latex clear in younger or white in older stems and roots. *Leaves* simple and decussate, with short or subsessile petiole 1–19 mm long with two outer and 2–14 inner axillary colleters and often puberulous; blade ovate to broadly ovate, ± 0.8 – $3.3 \times$ as long as wide, 20 – 125×12 – 65 mm, glabrous, puberulous or densely short-pubescent, sometimes slightly undulate at the margin, papyraceous or thinly coriaceous, with translucent dots; base obtuse, cuneate, rounded or subcordate; apex rounded or acuminate (then acumen 2–15 mm long); secondary veins about 3–8 pairs, indistinct, slightly curved, at an angle of 40–60° with midrib; tertiary venation conspicuous. *Inflorescences* on long or short branches (often on short lateral branchlets) or terminal, 1–12-flowered with 1–5 flowers open at a time, sessile or pedunculate, lax or congested, glabrous, puberulous or densely short-pubescent in all parts; peduncle (if present) up to 10 mm long; branches 0–20(–30) mm long; bracts oblong-lanceolate, ovate, narrowly ovate, or narrowly triangular, 2 – 6×0.6 – 1.5 mm, acute, subscarious, early deciduous; pedicels 3–17(–27) mm long. *Flowers* appear before or with leaves; tube maroon, lobes yellow to orange-yellow, becoming purple to dark red towards base on both sides, white-streaked inside. *Calyx* 5–6 mm long; sepals sub-equal or with the inner longer than the outer, ovate to obovate, 1.5 – 4.0 (– 5.5) $\times$ as long as wide, 3 – 11×1 – 4 mm; apex obtuse to rounded or acute, with 2–4 tooth-like glands (colleters) per sepal at base, glabrous, puberulous, or densely short-pubescent. *Corolla*: tube sub-cylindrical, 2.0 – $6.5 \times$ as long as calyx for 5–27 mm, then widening into a cylindrical or slightly infundibuliform upper part, at the mouth 6–13 mm wide, puberulous or short-pubescent on both sides, rarely glabrous outside; corona lobes pink or violet, linear-oblong, subulate, 2.5 – 7.5×1.5 mm, obtuse at tip, fleshy, minutely puberulous; corolla lobes reddish-violet on the right side and whitish-yellow on the left side outside, yellow inside; lobes ovate, 5 – 12×3.0 – 7.5 mm, gradually

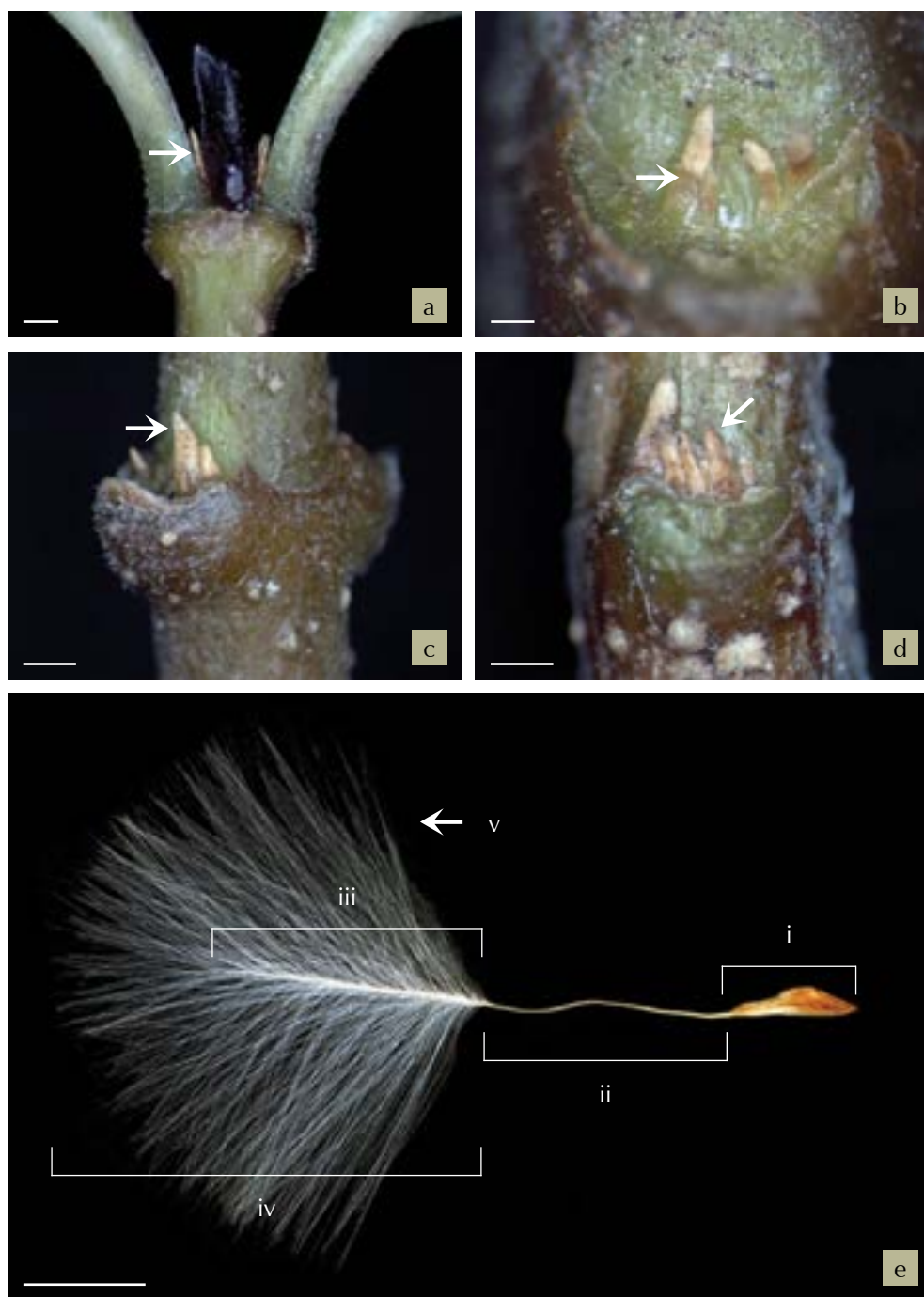


FIGURE 4.—*Strophanthus amboensis*: a–d, colleters (arrows) above the leaf scar from fresh material; e, morphological parts of the seed: i, grain; ii, beak; iii, coma-bearing part; iv, coma; v, individual coma fibres. All parts taken from fresh material. Scale bars: a, c, d, 0.5 mm; b, 0.2 mm; e, 10 mm. Photographs: S.P. Bester.

narrowing into 1–2(–4) mm wide spreading tails; lobes including tails 25–75 mm long, spreading, puberulous on both sides. *Stamens* included for 0–10 mm; filaments inserted at 5.0–7.5 mm from the base of the tube, straight or slightly curved, 1–3 mm long, pubescent inside, with faint or conspicuous 1.5–7.0 mm long ridges; anthers polliniferous in the upper half, lanceolate, sagittate, acuminate, 6.0–9.5 × 1.0–1.7 mm, glabrous or with a minutely puberulous acumen; tails 0.3–0.8 mm long; acumen (0.5–)1.6–4.2 mm long. *Pistil*: ovary consisting of 2 free carpels (0.7–)1.0–2.4 × 1.8–3.0 mm, glabrous, puberulous in the upper half, or densely pubescent all over; style 5.0–7.5 mm long; clavuncula 1.4–2.6 × 1.0–2.3 mm; stigma enclosed by the anthers, capitate, with a reflexed frill at base, 0.1–0.3 mm long. *Fruit* paired fusiform woody follicles, usually diverging at an angle of 180–272°, each follicle ± broadest at lower quarter, tapering into an obtuse tip, 120–270 × 14–34 mm; exocarp thick and hard, smooth or sulcate, glabrous or densely short-pubescent, if lenticellate then only sparsely so, peduncle in fruit 29–36 mm long. *Seed*: grain narrowly ovate, 8–16 × 2–5 × 1–2 mm, densely pubescent with golden hairs, apex rounded, neck narrowing acutely into beak; beak glabrous for 22–50 mm and then with a coma from 22–70 mm; coma fibres 13–70 mm long. *Flowering time*: September–February. Plate 2353; Figure 3 & 4.

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PLATE 2354 *Orbea namaquensis*

Orbea namaquensis Apocynaceae (Asclepiadoideae: Ceropegieae)

South Africa

Orbea namaquensis (N.E.Br.) L.C.Leach in Kirkia 10: 290 (1975); Lückhoff: 153, t. (1952); Leach: 12 (1978); Bruyns: 168 (2002); Müller et al.: 198 (2002); Bruyns: 317 (2005); Bruyns: 256 (2013); Le Roux: 349 (2015). *Stapelia namaquensis* N.E.Br.: 648 (1882), t.1908 (1890); Schlechter: 482 (1898); Brown: 990 (1909); Berger: 201 (1910); White & Sloane: 114 (1933); White & Sloane: 667 (1937). *Stapelia namaquensis* var. *ciliolata* N.E.Br.: 648 (1882), t.1908 (1890); Brown: 991 (1909); Berger: 202 (1910); White & Sloane: 668 (1937). *Stapelia ciliolata* (N.E.Br.) Rüst: 43 (1896). *Stapelia namaquensis* var. *minor* N.E.Br.: 648 (1882). *Stapelia namaquensis* var. *tridentata* N.E.Br.: 648 (1882), t.1908 (1890), 991 (1909); Berger: 202 (1910); White & Sloane: 668 (1937). *Stapelia tridentata* (N.E.Br.) Rüst: 43 (1896). *Stapelia namaquensis* var. *bidens* N.E.Br.: 991 (1909); White & Sloane: 668 (1937).

The genus *Orbea* Haw. is widely distributed throughout Africa and the Arabian Peninsula and consist of about 56 species (Bruyns 2002, 2005; Leistner 2005). Of these, about 30 species are indigenous to South Africa (Victor et al. 2000; Bruyns 2005). In southern Africa, *Orbea* species exhibit an oddly contradicting biogeographical distribution when compared to the rest of the stapeliads (generally members of the Apocynaceae with highly succulent stems and much reduced leaves) in that a higher diversity is found in the moister northeastern than the drier western areas. The endemic *O. namaquensis* is the only species of the genus found in the Namaqualand region of the Northern Cape Province in South Africa with its northernmost distribution extending to the Richtersveld (Le Roux 2015; Figure 1). Although it is found on the coastal Sandveld, Bruyns (2005) notes that it is quite scarce in that habitat. It seems to favour the Namaqua Klipkoppe and hills southwards, to near the Buffels River south of Springbok, as plants are more abundant here. Bruyns (2002) further cite a collection with an odd distribution close to Pella (near Pofadder) which is somewhat disjunct from the main Namaqualand distribution and, unlike the bulk of the distribution, receives summer rainfall instead of winter rainfall. This could represent a gap in sampling of the species and the gap needs to be explored to determine if it is merely a collection bias. As Bruyns (2005) states that *O. namaquensis* seems to be restricted to the arid parts of the winter-rainfall area, the Pella collection probably originate from the Bushmanland inselbergs, which is still regarded as part of the Succulent Karoo due to floristic affinities (Mucina & Rutherford 2006).

Plants are generally found growing on sandy plains under nursing bushes, sometimes in extensive clumps of up to 1 m in diameter (Bruyns 2005), in the Richtersveld and Namaqualand Klipkoppe (Le Roux 2015). Exposed plants are less commonly found, and in such cases only as well-established plants, usually after the death of their nursing plants. The species has been assessed and is Red-Listed as Least Concern (Matlamela & Kamundi 2006) as there are no current threats to the plants.

The members of *Stapelia* L. and *Orbea* are well known for their putrid-smelling flowers. Other morphological adaptations to their carrion-mimicking flowers may include fleshy,

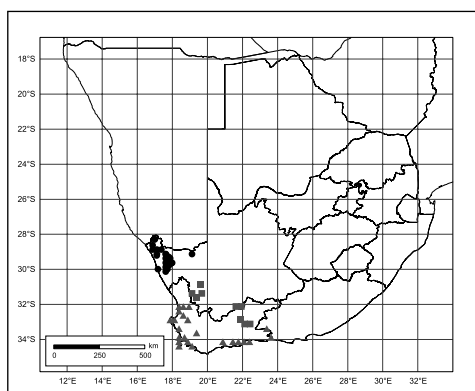


FIGURE 1.—Known distribution of *Orbea namaquensis* (●), *Orbea variegata* (▲) and *Orbea ciliata* (■). Records were obtained from the PRE collection, SANBI database (BODATSA – Botanical Database of southern Africa), literature (Leach 1978; Bruyns 2005) and GBIF occurrence data.

textured flowers covered with hairs, protuberances, papillae and vibratile clavate cilia in order to attract pollinators (Jürgens & Shuttleworth 2015). *Orbea namaquensis* is no exception and its flowers has a strong scent, similar to decaying fish (first author, personal observation), which was observed from the depicted plant. Le Roux (2015) reported a sharp urine-like odour. As pollinators, or at least flower visitors, Meve & Liede (1994) observed large flies of the taxa *Lucilia sericata*, *Musca domestica* subsp. *curviforceps* and *Sarcophaga* species (Diptera).

Orbea namaquensis is closely related to *O. ciliata* (Thunb.) L.C.Leach and *O. variegata* (L.) Haw. These three species are all found in the dry western parts of South Africa and do not overlap in distribution (Figure 1). They feature in the same derived clade, which indicates that their diversification was probably relatively recent (Bruyns 2002). These species all have a very prominent annulus forming a tube in the centre of the corolla. The outstanding characters used to distinguish between them are summarised in Table 1. Almost no two plants of *O. namaquensis* have exactly the same colour pattern, making it almost as variable as *O. variegata* for which up to 19 varieties have been listed (Brown 1909; White & Sloane 1933, 1937) and over 50 synonymous names have been coined (Müller et al. 2002). The outstanding features of *O. namaquensis* are its corolla with a distinct raised and bulky annulus, a corolline corona (sensu Kunze 2005), and its inner (staminal) corona lobes that have only one horn each.

In the vegetative state *Orbea namaquensis* is indistinguishable from *O. ciliata*. The flowers, however, are very distinct with those of *O. ciliata* pale cream compared to the purple-brown

Table 1.—Comparison of the three closely related *Orbea* species from the western parts of South Africa (adapted from Bruyns 2002, 2005)

	<i>O. ciliata</i>	<i>O. namaquensis</i>	<i>O. variegata</i>
Annulus	± tubular, erect. More than double the height of gynostegium.	Spreading to recurved. Shorter than height of gynostegium.	Spreading to recurved. Shorter than height of the gynostegium.
Corolla lobe margins	With prominent vibratile, clavate cilia.	Short rigid cilia.	Eciliate.
Outer corona lobes	Subquadrate. Apex obtuse to emarginate or sometimes bidentate.	Linear or linear-lanceolate. Apex acute.	Linear-oblong. 2–3-toothed apex.
Inner corona lobes	Without prominent dorsal horn.	Without prominent dorsal horn.	With prominent dorsal horn.



FIGURE 2.—a, *Orbea namaquensis* in habitat with clump of stems, here at Steinkopf, protected by *Crassosonthonna* cf. *sedifolia*; b, *O. namaquensis*, close-up of flowers; c, *O. ciliata*, close-up of flowers; d, *O. variegata*, close-up of flowers. Photographs: a, b, S.P. Bester; c, d, L. Viljoen.

spotted yellow corolla of *O. namaquensis*. The annulus of *O. ciliata* is also flattened and bowl-like, and not as thick and lifebelt-like as in *O. namaquensis* (Figure 2). Another feature that separates the two species is that *O. ciliata* has long ciliate vibratile hairs on the margin of the corolla and in *O. namaquensis* the hairs are short and rigid (Bruyns 2005; Figure 5).

Although the colour of vegetative stems of *Orbea namaquensis* and *O. variegata* are very similar, they are distinguished mainly based on their different natural distribution ranges, in *O. variegata*'s much longer and narrower stems with denticles less prominent, and some differences in their coronas (Bruyns 2002). The outer lobes taper gradually to a single acute point in *O. namaquensis* and are strongly bifid in *O. variegata*. In both these species the inner lobes have apices that are clavate-tuberculate and cluster into a connivent column above the centre of the flower. In *O. namaquensis*, however, there is no dorsal horn, but in *O. variegata* such a horn is present and very conspicuous (Bruyns 2005). Furthermore, the inner lobes are well-exserted beyond the annulus in *O. variegata*, but almost always fully sunk in the annulus in *O. namaquensis*.



FIGURE 3.—a, cross-section through annulus (i) section of central part of corolla with gynostegium removed (note the basal straight hairs (ii)); b, cross-section through annulus section of the central part of the corolla with gynostegium intact; c, gynostegial column in 'tube' formed by annulus (iii); d, gynostegial column removed with inner (iv) and outer (v) corona lobes; e, close-up of two anthers carrying pollinaria, inner corona lobe with an anther on either side each with its guide-rail; f, pollinarium showing corpuscle (vi), caudicle (vii), pollinium (viii) and insertion crest (ix). Scale bars: a, b, 2 mm; c, d, 1 mm; e, 0.5 mm; f, 0.2 mm. Voucher: clone of Bester 12816 in National Herbarium (in spirit), Pretoria. Photographs: S.P. Bester.

Orbea namaquensis, with four varieties, was originally described by N.E. Brown (1882) under *Stapelia* after receiving specimens from Henry Barkly in 1874. Brown (1909) later added a fifth variety, however, in all later treatments these varieties were abandoned.

The genus *Orbea* is attributed to Haworth (1812) with the type species *Orbea variegata* (L.) Haw. (= *Stapelia variegata* L.). At that time Haworth (1812) recognised 12 species. The

genus is probably one of the stapeliad genera that have undergone the most taxonomic changes since its inception. Shortly after Haworth (1812) described *Orbea*, it was sunk into *Stapelia* (Schultes 1820). This view was upheld until Leach (1975) reinstated the genus. At that stage most of the known species were allocated to either *Stapelia* or *Caralluma* R.Br. Leach (1978) created *Orbeopsis*, *Orbeanthus* and *Pachycymbium* as genera closely related to *Orbea*, but these were sunk by Bruyns (2002) who moved these taxa, as well as *Angol-luma* (Munster 1990), back to *Orbea*. One taxon was then moved out of *Orbea* to a new genus called *Ballyanthus*. A detailed account of the taxonomic history of *Orbea* is given in the treatments of Leach (1978) and Bruyns (2002). Recently, in order to make *Ceropegia* L. monophyletic, a revised phylogenetically based classification was, not only proposed, but new combinations were also made to accommodate this taxonomy (Bruyns et al. 2017). This resulted in the transfer of the whole assemblage of stapeliads to *Ceropegia*. However, we here favour a taxonomy which keeps the stapeliads separate, since they are monophyletic on their own and morphologically distinct. In the overview of the Apocynaceae by Endress et al. (2018) the placement of the stapeliads in *Ceropegia* were also not followed. For clarity, the alternative names given by Bruyns et al. (2017) are as follows: *Orbea variegata* (L.) Haw. (= *Ceropegia mixta* (Masson) Bruyns); *Orbea namaquensis* (N.E.Br.) L.C.Leach (= *Ceropegia namaquana* Bruyns); and *Orbea ciliata* (Thunb.) L.C.Leach (= *Ceropegia ciliatior* Bruyns).

Description (adapted from Müller et al. 2002; Bruyns 2005).—Succulent, forming clump of 0.05–1.00 m in diam., not rhizomatous. Stems 30–100 × 15–40 mm, stubby and shortly prostrate then decumbent, nearly cylindrical to distinctly 4-angled (as demarcated by the 4 flanks of tubercles), green heavily mottled with purple-brown; tubercles 4–10 mm long, arranged loosely into 4 broad obtuse rows along stem ± without groove between rows (unless when plants in stress), tapering into spreading conical stoutly acute tooth, sometimes with rudimentary leaves as 1 or 2 hardened denticles near apex. *Inflorescence* 1 per stem from the base, 1–4 flowers develop in succession from short peduncle to 10 mm long; pedicel 25–60 × 4–5 mm, purple-red, pink or pale cream-green, spreading with upturned apex holding flower facing upward on ground; calyx 6.0–8.5 × 3–5 mm at base, ovate, acuminate. *Corolla* 70–100 mm in diam., rotate; outside smooth, pale green-yellow streaked or reticulate or with confluent purple-brown blotches, with 3–5 mm long darker longitudinal veins running down each lobe and fading towards base of tube; tube embracing the corona, inside rugose with transverse papillate ridges on lobes and around annulus, obscurely rugulose on annulus becoming smooth towards centre, pale greenish yellow to bright yellow variously spotted and lined with purple-brown, bright yellow under annulus and with dark purple-brown ring around base of gynostegium; tube developed into a lifebelt-shaped and ± pentagonal annulus (corolline corona) which is 3–4 mm thick, 8–10 mm tall and to 10 mm broad, recurved so that rim often touches corolla surface outside tube, with narrow ring of cylindrical-acute black bristles (to 1.8 mm long) in base around gynostegium; lobes 25–32 × 20–25 mm at base, spreading to recurved, broadly ovate, acuminate, often with dense fringe of 0.5–1.4 mm long clavate rigidly fixed white to maroon marginal cilia except towards base and apices. *Corona* ± 8 × 16 mm, raised above base of tube on stout cylindrical often dark purple stipe 1–2 mm tall; outer lobes 6–8 × 1.2–2.0 mm, initially horizontal then ascending, overtopping the style head, linear or linear-lanceolate, acute, yellow dotted with large purple-brown patches at base; inner lobes 1.2–1.5 × 0.3–1.0 mm long, adpressed to backs of anthers where 0.8–1.0 mm broad



FIGURE 4.—a, tubercles; b, denticle (indicated with arrow); c, developing rooting nodule at base of stem adpressed to soil surface. Scale bars: a, c, 2 mm; b, 0.5 mm. Voucher: clone of *Bester 12816* in National Herbarium (in spirit), Pretoria. Photographs: S.P. Bester.

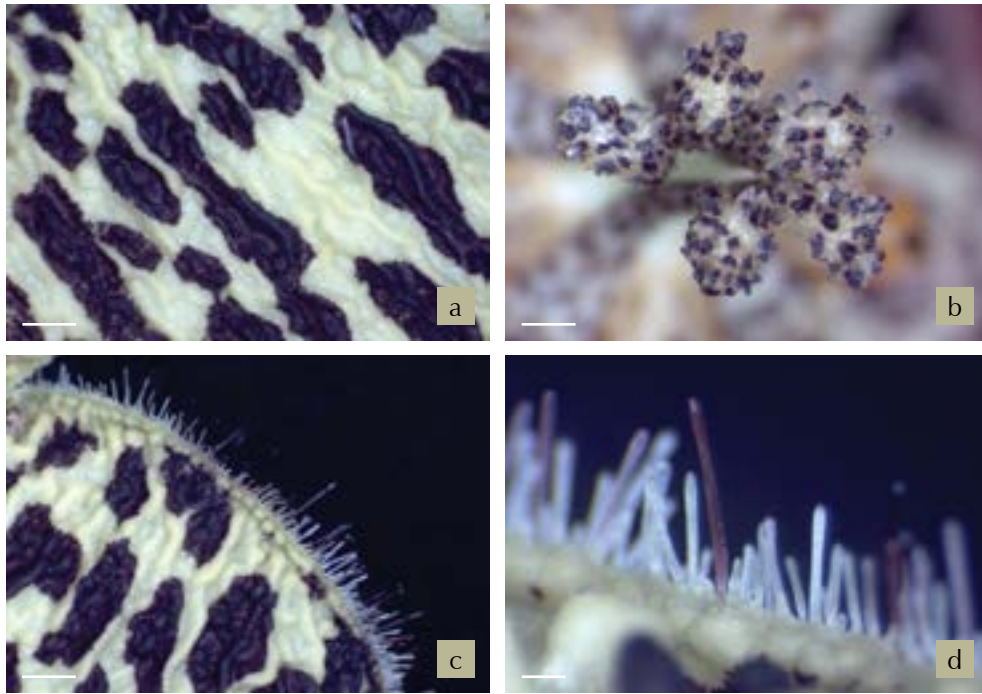


FIGURE 5.—a, rugose surface of corolla lobe with sparse hispid hairs; b, outgrowths on top of tips of inner corona lobes; c, margin of corolla lobe showing setae of various lengths and colouring; d, close-up of marginal bristles. Scale bars: a, c, 1 mm; b, 0.5 mm; d, 0.2 mm. Voucher: clone of *Bester 12816* in National Herbarium (in spirit), Pretoria. Photographs: S.P. Bester.

then 0.3–0.4 mm broad slender $\pm$ terete connivent-erect with clavate-tuberculate usually recurved tips, with slight rounded dorsal gibbosity at base, yellow dotted with purple-brown. *Pollinia* 0.8–1.1 $\times$ 0.3–0.5 mm, kidney-shaped; conical pad 0.4–0.8 $\times$ 0.1–0.2 mm joining the 0.3–0.4 $\times$ 0.1–0.2 mm caudicles to the ovate 0.4–0.5 $\times$ 0.18–0.20 mm corpuscle; insertion crests 0.58–0.72 mm long. *Fruits* to 150–190 $\times$ 10–14 mm, green speckled with darker green blotches. *Flowering time*: March to August. *Chromosome number* $2n = 22$ (Albers 1976). Plate 2354; Figures 2–5.

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PLATE 2355 *Pachycarpus natalensis*

Pachycarpus natalensis

Apocynaceae: Asclepiadoideae

South Africa

Pachycarpus natalensis N.E.Br. in Thiselton-Dyer, *Flora capensis* 4,1: 724 (1908); Hulme: t.40 (1954); Ross: 288 (1972); Gibson: 87, t.87, 1 (1978); Smith: 237 (1980), 428 (1988); Hutchings: 251 (1996); Nicholas: 526 (1999); Pooley: 548 (2005).

The genus *Pachycarpus* was established by Meyer (1838) and consisted of 16 species at that time. Although the bulk of these species remain in the genus, some have been moved to other genera, including *Asclepias*, *Gomphocarpus* and *Xysmalobium*, and some have been taken into synonymy under various other taxa. Major authors after Meyer did not recognise *Pachycarpus*. Decaisne, Bentham and Hooker, and Schumann included it in *Gomphocarpus*; Dietrich included it in *Xysmalobium*; and Schlechter included it in *Asclepias* (Brown 1902). Despite the very diverse placement of the various species, Brown (1908) retained them in the genus as distinct, based on the very broad sessile and truncate gynostegial core with its very rigid anther wings, unique coronal structure and distinctive character of the fruit. The habit and general appearance is very uniform and sufficient to distinguish *Pachycarpus* from its allies. The plants are much more robust than *Xysmalobium* and the leaves are scabrid and rough to the touch compared to the former and other genera like *Parapodium* and *Woodia*. When Brown published his revision of *Pachycarpus* in *Flora capensis* (1908), he contributed 19 new species and the genus grew to 27 species (Brown 1902, 1908). Today the genus is taxonomically well established, although a recent molecular analysis provided little support for the circumscription of genera in the African *Asclepias*-complex (Chuba et al. 2017). Currently *Pachycarpus* consists of 45 taxa, distributed throughout Africa (Goyder 1998; Goyder & Condy 2003). Thirty of these taxa occur in southern Africa, of which 90% are endemic to this region (Smith 1988). The taxa within the section *Trichocodon* D.M.N.Sm. (Hilliard & Burt 1983) are excluded. The genus is a morphologically well-correlated group in southern Africa with many common corresponding diagnostic characters (Nicholas 1999). These include deep-seated, cylindrical rootstocks, stout stems with large piths, broad leaves, inflorescences that are lateral at the nodes (very rarely terminal), stout peduncles (when present), flowers not causing the stems to droop, smooth carpels, and fruits that are leathery and inflated in many species (Glen et al. 2011). Analyses of morphological data indicate that southern African *Pachycarpus* could be divided into two sections (Smith 1980), or even genera (Nicholas 1999), but only the former of these views has been formally published.

Pachycarpus is an African endemic genus (Figure 1) and has been recorded from grasslands, savanna and miombo woodlands in sub-Saharan West and East tropical Africa. It is especially speciose in southern Africa (Smith 1980; Kloppe et al. 2006). At the time that

PLATE 2355.—1, in habit showing apical portion of stem with several nodes carrying leaves and inflorescences, × 1; 2, flower with slanted-angled view from above showing corolla and corona lobes covering the gynostegial column, × 1.6; 3, side view of corona lobe showing basal flaps and tip arching over the anther, × 6; 4, dorsal view of corona lobe, × 3; 5, ventral view of corona lobe, × 3. Voucher specimen: Beaumont, Beckett & Shuttleworth s.n. in Bews Herbarium, Pietermaritzburg. Artist: Angela Beaumont.

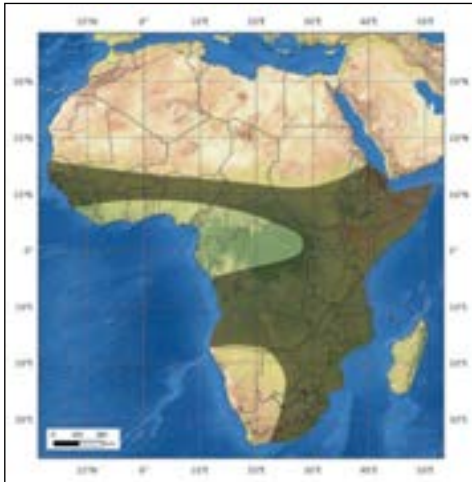


FIGURE 1.—Distribution of the African endemic genus *Pachycarpus* (Smith 1980).

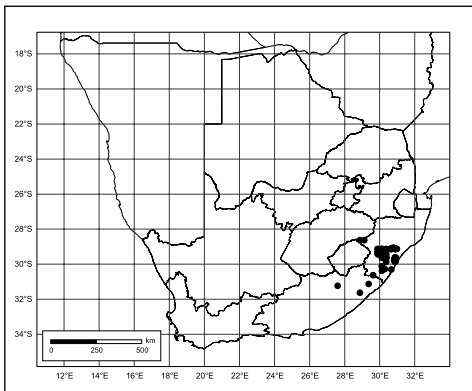


FIGURE 2.—Known distribution of *Pachycarpus natalensis* based on specimens in the BODATSA database (SANBI) and localities added from Smith (1988).

Smith (1988) published the latest revision of the genus in southern Africa, *P. natalensis* appeared to be endemic to KwaZulu-Natal, confined to the Midlands and Uplands south of the Tugela (Smith 1988). Since then, many collections of the species have been made in the northern parts of the Eastern Cape and material from the border of KwaZulu-Natal and the eastern Free State has now been confirmed to belong to this taxon (Figure 2).

The Zulu name of *Pachycarpus natalensis* is *ishongwe elibomvu elikhulu*. Other vernacular names used for this plant are Natal *Pachycarpus* or Natal thick-fruit (Pooley 2005). The plant is used for traditional medicine in various ways. Infusions of the root are sprinkled on eggs to prevent dogs from eating them (Hulme 1954) – when they do eat them they apparently become violently ill. Tubers are taken for stomach ailments by the Xhosa (Hutchings 1996). Cardenolides (a cardiac glycoside) have been found in the genus (Gibbs 1974) and potential toxins known in the genus include anhydrop-eriplogenone, cymarins and strophanthidin (Duke 1985).

Plants have been recorded to grow in open veld, on moderate hill slopes in mist-belt grassland in seasonally moist areas; amongst rocks on hillsides; in well-drained soil in full sun and predominantly on south-facing slopes; with an altitudinal range from (?131–)262–1 505 m above sea level. The habitat of *Pachycarpus natalensis* is prone to

frequent fires (natural and anthropogenic) and plants have adapted by developing deep-seated rootstocks from which stems are produced annually. The plants flower over an extended period from October to mid-February (Shuttleworth & Johnson 2012) depending on local weather conditions.

The corona in *Pachycarpus* is probably the most useful character to distinguish between species. In *P. natalensis* the corona is intermediate between that of *P. macrochilus* and *P. reflectens* (Figure 3e, 3f). Nicholas (1999) further points out that these three species are very closely related and can easily be misidentified when preserved as herbarium specimens. In the fresh state they are, however, very distinct species and easily identified. The



FIGURE 3.—Colour variation in corolla lobes: a–d, *Pachycarpus natalensis*; e, f, *P. reflectens*. Photographs: a, b, A. Shuttleworth; c, G. Grieve; d, J. Kirkel; e, f, S.P. Bester.

coronas of *P. natalensis* and *P. reflectens* are very similar with the most obvious difference being the margin – it is entire in the former and somewhat serrated in the latter (Figure 3). In *P. reflectens* the corona blade is orbicular, broadly ovate to broadly elliptic (not lanceolate, ovate or broadly ovate-cordate), the apex is obtuse, obtusely-apiculate or cuspidate with a linear obtuse appendage-like apex (not acute) or slightly mucronate, and the corona keels have no wings on the inner face. The narrow corona-lobe neck of *P. natalensis* is

much shorter and the two basal teeth much larger than in *P. macrochilus*. In *P. natalensis* the upper leaf-like portion of the corona is reflexed and connivent over the gynostegial column and collectively form a hood-like enclosure around it (Nicholas 1999; Plate 2355; Figure 3a–3d; Figure 4a–e).

The morphology of the corona alone is often not enough to distinguish between these closely related species. In *Pachycarpus natalensis* the corolla lobes are spreading, flat and rotate, and only slightly revolute or twisted near the apex. In comparison, in *P. reflectens* the corolla is strongly reflexed and lie almost parallel to the pedicel, the margins are strongly revolute and diagonally twisted (Figure 3e, 3f), and the anther wings are smaller (1.3–2.4 mm long, as opposed to 3–6 mm long in *P. natalensis*). The leaves of *P. natalensis* are broadly elliptic to slightly orbicular (23–47 mm wide), with prominent primary, secondary and tertiary veins (Nicholas 1999). In comparison, the leaves of *P. reflectens* are lanceolate to narrowly oblong (12–28 mm wide) with the veins less prominent, especially at the tertiary level.

The flowers of *Pachycarpus natalensis* exhibit a wide range of colouring. It varies from a pale yellow to greenish or white background filled with random maroon, red, brownish or purple blotches in the foreground. The degree of blotching also varies much in its density. Some variations are shown in Plate 2355 and Figure 3. The flowers of *P. natalensis* are reported to have a spicy scent and produce about 16.4 µl of nectar in a 24-hour period consisting of mainly sucrose (96.7%). The pollen placement is on the mouthparts of members of the *Hemipepsis* wasp pollination guild (Shuttleworth & Johnson 2012). Bitter nectar is characteristic of all *Pachycarpus* guild members and their flowers are visited by considerably fewer non-pollinating insects, suggesting that differentially palatable nectar may play an important role in reducing visits by nectar thieves (Shuttleworth & Johnson 2006, 2009a). Specialised pollination by *Hemipepsis* wasps is known to be present in *Pachycarpus natalensis* (Ollerton et al. 2003; Shuttleworth & Johnson 2006, 2009a,b). Shuttleworth & Johnson (2009a) suggests that specialised chafer beetle pollination occurs in the genus *Pachycarpus*, and Ollerton et al. (2018) comment that there have been parallel shifts between wasp and beetle pollination in both southern African *Pachycarpus* and in a different subtribe of asclepiads in South America.

The plant illustrated here originates from Wahroonga farm, near Mpophomeni, KwaZulu-Natal, and was collected on 3 January 2017. The habitat consisted of open grassland with patchy rocky outcrops on the crests, near the old farmhouse. The plant was about 0.5 m tall. At this location there are a small and scattered population with other plants growing closer to the farmhouse in rocky grassland.

In the conservation assessment done by Foden & Potter (2005) this taxon was assessed and Red-Listed as Least Concern, as it was not selected in any one of four screening processes, namely: (1) it was not on any Red List prior to 2009; (2) it was not highlighted by experts (through a consultation process) as being of potential conservation concern; (3) in the latest revision it was not known from only very few locations; and (4) it was known from more than 5 quarter degree grid squares from the national database (Raimondo et al. 2009). The grassland habitat in which it grows, however, is in danger of transformation and

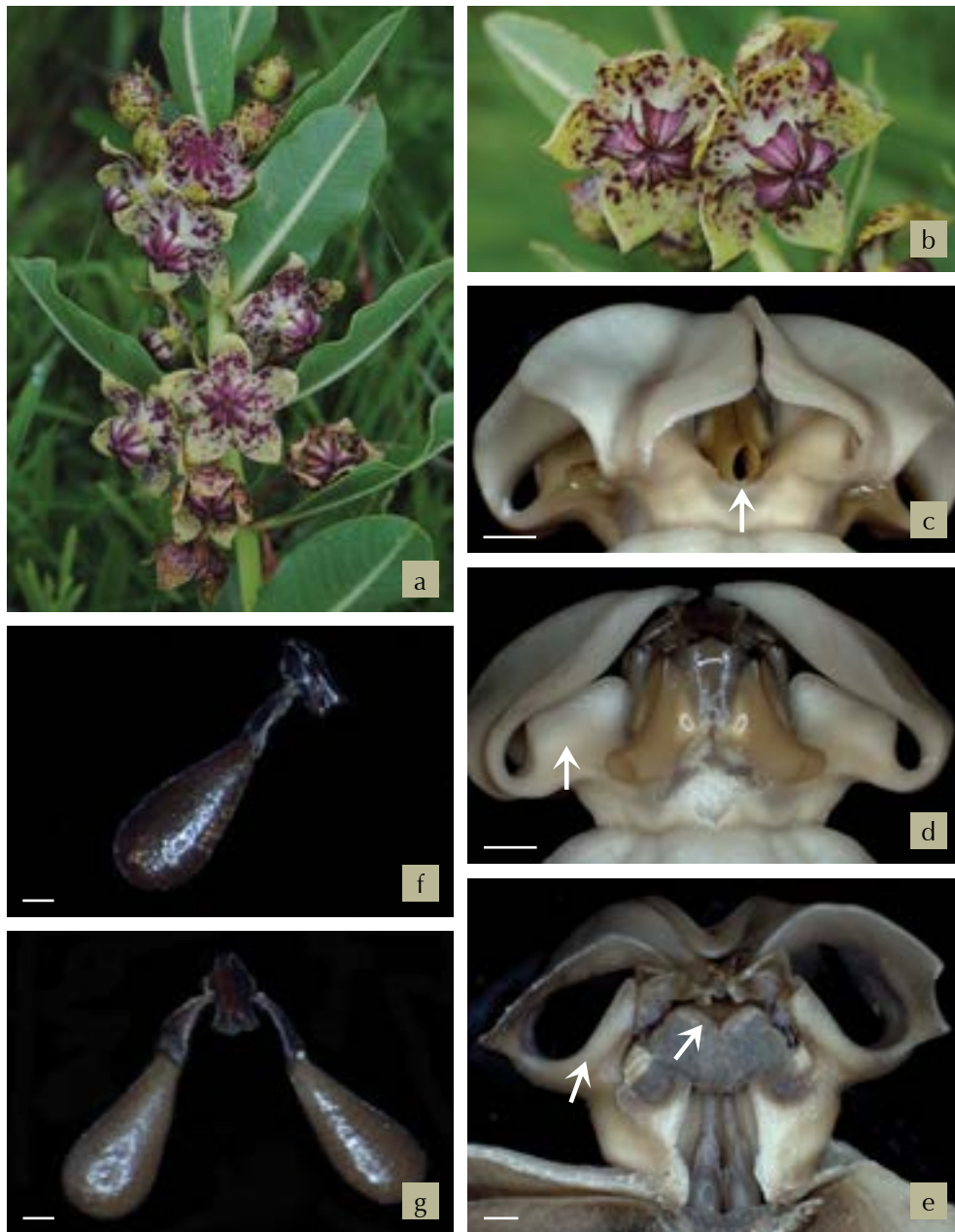


FIGURE 4.—*Pachycarpus natalensis*: a, in habit at Wahroonga farm, KwaZulu-Natal; b, close-up of flower; c, side view of gynostegial column and corona lobes, note the opening of the anther wings (arrow); d, side view of gynostegial column and corona lobes with front corona lobe removed showing anthers and anther wings, note $\pm$ truncate-sloping lateral wing of coronal lobe (arrow); e, cross-section through gynostegial column and corona lobes, see involute style head (upper arrow) and conical lateral appendage of coronal lobe (lower arrow); f, pollinium, broad caudicle and corpuscle; g, pollinarium. Vouchers: c, d, g, *Nicholas 1030* (PRE); e, *Mani s.n.* spirit material only (PRE); f, *Nicholas 1000* (PRE). Scale bars: c, d, 2 mm; e, 1 mm; f, g, 0.2 mm. Photographs: S.P. Bester.

overgrazing and may lead to loss of populations. This, however, has not yet lead to a change in this conservation assessment of this taxon.

Description (adapted from Nicholas (1999) and Smith (1988) with additional measurements from specimens at PRE).—Geophytic perennial herb with milky latex throughout; tuber as long as, or longer than stem, rooted. *Stem* 300–600 mm tall, slender to stout, simple or branched at the base, $\pm$ glabrous or pubescent. *Leaves* ascending-spreading; petiole 4–13 mm long; blade 42–77 $\times$ 23–47 mm, narrowly ovate or narrowly oblong to broadly ovate, broadly oblong or broadly elliptic, $\pm$ glabrous to densely pubescent above, puberulous or pubescent below with scabrous midvein, margins pubescent or scabrous. *Inflorescence* umbellate, 2–5-flowered, sessile or subsessile, rarely pedunculate, at upper nodes and terminal; peduncles 0–5(–30) mm long, pubescent. *Bracts* 0.5–10.0 mm long, narrowly linear, acute or acuminate, pubescent below. *Pedicels* 8–20 mm long, pubescent. *Sepals* 8–4 mm long, lanceolate, linear-lanceolate, narrowly elliptic or ovate, acute or acute-acuminate, glabrous or slightly pubescent towards apex above, pubescent below. *Corolla* 14–21 mm long, lobed almost to base; lobes spreading horizontally with apical half or tips up-curved or slightly reflexed in old flowers, 11–17 $\times$ 5–11 mm, narrowly to broadly elliptic, broadly ovate or sub-orbicular, apex obtuse, margins slightly revolute towards apex and imbricate at base, green or greenish-yellow or cream with brown, maroon, purple or reddish blotches, glabrous above, puberulous to pubescent below. *Corona* lobes 6–14 mm long, basal part narrowly linear, claw-like and spreading horizontally, often slightly dilated at extreme base, 1.5–4.0 $\times$ 0.7–1.5 mm, with a pair of sub-contiguous oblong or sub-deltoid keels at base, keels 0.8–2.0 mm long, 1.5–3.5 mm high, obliquely acute, obtuse or truncate, often with a narrow wing on inner margin extending to broadest part of the claw-like base, beyond the keels the lobe dilate to form a lanceolate, ovate or broadly ovate-cordate blade rising vertically at first and then inflexed over the claw and keels, blade 4–8(–10) mm long, 4–8 mm broad at base, apex acute or $\pm$ mucronate, margin frequently undulating, lobes dark purple with white keels. *Anther wings* 1.3–2.4 mm long, slightly oblique, outer margin straight or $\pm$ concave with basal angles slightly upcurved; appendages 2.0–4.6 mm long, ovate, elliptic or $\pm$ obovate to broadly ovate or broadly elliptic, acute, margins $\pm$ reflexed, erect at first and then curved over and much above style apex. *Follicles* 93–100 $\times$ 25 mm, narrowly ovoid, 6-winged, apex obtuse. *Flowering time*: October–February. Plate 2355, Figures 3 & 4.

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PLATE 2356 *Cynium racemosum*

Cycnium racemosum

Orobanchaceae

South Africa, Swaziland, possibly Lesotho

***Cycnium racemosum* Benth.** in Hook. Companion to the Botanical Magazine 1: 368 (1835); Hiern: 396 (1904); Hansen: 55 (1978).

Cycnium racemosum, is a partially parasitic (hemiparasite) herb with attractive pink flowers in the family Orobanchaceae (broomrape family) within the order Lamiales. The hemiparasitic members of the Orobanchaceae were previously considered as part of the Scrophulariaceae, while the complete parasitic species (holoparasites) were included in the Orobanchaceae (Hallier 1903; Bellini 1907; Melchior 1964; Cronquist 1981; Barringer 1993). More recently, phylogenetic studies showed both hemi- and holoparasitic members in these families to be descendants of a common ancestor (monophyletic) and they were, therefore, all placed in the Orobanchaceae (Young et al. 1999). With 99 genera and $\pm 2\,060$ species (Stevens 2001 onwards), the Orobanchaceae is the most species-rich family of parasitic plants. The family has a worldwide distribution with a higher concentration of species in the Mediterranean, southern Africa, the Himalayas and western North America; they are absent from eastern South America, eastern Australia and New Zealand (Bennett & Matthews 2006).

Functionally, parasitic plants are able to obtain water, mineral nutrients and limited amounts of carbon from their host plants by attaching haustoria to the hosts' roots or stems (Těšitel 2016). The site of attachment to the host classifies the parasite as either a root or stem parasite, and the presence or absence of functional chloroplasts classifies it as either hemiparasitic or holoparasitic respectively (Musselman & Press 1995). The presence of chloroplasts means that hemiparasites are able to fix carbon dioxide through photosynthesis, making them partially dependent on the host plants (Visser 1981; Moreau et al. 2016). On the contrary, since holoparasites lack chloroplasts, they derive all their fixed carbon from their host plants (Visser 1981). Parasites are a taxonomically diverse group of plants making up about 1% ($\pm 4\,500$ species) of the flowering plants (Heide-Jørgensen 2008). Parasitism is believed to have evolved once in the order Lamiales, followed by independent origins of holoparasitism from hemiparasitic ancestors (Young et al. 1999).

The genus name *Cycnium*, derived from Greek (κύκνος) and Latin (cygneus), means 'curved suddenly downwards like a swan's neck' (Stearn 1995) in reference to the slender elongated corolla tube (Clarke & Charters 2016), probably in white-flowered *Cycnium adonense* E.Mey. ex Benth., the first described species. The corolla tube in *C. adonense* is three times longer than that of *C. racemosum* and both species were described in the same publication by Bentham (1835). Don (1838) remarked that the application of the name is not obvious to the genus. The specific epithet *racemosum* refers to flowers arranged in a raceme. *Cycnium racemosum* is commonly known as the Christmas flower, large pink ink



FIGURE 1.—Herbarium specimen of *Cycnium racemosum* showing blackening of floral and vegetative parts when dried (Ward 6326 in Ward Herbarium, University of KwaZulu-Natal).

plant, large mountain ink flower, large pink mushroom flower; *kersfeesblom*, *berginkplant* (Afrikaans); *uHlabahlangane*, *hlabalanganane*, *shlabahlangane* (Zulu) (Williams et al. 2001); and *injanga* (Xhosa) (Pooley 1998). The plants turn blue-black when bruised and black on drying, giving rise to 'ink' in the common names (Figure 1). The colouring is similar to plants in the genus *Buchnera* L. (also in the Orobanchaceae) where iridoids are believed to be responsible for the colouring action (Jansen 2005). Dried plant material of *Buchnera hispida* Buch.-Ham. ex D. Don is crushed to a powder and used as a source of black dye for skin and textiles in Gambia (Jansen 2005).

Cycnium racemosum can be recognised by its narrow leaves with minute hairs, flowers in terminal racemes, a tubular calyx that is not split down one side, short calyx lobes with hooked teeth and pink flowers. *Cycnium racemosum* is most closely related to *C. erectum* Rendle; both species have flowers in racemes, tubular calyces and dry capsules (Hansen 1978). It differs from *C. erectum* in having pink flowers, the calyx is not split, smaller warty seeds (1.0–2.2 mm long), and distributed in South Africa and Swaziland. In *C. erectum*, flowers are white, the calyx has a ventral split and seeds are

smooth, 2–3 mm long. Furthermore, *C. erectum* is found in Kenya, Uganda, Sudan and Ethiopia. In our region, *C. racemosum* is closely related to *C. adonense* in having leaf margins toothed and flowers in racemes. It differs from *C. adonense* in having erect stems and a dry capsule – in *C. adonense*, the stems are prostrate and the fruit is a berry. Hiern (1904) distinguished *C. huttoniae* Hiern from *C. racemosum* by its smaller flowers (17–19 mm long) and calyx split down one side. Hansen (1978) found the calyx split in the type specimen of *C. huttoniae* to be variable and suggested this is possibly caused by environmental factors. This led him to reduce *C. huttoniae* to *C. racemosum*.

Cycnium is reported to have species (*C. tubulosum* (L.f.) Engl. and *C. ajugifolium* Engl.) with floral traits consistent with hawkmoth pollination in East Africa (Martins & Johnson 2013). These traits include pink and white flowers with long, narrow corolla tubes that open in the evening and that are sometimes (as in *C. racemosum*) lightly scented. With its many delicate pink flowers, clustered in racemes, *C. racemosum* is an attractive plant. During a study of pollinator visitors to the orchid, *Disa pulchra* Sond., Johnson (2000) recorded the long-tongued tabinid horsefly, *Philoliche aethiopica* Thunberg also visiting *C. racemosum*.



FIGURE 2.—*Cynium racemosum*: a, in habitat, Kemps Height, Mpumalanga; b, close-up of flower, Kemps Height, Mpumalanga; c, inflorescence, Naudes Nek, Eastern Cape. Photographs: M. Koekemoer.

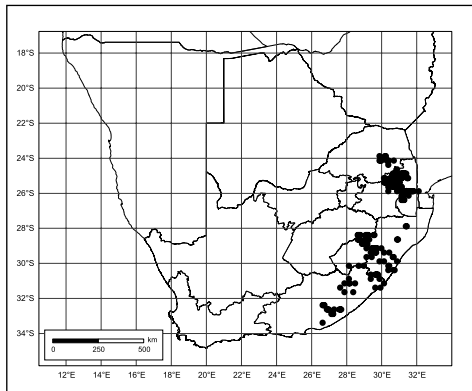


FIGURE 3.—Known geographical distribution of *Cycnium racemosum* in southern Africa.

Later, Johnson (2006) reported the long-proboscid nemestrinid fly, *Prosoeca ganglbaueri* Lichtwardt collecting nectar from *C. racemosum*.

Members of the genus *Cycnium* are root parasites with a primary haustorium present or reduced in some species (Těšitel 2016). *Cycnium racemosum* grows in dense grasslands where it can attach its root to different plants. Known host plants include grasses (*Eragrostis* Wolf., *Setaria* P.Beauv., *Themeda* Forssk., *Vulpia* C.C.Gmel.), sedges (*Cyperus* L.) and forbs (*Acalypha* L.) (Visser 1981). Being a hemiparasite, *C. racemosum* cannot be cultivated without a host plant

(Pearse 1978; Těšitel 2016), making it unsuitable as a garden plant despite its showy flowers (Figure 2). However, large commercial seed companies have seeds of *C. racemosum* on offer to the gardener.

Cycnium, a genus of about 15 species with a distribution from East Africa southwards to South Africa, is dominant in tropical Africa where there are 14 species (African Plants Database 2019). Four species occur in southern Africa namely *C. adonense*, *C. filicalyx* (E.A.Bruce) O.J.Hansen, *C. racemosum* and *C. tubulosum* (L.f.) Engl. and of these only *C. racemosum* is endemic to the region. *Cycnium racemosum* occurs in South Africa and Swaziland, and possibly also in Lesotho (Figure 3). In South Africa, it occurs in the Eastern Cape, Free State, KwaZulu-Natal, Limpopo and Mpumalanga. In these areas, *C. racemosum* grows in mountain grassland, in open areas, rock outcrops or sheltered depressions. The species prefers shade and damp conditions and is usually found amongst tall grasses. It occurs at mid to high altitudes of 1 300–3 048 m above sea level. According to the Red List (Foden & Potter 2005), *C. racemosum* is classified as Least Concern in South Africa.

The leaves of *Cycnium racemosum* are used in traditional medicine as a general painkiller (Watt & Breyer-Brandwijk 1962) and for the treatment of skin disorders where the leaves are made into a paste and applied as a topical cream (Afolayann et al. 2014). In Zulu medicinal practices, the pounded roots are used with the placenta of a mare by midwives for difficulties during childbirth (Hutchings et al. 1996). Xhosa women reportedly use the roots of the species in decoctions to facilitate labour (Veale et al. 1992). Animals to be slaughtered in rituals are passed through the smoke of burning leaves of *C. racemosum* (Hutchings et al. 1996) and it is traded at the Witwatersrand umuthi market as a medicinal herb (Williams et al. 2001).

Description.—Perennial herb, hemiparasite, erect, 200–700(–900) mm tall, woody towards base. *Stems* simple or with many branches, ribbed, glabrous or minutely hispid. *Leaves* opposite or nearly so, sometimes in whorls of threes, subsessile, elliptic, oblong or narrowly ovate, 20–80 × 5–20 mm, apex acute, narrowing towards base, margins toothed in upper half, purplish red. *Inflorescence* terminal raceme with many flowers. *Pedice*l 7–30 mm long; bracteoles linear, tapering to a fine point, 1–8(–11) mm long, inserted on pedicel close

to calyx tube. *Flowers* 30–60 mm in diameter, pale to deep pink, pinkish mauve to mauve with white patches in throat, turning black on bruising or drying, lightly fragrant; calyx tubular, tube straight (9–)13–20 × 3–7 mm, distinctly ribbed, minutely hispid, lobes 5, triangular, 1.5–6.0 mm long, erect or spreading; corolla tubular, tube straight, curved or bent, constricted at throat, 18–23 mm long, glabrous outside, pilose within, lobes spreading, broadly obovate, 20–25 × 12–18 mm, 2 upper lobes connate, higher up than the rest. *Stamens* 4, 2 short and 2 long (didynamous); filaments inserted in corolla tube, bearded at apex on one side, with hairs down the length on one side, shorter filaments 3–8 mm long, longer pair 5–11 mm long; anthers 3–4 mm long, dorsifixed, tip apiculate, dehiscence introrse by longitudinal slits. *Ovary* superior, bilocular, glabrous, somewhat compressed, ovoid 2–4 mm long; style 1.5–2.0 mm long; stigma simple, 2.5–3.0 mm long, style and stigma not exceeding the shorter stamens. *Fruit* capsule, ovoid 6–10 × 4–7 mm, enclosed in calyx. *Seeds* over 100 per capsule, 1.0–2.2 mm long, black-brown, testa finely warty. *Flowering time*: October to March (May), mostly December and January. Plate 2356.

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Dalman — Reesalt

PLATE 2357 *Acanthopsis pagodiformis*

Acanthopsis pagodiformis

Acanthaceae

South Africa

Acanthopsis pagodiformis *H.M.Steyn* sp. nov., resembling those species which are subshrubs with broad, sessile inflorescences and distinctly glandular bracts, but distinguished from them by the combination of being biennial/perennial with inflorescences (10–)12–14 mm in diameter, bracts with secondary spines shorter than primary spines and ending in 5(–7) broadly winged (ovate) primary spines, and the corolla being relatively small (24–26(–29) mm long) with tube 8–9 mm long.

TYPE.—South Africa, Northern Cape: Namaqualand District, Richtersveld, Rooiberg NE of Eksteenfontein, western footslopes, 662 m (2817CD), *Steyn* 2147 (PRE, holo.; KMG, NBG, iso.).

Acanthopsis Harv. is a distinct and easily recognisable genus confined to arid parts of southern Africa. Although the genus is supported by molecular evidence as a monophyletic group belonging to the so-called ‘one-lipped corolla lineage’ in the tribe Acantheae (McDade et al. 2005), the infrageneric relationships remain obscure. The phylogenetic relationship among *Acanthopsis*, *Acanthus* L. and *Blepharis* Juss. is not yet fully resolved, but available molecular evidence suggests that *Acanthopsis* and *Acanthus* are sister taxa (McDade et al. 2005), the latter not occurring naturally in southern Africa.

With the exception of *Blepharis*, members of *Acanthopsis* are unlikely to be confused with any other genus of Acanthaceae native to the subcontinent. *Acanthopsis* and *Blepharis* are morphologically similar with their one-lipped corollas, four stamens and monothecous anthers, as well as glabrous capsules and white, hygroscopic hairs on the seeds. However, in *Acanthopsis* the corolla tube is distinctly longer, the stamen filaments are without appendages and the style is unlobed (Vollesen 2000).

Although *Acanthopsis* is morphologically distinct, it was until recently a taxonomically poorly understood member of the Acanthaceae (tribe Acantheae), especially as to the number of species involved and the most reliable characters for their identification. Following a taxonomic revision of the group, a new species-level classification was proposed that includes 20 species, four subspecies and one form (not formally described), thereby answering the great need for a new classification (Steyn & Van Wyk 2015, 2016, 2017a, b; Steyn 2018).

The name *Acanthopsis* refers to the plants’ general resemblance to the genus *Acanthus*. It is derived from the Greek *acantho*, meaning ‘spiny’ in reference to the overall appearance of the plants, and *opsis*, meaning ‘looks like’. *Acanthopsis* species can generally not be reliably identified using a single character and a combination of characters nearly always has to

PLATE 2357.—1, habit, × 1; 2, leaf, × 1; 3, bract, × 1; 4, bracteoles, × 1; 5, lateral sepals, × 1; 6, dorsal sepal, × 1; 7, corolla, × 1; 8, capsule, × 1; 9, seed, × 1. Voucher specimen: *Steyn* 2147 in National Herbarium (PRE), Pretoria. Artist: Daleen Roodt.

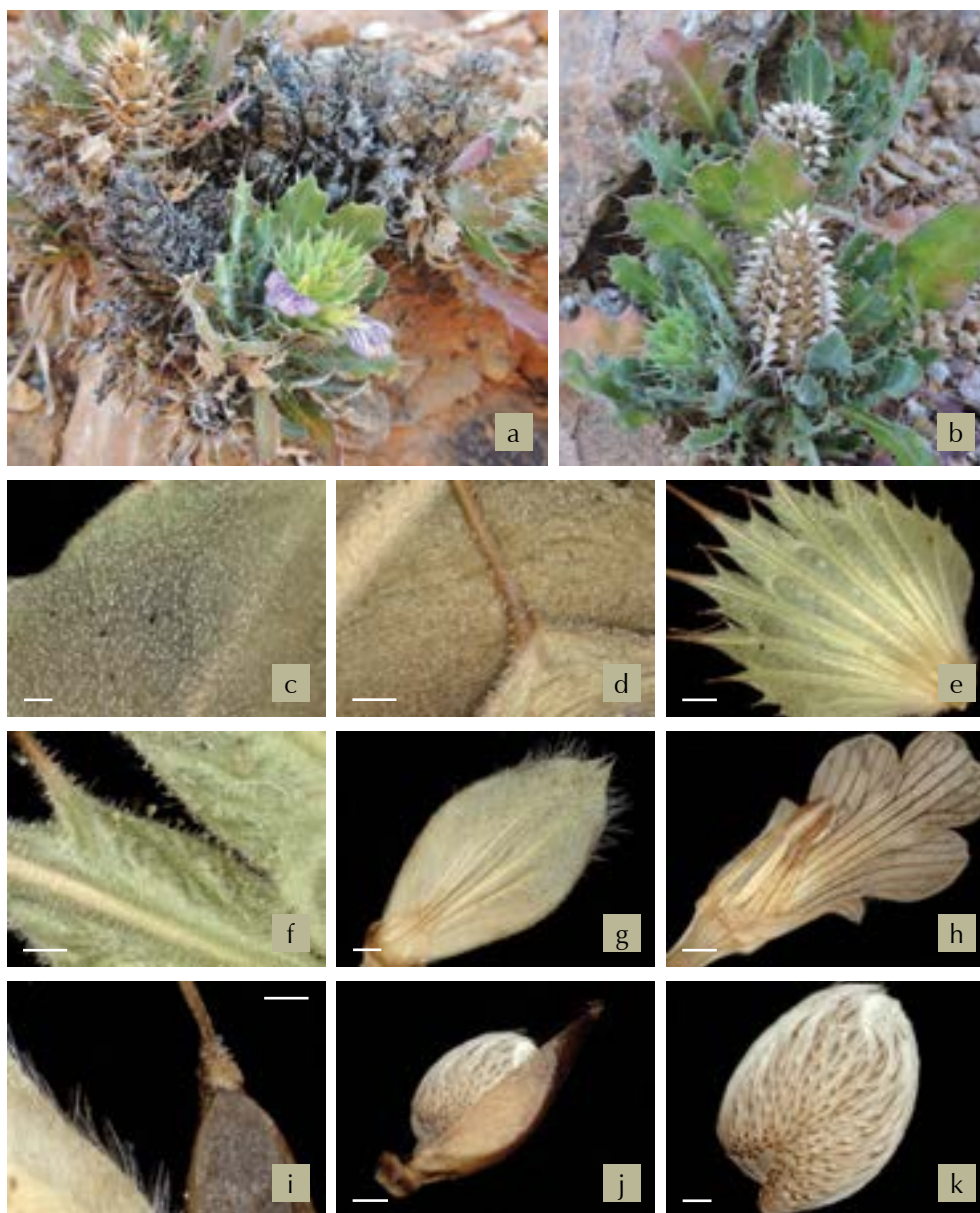


FIGURE 1.—*Acanthopsis pagodiformis*. a, b, habit; c, d, leaf indumentum (abaxial); e, f, bract (lower); g, calyx; h, corolla (lobes lilac to purple; throat lemon-yellow); i, glandular hairs at base of style; j, part of capsule with seed; k, seed. Scale bars: c, d, f, i, k, 0.5 mm; e, h, 2 mm; g, j, 1 mm. Vouchers: c, e–i, Steyn 2147 (PRE); d, j, k, Steyn 1885 (PRE). Photographs: a, M. Koekemoer; b–k, H.M. Steyn.

be applied to distinguish among taxa. The shape and size of leaves, capsules and seeds are relatively uniform within the group, while characters such as habit, morphology of inflorescences, floral bracts and corolla, as well as bract indumentum and distribution range are of considerable taxonomic importance at species level.



FIGURE 2.—Floral parts of *Acanthopsis pagodiformis* (from left to right): two bracts, two bracteoles, calyx (four sepals) and flower. Note: the bract on the left is from lower down in the same inflorescence. Scale bar: 10 mm. Voucher: Steyn 2147 (PRE). Photograph: E. Fouché.

Members of *Acanthopsis* range from annual, acaulescent herbs to perennial subshrubs. They flower mainly during spring and early summer. In most species the corollas are either lilac to purple with darker veins, or whitish/cream with purple veins. The corolla throat varies from white or cream to lemon-yellow among different species; this is species-specific and may be an adaptation to specific pollinators. Very little is still known of the pollination of the group, but the presence of nectar, a lack of a pronounced floral odour, the darker purple veins on the corolla (nectar guides), and the size and sculpture of the pollen grains suggest the possible involvement of diurnal insects (bees, ants, bee flies and fruit flies).

The region with the highest diversity of *Acanthopsis* species is the Richtersveld part of Namaqualand in the Northern Cape with 13 taxa (11 endemic or near-endemic to the region), followed by central Namaqualand (including the Kamiesberg area and coastal plains) with five taxa (three endemic or near-endemic) and southern Namibia with three taxa (one endemic). Diverse topography, climate and rich geological diversity in the Richtersveld has undoubtedly contributed to the many endemics in this region. In terms of biomes, the Succulent Karoo and the Desert biomes have the highest diversity with 21 and six *Acanthopsis* taxa respectively.

While collecting plants in the Richtersveld World Heritage Site during August 2012, an unusual *Acanthopsis* specimen (past flowering) was collected from the lower slopes of Rooiberg (2817CD), to the east of Eksteenfontein. This turned out to be an undescribed species and more material (including the type specimen, Steyn 2147) was collected in 2015. This species is formally described and illustrated here as *A. pagodiformis* (Figures 1 & 2). This is the second member of *Acanthopsis* to be figured in this series, the first being *A. disperma* (Steyn & Condry 2015).

The Rooiberg consists mainly of red granite and forms part of the Richtersveld Igneous Complex with an approximate age of 102–809 million years (Ritter 1978). *Acanthopsis pagodiformis* is endemic to the Rooiberg area (Richtersveld, Northern Cape) (Figure 3) and is highly range-restricted (Extent of Occurrence [EOO] <10 km²), known from a single site (two sublocalities). It grows wedged among rocks (Figure 4), where it is somewhat protected from the effects of erosion and trampling by livestock, and in addition, it appears not to be browsed (pers. obs.). It is therefore assessed as Least Concern (IUCN 2001), but

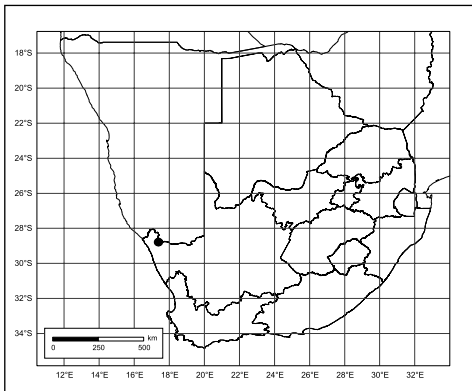


FIGURE 3.—Known distribution of *Acanthopsis pagodiformis*.

Critically Rare (L. von Staden, pers. comm. 2017). *Acanthopsis pagodiformis* is centred in the core part of the Gariep Centre of Endemism, a biogeographical region rich in restricted-range plants and animals in northwestern South Africa and adjacent southwestern Namibia (Van Wyk & Smith 2001). This distribution falls within the Succulent Karoo Biome (Rutherford & Westfall 1994; Low & Rebelo 1996), or in the Desert Biome according to Mucina & Rutherford (2006). It is found in the Gariep Desert Bioregion, Kahams Mountain Desert (Mucina & Rutherford 2006) where it receives predominantly winter rains with an average of 45–70 mm per year (fog claimed

to be absent). The specimens were collected on mountain slopes associated with granite and quartzite in well-drained, sandy soils at elevations between 660 and 700 m.

The specific epithet *pagodiformis* (Latin, meaning ‘resembling a pagoda’) refers to the shape of the inflorescences – a pagoda being a tiered tower with multiple eaves. *Acanthopsis pagodiformis* has a dense spike with 5-fid bracts, usually ending in a compound central



FIGURE 4.—Habitat of *Acanthopsis pagodiformis*. Photograph: H.M. Steyn.

primary spine with 1 (or 2) pair(s) of short marginal secondary spines; the primary spines are longer than the secondary spines (Figures 1 & 2).

Acanthopsis pagodiformis could be confused with three other species to which it is probably closely related. All four are subshrubs with broad, sessile inflorescences and distinctly glandular bracts (Figure 5). Two species (*A. hoffmannseggiana* (Nees) C.B. Clarke and *A. pagodiformis*) are in the so-called ‘dense spike group’ (Steyn & Van Wyk 2015), while the other two (*A. glandulopalmata* H.M. Steyn and *A. tetragona* H.M. Steyn subsp. *tetragona*) are in the group with ‘semi-dense spikes’ (Steyn & Van Wyk 2017a, b). Three of the species, with the exception of *A. hoffmannseggiana*, occur in the northeastern Richtersveld. These four species can be distinguished using the key on pg. 150 (Steyn 2018).



FIGURE 5.—*Acanthopsis* species with broad, sessile inflorescences and glandular bracts. a, *A. hoffmannseggiana*; b, *A. glandulopalmata*; c, *A. pagodiformis*; d, *A. tetragona* subsp. *tetragona*. Photographs: a, b, H.M. Steyn; c, M. Koekemoer; d, S.P. Bester.

Key to similar looking *Acanthopsis* species (Steyn 2018):

- 1a Middle to upper floral bracts ending in 3 ovate, mucronate to spinose lobes (Richtersveld, Northern Cape) *A. tetragona* subsp. *tetragona*
- 1b Middle to upper floral bracts ending in 5(–7) primary spines 2
- 2a Plants annual to short-lived perennial acaulescent herbs or subshrubs; inflorescences (12–)15–18(–22) mm in diameter; bracts with secondary spines usually longer than primary spines (southern Namibia to Gordonia and Great Karoo, Northern and Western Cape) *A. hoffmannseggiana*
- 2b Plants biennial/perennial subshrubs; inflorescences 8–14 mm in diameter; bracts with secondary spines shorter than primary spines 3
- 3a Inflorescences 8–10(–12) mm in diameter; bracts palmate, ending in winged (lanceolate) primary spines; primary spines nearly always simple; corolla relatively large (28–32 mm long), tube 9–10 mm long (Richtersveld, Northern Cape) *A. glandulopalmata*
- 3b Inflorescences (10–)12–14 mm in diameter; bracts broadly ovate to wedge-shaped, ending in 5(–7) broadly winged (ovate) primary spines; primary spines usually compound; corolla smaller (24–26(–29) mm long), tube 8–9 mm long (Richtersveld, Northern Cape) *A. pagodiformis*

Additional specimen

South Africa, Northern Cape: Namaqualand District, Rooiberg, N slopes, 698 m (2817CD), 23 August 2012, Steyn 1885 (PRE).

Description.—Perennial, compact subshrub, 100–120 mm tall with very short internodes. Leaves sessile, base attenuate, petiole-like, with spines 2–5 mm long, conspicuous tufts of long, silky hairs in axils; lamina oblanceolate, (35–)40–55(–65) × 8–10(–12) mm, puberulent to hirsute with spreading short hairs also with subsessile and short glandular hairs; margin undulate, coarsely dentate-spinose, spines rigid, 3–5 mm long, yellow. Inflorescence sessile, dense to semi-dense, cylindrical spike, (35–)45–60(–90) mm long, (10–)12–14 mm in diameter. Bracts broadly obovate to wedge-shaped, 20–23(–27) mm long (including spines), lamina 12–16 mm long, base attenuate; lower bracts ending in 5(–7) primary spines; middle and upper bracts ending in 5 broad (winged) primary spines, central and lateral primary spines usually compound, with short marginal secondary spines; primary spines spreading to recurved in fruit; spines and lamina covered in glandular hairs, also with spreading short hairs abaxially and adaxially. Bracteoles linear, 8–11 mm long, silky hairy, also with glandular hairs. Calyx with dorsal sepal ovate, acuminate, 13–14 mm long, silky hairy, 5–7-veined; ventral sepal ovate, 10–13 mm long, silky hairy, 5–7-veined; lateral sepals 8–9 mm long, silky hairy, also with glandular hairs, often 3-veined from the base. Flowers purple with lemon-yellow throat; corolla 24–26(–29) × 9–10 mm, tube 8–9 mm long, central lobe wider than long, constricted at base, emarginate. Stamens with beige to orange-brown anthers, 2–3 mm long; filaments 6 mm long, glandular. Style with patch of glandular hairs at the base. Capsules 7–8 × 3 mm. Seeds 4 × 3 mm. Flowering time: August to October. Plate 2357.

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Barleria monticola

Acanthaceae

South Africa (and possibly Lesotho)

Barleria monticola *Oberm.* in *Annals of the Transvaal Museum* 15,2: 165–166 (1933); Pooley: 240 (2003); Pooley: 490 (2005); Retief & Meyer: 149 (2017). *B. ovata* E.Mey. ex Nees, pro parte, Clarke: 52 (1901).

The Acanthaceae Juss., nom. cons. is one of the largest flowering plant families with over 220 genera and between 2 500 and 4 000 species worldwide (Heywood et al. 2007; Mabberley 2008; Vollesen 2008, 2013) and is represented by 42 genera and ca. 375 species in southern Africa (Koekemoer et al. 2013; SANBI 2017). Members of the Acanthaceae are mainly found in tropical and subtropical regions and are mostly represented by annual and perennial herbs, shrubs and climbers, with relatively few trees (Heywood et al. 2007; Vollesen 2008, 2013).

A combination of the following, mainly morphological, characters is usually diagnostic for the family: opposite, decussate leaves with cystoliths (calcium oxalate crystals); leaves usually on swollen nodes; absence of stipules; presence of well-developed and conspicuous bracts; irregular flowers with one- or two-lipped corollas; two or four stamens; club-shaped, dehiscent capsules with two locules and a single row of ovules; and seeds borne on hook-like structures (retinacula). The family is known for the remarkable diversity in its pollen morphology and many genera can be recognised by a distinctive pollen type (e.g. Scotland 1993; Furness 1990, 1991, 1995, 1996; Daniel 1998).

The classification of the family followed here includes four subfamilies and six tribes and is a combination of the classification systems of Scotland & Vollesen (2000), Mabberley (2008), McDade et al. (2008) and is summarised by APW (2016). The genus *Barleria* L. is in the subfamily Acanthoideae, tribe Barlerieae and commemorates Jacques Barrelier, 1606–1673, a Dominican monk and French botanist (Pooley 2005). *Barleria* comprises ca. 300 species and is found in the warmer parts of Africa and Asia with a single species from Central America. The genus is well represented in southern Africa, especially in the northeastern parts, by ca. 69 species of which 65% are endemic to the region (Balkwill & Balkwill 1997).

Many characters in *Barleria* are highly variable, but the genus is defined by a combination of the following three characters: the presence of a four-lobed calyx consisting of two outer and two inner segments; spheroidal, honeycombed pollen; and a predominance of double cystoliths in the leaves (Balkwill & Balkwill 1997). Other characters include quincuncial aestivation of the flower bud; a relatively large, variously coloured corolla;

PLATE 2358.—1, flowering stem, $\times 1$; 2, habit; 3, bract, $\times 1$; 4, 5, dorsal and ventral sepals, $\times 1$; 6, bracteoles, $\times 1$; 7, lateral sepals, $\times 1$; 8, style, $\times 1$; 9, corolla, $\times 0.5$; 10, capsule showing retinacula, $\times 1$; 11, seed, $\times 1$. Voucher specimens: 1–9, *Condy* 282; 10, 11, *Flanagan* 1988, both in National Herbarium, Pretoria. Artist: Gillian Condy.

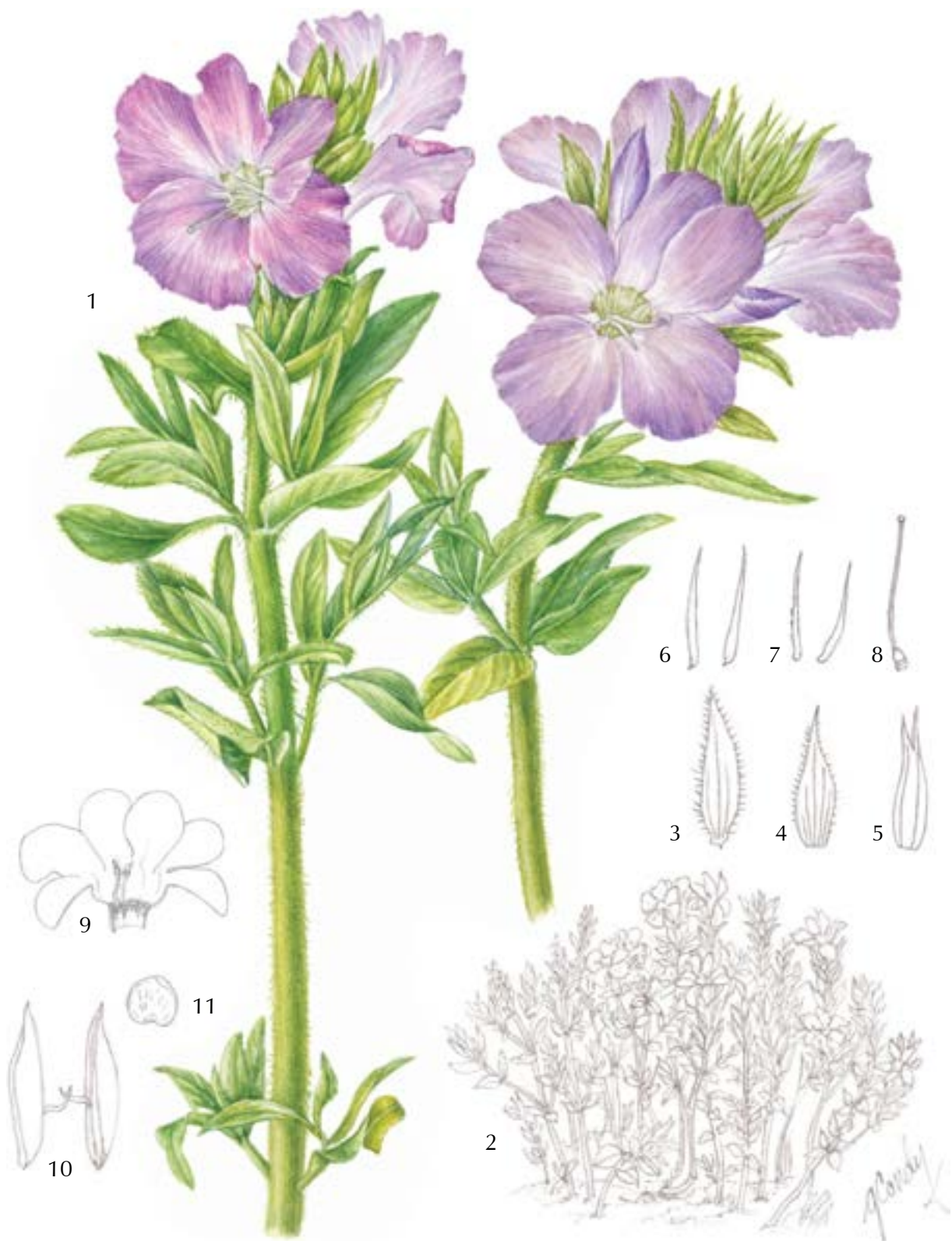


PLATE 2358 *Barleria monticola*

2–5 unequal stamens (including staminodes) inserted in the corolla tube; and seeds usually covered with hygroscopic hairs.

The general habit of *Barleria* species differs as a result of the geographical and climatological conditions, with the western species usually small (often procumbent), spinous plants with small coriaceous leaves. The eastern species, on the other hand, are profusely branched shrubs with herbaceous, well-developed leaves, usually without spines (Obermeyer 1933; Balkwill 1993).

Balkwill & Balkwill (1997) divided *Barleria* into two subgenera (mainly based on mature fruit and seed characters), namely subgenus *Prionitis* and subgenus *Barleria* which are subdivided into five and two sections respectively. Subgenus *Prionitis* is characterised by usually having two-seeded beaked or unbeaked capsules and a one-lobed stigma and subgenus *Barleria* by unbeaked, four-seeded capsules and a bilobed stigma. According to the classification of Balkwill & Balkwill (1997), *Barleria monticola* is a member of subgenus *Barleria* (section *Chrysothrix*). This section is characterised by compound inflorescences without prominent spines on the margins of the calyx; blue, white or yellow corollas; softly-textured leaves; and an indumentum of simple hairs, usually conspicuously yellow and adpressed (Balkwill & Balkwill 1997). In his contribution to *Flora zambesiaca*, Darbyshire (2015) transferred section *Chrysothrix* into section *Barleria*.

Barleria monticola is most similar to *B. ovata*, from which it differs most obviously in the shorter flared corolla tube with a ring of dense hairs at the base of the two fertile stamens (see Plate 2358) (vs. longer cylindrical corolla tube with a glabrous to sparsely hairy throat and four fertile stamens) (for more differences see Table 1). It might be problematic to distinguish between herbarium specimens of these two taxa especially if the specimens do not include mature, well-pressed inflorescences and notes on the altitude and flowering time. The oldest specimen of *B. monticola* in a SANBI herbarium was collected by J. Thode in

TABLE 1.—Comparison of characters used to distinguish between *Barleria monticola* and *B. ovata* (adapted from Obermeyer 1933)

Characters	<i>Barleria monticola</i>	<i>Barleria ovata</i>
Distribution	Drakensberg Mountains in Free State, KwaZulu-Natal; possibly Lesotho	Limpopo, Mpumalanga, KwaZulu-Natal; Swaziland
Altitude (m)	1 350–2 200	460–1 800
Plant height (mm)	(150–)400–450	300–500(–800)
Ventral (anticous) sepal	Deeply bifid	Shallowly notched or entire
Corolla throat at stamen insertion	Densely hairy	Glabrous to sparsely hairy
Corolla tube	Broadly funnel-shaped	Cylindrical to narrowly funnel-shaped
Corolla colour	Lilac to mauve	Blue to purple (some specimens creamy to bright yellow)
Flowering time	Mainly August–December	December–March
Stamens	2 fertile + 2 staminodes	4 fertile



FIGURE 1.—*Barleria monticola*: a, habit; b, c, terminal inflorescences showing mauve/lilac corolla with two fertile stamens. Photographs: S.P. Bester.

October 1892 from Natal (now KwaZulu-Natal). This species was described 41 years later by Obermeyer, with *Schweickerdt* TRV 29926 as the type specimen (Obermeyer 1933).

Barleria monticola is a cushion-shaped plant (Figure 1a) from moist grasslands (Grassland Biome) in the high mountains of the Free State and KwaZulu-Natal, South Africa (probably also from Lesotho) (Figure 2) at altitudes between 1 350–2 200 m. It is found in

the Sub-Escarpment Grassland, Mesic Highveld Grassland and Drakensberg Grassland bioregions of Mucina & Rutherford (2006) and grows up to 450 mm high, resprouting each spring from a woody rootstock. Plants can tolerate frost and flowering seems to be dependent on fires. They have bright green leaves and mauve or lilac flowers (Figure 1) and the nectar-rich flowers are known to attract butterflies and bees (Coulson 2015).

The specific epithet 'monticola' refers to the habitat of this species – found on high-lying areas (*monticola* = growing on mountains). *Barleria monticola* has a Red List status of LC (Least Concern) according to Raimondo et al. (2009).

Barleria monticola can be grown from seed and is recommended as a garden subject in the cooler parts of South Africa and Lesotho, however, fire is required to stimulate flowering.

Description (based on Obermeyer 1933).—Suffrutex, (150–)400–450 mm high; densely hairy with long tawny hairs. *Stems* squared, produced from protected, hibernating, partly subterranean buds (protective scales visible on base of fully grown branches). *Leaves* subsessile, lanceolate to ovate, 45–65 × 12–20(–25) mm, villous on both surfaces, more densely so on younger leaves; upper side with distinct cystoliths; leaves in inflorescence smaller, often glandular-pubescent. *Flowers* solitary, approximated into more or less distinct terminal spikes, 50–80(–100) mm long. *Bracteoles* linear to linear-lanceolate, 18 × 2 mm, glandular pubescent on outside. *Calyx* densely glandular pubescent on outside, enlarged in fruit; dorsal sepal oblong, tapering to apex, 7-nerved, 18 × 6 mm; ventral sepal similar to dorsal, but bifid to about $\frac{1}{3}$ of the way from apex, lobes diverging; inner sepals linear-lanceolate, 15 × 3 mm. *Corolla* lilac to mauve, puberulous; tube 15 mm long, lower part cylindrical, upper part broadly funnel-shaped, densely hairy on inside at insertion of stamens; limb subregular, longer than tube, spreading. *Filaments* hairy at base; 2 perfect stamens with fairly thick filaments, $\pm$ 9 mm long, anthers 7 mm long; 2 imperfect stamens with short filaments bearing rudimentary anthers. *Ovary* glabrous, 3 mm long; style filiform, 25 mm long, exserted; stigma capitate. *Capsule* glabrous, 25 × 10 mm. Plate 2358.

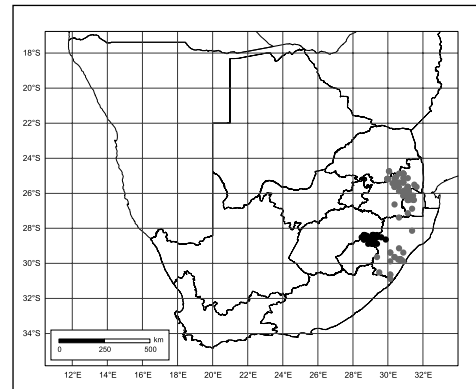


FIGURE 2.—Known distributions of *Barleria monticola* (●) and *B. ovata* (●) in southern Africa.

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PLATE 2359 *Senecio voigtii*

Senecio voigtii

Asteraceae: Asteroideae: Senecioneae

Eastern Cape and KwaZulu-Natal provinces, South Africa

Senecio voigtii Van Jaarsv., sp. nov. differs from *S. angulatus* L.f. by its shrubby, non-scandent growth, to 600 mm tall; 5-angled petioles often auriculate (or with a leaf-like stipule); leaf blade 35–65 × 25–50 mm, base truncate, hastate to subcordate, margin irregularly dentate, the teeth often with smaller teeth, sparingly pilose on both surfaces, rarely glabrous; corymb less branched and with slightly smaller capitula, 7–8 × 2.5 mm.

TYPE.—South Africa, Eastern Cape Province, 3227 (Stutterheim): Nahoon Dam, southern rocky slope, on fringe of forest in Buffalo Thicket Vegetation (Albany Thicket Biome), 166 m, (–DD), 11 April 2016, Van Jaarsveld & Voigt 26297 (NBC, holo.).

Senecio voigtii is a new shrubby succulent species (closely related to *S. angulatus*) from the dry river valleys in the Eastern Cape (Figures 1 and 2). It can immediately be recognised by its non-scandent, spreading ascending terete stems, 5-angled petioles, triangular hastate, irregularly toothed, sparingly pilose to glabrous leaves, and corymb of yellow capitula. The cultivar *Senecio voigtii* ‘Ezra’ is a variegated selection from the Kei River, discovered by Werner Voigt and named for his son, Ezra (Figures 3 and 4).

The Asteraceae are one of the best known plant families with a cosmopolitan distribution. It is also one of the two largest flowering plant families in the world with about 1 627 genera and almost 25 000 species (Christenhusz et al. 2017). The family is well represented in southern Africa with many succulent members (Van Jaarsveld 1988; Rowley 1994). The Asteraceae has been divided into three subfamilies, namely Barnadesioideae, Mutisioideae and Asteroideae – the latter by far the largest with 1 525 genera (Christenhusz et al. 2017). Other authors (Funk et al. 2009) recognise 13 subfamilies. The large cosmopolitan genus, *Senecio* (Senecioneae), was established by Linnaeus in 1753. *Senecio* consists of more than 1 600 species (Christenhusz et al. 2017), with a cosmopolitan distribution, most of which are annual or herbaceous perennials, ranging from dwarf geophytes to large shrubs, sometimes scandent. Within the Asteraceae family, just over 120 species, represented in 15 genera, have been recognised as being succulent (stems, leaves, roots) (Eggl 2002; Rowley 1994).

Senecio is well represented in southern Africa, especially in the winter-rainfall regions of the Western Cape and Northern Cape provinces of South Africa (Williamson 2010; Snijman 2013; Koekemoer et al. 2014). Of these, about 44 species are succulent (Herman et al. 1997; Van Jaarsveld & Visagie 2015). The genus has been restructured as a result of ongoing DNA investigation. Consequently, as is the case with so many other plant families, DNA evidence, within a multi-disciplinary approach, has resulted in separating distinct groups that had formerly been placed within *Senecio*. Examples include the genera *Caputia*

PLATE 2359.—1, flowering branch (left) and variegated clone of the cultivar *Senecio voigtii* ‘Ezra’ (right) from the Kei River, × 1; 2, leaves, × 1; 3, disc floret, × 1; 4, mature seed with feathery pappus, × 4.5. Voucher specimen: Voigt 642 in Compton Herbarium, Cape Town. Artist: Marieta Visagie.



FIGURE 1.—*Senecio voigtii* growing on a shale cliff in Valley Bushveld at the Nahoon Dam, Eastern Cape Province. Photograph: E.J. van Jaarsveld.

B.Nord. & Pelser and *Curio* P.V.Heath, of which all members are succulents (Nordenstam 2012; Nordenstam & Pelser 2012).

Senecio voigtii belongs to Scandentes, a section within the genus *Senecio* with mainly scandent shrubs, represented by nine species in South Africa (Harvey 1864). Of these, *S. angulatus*, *S. tamoides* DC., *S. bryoniifolius* Harv. and *S. macroglossus* DC. are succulent and frequently cultivated in South Africa and abroad. *Senecio voigtii* is most similar to *S. angulatus*, but is immediately distinguished by being much smaller and not a scandent shrub. Furthermore, the petioles of *S. voigtii* are 5-angled, and leaves are truncate to cordate at their bases and sparingly pilose or subglabrous. The bases of petioles are often auriculate and the stipules sometimes leaf-like – another distinctive feature separating it from *S. angulatus*. *Senecio angulatus* is a much larger, scandent shrub with glabrescent stems and leaves, the ovate to broadly ovate leaves have a distinct cuneate base and with slightly larger capitula and ray florets. *Senecio angulatus* grows extended branches of which the internodes lengthen, scrambling up other shrubs and trees. The midrib and veins are very prominent on the abaxial surface in *S. voigtii* and hardly raised in *S. angulatus*. *Senecio angulatus* and *S. voigtii* do sometimes occur sympatrically. Table 1 compares the two species.

At first glance, in its natural habitat, *Senecio voigtii* superficially resembles a species of *Plectranthus* with which it sometimes shares its habitat.

TABLE 1.—Comparison between *Senecio voigtii* and *S. angulatus*

Character	<i>Senecio voigtii</i>	<i>Senecio angulatus</i>
Habit	Spreading ascending shrublet, to 700 mm high	Scandent shrub, to 4 m tall
Pubescence	Sparingly pilose	Glabrous
Leaf blade size and shape	35–65 × 25–50 mm, triangular to triangular-ovate, base truncate, hastate to sub-cordate	40–60 × 27–40 mm, ovate to broadly ovate, base cuneate
Leaf margin	Irregularly dentate, often with smaller teeth (duplicato-serratus)	Angle-lobed, lobes short and broad
Capitula	7–8 × 2.5 mm, with spreading ray florets about 24 mm in diameter	9 × 4 mm, with spreading ray florets about 22 mm in diameter
Flowering time	Autumn and winter	Winter

Senecio voigtii has been known for a considerable time. It was collected in dry river valleys, from the Mtamvuna River in southern KwaZulu-Natal to the Nahoon River at East London in the Eastern Cape, and grown at the Kirstenbosch National Botanical Garden succulent collection. The plant was found by the author and his team exploring these rivers by rubber canoes, from the Keiskamma and Kei rivers (Figure 5) in the south to the Msikaba River in the north (just south of the KwaZulu-Natal border) (Figure 6). These dry, rocky, river valleys with poorly known vegetation are often fringed by high cliffs. The geology consists mainly of shales of the Karoo Supergroup, but in the northern part also mineral-poor quartzitic sandstone of the Natal Group (Keyser 1997). The vegetation consists of Eastern Valley Bushveld (Sub-Escarpment Savanna Bioregion), which is part of the Savanna Biome (Mucina & Rutherford 2006). These thickets and semi-deciduous woodlands are rich in succulent species. *Senecio voigtii* grows on steep, rocky embankments, mostly in partial shade. The climate is subtropical and, although cooler during winter, frost is absent. Rainfall ranges from 600–800 mm per annum, occurring mainly during the summer months as a result of convection, through thundershowers. However, some rainfall may occur during winter as a result of cold fronts moving in from the west.

At the Mbashe River (Figure 2), *Senecio voigtii* was found below steep shale cliff ledges growing with various other plants. Trees and shrubs include *Bauhinia bowkerii*



FIGURE 2.—*Senecio voigtii* growing along the Mbashe River, Eastern Cape Province. Photograph: E.J. van Jaarsveld.



FIGURE 3.—*Senecio voigtii* 'Ezra', the striking variegated clone. Photograph: E.J. van Jaarsveld.

Harv., *Cussonia spicata* Thunb., *Encephalartos altensteinii* Lehm., *Commiphora harveyi* (Engl.) Engl., *Ficus burtt-davyi* Hutch. Associated succulents included *Aloe pluridens* Haw., *A. reynoldsii* Letty, *Aptenia cordifolia* (L.f.) Schwantes, *Delosperma laxipetalum* L.Bolus, *Plectranthus madagascariensis* (Pers.) Benth., *Cotyledon pendens* Van Jaarsv., *C. petiolaris* Van Jaarsv., *Fockea edulis* (Thunb.) K.Schum., *Chlorophytum comosum* (Thunb.) Jacques, *Bulbine thomasiae* Van Jaarsv., *Gasteria excelsa* Baker, *Crassula multicava* Lem. and *Pelargonium acraeum* R.A.Dyer.

At the Nahoon Dam (Figure 1), plants were collected on a south-facing slope on a shale bank in the shade of various tree species: *Calodendrum capense* (L.f.) Thunb., *Cussonia spicata*, *Euphorbia triangularis* Desf., *E. tetragona* Haw., *Ficus burkei* (Miq.) Miq., *F. ingens* (Miq.) Miq., *F. burtt-davyi* Hutch., *Harpephyllum caffrum* Bernh. ex



FIGURE 4.—The Kei River in the Eastern Cape Province, habitat of *Senecio voigtii*. Photograph: E.J. van Jaarsveld.



FIGURE 5.—Werner Voigt (left) and Ricardo Riddles (right), both from the Karoo National Botanical Garden, Worcester, South Africa, in a rubber canoe on the Kei River. Werner, curator of the Karoo National Botanical Garden, discovered and collected the variegated cultivar *Senecio voigtii* 'Ezra'. Photograph: E.J. van Jaarsveld.

Krauss, *Portulacaria afra* Jacq., *Schotia latifolia* Jacq. and *Commiphora harveyi* (Engl.) Engl. Smaller associated succulents include *Aloe pluridens* Haw., *Aloiampelos ciliaris* (Haw.) Klopfer & Gideon.F.Sm., *Crassula lactea* Sol., *C. ovata* (Mill.) Druce, *C. multicava*, *C. perforata* Thunb., *Dracaena aletriformis* (Haw.) Bos and *Plectranthus madagascariensis*.

Senecio voigtii honours Werner Voigt, curator of the South African National Biodiversity Institute's Karoo National Botanical Garden at Worcester, for his contribution towards rebuilding the succulent collections and adding new life to this famous garden. Werner has assisted the author (EJV) on several rubber boat expeditions to the Eastern Cape. He collected, on our Kei River expedition, a mutant, variegated branch of *S. voigtii* (Voigt 642 in NBC) which he propagated and distributed. This cultivar (Figure 3) is here named for his son 'Ezra', who was healed from leukaemia in 2017. Werner has been an ambassador for South African succulent plants, promoting them both in his

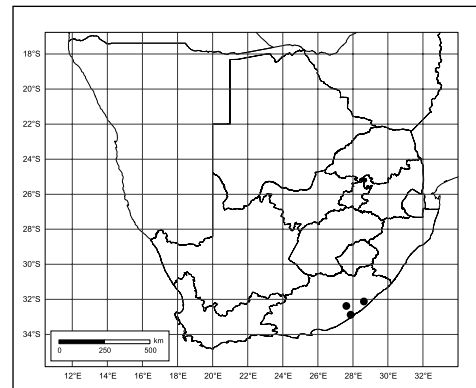


FIGURE 6.—Distribution of *Senecio voigtii* based on specimens in Compton Herbarium (NBC), Cape Town.

collections and many lectures to various societies. The generic name, *Senecio*, is derived from the Greek *senex*, meaning ‘old man’, which is in reference to the white hairs of the pappus resembling the beard of an old man (Clarke & Charters 2016).

Senecio voigtii is an attractive, small, evergreen succulent shrub that flowers during winter – ideal for dry Mediterranean-type gardens (Van Jaarsveld 2010). It grows relatively fast and can easily be propagated from stem cuttings. The cuttings will root in a sandy, well-drained mixture in autumn or winter. Plants are best used in sheltered areas with dappled shade, but also grow well in containers in a greenhouse.

Specimens of *Senecio voigtii* were studied in habitat and in cultivation at Babylonstoren Farm. The geographical distribution is mapped according to the grid reference system of Edwards & Leistner (1971). The description was prepared from living specimens in their habitat, as well as herbarium specimens in Compton Herbarium.

Additional specimens

SOUTH AFRICA, Eastern Cape Province, 3227 (Stutterheim): Variegated selected clone collected from along the rocky banks of the Kei River, in Eastern Valley Bushveld (savanna biome), (–BC), 14 April 2013, Voigt 642, 38/2013 (NBG).

SOUTH AFRICA, Eastern Cape Province, 3228 (Butterworth): Plakkieskrans, Mbashe River downstream from Collywobbles, (–BA), 29 April 2014, Van Jaarsveld & Mabuya 24771 (NBG).

Description.—Moderately branched, ascending evergreen succulent shrub, 300–600 mm high. Roots fibrous. Stems succulent, terete, 5–7 mm in diam., sparingly pilose at first becoming glabrescent, green becoming purplish. Leaves succulent, ascending spreading, alternately arranged, petiolate; petiole 22–55 mm long, often with an auricle or 3-lobed leaf-like stipule to ± 10 mm long at the base of the petiole; blade triangular to triangular ovate, 35–65 $\times$ 25–50 mm, surface sparingly pilose, more so on the veins; veins sparingly pinnate; apex acute; base truncate, hastate to subcordate; margin irregularly dentate, teeth often doubly serrated (duplicato-serratus – with smaller teeth). Inflorescence 200–300 mm high, corymbose; peduncle purplish-green, 2–3 mm in diam., branched with ± 8 –15 radiate heads. Capitula 7–8 $\times$ 2.5 mm, ± 24 mm in diam. across spreading ray florets. Involucre green; bracts in one series, linear, 5 $\times$ 1 mm, opening in a flat bicycle wheel shape when releasing seed with 12–13 spikes, calyculus (outer bracts) 5, inconspicuous, linear triangular, acute, 1.7 mm long. Ray florets with corollas spreading recurved, yellow, oblong obovate, 10 $\times$ 3–4 mm. Disc florets bisexual, corollas tubular, yellow, 5 mm long. Flowering time: autumn and winter, seeds released during spring. Plate 2359.

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Caputia tomentosa

Asteraceae: Asteroideae: Senecioneae

South Africa

Caputia tomentosa (Haw.) B.Nord. & Pelser in Comp. Newsl. 50: 65 (2012). *Kleinia tomentosa* Haw.: 314 (1812); Berger: 35 (1905); Berger: 390 (1910); Berger: 154 (1931); Marloth: 269, t.68 (1932); Van Laren: 94, fig. 126 (1934); Brown: 130 (1945); Higgins: 64, t.23 (1949); Butterfield: 153 (1954). *Cacalia tomentosa* Haw.: 189 (1803) non Jacq. (1775). *Cacalia canescens* Willd.: 56 (1814). *Cacalia haworthii* Sweet: 336 (1830). *Kleinia haworthii* DC.: 338 (1838); Harvey: 318 (1865). *Kleinia cana* DC.: 338 (1838); Harvey: 319 (1865). *Senecio haworthii* (Sweet) Steudel: 561 (1841); Jeffrey: 934 (1986). *Senecio quinquangulatus* Sch.Bip.: 500 (1845). *Senecio haworthii* (DC.) Sch.Bip.: 500 (1845); Hooker: t.6063 (1873); Jacobsen: 832 (1960); Rowley: 37 (1967a); Rowley: 39 (1967b); Jacobsen: 368, t.130.2 (1974); Rowley: 102 (1994); Rowley: 34 (2002); Smith et al.: 197 (2017a).

The Asteraceae (the daisy family) have a cosmopolitan geographic distribution and with between 25 000 and 30 000 species, it is the largest family of flowering plants. In southern Africa the daisy family has also diversified extensively and some 2 000 species – just less than 10% of the global total – have been recorded in the region. Locally, the Asteraceae are especially well known for being the main contributor to the remarkable spring wild flower display in Namaqualand and surrounding areas along South Africa's western, Atlantic coastline.

As can be expected of a family that includes thousands of species, a vast range of life and growth forms is found among the daisies. Daisy species are annual or perennial herbs, shrubs, or trees. In the western arid, winter-rainfall areas of southern Africa many species have opted for leaf, stem, or caudiciform succulence as a survival strategy in a region that has very hot, dry summers. Succulence is found among about 100 daisy species that belong especially to *Kleinia* Mill. (formerly included in *Senecio* L.) and *Othonna* L., with succulence also present in several other smaller genera (Smith et al. 1997).

Even when not in flower, *Caputia tomentosa* (*tontelbos* in Afrikaans) is an especially attractive and distinctive succulent plant, and so it is surprising that it has not previously been featured in this illustrated series. Its absence from these pages can perhaps be explained by the reticence of some clones to flower in cultivation, particularly when grown under glass in the suboptimal conditions of northern Europe. Despite this and even though their capitula lack ray florets, the discoid heads with butter-yellow disc florets are no less attractive than the downy white leaves.

Caputia tomentosa has a very long and complex taxonomic and nomenclatural history, only summarised here. This species was first described as *Cacalia tomentosa* Haw. (Haworth 1803), but this name is predated by *Cacalia tomentosa* Jacq. (Jacquin 1775). Haworth (1812) transferred the species to *Kleinia*, but with the illegitimate combination *Kleinia tomentosa* Haw.



PLATE 2360 *Caputia tomentosa*

Nordenstam & Pelsner (2012) therefore treated *Kleinia tomentosa* Haw. 'as a new name dating from 1812 and not a new combination since the earlier potential basionym [Haworth 1803] is illegitimate'. This name, however, was adopted by many subsequent authors who separated many species of succulent Asteraceae from the broad concept of *Senecio*, for which the binomial *Senecio haworthii* (DC.) Sch.Bip. was published in 1845.

There has been much debate on the generic placement of most succulent Asteraceae with the result that the genus *Kleinia* Miller (1754) has not been universally accepted. Rowley (1967a, b, 1994, 2002) adopted a broad approach to *Senecio*, notably in his book *Succulent Compositae*, resolutely ignoring *Kleinia*. However, taxonomic tides tend to turn and Jeffrey (1986), emphasising morphological evidence, resuscitated the succulent genus *Kleinia* containing ca. 40 taxa. More recently, molecular evidence (Pelsner et al. 2007, 2010) supports the fragmentation of the huge genus *Senecio* into many segregates including an entity that approximates to *Kleinia*. *Caputia tomentosa*, however, belongs to a distinct clade within the Senecioneae for which the new generic name *Caputia* B.Nord. & Pelsner was subsequently published (Nordenstam & Pelsner 2012). Pelsner et al. (2010) had earlier interpreted the incongruent phylogenetic position occupied by *Caputia* to relate to an ancient hybridisation event, a notion supported in part by morphological data. As originally conceived, this new genus contained just four species confined to South Africa and Swaziland, all succulent perennial herbs with more or less fleshy tomentose or glabrescent leaves. The generic name commemorates the old geographical name *Caput bonae spei*, applied to the Cape of Good Hope, Cape Province, South Africa, or even to the whole of southern Africa. A fifth species (*C. oribiensis* (Van Jaarsv.) J.C.Manning) was added just a year later (Manning 2013). Our species became *Caputia tomentosa* (Haw.) B.Nord. & Pelsner, whose authors regarded *Kleinia tomentosa* Haworth (1812) as a new name not based on the illegitimate earlier name of *Cacalia tomentosa* Haworth (1803).

Caputia tomentosa has acquired a number of other synonyms. *Kleinia cana* DC., for example, was described as a distinct species with shorter and stouter leaves. This was dismissed as phenotypic variation and reduced into synonymy by Marloth (1932).

Further consideration of its history provides fascinating insights to this succulent. Haworth (1812) wrote that this plant had been introduced into cultivation in 1795 and that 'this extraordinary plant has not yet produced any flowers with me. It is completely enveloped in a short dense skin-like cover of cottony wool, which is even capable of being stripped off the leaves like a skin, leaving the leaves themselves green after being divested of it. This cotton, if lighted in the flame of a candle ... slowly consumes in the manner of touch-paper; owing to the resinous quality this genus abounds in. *C. [K.] tomentosa* is capable of living very long without water, as are also other woolly succulents ...' In being difficult to flower, this *Caputia* finds good company with several succulent introductions from southern Africa that grew well in Europe for decades before yielding a single bloom. *Crassula arborescens*, described initially as a species of *Cotyledon*, is another notable such example (Smith et al. 2017b).

It is worth emphasizing that Haworth (1812) placed his new species in two different genera without any knowledge of its flowers. The tardy flowering performance of this species in the northern hemisphere appears to be a persistent feature, for over a half-century



FIGURE 1.—*Caputia tomentosa* in flower in the Conservatory of the Kirstenbosch National Botanical Garden, Cape Town. Photograph: N.R. Crouch.

later Harvey (1865) would document that the flowers were still not known. In fact, the first description and illustration of the reproductive parts appear to be by Hooker (1873), based on a plant that flowered in the garden of Thomas Hanbury at Palazzo Orengo (now well known as La Mortola) near Ventimiglia on the Italian Riviera. Rowley (1967a, b) next recorded flowering in London. He was astonished when one of his plants ‘burst into bloom in a small, grimy London glasshouse in the wet autumn of 1966’. In contrast, flowering (Figure 1) and fruiting (Figure 2) in the conservatory in the Kirstenbosch National Botanical Garden appears to be a regular occurrence.

Caputia tomentosa is unique in the genus in having a dense silvery-white persistent tomentum and disciform capitulum. The other four species, *Caputia medley-woodii* (Hutch.) B.Nord & Pelsner, the type species, first described in this journal (Hutchinson 1923) (Figure 3); *C. oribiensis*; *C. pyramidata* (DC.) B.Nord. & Pelsner; and *C. scaposa* (DC.) B.Nord. & Pelsner (also included here by Dyer 1931) are in contrast all araneose-tomentose or glabrescent, and with prominently radiate capitula (Nordenstam & Pelsner 2012). Of these close relatives, the most recently discovered species, *C. oribiensis*, is closely related to *C. medley-woodii*, but has spatulate leaves arranged in dense terminal rosettes (Van Jaarsveld 2011). *Caputia oribiensis* has a very narrow distribution range, being endemic to the Oribi Gorge in southern KwaZulu-Natal, whereas its sister species, named for John Medley Wood, is more widespread in the Eastern Cape, KwaZulu-Natal, and neighbouring Swaziland.



FIGURE 2.—*Caputia tomentosa* in fruit in the Conservatory of the Kirstenbosch National Botanical Garden, Cape Town. Photograph: N.R. Crouch.



FIGURE 3.—*Caputia medley-woodii*, the type species of the genus, which in contrast to *C. tomentosa* lacks densely woolly leaves and possesses capitula with prominent ray florets. Photograph: N.R. Crouch.

As a typical leaf succulent that contains aerial water-storing tissues, it is to be expected that *Caputia tomentosa* would have evolved mechanisms to protect its stockpile of this essential resource, considering the extreme aridity of at least some of its natural habitats. Commonly, succulents that grow in such regions have thickened outer epidermal cell walls, a thick cuticle, and often even epicuticular waxes (Von Willert et al. 1992). Examples of succulents rendered virtually pure white by such protective waxes abound: the Madagascan *Kalanchoe pumila* Baker and *Dudleya saxosa* (M.E.Jones) Britton & Rose subsp. *col-lomiaae* (Rose) Moran from Arizona, USA, both Crassulaceae, being well-known examples. The papery-scaled members of *Anacampseros* (Anacampserotaceae) also come to mind. Hairy leaves are, however, much rarer among succulents than those with a waxy bloom. The presence of hairs on leaf surfaces, such as abound in *C. tomentosa*, fulfils a role similar to that of wax in preventing excessive water loss. It also protects plants against damage by UV-radiation (Von Willert et al. 1992).

Caputia tomentosa is generally an easy subject in cultivation. Higgins (1949) noted that it 'is inclined to grow leggy and lose its lower leaves; if this occurs the tops of the branches can be cut off and re-rooted and the old plants will probably break again from the base'. Rowley (1974) described *C. tomentosa* [*Senecio haworthii*] as being 'surely the whitest of all white succulents', a statement emphasizing the attractiveness to growers of this remarkable succulent (Figure 4). There are at least two named cultivars. The first, 'Cass's Variety' (Figure 5) was named by Brown (1945) for a mutant that originated in the nursery of



FIGURE 4.—*Caputia tomentosa* growing in the Conservatory of the Kirstenbosch National Botanical Garden, Cape Town. Photograph: N.R. Crouch.



FIGURE 5.—*Caputia tomentosa* 'Cass's Variety' in cultivation in Scotland. Plant ca. 350 mm tall growing in a 140 mm diameter pot. Photograph: C.C. Walker.

Charles L. Cass in San Diego, describing it as 'distinct from the type by its more robust growth. The leaves are more erect and incurving, longer and broader, flattened on the face, more obtusely pointed, the base of leaves never narrowing into a petiole. The leaves and stems are whiter due to the thicker felt-like covering'. The second, 'Hans Herre', has cylindrical leaves near the base, expanding above into a flattened wedge-shaped tip with low notches (Rowley 1994). This cultivar was named by Rowley (1967b) in honour of the mesemb expert and intrepid explorer Hans Herre, who originally collected it at the top of the Karrachab Mountains in the Richtersveld. Unfortunately, this very attractive plant has proven tricky in cultivation and slow to propagate (Rowley 1994), and no longer exists in at least European collections.

Caputia tomentosa is a South African endemic that flowers between November and March, and prefers a rocky slope habitat (Figure 6). It has a wide distribution from the southern Richtersveld in the Northern Cape, southwards to the Great Karoo where it may be found, for example, near Laingsburg and in the Camdebo, and with outlying populations in the more mesic western parts of the Eastern Cape Province (Marloth 1932; Nordenstam & Pelter 2012; Herman et al. 2013) (Figure 7). It is not known from the generally less arid Core Cape floral region.



FIGURE 6.—The habitat of *Caputia tomentosa* in the Richtersveld National Park (July 2010). Photograph: A.W. Klopper.

Apart from *tontelbos*, it is recorded by Smith et al. (2017a) as having the additional Afrikaans common name of *kapokmadeliefie*, while in English it is known as snow daisy in South Africa, and is documented (Watt & Breyer-Brandwijk 1962) to contain inulin and be used to treat chest complaints.

Description.—Perennial, evergreen, sparsely to densely branched shrublets, 0.5(–1.2) m tall, stems erect, 10–15 mm in diameter, virtually all aboveground plant parts covered by a bright white tomentum. *Branches* erect to leaning to creeping, usually branching from near the base, often leafless below and branching at tips, white-felted when young. *Leaves* sessile, fusiform-cylindrical, or biconvex, distinctly tapering at both ends, densely to subdensely arranged along branches, particularly crowded at tips, white-tomentose, 20–40(–60) × 6–15 mm; apex pointed or rarely slightly notched. *Inflorescence* a solitary, terminal, disciform capitulum; peduncle white-felted, to 150 mm long; involucre cylindrical-campanulate, 15–20 mm in diameter; phyllaries 10–15, uniserial, obtuse, fleshy, 15–20 × 3–5 mm; calyx bracts 1–3, resembling the peduncular bracts; ray florets absent; disc florets up to

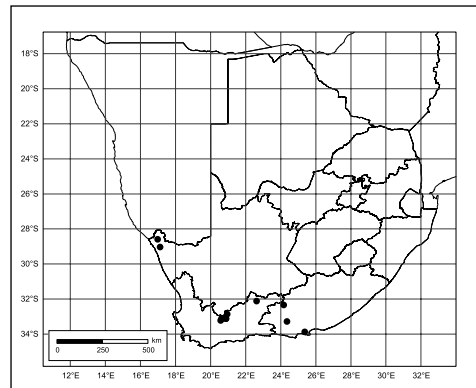


FIGURE 7.—Known distribution of *Caputia tomentosa*.

40, marginal florets female, filiform, bright yellow; hermaphrodite; corolla tubular, 5-lobed; lobes triangular-ovate, apically subcucullate and papillate. *Anthers* basally obtuse, shortly sagittate. *Style* bifurcate, apically subtruncate. *Cypsel*a ellipsoid-oblong, densely puberulous basally. *Pappus* to 15 mm long, white, barbellate. *Chromosome number* $2n = 20$ (Arano 1977). Plate 2360.

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Guide for authors and artists

INTRODUCTION

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

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

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

AUTHORS

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

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

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

Manuscripts should be **submitted electronically** by June 2020 to the editor and should conform to the general style of the most recent issue of FPA. From Volume 58 onwards, literature references are treated as described under headings 1, 2 and 3 further on.

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

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

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

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

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

ARTISTS

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

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

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

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

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

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

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

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