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The Cape genus *Micranthus* (Iridaceae: Crocoideae), nomenclature and taxonomy

P. GOLDBLATT[1,3], J.C. MANNING[2,3] & R.E. GEREAU[4]

Keywords: Cape flora, Iridaceae, *Micranthus*, new species, nomenclature, taxonomy

ABSTRACT

The genus *Micranthus* (Pers.) Eckl., has traditionally been treated as comprising three species, all with virtually identical, bilaterally symmetric, deep or pale blue to white flowers arranged in crowded, 2-ranked spikes and with divided style branches, but differing in their foliage. Examination of plants in the field and herbarium shows that there are four additional species. *M.* **filifolius** Goldblatt & J.C.Manning, from the Caledon District of the southwestern Western Cape, has up to six, filiform leaves, the blades of at least the lowermost terete and cross-shaped in section, and usually pale blue-mauve flowers. *M.* **simplex** Goldblatt & J.C.Manning from high elevations on Zebrakop, Piketberg, has the smallest flowers in the genus, white but tinged lilac as they age, linear leaves up to 1.5 mm wide, and undivided style branches. *M.* **cruciatus** Goldblatt & J.C.Manning, from the northern Cedarberg and Bokkeveld Mtns, has up to four leaves, the lower with linear or terete blades with heavily thickened margins and central vein and relatively large flowers, unusual in having the style dividing at the mouth of the perianth tube into particularly long branches, these deeply divided as is typical of the genus. *M.* **thereianthoides** Goldblatt & J.C.Manning, from the Paardeberg south of Malmesbury, is unique in the genus in having flowers with an elongate perianth tube. We also document the occurrence of large populations of putative hybrids at some sites. We provide a complete revision of *Micranthus* with original observations on leaf anatomy, pollen morphology and reproductive biology and discuss its confused taxonomic and nomenclatural history and that of the three common species of the genus, known for over 150 years. In so doing, we neotypify *Gladiolus alopecuroides* L. (1756) [= *Micranthus alopecuroides* (L.) Eckl. (1827)], type of the genus, and choose lectotypes for *M. plantagineus* Eckl. var. *junceus* Baker (1892) and *Gladiolus fistulosus* Jacq. Now with seven species, *Micranthus* remains endemic to the Cape flora region, extending from its extreme northern limit in the Bokkeveld Mtns south-eastwards to Port Elizabeth. We also deal with the genera *Paulomagnusia* Kuntze and *Beilia* Kuntze with which *Micranthus* has sometimes been associated, although both are nomenclatural synonyms of *Thereianthus* G.J.Lewis, a genus close allied to *Micranthus*.

INTRODUCTION

Micranthus (Pers.) Eckl., endemic to the Cape flora region of South Africa, was first recognized as a genus when Ecklon (1827) raised *Gladiolus* subgen. *Micranthus* Pers. to generic rank. He admitted three species to the genus, in this order: *M. plantagineus* Eckl., *M. alopecuroides* (L.) Eckl. (based on *Gladiolus alopecuroides* L.), and *M. fistulosus* Eckl. The names *M. fistulosus* and *M. plantagineus* appear to be implicit references respectively to *Gladiolus fistulosus* Jacq. (1797) and *Ixia plantaginea* Aiton (1789), the latter a superfluous name for *G. alopecuroides*. An indirect reference opposite the genus name '*Watsonia* Link', leads to Link (1821), in which *Watsonia plantaginea* Ker Gawl. (1803) is listed, and this work in turn cites *Ixia plantaginea*. We thus treat *M. plantagineus* Eckl. as a new name in *Micranthus* with its type that of *Ixia plantaginea*. We find no such indirect reference for *M. fistulosus* and the name must continue to be regarded as a nomen nudum and therefore invalid.

Until now, *Micranthus* has included just three species (Lewis 1950; Goldblatt & Manning 2000): *M. alopecuroides*, *M. tubulosus* (Burm.f.) N.E.Br. (1929) [with *Gladiolus fistulosus* a heterotypic synonym], and *M. junceus* (Baker) N.E.Br. (1929) [a combination based on *M. plantagineus* var. *junceus* Baker (1892) and a later name for *M. plantagineus* Eckl.]. *Micranthus* (Pers.) Eckl. (1827), itself a later homonym, is conserved against *Micranthus* J.C.Wendl. (1798), a genus of Acanthaceae, with *Gladiolus alopecuroides* L. (*M. alopecuroides* (L.) Eckl.) as its conserved type (Rickett & Stafleu 1959: 241; McNeill *et al*. 2006: 272).

These three species of *Micranthus* are mostly readily distinguished by their leaf morphology: *M. alopecuroides* has plane, ± lanceolate to falcate leaves with an evident main vein (Figure 1A); *M. tubulosus* has two or more short, inflated, terete, hollow (fistulose), falcate leaves, usually half as long as the stem (Figure 1E); and *M. plantagineus* is a taller plant with long, terete, hollow, straight foliage leaves (Figure 1F). All three species have apparently identical, small, mid to deep blue (sometimes described as violet), blue-mauve or occasionally white, bilabiate flowers arranged in congested, 2-ranked spikes subtended by dry, brittle bracts with broad membranous margins. The corms, capsules, and specialized, narrow, 3-sided, elongate seeds are also similar in all three species. Apart from their leaf differences, each species shows a modest preference for a different habitat: *M. alopecuroides* is most often found on sandy ground; *M. tubulosus* on dry, usually shale- or granite-derived soils; and *M. plantagineus* in wet habitats, often in marshes, seeps or along streams, most often in sandy or peaty soils. That said, we have seen two or even all

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three species growing together locally with only very small habitat differences, if any, so habitat preferences are far from absolute.

Several additional populations of *Micranthus* extend the range of leaf morphology in the genus. Plants at high elevations in the Piketberg (*Goldblatt & Manning 10172*, MO, NBG) have narrow, straight to falcate leaves ± 1 mm wide with one or more strongly thickened veins, small, white flowers fading pale lilac, and undivided style branches. These plants grow in an unusual habitat for *Micranthus*, crevices and shallow pockets of soil on wet sandstone rocks.

A second series of populations (e.g. *Goldblatt 10438* MO, NBG) from the northern Cedarberg and Bokkeveld Mtns has long, slender, linear leaves with a heavily thickened main vein and equally thick margins, thus often cross-shaped in transverse section (Figure 1D). These slender, often tall, plants also stand out in having the style dividing at the mouth of the perianth tube, with unusually long style branches divided for less than a

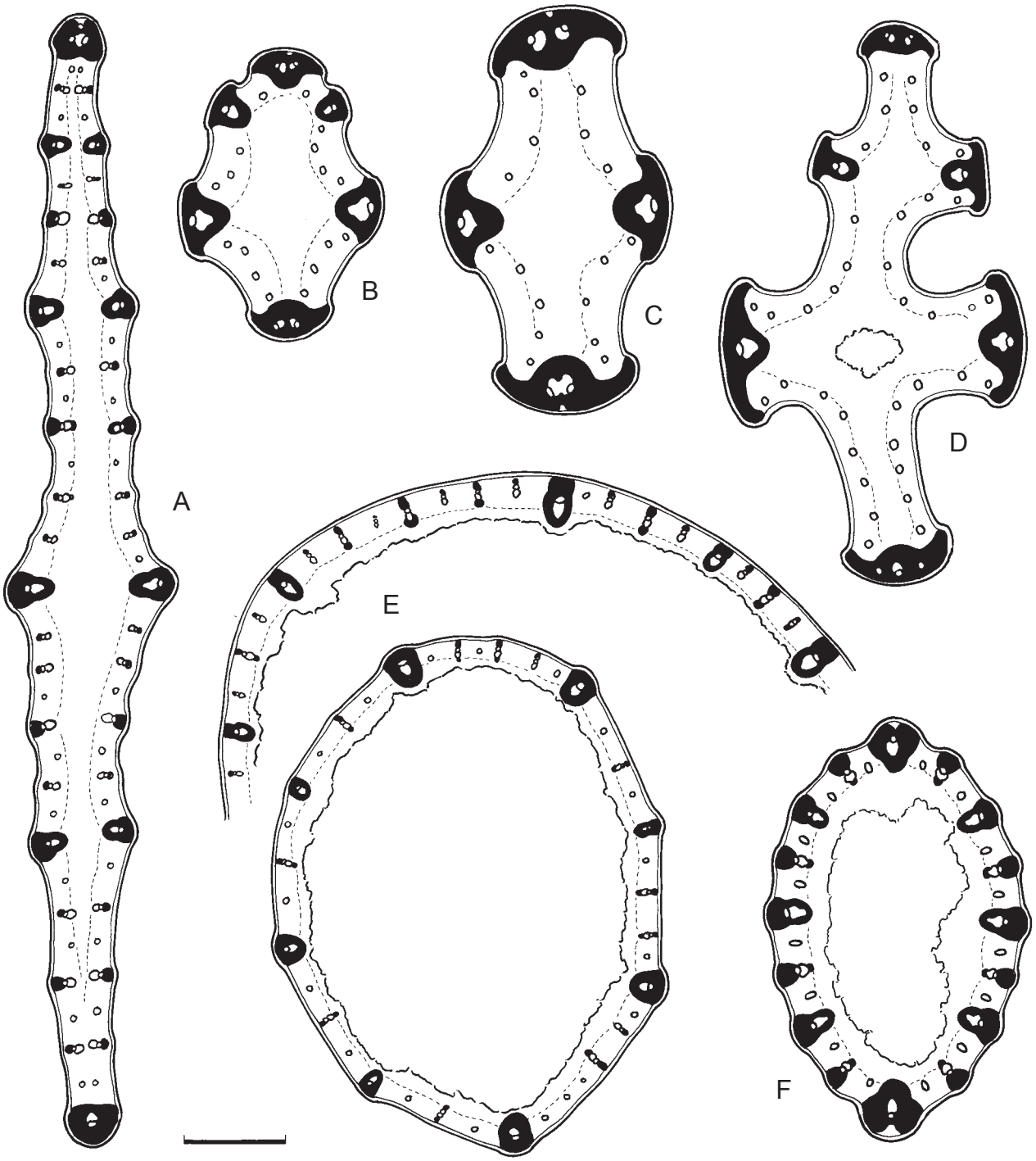


FIGURE 1.—Leaf anatomy in *Micranthus*. A, *M. alopecuroides*, Elandsberg Nature Reserve, *Goldblatt & Manning 13616*; B, *M. filifolius*, Kogelberg, no voucher; C, *M. filifolius,* Drayton, *Goldblatt & Manning 13623*; D, *M. cruciatus*, Pakhuis, *Goldblatt & Porter 13766*; E, *M. tubulosus*, Rondebosch Common, *Goldblatt & Manning 13620*; F, *M. plantagineus*, Drayton, *Goldblatt & Manning 13632.* Scale bar: 500 µm.

quarter of their length. They grow in seasonally marshy sites in peaty soil, often in moss on sandstone pavement, and appear to flower particularly well after fire.

A third series of populations from the Caledon District of Western Cape has up to 6 leaves with linear to filiform blades, often cross-shaped in section (Figure 1B, C), with the bases persisting in a well-developed fibrous neck. These plants grow on stony, loamy clay or sandy soils, usually in well drained sites that are dry at flowering time.

Lastly, a population from the Paardeberg south of Malmesbury, only discovered in 2012, has hollow leaves reminiscent of those of *Micranthus tubulosus* but is unique in the genus in having dark blue flowers with an elongate perianth tube, 20–22 mm long, thus more than twice as long as in any other species of *Micranthus*.

Consistent treatment of the genus suggests that these divergent populations should logically be recognized as separate species. The circumscriptions of the existing species cannot be expanded to accommodate these plants. We describe these new species as *Micranthus cruciatus* Goldblatt & J.C.Manning, *M. filifolius* Goldblatt & J.C.Manning, *M. simplex* Goldblatt & J.C.Manning and *M. thereianthoides* Goldblatt & J.C.Manning. Other variants, which we believe are interspecific hybrids, occur locally and we discuss these below. One of them, evidently *Micranthus plantagineus* × *M. tubulosus*, is particularly common at the foot of the Elandskloof Mtns. Plants have a flexuose stem, terete, hollow leaves and short spikes of up to 10 flowers, and appeared at first to be a separate species, so different were they from their putative parents.

We review the nomenclature of *Micranthus*, choose types for the two species currently lacking designated types, and present a systematic revision, thus dealing with collections that do not accord with the current circumscriptions of the three species included in the genus. We also deal with *Paulomagnusia* Kuntze (1891). When described, *Paulomagnusia* included two species, one a *Micranthus* and the other, *P. spicatus* (L.) Kuntze, now the type species of *Thereianthus* G.J.Lewis (1941). Our revision includes new observations on leaf anatomy, pollen morphology, and reproductive biology and pollination; these presented following the generic description and nomenclature.

TAXONOMIC HISTORY AND RELATIONSHIPS

Micranthus is most closely allied to *Thereianthus*, also endemic to the Cape flora region. Lewis (1950) first pointed out an unusual, specialized feature shared by the two genera, namely that the lowermost foliage leaf is inserted on the flowering stem as it is in *Lapeirousia* Pourret, also in tribe Watsonieae Klatt, rather than on the corm. This means that the corm tunics are formed solely from the cataphylls, without any contribution from the leaf bases as is found in *Watsonia* Mill. and some other members of the tribe. Molecular systematic studies of plastid DNA sequences confirm the immediate relationship of the two genera, which together are sister to *Watsonia* plus *Pillansia* L.Bolus (Reeves *et al.* 2002; Goldblatt *et al.* 2008), with *Lapeirousia* (*sens lat.*) retrieved as member of a second clade of the tribe, which includes *Cyanixia* Goldblatt & J.C.Manning and *Savannosiphon* Goldblatt & Marais. The close relationship of *Micranthus* and *Thereianthus* is reflected in their largely shared taxonomic and nomenclatural history.

Although *Micranthus* was maintained by most authors dealing with the genus since its recognition at generic rank by Ecklon (1827), species now recognized as *Thereianthus* have had a more chequered history, beginning with Ecklon (1827), who placed two species of that genus in '*Beilia*', then lacking a validating description. Although species of *Micranthus* and *Thereianthus* had first been referred respectively to *Ixia* L. or to *Gladiolus* L., they were included by Ker Gawler (1804) in *Watsonia*, largely because they share divided style branches with that genus. Their nomenclature subsequently became intertwined. Heynhold (1847) included the two species of *Thereianthus* known at that time in *Micranthus* as *M. spicatus* (L.) Heyn. and *M. triticeus* (Thunb.) Heyn. The British botanist and specialist in the taxonomy of Iridaceae, Baker (1877), recognized *Micranthus* in its current sense and included one species of *Thereianthus* in *Watsonia* unranked *Beilia* Eckl. ex Baker, as *W. punctata* (Andrews) Ker Gawl. (now *Thereianthus bracteolatus* (Lam.) G.J.Lewis). Baker (1892) later formalized *Watsonia* unranked *Beilia*, then with several species, as *Watsonia* subgen. *Beilia* (Eckl. ex Baker) Baker. His German contemporary, Klatt (1882), completely misunderstood the situation, and in his worldwide account of the Iridaceae, he included two species of *Thereianthus* in *Micranthus,* as *M. spicatus* (L.) Klatt (evidently referring to what is now *T. spicatus* (L.) G.J.Lewis) and *M. triticeus* (Burm.f.[sic]) Klatt [he was evidently unaware of combinations in *Micranthus* for these species by Heynhold in 1847; we also assume that the basionym attributed to Burman fil. was an error for Thunberg, as *Ixia triticea* Burm.f. is a very different species, currently *Tritoniopsis triticea* (Burm.f.) Goldblatt]. Klatt (1882) also included one species of *Thereianthus*, *T. juncifolius* (Baker) G.J.Lewis, in *Anomatheca* Ker Gawl. as *A. calamifolia* Klatt, and several more in *Watsonia* unranked *Beila*. Usually astute, Klatt apparently made no reference to any species we now regard as belonging to *Micranthus* but partly corrected the error when he recognized *M. plantagineus* with one variety, var. *junceus* (Klatt 1894). *Thereianthus spicatus*, however, remained in *Micranthus*.

Kuntze (1891) included both what are now *Micranthus alopecuroides* and *Thereianthus spicatus* in his new genus *Paulomagnusia*, evidently intended as a *nomen novum* for the later homonym, *Micranthus* (Pers.) Eckl. 1827 (non *Micranthus* J.C.Wendl. 1798). This genus has now been conserved, although not against *Paulomagnusia*. Kuntze (1898) validated Ecklon's '*Beilia*' at generic rank as *Beilia* Kuntze, and included in the genus only *B. spicata* (L.) Eckl. ex Kuntze, which is thus its type. Unfortunately *Beilia* is superfluous because Kuntze listed the valid *Paulomagnusia* in synonymy. It remained for Lewis (1941), over a century after Ecklon (1827) used the invalid '*Beilia*', to erect the valid genus *Thereianthus* in which she placed the two species of Ecklon's '*Beilia*' and several more then included in

Watsonia. *Thereianthus* now has 11 species (Manning & Goldblatt 2011).

SYSTEMATICS

Micranthus *(Pers.) Eckl*., Topographisches Verzeichniss der Pflanzensammlung von C.F. Ecklon: 43 (1827), name conserved, non J.C.Wendl. (1898, Acanthaceae). *Gladiolus* subg. *Micranthus* Pers.: 46 (1805). *Hebea* subg./unranked *Micranthus* (Pers.) R.Hedw.: 24 (1806). Type (conserved): *Gladiolus alopecuroides* L. (= *M. alopecuroides* (L.) Eckl.).

Paulomagnusia Kuntze: 702 (1891). Type: *P. alopecuroides* (L.) Kuntze [= *Micranthus alopecuroides* (L.) Eckl.)], lectotype designated by Goldblatt & Manning: 133 (2008).

Note: although Persoon's (1805) infrageneric taxa appear at first to be unranked, the preface (ix) to his *Synopsis* has the following statement: *Melius autem judicavi, eas species (nonnullis forte tamen excipiendis) ab aliis leviter in charactere aberrantes, imprimis si genus minus amplum sit, sub divisione peculiari aut SUBGENERE, quo etiam nonnula Botanicorum recentium genera relata sunt, comprehendere, ne ultra necessitatem genera multiplicentur.* This is a clear statement that his infrageneric taxa are subgenera. [We have judged it better to include those species (with some exceptions) that in their character(s) are only slightly different from others, especially if the genus is not very large, under the 'particular division' or subgenus (which are some of genera of recent botanists), so that genera are not multiplied beyond necessity.]

Deciduous geophytes. *Corm* axillary in origin, subglobose, rooting from below; tunics coarsely fibrous. *Leaves* few, the lower 2 or 3 cataphylls, lowermost foliage leaf longest, inserted on stem above corm, blades either plane with a definite main vein and falcate or lanceolate with margins moderately to heavily thickened, or ± tubular and hollow, or terete and ± solid with heavily thickened central vein and margins separated by narrow longitudinal grooves. *Stem* erect and straight or ± flexuose, simple or few- to several-branched. *Inflorescence* a congested, 2-ranked spike, usually weakly rotated; *bracts* short, overlapping, with leathery or dry central portion and broad membranous margins, inner forked apically and shorter than to ± as long as outer. *Flowers* zygomorphic, lasting several days, blue to violet, mauve, white or flushed lilac, scentless or pleasantly scented, with nectar from septal nectaries; *perianth tube* short, curving outward, ± cylindric below, flaring in upper half; *tepals* ± equal, dorsal slightly larger and arching over stamens, lower tepals extended ± horizontally. *Stamens* unilateral and arcuate; filaments slender, free; anthers oblong, held under the dorsal tepal, splitting longitudinally. *Ovary* ovoid, sessile; style branches slender, usually deeply divided and recurved, or barely notched at apex. *Capsules* woody, small, narrowly ovoid-ellipsoid or urn-shaped with ovules in lower fourth. *Seeds* 2–4(5) per locule, 3(4)-sided below, elongate, widest at micropylar end with micropylar crest and micropyle above base, tapering and pointed at chalazal end, surface slightly wrinkled. *Basic chromosome number* $x = 10$.

The diagnostic features of *Micranthus* are the crowded, 2-ranked spike; small, bilaterally symmetric, tubular flowers; distinctive dry outer floral bracts with broad membranous margins; basal leaf inserted on the stem above the level of the corm (shared with *Lapeirousia* and *Thereianthus*); and small, narrow capsules, each locule containing up to four slender seeds almost as long as the locules and with a micropylar crest at the proximal end. *Micranthus* is unique among subfamily Crocoideae in having zonasulcate pollen grains (Figure 2). The sulci are distal as seen at the tetrad stage (S. Nilsson, pers. comm. Oct. 1996) and the zonasulcate condition in *Micranthus* is thus derived from the basic monosulcate grain by extension of the sulcus until it encircles the grain. Exine sculpturing is reticulate, grading to tectate-perforate close to the aperture margin. Among Crocoideae, only a few species of *Thereianthus* also have reticulate exine sculpturing (Manning & Goldblatt 2011). Most genera of Crocoideae, including *Thereianthus*, have sulcate pollen grains, with a pair (sometimes solitary) of narrow bands of exine (elongated opercula) lying parallel to one another along the long axis of the aperture. Other more complex apertures are known in *Geissorhiza* Ker Gawl. (Goldblatt & Manning 2009). *Cyanixia* and *Zygotritonia* have trisulculate grains. All these pollen types have tectate-perforate exine with small supratectal spinules.

Leaf marginal anatomy in species with plane leaves conforms to the norm for Watsonieae in combining unspecialized marginal epidermal cells and a marginal vein with a sclerenchyma cap below the epidermis. This condition prevails in *Watsonia* and the *Lapeirousia* clade (excluding *L. corymbosa* (L.) Ker Gawl. and its immediate allies), but notably not in *Thereianthus* or *Pillansia*, both of which lack a marginal vein or sclerenchyma strand below the unspecialized marginal epidermis (Goldblatt & Manning 1990; Rudall & Goldblatt 1991; Goldblatt *et al.* 2004; Manning & Goldblatt 2011).

Chromosome cytology: the basic chromosome number for *Micranthus* is $x = 10$. One population each of the four species counted, namely *M. alopecuroides,* the new *M. filifolius* (reported as *M. junceus*), *M. plantagineus* (as *M. junceus*) and *M. tubulosus*, are diploid, $2n = 20$ (Goldblatt 1971; Goldblatt & Takei 1997). The base number and karyotype, consisting of one long and nine short chromosome pairs, are matched exactly in *Thereianthus*. The related genus *Watsonia* has $x = 9$ and a derived karyotype with two long chromosome pairs. *Pillansia*, the fourth and last genus of this lineage of Watsonieae, also has $x = 10$, with its single species tetraploid, $2n = 40$ (Goldblatt 1977; not 44 as originally published by Goldblatt 1971).

Reproductive system, compatibility and pollination: virtually nothing has been reported about the reproductive system in *Micranthus*, but we infer that self-incompatibility and compatibility are important in the evolution and distribution of the genus. It is notable that three species, *M. alopecuroides*, *M. plantagineus* and *M. tubulosus* typically have all flowers producing a full complement of capsules and we infer self-compatibility and facultative autogamy for these species. In contrast, *M. filifolius* and *M. thereianthoides* exhibit lower capsule production and we infer self-incompatibility for these species. We are unable to infer compatibility relations



FIGURE 2.—Pollen morphology of *Micranthus plantagineus,* Piketberg, *Manning 2093*. Scale bar: 20 µm.

for *M. cruciatus* and *M. simplex* as good fruiting material is not available. Significantly, the putatively self-compatible species *M. alopecuroides*, *M. plantagineus* and *M. tubulosus* have the widest ranges in the genus, with *M. plantagineus* occurring over the entire range of the genus. *M. filifolius* has a modest range, entirely within the Caledon District of Western Cape but *M. cruciatus*, *M. simplex* and *M. thereianthoides* are local endemics, the latter two currently known from only one or few populations. Self-incompatibility is believed to be ancestral for Iridaceae (Goldblatt & Manning 2008). In genera that we have studied, we have found relatively few species to be facultatively autogamous, and we assume such species are specialized. Reversals from self-compatibility to incompatibility are believed to be unlikely. Thus in *Micranthus* we infer that the self-compatible *M. alopecuroides*, *M. plantagineus* and *M. tubulosus* are derived for this character. The latter two species are also derived in their hollow leaves as outgroup comparison indicates that plane, isobilateral leaves are the plesiomorphic condition (present in most members of the family and universal in sister genus *Thereianthus*). Reproduction through aerial cormlets that replace flowering on the spike axis is also known only in these three species. The arrangement of species in our account reflects our belief that the self-incompatible species are closer to the ancestral stock of *Micranthus*.

The small flowers of all species except *Micranthus thereianthoides* are so similar in size, shape and colour (perianth tube 3–5 mm long) that they almost certainly share the same generalist pollination ecology, though we have only recorded insect visitors for *M. alopecuroides, M. plantagineus* and *M. tubulosus*. Goldblatt & Manning (2006) regarded these three species as having a generalist pollination strategy and insect visitors to these species include large-bodied bees (Apidae), bee-flies (Bombyliidae), hopliine beetles (Scarabaeidae: Hopliini) and butterflies. Among the latter are *Pieris helice* (Pieridae) (*M. plantagineus*) and *Cynthia cardui* and *Colias electo* (Pieridae) (*M. tubulosus*). New observations confirm to the generalist pattern with anthophorine bees and wasps including *Delta* cf. *caffra* (Eumenidae), a species of Sphecidae visiting *M. plantagineus*. The longer perianth tube of *M. thereianthoides*, 22–25 mm long, suggests a specialized pollination system using a long-proboscid pollinator, possibly a long-proboscid fly species or large butterfly. The nectar reward, retained in the lower part of the perianth tube, is only accessible to pollinators with a proboscis at least 18 mm long, thus excluding access to smaller butterflies, bees, bee-flies and wasps that visit flowers of other *Micranthus* species.

Key to the species

Note: plants with the lower part of the spike bearing smaller, paler floral bracts subtending one or more small cormlets may be *Micranthus junceus* or *M. tubulosus* or may be hybrids involving these two species or with *M. alopecuroides* and are not accommodated in the key.

1a Leaf blades either plane with evident central vein or one or two prominently thickened veins, or terete and 4-grooved with thickened margins, not hollow; style variously dividing between mouth of perianth tube to opposite middle of anthers:

2a Lowermost leaves plane and linear to lanceolate or falcate, (2–)4–12 mm wide; style branches divided ± halfway . . . . . 1. *M. alopecuroides*

2b Lowermost leaves either plane and linear or terete and cross-shaped in section, up to 2 mm wide; style branches divided up to halfway or undivided:

3a Flowers white, outer tepals tipped palest lilac, fading slightly darker lilac; style branches undivided or barely notched at apex . . . . . 2. *M. simplex*

3b Flowers pale blue, blue-mauve or deep blue or white; style branches divided up to halfway:

4a Style dividing at mouth of perianth tube opposite middle of filaments; style branches ± 2.5 mm long, divided less than one third; leaves at least 1.5 mm wide . . . . . 6. *M. cruciatus*

4b Style dividing between base and middle of anthers; style branches usually ± 1.0 mm (up to 1.5 mm) long, divided up to halfway; leaves < 1 mm wide . . . . . 5. *M. filifolius*

1b Leaf blades tubular and hollow, round or ± compressed in section; style dividing opposite base to middle of anthers (rarely just below anther bases):

5a Perianth tube elongate and ± twice as long as bracts, 22–25 mm long; bracts 8–15 mm long . . . . . 3. *M. thereianthoides*

5b Perianth tube shorter than bracts, < 10 mm long; bracts 5–7 mm long:

6a Flowering stem ± flexed at each aerial node; stem with prominent, coarsely fibrous collar around base . . . . . *M. plantagineus* × *M. tubulosus*

6b Flowering stem straight, stiffly erect; stem with or without collar of fibres around base:

7a Blade of lowermost leaf terete or oval in section, ± straight, green at flowering and smooth when fresh (with evident thickened veins when dry); stem without collar of fibres around base; capsules narrowly ovoid to ± urn-shaped . . . . . 7. *M. plantagineus*

7b Blade of lowermost leaf tubular and inflated, falcate with prominent apical mucro, often dry at flowering, without prominent veins when alive or dry; stem with collar of fibres around base; capsules narrowly ovoid . . . . . 4. *M. tubulosus*

1. **Micranthus alopecuroides** *(L.) Eckl*., Topographisches Verzeichniss der Pflanzensammlung von C.F. Ecklon: 43 (1827). *Gladiolus alopecuroides* L.: 5 (1756). *Ixia alopecuroides* (L.) L.f.: 92 (1782). *Ixia plantaginea* Aiton: 59 (1789), nom. illeg. superfl. pro *Gladiolus alopecuroides* L. [see note 1]. *Paulomagnusia alopecuroides* (L.) Kuntze: 702 (1891).Type: South Africa, [Western Cape], Somerset West, 19 Nov. 1944, *Barker 3384* (NBG, neo., here designated; PRE isoneo.) [see note 2].

Watsonia compacta Lodd.: t. 1577 (1830), nom. nud.

Plants mostly 200–450 mm high, base usually sheathed with collar of short fibres. *Corm* mostly 10–12 mm diam., tunics of dark brown, relatively coarse, reticulate fibres, drawn into short bristles above. *Stem* usually simple or 1- or 2(3)-branched, when unbranched often with one or more scales below base of spike, usually bearing 1 or more cormlets in axil of lowermost foliage leaf. *Leaves* 2–4(5), lowermost 1 or 2 plane, broadly to narrowly falcate (occasionally ± lanceolate) or linear, (2–)5–10(–15) mm wide, with moderately prominent main vein; margins slightly or occasionally heavily thickened (*De Vos 2288*), hyaline when dry; upper 1 or 2(3) leaves largely sheathing. *Spike* mostly 40–80-flowered, often much congested, with internodes 1.5–3.0 mm long; bracts 5–7 mm long, outer with broad to narrow brown centre and translucent membranous margins, inner ± as long as outer, notched apically, translucent with 2 dark veins slightly broader toward base; lower or all nodes sometimes vegetative and then bracts paler in colour and subtending one (or more) cormlets in each axil. *Flowers* usually dark blue, sometimes pale blue, often lower third to fourth of tepals paler blue or white, distally edged with a thin darker blue line, unscented; perianth tube ± 5 mm long; tepals subequal, elliptic, 7–8 × ± 3 mm, with short narrow, claw-like base. *Stamens* with filaments ± 5 mm long, diverging in upper half; anthers oblong, 3–4 mm long, pale mauve; pollen white to pale blue. *Style* ± 7 mm long, mostly dividing between upper third of filaments and lower third of anthers; branches ± 1.2–1.6 mm long, divided for ± half their length. *Capsules* oblong to narrowly ovoid, ± 5 mm long but ± 4 mm long when dry. *Seeds* angular-elongate, 3.5–4.0 mm long, 3 or 4 per locule. *Flowering time*: October in the north, November to December in the south.

Distribution: centred in the southwestern Western Cape, *Micranthus alopecuroides* has a relatively narrow range, extending from the Cape Peninsula north into the Olifants River Valley and east locally to Hermanus and Swellendam (Figure 3). Plants typically grow on well-drained clay or loamy, seasonally wet, slopes and flats

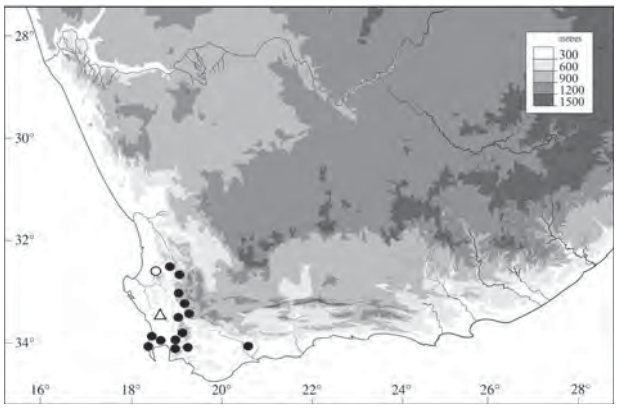


FIGURE 3.—Distribution of *Micranthus alopecuroides*, ●; *M. simplex,* ○; *M. thereianthoides*, Δ.

but have also been recorded on sandy ground. The Olifants River Valley populations grow in thin clay or sandy gravel, often over rocky pavement that is totally dry even before flowering commences.

Diagnosis: *Micranthus alopecuroides* is distinctive in its plane (Figure 1A), sometimes very broad basal leaves; the blades lanceolate to linear or falcate, sometimes up to 12 mm wide or exceptionally to 15 mm in plants from the Roman's River area of the upper Breede River Valley. Exceptions are numerous and there are collections with ± linear leaves 3–5 mm wide and only up to 25 mm long (notably *Purcell s.n.*, NBG). The flowers are typical of the genus, usually dark blue, with a perianth tube ± 5 mm long. The spikes of 40 or more flowers are often unusually congested with the internodes ± 1.5 mm long.

Populations from the Olifants River Valley and flowering in October, at least three weeks earlier than elsewhere, stand out in their relatively lax spikes with internodes 2.5–3.0 mm long (vs. ± 1.5–2.0 mm elsewhere) and relatively short, straight leaves, 5–8 mm wide with particularly prominent mucronate tips. The outer bracts of these plants also differ from those in populations to the south in their broader translucent margins, thus with a significantly narrower central band of green tissue (brown when dry). These plants are typically restricted to thin clay or light sandy soils over rocky pavement and represent a distinctive race of the species.

Hybrids: certain collections from sandy flats south of Malmesbury constitute a puzzle. They consist of plants with abnormally elongated spikes up to 120 mm long, more than 3/4 of their length bearing small, pale bracts each enclosing not a flower but a small cormlet. Only the top fourth of the spikes have properly formed, dark brown bracts subtending either pale blue flowers (e.g. *Goldblatt & Manning 10431*, MO, NBG, with tubular leaves) or deep blue flowers (*Goldblatt & Manning 10432*, MO, NBG, with plane leaves). The leaves, either tubular or plane with a central vein, correspond to *Micranthus tubulosus* or *M. alopecuroides* respectively. We conclude that these plants constitute hybrids or a hybrid swarm with *M. alopecuroides* as one parent and *M. tubulosus* or possibly *M. plantagineus* as the other. Microscopic examination of the pollen shows some apparently normal grains and others smaller than normal

and evidently sterile. The available collections of this putative hybrid were made too early in the life cycle to have capsules, which if developed, would have appeared later in the season.

Similar specimens from other sites show the same striking feature (e.g. *Goldblatt 8711* MO, from Greyton; *Leighton 722* BOL from Camp Ground, Rondebosch; and *Williams 1195* MO, NBG from near Vogelgat, Hermanus). This last collection consists of plants with the sterile part of the spikes 180–250 mm long and the fertile part 20–30 mm long. Populations at Elandsberg near Bo-Hermon, with plane, narrowly lanceolate leaves (e.g. *Goldblatt & Manning 13616*) have the inflorescence sterile throughout and bearing a cormlet in all bract axils as do many individuals of the species from Rondebosch Common, Cape Town (*Goldblatt & Manning 13619*). The status of these plants is uncertain but we suspect them to have a hybrid origin.

[*Note 1*. Daniel Solander, the unacknowledged author of *Hortus kewensis* published under William Aiton's name (1789), described the new species *Ixia plantaginea* '*foliis linearibus strictis, spica disticha imbricata*', based on a collection of Francis Masson and, for reasons that are obscure, at the same time cited Linnaeus's *Gladiolus alopecuroides* in synonymy. The epithet *plantaginea*, alluding to the similarity of the inflorescence to that of *Plantago* L., is no more apt than Linnaeus's recalling the resemblance to the grass, *Alopecurus* L., and constitutes an illegitimate superfluous name. Nevertheless, the broad-leaved species remained known by the later epithet *plantagineus*, until well into the 20th century (e.g. Lewis 1950) despite the leaves being described as narrow and linear in the protologue. The epithet *plantagineus* was applied to *M. alopecuroides* by, among others, Ker Gawler (1803), who evidently did not realize it applied to two different species. Baker (1892, 1896), who also used the name *M. plantagineus* for *M. alopecuroides,* compounded this error and recognized *M. plantagineus* var. *junceus* not realizing that the type of the species was in fact identical with his new variety.]

[*Note 2*. Described in 1756 by Linnaeus as *Gladiolus alopecuroides*, with the brief diagnosis '*foliis linearibus, spica disticha imbricata*,' the species was transferred to *Micranthus* by Ecklon (1827), when he raised Persoon's *Gladiolus* subg. *Micranthus* to generic rank. Of the three sheets identified as *G. alopecuroides* in the Linnaean herbarium, one [LINN 59.13] is a Sparrman collection post-dating the protologue, and the other two cannot be unambiguously related to the name. One [LINN 59.15] is *M. tubulosus* and the other [LINN 59.14] may be *M. alopecuroides* but is atypical in its large size, numerous branches and particularly broad leaves that hardly accord with the protologue [leaves linear]. We prefer to choose a neotype: *Barker 3384*, which has relatively narrow leaves and conforms exactly to the protologue. This action unambiguously preserves the current application of the name to the plane-leaved species (Lewis 1950; Goldblatt & Manning 2000).]

[*Note 3*. *Gladiolus minutiflorus* Schrank (1822) has been associated with *Micranthus alopecuroides*, which Schrank also recognized (as *Gladiolus*), but the description is vague (flowers small, secund, tepals subequal) and we are unable to determine the plant to genus with confidence, let alone to species. Schrank did, however, explicitly describe the leaves as short, striate and narrow, the lower ± 5 inches (125 mm) long. No authentic material has been located either at the Munich (M) or Brussels (BR) Herbarium, the institutions where the types of Schrank's species, where they exist, are believed to be located.]

Representative specimens

WESTERN CAPE.—**3218** (Clanwilliam): clay hillside S of Algeria turnoff on Clanwilliam–Citrusdal road (N7), (–BD), 13 Oct. 1974, *Goldblatt 3030* (MO). **3220** (Wuppertal): near Citrusdal on old Clanwilliam road, (–CA), 11 Oct. 1984, *Bean & Viviers 1504* (BOL); N of Citrusdal, (–CA), 16 Oct. 1935, *Taylor 1224* (BOL); clay slope near Farm Klawervlei on road to Algeria, (–CA), 11 Oct. 2011, *Goldblatt & Porter 13864* (MO, NBG, PRE). **3318** (Cape Town): Cape Peninsula, Wynberg Hill, (–CD), Nov. 1950, *Pillans 10208* (BOL, MO); Wynberg Hill, Edinburgh Drive, (–CD), 25 Jan. 2011 (fr.), *Goldblatt & Manning 13631* (MO, NBG); fields near Cape Town, (–CD), Aug.–Nov., *H. Bolus 2829* (BOL); Devil's Peak above Vredehoek, clay slopes, (–CD), 30 Oct. 1982, *Goldblatt 6637* (MO); slopes of Lions Head, (–CD), 20 Nov. 1938, *Penfold s.n. SAM53159* (SAM); Jonkershoek, Bosboukloof, (–DD), 27 Nov. 1973, *Smith 140* (NBG); Jonkershoek Valley, (–DD), 27 Nov. 1975, *Kruger 84* (NBG). **3319** (Worcester): Grootwinterhoek, (–AA), without date, *Pappe s.n. SAM21101* (SAM); Mostertshoek, (–AC), 8 Dec. 1973, *De Vos 2288* (NBG); slopes at Wabooms R., foot of Waaihoek Peak, (–AD), 11 Dec. 1948, *Esterhuysen 14822* (BOL); Bo-Hermon, Elandsberg Nature Reserve, entrance to Bosplaas, (–AC), 22 Jan. 2011 (fr. and sterile); *Goldblatt & Manning 13616* (MO, NBG); Wemmershoek, (–CC), 2 Nov. 1947, *Barker 4903* (BOL, NBG). **3418** (Simonstown): Cape Peninsula, Bergvliet Farm, E of sandpit, (–AB), 22 Nov. 1918, 5 Dec. 1818, *Purcell s.n.* (NBG); Helderberg, Somerset West, (–BB), 2 Dec. 1944, *Parker 3959* (BOL, NBG). **3419** (Caledon): Elgin Basin, Arieskraal, well drained clay ground, (–AA), 5 Dec. 1994, *Rode & Boucher 0207* (NBG); Elgin, (–AA), 19 Nov. 1944, *Barker 3369* (NBG). **3420** (Bredasdorp): Swellendam, Bontebok Park, (–AB), 2 Nov. 1965, *Grobler 552* (NBG).

2. **Micranthus simplex** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—Western Cape, 3218 (Clanwilliam): Piketberg, southwestern slopes of Zebrakop, (–DB), shallow soil on sandstone pavement, 4 Jan. 1995, *Goldblatt & Manning 10172* (NBG, holo; K, MO, PRE, iso.).

Plants (100–)140–200 mm high, base sheathed by short collar of brittle fibres. *Corm* tunics of dark brown, reticulate fibres. *Stem* usually simple, rarely 1-branched. *Leaves* (2)3, plane, linear or falcate, ± 1 mm wide, usually with 1 or 2 prominent veins, margins thickened, hyaline when dry. *Spike* 16- to 40-flowered; bracts purple-brown with broad translucent, brown-flecked membranous margins, ± 5 mm long, inner bracts ± as long as outer, membranous with 2 dark keels, notched at apex. *Flowers* white fading to lilac, outer tepals tipped pale lilac, with subapical brown ridge on reverse; perianth tube ± 3 mm long; tepals oblong, ± 4 × 1.2 mm. *Stamens* with filaments ± 2.5 mm long; anthers oblong, ± 2.5 mm long. *Style* ± 7 mm long, dividing opposite middle of anthers; branches ± 1 mm long, barely notched at apex. *Capsules* oblong, slightly warty in distal half, ± 4 mm long. *Seeds* elongate-angular, ± 3 mm long. *Flowering time*: December to at least mid-January.

Distribution: known only from the slopes of Zebrakop, highest peak in the Piketberg, *Micranthus simplex*, like *M. cruciatus*, grows in shallow soils in moss or in rock crevices on wet sandstone rocks (Figure 3). The

habitat remains moist as late as January when the species blooms.

Diagnosis: unusually small for the genus, stems of *Micranthus simplex* rarely exceed 180 mm and the white flowers with lilac-tipped outer tepals are distinctive, other species having flowers in shades of deep to pale blue or blue-mauve, or occasionally white. The inflorescence has the appearance of being relatively lax, the bracts of the lower flowers of the spike not overlapping those above them, but the upper bracts are as closely set as in other species. It is one of two species of *Micranthus* with consistently plane leaves; the other, *M. alopecuroides*, is a taller plant with congested spikes of 40 to 80 flowers and broader leaves mostly 5–12 mm wide. The flowers of *M. simplex* are the smallest in the genus, the perianth tube just 3 mm long and the short anthers ± 2.5 mm long. The short, undivided style branches, ± 1 mm long, are likewise unusual for *Micranthus*, other species of which normally have the style branches somewhat to considerably longer and divided for at least one third their length.

Additional specimens

WESTERN CAPE.—**3218** (Clanwilliam): Piketberg, Zebrakop, (–DB), in moist sand, 800 m, 3 Jan. 1973, *Linder 193* (BOL).

3. **Micranthus thereianthoides** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—Western Cape, 3318 (Cape Town): Paardeberg, Vondeling, (–DB), rock cracks and sands along stream, 9 Jan. 2013, *Nicolson 995* (NBG, holo.; K, MO, iso.).

Plants 300–800(–1200) mm high, base weakly sheathed by fine fibres. *Corm* 10–15 mm diam., tunics of fine to moderately coarse, dark brown, reticulate fibres. *Stem* simple or rarely branched, with solitary cormlet in axil of second leaf and sometimes also third leaf. *Leaves* (4)5 or 6, green or drying at flowering, lowermost 2 or 3 longest, blades 100–300(–800) mm long, 2.5–5.0 (–15) mm diam., tubular and hollow, sometimes inflated, acute-mucronate, upper leaves progressively shorter and narrower, uppermost bract-like and entirely sheathing. *Spike* 10- to 40(–70)-flowered, bracts brown with broad translucent membranous margins, 8–11(–15) mm long, as long as 1.5–2.0 spike internodes, inner bracts slightly shorter than outer, forked apically, membranous with 2 dark keels broadened toward base. *Flowers* suberect, dark violet or purple, unscented; perianth tube ± cylindric, 22–25 mm long, tepals oblong, 5–6 × 1.5–2.5 mm, reverse of outer tepals with prominent subapical ridge. *Stamens* with filaments 6–8 mm long, exserted ± 3 mm; anthers oblong, 3.5–4.0 mm long. *Style* 24–27 mm long, dividing between middle and slightly beyond anthers, branches ± 1.5(–2.0) mm long, divided for ± half their length. *Capsules* ovoid, smooth, 5–6 mm long, with ± 4 seeds per locule. *Seeds* elongate-angular, tapering to points at both ends, ± 3.5 mm long. *Flowering time*: January. Figure 4.

Distribution: a highly local endemic, *Micranthus thereianthoides* is restricted to the Paardeberg near Malmesbury (Figure 3), where it grows at mid to upper altitudes along the banks of seasonal streams, the corms usually wedged among granite rocks, sometimes in humic loam, where the plants are more robust. Plants are locally plentiful along several streams on the range. The long-tubed, violet flowers are evidently adapted to pollination by long-proboscid flies. The incomplete fruit set in wild plants suggests that *M. thereianthoides* is an obligate outcrosser.

Diagnosis: *Micranthus thereianthoides* closely resembles *M. plantagineus* and some forms of *M. tubulosus* in its cylindrical leaves but is unique in the genus in the relatively large floral bracts, 8–11 mm long, and most strikingly in its dark violet flowers with elongate, cylindrical perianth tube 22–25 mm long, thus ± twice as long as the bracts (Figure 4). The species appears never to develop cormlets in the floral bract axils.

The long-tubed flowers suggest the genus *Thereianthus*, but the hollow leaves, the small, obtuse tepals, and the bracts with broad, membranous margins are characteristic for *Micranthus*. The zonasulcate pollen grains with reticulate exine conform exactly to those of other species of *Micranthus*, leaving no doubt as to its generic placement.

This extraordinary species was discovered in January 2012 by local plant enthusiasts Greg Nicholson and Dewan Roets during a botanical survey of the Paardeberg.

Additional specimens

WESTERN CAPE.—**3318** (Cape Town): Paardeberg, between Wellington and Malmesbury, Paardeberg Nature Reserve next to Malmesbury Dam, (–DB), rocky crevices near water, 10 Jan. 2012, *Nicolson & Roets 788* (NBG); Vondeling, (–DB), Feb. 2012 (fruiting), *Nicolson 994* (MO, NBG).

4. **Micranthus tubulosus** *(Burm.f.) N.E.Br*. in Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew 1929: 133 (1929). *Gladiolus tubulosus* Burm.f.: 2 (1768). *Ixia cepacea* Basseporte ex DC. in Redouté: t. 96 (1804), nom. nov. in *Ixia,* non *I. tubulosa* Burm. f. (= *Babiana tubulosa* (Burm.f.) Ker Gawl.). Type: South Africa, without precise locality or collector (G: Herb. Burman, holo., image seen).

Gladiolus fistulosus Jacq.: 8 (1797). *Ixia fistulosa* (Jacq.) Sims: t. 523 (1801), hom. illegit. non Andrews (1799) [= *Hesperantha radiata* (L.f.) Ker Gawl.]. *Micranthus fistulosus* (Jacq.) Eckl. ex Baker: 179 (1892), nom. superfl. pro *G. tubulosus* Burm.f. Type: South Africa, without precise locality or collector, illustration in Jacq.: t. 16 (1797), left hand plant, lectotype designated here.

Watsonia spicata Sol. ex Ker Gawl.: sub t. 553 (1803). nom. superfl. pro *G. spicatus* L. (1753), *G. tubulosus* Burm.f. (1768) et *G. fistulosus* Jacq. (1797). [The citation *Watsonia spicata* (L.) Ker Gawl. in Annals of Botany (König & Sims) 1: 229 (1804) is an error]. Type: South Africa, without precise locality, illustration in Curtis's Botanical Magazine 15: t. 523 '*Ixia fistulosa*' (1801).

Ixia teretifolia Herb. Banks ex Sims: t. 523 (1801), nom. nud. pro syn.



FIGURE 4.—*Micranthus thereianthoides*, Paardeberg, *Nicolson 995* (NBG). A, flowering plant; B, flower; C, outer (left) and inner (right) bract; D, capsule; E, seed. Scale bar: A, 10 mm; B–D, 2.5 mm; E, 1.25 mm. Artist: John Manning.

Micranthus fistulosus Eckl.: 44 (1827), nom. nud. [Probably intended as a combination but basionym not cited.]

Plants (70–)150–350(–600) mm high, base sheathed by collar of short, stiff, bristly fibres. *Corm* 14–18 mm diam., tunics of coarse, dark brown, reticulate fibres. *Stem* simple or branched, occasionally with cormlets in axil of lowermost leaf and of uppermost cataphyll. *Leaves* (2)3–5, usually dry at flowering, lowermost 1 or 2 longest, blades 50–200 mm long (to 300 mm in sterile plants), 4–7 mm diam., inflated, tubular and hollow, apex obtuse-mucronate, upper leaves progressively shorter and narrower. *Spike* 16- to 40-flowered; bracts mid to dark brown, 5–6 mm long, outer with broad translucent membranous margins, inner bracts ± as long as outer, forked apically, membranous with 2 dark keels broadened toward base; lower nodes sometimes vegetative with one or more cormlets and bracts then pale. *Flowers* pale or dark blue or white, sweetly scented; perianth tube 5–6 mm long; tepals oblong, 5–6(–10) × 1.2–2.5 mm, reverse of outer tepals with prominent subapical ridge. *Stamens* with filaments 6–8 mm long; anthers oblong, 3.5–4.0 mm long. *Style* 7–8 mm long, dividing opposite or slightly below base of anthers, branches ± 1.5(–2.0) mm long, divided for ± half their length. *Capsules* ovoid, smooth, 4–5 mm long, with 3 or 4 seeds per locule. *Seeds* elongate-angular, tapering to points at both ends, ± 3 mm long. *Flowering time*: November to December.

Distribution: typically a species of lower slopes usually on clay and granite-derived soils but also on sandstone, *Micranthus tubulosus* is restricted to the western half of Western Cape. It extends north of the Cape Peninsula as far as the northern Cedarberg, where an early (1923) collection documents its occurrence at Heuningvlei, and no further east of the Peninsula than Suurbraak near Swellendam and the Agulhas Peninsula (Figure 5). Like other species of the genus, it blooms late in the season when the hollow, inflated leaves are often dry and brown. Plants from the Pakhuis Mtns growing in moist, sandy ground are exceptional in their small size (leaves up to 100 mm long) and require additional study. A much dwarfed fragment of *Micranthus tubulosus*, said to be from Garies (*Caporn s.n.*, ex hort. Kirstenbosch (as Nat Bot Gard. 915/15) in BOL) is unlikely to be from there as no other records of the genus from Namaqualand exist.

Diagnosis: the inflated, tubular, falcate leaves (Figure 1E) are diagnostic for the species, the spikes and flowers of which differ hardly at all from those of *Micranthus alopecuroides*. A particularly distinctive feature of the leaves is the prominent brown mucro at the obtuse to ± truncate apices. The leaves are often ± dry at flowering time—Marloth's (1915: plate 41) has a particularly apt illustration of the species. As in *M. plantagineus*, one or more cormlets may be produced in the lower axils of the spike, a phenomenon first noted by Ker Gawler (in Sims 1801) and later confirmed by Lewis (1950). The condition is more frequent, although not consistent, in *M. plantagineus*. Despite its apparently preferred habitat on relatively dry slopes, *M. tubulosus* can occasionally be found on moist sandy flats, sometimes co-occurring with *M. alopecuroides* and *M. plantagineus* (*Wurts 519* consists of just such a mixture, *M. tubulosus* and *M. plantagineus* evidently found growing in close proximity). Hybrids between these two species at shared sites blur their usually clear foliar differences. We discuss putative hybrids between *Micranthus tubulosus* and *M. alopecuroides* or *M. plantagineus* in more detail below.

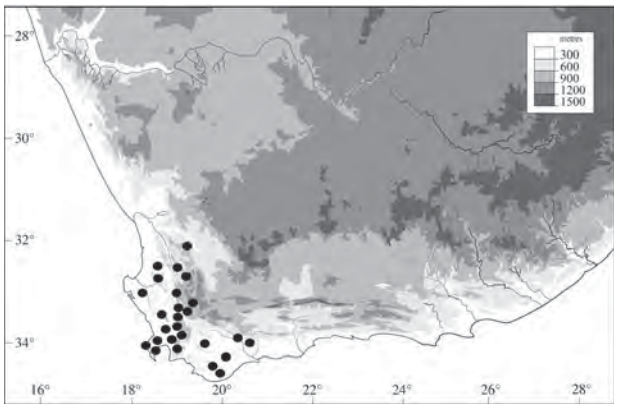


FIGURE 5.—Distribution of *Micranthus tubulosus.*

Plants collected near Saron (e.g. *Schlechter 10618*) are unusually small, mostly 100–150 mm but some just 70 mm tall, and have shorter, fewer-flowered spikes than usual. They appear linked to taller, more robust specimens by a range of intermediates. In contrast, plants from Gouda (*Barker 9861*), nearby, are exceptionally robust, up to 600 mm tall, with leaves almost as long, and the white flowers have tepals 10 mm long, the outer 2.5 mm wide.

A curious feature of *Micranthus tubulosus* is that populations may consist of a mixture of some plants with entirely fertile spikes and others with the lower part of the spike sterile (e.g. *Ecklon & Zeyher Irid 192* and *190*). All three specimens of *Goldblatt 8711* and several of *Purcell 43* have spikes sterile in the lower half. Particularly short leaves in *Goldblatt 8711* are also puzzling but not unique.

History: Long known as *Micranthus fistulosus* (Jacq.) Eckl. (e.g. Baker 1896), based on *Gladiolus fistulosus* Jacq. (1797), that combination was in fact not valid, though it was used as *M. fistulosus* Eckl. (a nomen nudum assumed to be a valid combination) by Baker (1892, 1896). By citing the basionym, Baker's use of the name *M. fistulosus* becomes a valid (albeit unintended) combination, also superfluous through his citing of valid earlier synonyms, including *Gladiolus tubulosus* Burm.f. (1768). Jacquin's illustration of *G. fistulosus* has two plants: we designate as lectotype the left hand one, which has dark blue flowers and leaves typical of *M. tubulosus*. The right hand plant, which has pale blue flowers and the upper leaf more typical of *M. plantagineus*, may be a hybrid with that species. The sterile lower nodes of the spike, bearing silvery bracts, are more typical of *M. plantagineus* and represent at least a different genotype from the right hand plant.

Brown (1929) identified the type of *Gladiolus tubulosus* among specimens in Burman's herbarium, and realizing that it was an earlier name for *M. fistulosus*, provided the combination *M. tubulosus*. A fine illustra-

tion of the species in Redouté's *Les Liliacées* (1804), as *Ixia cepacea*, a name coined by the artist, Madeleine Françoise Basseporte, shows that *M. tubulosus* was cultivated in France in the late 18th and early 19th centuries. The Basseporte painting, which indeed represents *M. tubulosus*, is part of an unpublished collection of vélins (paintings on parchment), which document plants and animals in the Jardin Royal in Paris and the Ménagerie Royale in Versailles, now in the Bibliothèque Centrale of the Muséum National d' Histoire Naturelle in Paris. We treat the name as having been validated by De Candolle in 1804 in the Redouté volume. De Candolle's citation of the earlier *Gladiolus tubulosus* Burm.f. appears to render his epithet superfluous, but the name *Ixia tubulosa* Burm.f. (now *Babiana tubulosa* (Burm.f.) Ker Gawl.) prevents transfer of *Gladiolus tubulosus* to *Ixia*. *Ixia cepacea* must be regarded as legitimate and a new name in *Ixia* for *G. tubulosus*.

Hybrids: the following interspecific hybrids are known involving *Micranthus tubulosus*: *M. tubulosus* × *M. alopecuroides* and *M. tubulosus* × *M. plantagineus*. Those with *M. plantagineus* can form large populations locally, probably backcrossing with one other parental species. We discuss these separately at the end of the species account.

Additional specimens

WESTERN CAPE.—**3218** (Clanwilliam): Goedverwacht, Piketberg, (–DC), 23 Nov. 1982*, Koutnik 1037* (BOL, MO); Piketberg, top of Versfeld Pass, (–DC), 2 Nov. 2011 (in bud), *Goldblatt & Porter 13707* (MO, NBG). **3219** (Wuppertal): Cedarberg, Heuningvlei, sandy vlakte, (–AA), 23 Oct. 1923, *Pocock 586* (NBG); Olifants River near Villa Brakfontein [Citrusdal], (–?CA), Nov., *Ecklon & Zeyher Irid 190* (MO, SAM); Elandskloof, bridge ± 10 miles [± 16 km] SE of Citrusdal, (–CA), 21 Sept. 1952 (sterile), *Maguire 1832* (NBG). **3318** (Cape Town): near Hopefield, (–AB), 19 Oct. 1932, *Lavis s.n.* (BOL); Malmesbury, clay slope, (–BC), 3 Nov. 1986, *Goldblatt 8048* (MO); Cape Town, Camps Bay, (–CD), *Barker 7191* (NBG); Signal Hill, (–CD), Nov. 1939, *Lewis 707* (SAM); Rondebosch Common, dry, hard ground, (–CD), 24 Jan. 2011, *Goldblatt & Manning 13620* (MO, NBG); Wynberg Hill, (–CD), Nov. 1922, *L. Bolus s.n. (BOL17188)*; Langverwacht, Kuils River, main kloof, (–DC), 14 Dec. 1973, *Oliver 4820* (NBG); Stellenbosch Mtn, S of Paradys Kloof, (–DD), 3 Dec. 1989, *Buys 132* (NBG); Muldersvlei, (–DD). Nov. 1916, *Duthie 352* (BOL). **3319** (Worcester): near Saron, 800' [244 m], (–AC), Oct. 1896, *Schlechter 10618* (MO); Elandsberg Estate, Vangkraal road near Mountain road, (–AC), 22 Jan. 2011 (fr.), *Goldblatt & Manning 13610* (MO); Gouda, (–AC), 6 Dec. 1962 (white flowers, very robust), *Barker 9861* (NBG); Worcester [District], Waterfall, (–CC), Nov., *Ecklon & Zeyher Irid 192* (MO); Ceres, Schurfdeberg, lower slopes, (–AD), Dec. 1944, *Lewis 863* (SAM). **3320** (Montagu): Swellendam, hill below Eleven O'Clock Mtn, (–CD), 25 Nov. 1952, *Wurts 519* (mixed with *M. plantagineus*) (NBG). 3418 (Simonstown): Bergvliet Farm, flats near sand pit, (–AB), *Nov. 1915, Purcell 43* (SAM); Helderberg Nature Reserve, (pale blue or white), (–BB), 23 Dec. 1993, *Runnals 647* (NBG). **3419** (Caledon): Greyton Nature Reserve, dry flats, 1000' [305 m], 5 Dec. 1987, *Goldblatt 8711* (MO). **3420** (Bredasdorp): Suurbraak, Middelplaas, (–BA), 5 Dec. 1982 (sterile), *Viviers 274* (NBG); Struisbaai to Elim near Springfontein turnoff, hard sandy gravel, (–DB), 9 Nov. 2011 (in bud), *Goldblatt & Porter 13738* (growing with *M. plantagineus*) (MO, NBG); 4 km W of Elim (growing with *M. filifolius*), (–DA), 9 Nov. 2011, *Goldblatt & Porter 13738* (MO, NBG). Unknown locality: Leeufontein, burned veld, 28 Nov. 1908, *Pearson 3185* (BOL).

5. **Micranthus filifolius** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—Western Cape, 3419 (Caledon): Akkedisberg Pass, sandy hillside, (–AC), 18 Nov. 2011, *Goldblatt & Porter 13370* (NBG, holo.; MO, PRE, iso.).

Plants 180–300 cm high, base sheathed with sparse to well-developed collar of fibres. *Corm* 12–16 mm diam., tunics of relatively soft, fine or thicker fibres. *Stem* unbranched or rarely with single short branch, without cormlets in leaf axils. *Leaves* 4–6, green or beginning to dry from tips at flowering time, lowermost longest, reaching to middle of spike to shortly exceeding it, blade either ± terete and ± 1 mm diam. or ± plane and ± 2 mm wide, with heavily thickened central vein and margins, separated when dry by narrow longitudinal grooves, upper leaves shorter, with sheaths overlapping, uppermost 1 or 2 leaves sheathing for most of their length, with short free tips. *Spike* mostly 18–50-flowered, closely congested, lower bracts always subtending flowers; bracts mid to dark brown, ± 5 mm long, outer with broad translucent membranous margins, inner slightly shorter than outer, with 2 dark keels broadened toward base, notched apically. *Flowers* pale mauve or mid-blue, unscented; perianth tube ± 5 mm long; tepals oblong, ± 5 × 2.2–2.8 mm. *Stamens* with filaments ± 5 mm long, exserted ± 2.5 mm; anthers oblong, ± 3 mm long. *Style* ± 7 mm long, dividing between base and middle of anthers; branches 1.0–1.6 mm long, divided for up to half their length, rarely only notched at apex. *Capsules* narrowly ovoid, smooth, 4–6 × ± 2 mm, with up to 4 seeds per locule. *Seeds* elongate-angular, mostly 3-sided, tapering to points at both ends, 3–5 mm long. *Flowering time*: mid-November to late February. Figure 6.

Distribution: centred in the Caledon District of Western Cape, *Micranthus filifolius* is largely coastal with populations recorded from Steenbras and Cape Hangklip eastward to Hermanus and inland to Shaw's Mtns, the lower slopes of Caledon Swartberg and east to Akkedisberg Pass and Elim (Figure 7). Collections are mostly from clay and clay-loam soils, occasionally from sandy sites, but even collections from the Klein River Mtns above Hermanus at elevations of up to 400 m are from a shale band. The species is particularly abundant after fire (e.g. *Drewe 495*, *1101*) but will flower in unburned veld unless shaded out by taller vegetation. Plants bloom unusually late in the season, with most flowering collections made after mid-January, and two (*Gillett 520*; *Levyns 11269*) were in mid- to late February. We have confirmed late flowering at near-coastal sites ourselves but inland populations, as from Drayton Siding, east of Caledon, and Akkedisberg Pass, flower from mid-November to early January and are in fruit before any coastal populations come into flower. We suggest that this early flowering is due to warmer and drier conditions well inland of the coast. The coarser corm tunic fibres and collar of fibres around the base of the stems in these populations are perhaps adaptations to the drier habitat. Plants sometimes co-occur with or grow close to *M. plantagineus*, which is in fruit when *M. filifolius* begins to bloom, two or three weeks after the last flowers of *M. plantagineus* have faded, both at the coast and at inland sites. We have also found *M. filifolius* growing together with *M. tubulosus*.

Diagnosis: with its narrow leaves, the lowermost of which is linear or terete (Figure 1B & C), *Micranthus filifolius* is most like *M. plantagineus* in general appearance. It differs, however, from that species in several respects, particularly in the solid leaf blades of the

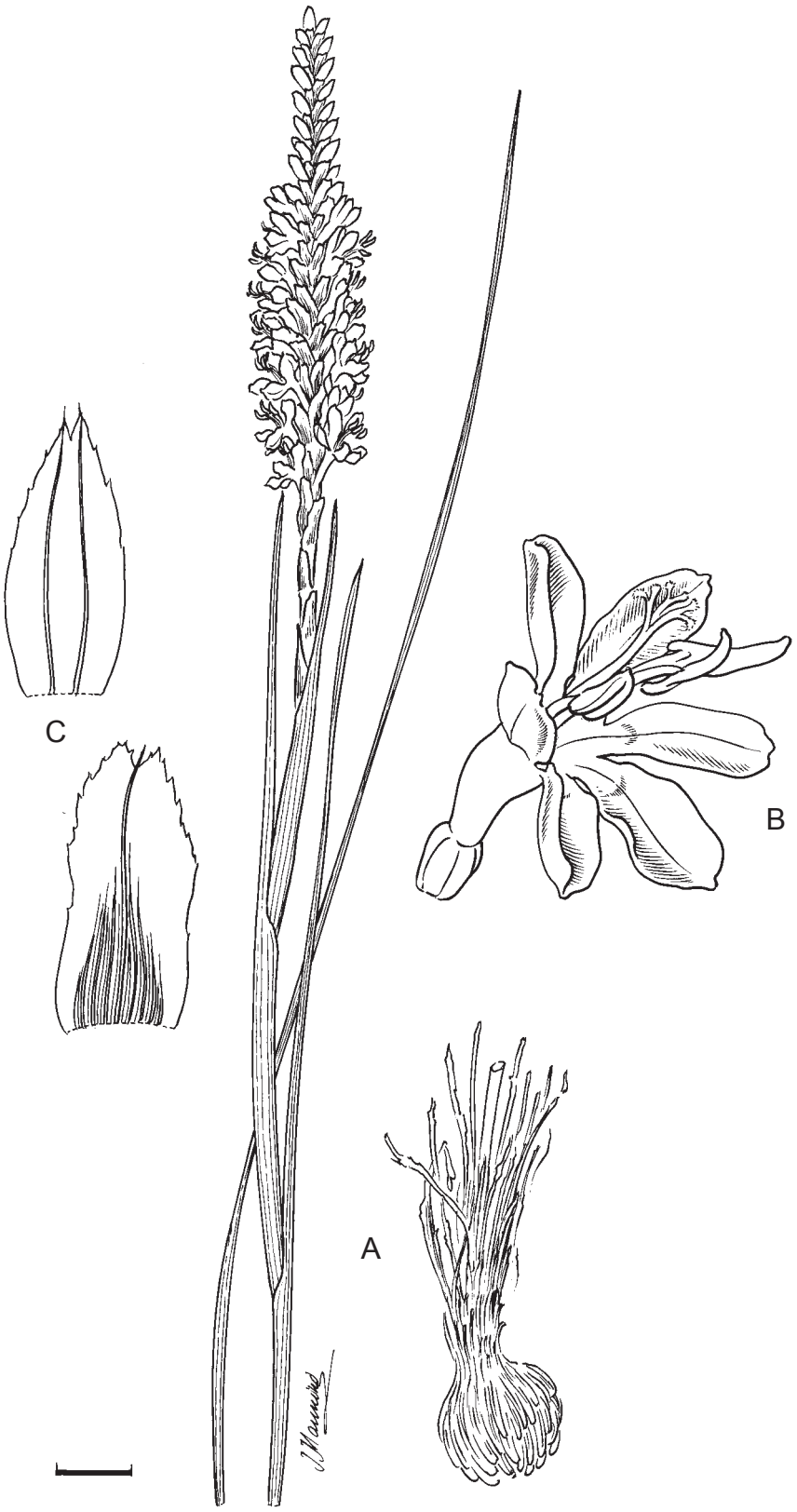


FIGURE 6.—*Micranthus filifolius*, Akkedisberg Pass, *Goldblatt & Porter 13370* (NBG). A, flowering plant; B, flower; C, outer (lower) and inner (upper) bract. Scale bar: A, 10 mm; B, C, 1.25 mm. Artist: John Manning.

lowermost and sometimes the upper leaves. The leaves closely overlap one another and sheath the stem up to the base of the spike. Plants typically have four or five leaves but several specimens have six leaves, the upper one or two largely to entirely sheathing. Unlike *M. plantagineus*, plants do not produce cormlets in the leaf axils and the corm tunics are usually soft-textured with the base enclosed by a collar of fibres, whereas *M. plantagineus* has coarser corm tunics, lacks a basal collar of fibres, and cormlet production is conspicuous in the lowermost and sometimes other leaf axils. In addition, the flowers, although typical of *Micranthus*, are somewhat smaller than in *M. plantagineus,* having a perianth tube mostly 4–5 mm long and tepals ± 4 mm long, and are more often pale mauve (drying white), although the western populations are dark blue (drying blue), the flower colour in most populations of *M. plantagineus.* Typical *M. plantagineus* has been recorded close to most localities of *M. filifolius*, flowering in November and December, supporting our conclusion that *M. filifolius* is not a local variant but a different species, flowering later, sometimes in the same habitats as *M. plantagineus*, or in drier sites.

Additional specimens

WESTERN CAPE.—**3418** (Simonstown): Steenbras, (–BB), Sept. 1944 (late fr.), *Stokoe s.n. SAM68012* (SAM); Buffels River dam area [near Rooiels], (–BD), 19 Feb. 1972, *Boucher 1822* (NBG, PRE); Cape Hangklip, peaty marsh, (–BD), *Levyns 10220* (BOL); Kogelberg Nature Reserve, (–BD), 19 Mar. 1983, *Kroon 10200* (PRE); Betty's Bay, sandy slopes, (–BD), 13 Feb. 1962, *Levyns 11269* (BOL). **3419** (Caledon): Drayton Siding, pale blue (–AB), 16 Dec. 1968, *Goldblatt 395* (BOL); field E of Drayton siding, (–BA), 25 Jan. 2011, *Goldblatt & Manning 13623* (MO, NBG); Kleinmond, near Palmiet River mouth, (–AC), 31 Jan. 1933, *Gillett 615* (NBG); Kleinmond, road to reservoir, (–AC), 27 Jan. 1947, *De Vos 485* (NBG); Hermanus, (–AC), Jan. 1920, *Burtt Davy 18711* (BOL); top of Shaw's Pass, (–AD), Jan. 1957, *Lewis 2904* (SAM); Shaw's Pass, east side, (–AD), 29 Dec. 1955, *Lewis 4454* (SAM); Hemel-en-Aarde, mountain side, (–AD), 15 Jan. 1933, *Gillett 520* (NBG); Vogelgat, Hermanus, Vogelpool to Fernkloof, S slopes on shale band, (–AD), 2 Jan. 1979, *Williams 2710* (NBG); Fernkloof, Hermanus, 350 m, clay area, 1 year after fire, (–AD), 17 Jan. 1987, *Drewe 495* (MO); 400 m, shale band, after fire, 25 Jan. 1996, *Drewe 1101* (MO); 4 km W of Elim, stony clay in renosterveld, (growing with *M. tubulosus*), (–DA), 9 Nov. 2011 (in bud), *Goldblatt & Porter 13745* (MO, NBG).

6. **Micranthus cruciatus** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—Western Cape, 3219 (Wuppertal): Pakhuis Mts, trail to Heuningvlei, (–AA), local in wet seep on rocky sandstone slope, 19 Dec. 1995, *Goldblatt 10438* (NBG, holo.; MO, iso.).

Plants 300–450 mm high. *Corm* globose, 8–10 mm diam., tunics of brown, soft membranous layers not accumulating. *Stem* simple or 1-branched, usually with 1 or 2 small cormlets in lowermost leaf axil. *Leaves* (3)4 or 5, lower 3 linear to subterete, ± 1.5 mm wide, margins and midrib heavily thickened with narrow longitudinal grooves between (often cross-shaped in section with 4 narrow longitudinal grooves), reaching to base or middle of spike, uppermost leaf sheathing stem almost to base of spike, with short free portion. *Spike* up to 70-flowered; bracts brown or straw-coloured with broad translucent membranous margins, ± 4 mm long, inner ± as long as outer, membranous with 2 dark keels, apically notched. *Flowers* pale blue-mauve (drying ± white) or deep blue, perianth tube ± 3 mm long, tepals oblong, ± 4 × 1.5 mm. *Stamens* with filaments ± 5 mm long; anthers oblong-linear, ± 3 mm long. *Style* ± 4 mm long, dividing ± at mouth of tube opposite middle of filaments, branches ± 2.5 mm long, divided for ± one third their length. *Capsules* oblong, smooth, 5.0–5.5 mm long. *Seeds* elongate-angular, mostly 3-sided, tapering to points at both ends, ± 3 mm long. *Flowering time*: mid-November to late December, possibly lasting into January.

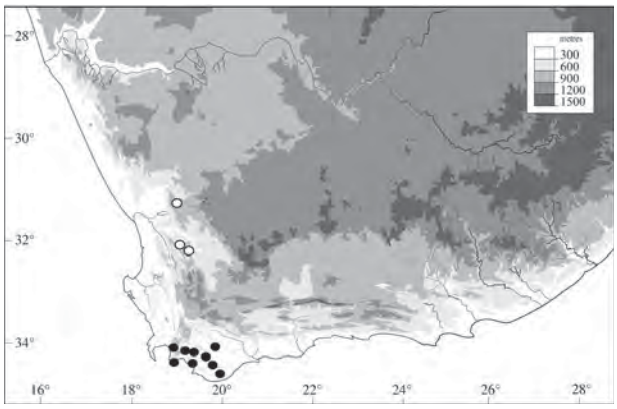


FIGURE 7.—Distribution of *Micranthus filifolius*, ●; *M. cruciatus*, ○.

Distribution: restricted to the northern Cape flora region, *Micranthus cruciatus* is known from the northern Cedarberg immediately south of Pakhuis Pass and in the Bokkeveld Mtns southwest of Nieuwoudtville (Figure 7). Plants grow on rocky slopes, in seeps on thin sandy soil over sandstone pavement, flowering in December as the habitat dries out in the hot weather. No doubt the species is rare but the very few collections are probably due to its midsummer flowering when little plant collecting is undertaken. We suspect that *M. cruciatus* occurs in suitable sites between its few stations, thus in the southern Bokkeveld Mtns and the Gifberg/Matsikamma Mtn complex and perhaps elsewhere in the Cedarberg. First collected by the late Elsie Esterhuysen in 1941 according to available records, *M. cruciatus* has elicited no attention until now and was assigned to the broadly similar *M. plantagineus* (as *M. junceus*) in herbaria.

Diagnosis: linear- to terete-leaved *Micranthus cruciatus* is immediately distinguished by its solid, narrow leaf blades, ± 1.5 mm wide, with heavily thickened veins and margins separated by narrow longitudinal grooves (Figure 1D). Leaves are either linear or terete becoming cross-shaped in section distally with only the margins and central vein thickened. Plants broadly resemble *M. plantagineus* although they are more slender than is usual in that species, which has hollow leaves 2–3 mm diam. and is conspicuous in the production of cormlets in the lowermost and sometimes upper leaf axils. In contrast, *M. cruciatus* has no more than one or two small cormlets, these borne in the axil of the lowermost leaf. The pale mauve-blue or sometimes dark blue flowers are typical of the genus in shape but notable in the short perianth tube, ± 3 mm long, in the style dividing at the mouth of the perianth tube and in the unusually long style branches up to 2.5 mm long, divided for up to one

third their length. Most species of *Micranthus* have the style dividing opposite the base to middle of the anthers and style branches typically less than 1.6 mm long. The narrow, heavily thickened leaf in *M. cruciatus* is convergent with that in *M. filifolius*, but in other critical details the two are very different, the latter with coarsely fibrous corm tunics and a collar of fibres around the base of the stem.

It is noteworthy that typical, hollow-leaved *M. plantagineus* with dark blue flowers also occurs in the Pakhuis and Bokkeveld Mtns (e.g. *Leipoldt 3596* BOL, NBG, PRE) as well as in the Cedarberg, but it has not been recorded growing near *M. cruciatus* and they evidently have somewhat different habitat preferences.

Additional specimens

NORTHERN CAPE.—**3119** (Calvinia): sandstone slope between Nieuwoudtville and Vanrhyns Pass on road to Keyserfontein, (–AD), 27 Nov. 1985, *Goldblatt 7399* (MO, PRE).

WESTERN CAPE.—**3218** (Clanwilliam): Zandfontein, Farm Verkeerde Vley (Klip-op-mekaar), 12 km N of Pakhuis Pass, (–BB), July 2013 (fr.), *Helme* 7778 (NBG). **3219** (Wuppertal): Cedarberg, Pakhuis to Heuning Vlei (–AA), 28 Dec. 1941, *Esterhuysen 7436* (BOL); Pakhuis Pass, Kliphuis campsite, wet seep on sandstone pavement, (–AA), 15 Nov. 2011 (in bud), *Goldblatt & Porter 13766* (MO, NBG).

7. **Micranthus plantagineus** Eckl., Topographisches Verzeichniss der Pflanzensammlung von C.F. Ecklon: 43 (1827), nom. nov. pro *Ixia plantaginea* Aiton: 59 (1789), nom. illeg. superfl. pro *Gladiolus alopecuroides* L. *Watsonia plantaginea* Ker Gawl.: t. 553 (1803), nom. nov. pro *Ixia plantaginea* Aiton et nom. illeg. superfl. pro *G. alopecuroides* L. *Gladiolus plantagineus* Pers.: 46 (1805), nom. nov. pro *Ixia plantaginea* Aiton et nom. illeg. superfl. pro *G. alopecuroides* L. Type: South Africa, without precise locality, *Masson s.n. BM922008* (BM, holo.!— narrow-leaved specimens mounted with *Nelson 1777* with broad, flat leaves [= *M. alopecuroides*]).

Phalangium spicatum Burm.f.: 3 (1768), nom. nud. [cited illustration, Plukenet: t. 310, f. 1 (1694) lacks text or figure analysis; it probably represents *Ixia scillaris* L.; specimen in G: Herb. Burman is *Micranthus* and designated the 'type'.]. *Micranthus spicatus* (Burm.f.) N.E.Br.: 138 (1929), nom. inval.

Phalangium spicatum Houtt.: 115 (1780). Type: South Africa, without precise locality or collector, illustration in Houtt., Nat. Hist. ed. 2, 12: t. 80 f. 2 (1780).

Micranthus plantagineus var. *junceus* Baker: 179 (1892). *Micranthus junceus* (Baker) N.E.Br.: 138 (1929). Type: South Africa, [Western Cape], Groenekloof and vicinity, *Zeyher 1611* (K, lecto!, designated here, K000320508; PRE!, isolecto.; other collections numbered *Zeyher 1611* in PRE and SAM are from Klipfontein or Tulbagh, thus not type material).

Plants 200–400(–650) mm high, base without collar of fibres. *Corm* globose, 12–15 mm diam., tunics of dark brown, medium-textured, reticulate fibres drawn into fine points above. *Stem* erect, simple or with up to 9 short branches, with cormlets in axil of lowermost leaf and sometimes of upper cataphyll and rarely other leaf axils. *Leaves* (2)3(4), green at flowering, lowermost leaf longest, blades terete or oval in section, hollow, 2.0–3.5 mm diam., smooth when fresh with translucent veins, when dry, veins appearing thickened with homologue of marginal vein pair more prominent, usually reaching to middle of spike to shortly exceeding spike, uppermost 1 or 2 leaves sheathing for most of length, with free part often slightly longer than sheath. *Spike* (16–)40–100-flowered, lower bracts sometimes subtending cormlets; bracts mid- to dark brown, ± 6 mm long but slightly smaller if subtending cormlets, outer with broad translucent margins, apices sharply acute and ultimately curved outward, inner bracts ± as long as outer, with 2 dark keels broadened toward base. *Flowers* usually dark blue, occasionally pale blue or white, evidently sometimes slightly sweetly scented, perianth tube 6–7 mm long, tepals oblong, with thickened subapical ridge on reverse, (4–)6–7 × ± 1.2 mm. *Stamen* filaments ± 5 mm long; anthers oblong, 3–4 mm long. *Style* ± 7 mm long, dividing between lower one third and middle of anthers (rarely ± 1 mm below anther bases), branches 1.0–1.8 mm long, divided for one third to half their length. *Capsules* smooth, ± urn-shaped or narrowly ovoid, (3)4–5 × 2–3 mm, with (2)3 or 4 seeds per locule, 5 mm long. *Seeds* elongate-angular, 3(4)-sided, tapering to points at both ends. *Flowering time*: October to December (rarely in May).

Distribution: *Micranthus plantagineus* has a wide range across the Cape flora region, extending from the Bokkeveld Plateau near Nieuwoudtville south to the Cape Peninsula and east to Port Elizabeth (Figure 8). An isolated population from the Anysberg Nature Reserve in the Little Karoo (*Vlok 2545*) appears typical of the species except for the shorter perianth tube, ± 4 mm long. Plants typically grow in seasonally wet habitats, often in marshy sites, along streams, or at least in places that are waterlogged in the winter months.

Diagnosis: the elongate inflorescence with up to 100 flowers and a perianth that is often deep blue, but sometimes pale blue or white, are unexceptional for the genus and identification of *Micranthus plantagineus* depends on leaf morphology. The two to four leaves are straight, stiffly erect, hollow and terete to oval in section, ± 2–3 mm diam., and reach or shortly exceed the spike (Figure 1F). When alive the leaves are smooth with the veins evident as paler, translucent lines. On drying, the veins appear hyaline and the veins at the adaxial and abaxial poles are somewhat more prominent. In addition, the stem is often branched, and as many as four (exceptionally nine) short branches may be produced shortly below the base of the main spike, these seldom exceeding half the length of the main spike. Lewis (1950) noted that the lower flowers of the spike are often replaced by cormlets [as many as five may be present in an axil]. That feature is not universal and many otherwise typical plants may have normal flowers and capsules from base to apex of the spike. A second characteristic feature of *M. plantagineus* is the presence of one or more cormlets in the lowermost leaf axil (not invariably present in other species) and occasionally in the axils of the upper cataphyll and one or more of the upper leaves. Plants lack a collar of fibres around the base (in contrast to superficially similar *M. filifolius* and *M. tubulosus*).

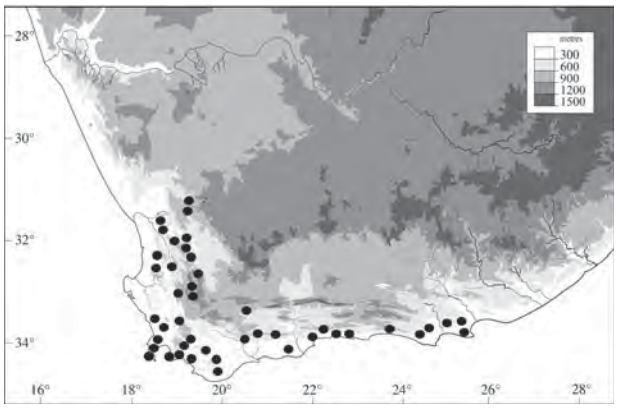


FIGURE 8.—Distribution of *Micranthus plantagineus.*

There are two, somewhat poorly defined, morphs of the species. One has narrow leaves, ± 2 mm diam. when alive, and slender capsules, ± 4.3 × 1.5 mm. Plants with mature capsules have 2(1) fusiform-angular seeds per capsule, ± 3.7–4.0 mm long. The second morph has broader leaves, 2–3 mm diam. when alive, and urn-shaped capsules ± 5 × 2–3 mm. Capsules have 4 seeds per locule, these flattened-angular, 3.0–3.5 mm long.

Collections of *Micranthus plantagineus* from Grootwinterhoek Forestry Station exemplify this situation: *Goldblatt 10451* with dark blue flowers represents the robust morph of the species, but slender-leaved plants (*Goldblatt 10452*), growing adjacent to stands of the robust morph, have white flowers. Other slender-leaved *M. plantagineus* (*Goldblatt10453*) growing nearby have blue flowers. These last two collections consist of shorter, less robust plants, 200–250 mm tall, and have more slender, but still hollow leaves ± 1.5 mm diam. No other *Micranthus* species were found in the area making the possibility that hybridization has played a role in this pattern of variation unlikely.

We must also mention a collection made by T.M. Salter in May 1935 from Viljoen's Pass. The morphology conforms closely to *Micranthus plantagineus* in the three terete and hollow foliage leaves, stems without a collar of fibres at the base, cormlets in axils of all leaves and in floral dimensions. Thus the only difference we see is the flowering time, noted as anomalous on the specimen label by Salter. The marshy habitat likewise conforms to the species. A search for the population in May 2013 failed to find any *Micranthus* species in bloom at this time of year, but the site may simply be lost to farming activity or dam construction.

Putative hybrids between *Micranthus plantagineus* and *M. alopecuroides* are discussed under the latter species.

Related species: until now, several collections of plants with filiform-linear and plane or terete, but not hollow, leaves with a thickened central vein and margins (cross-shaped in section) have been included in *Micranthus plantagineus* (as *M. junceus*) in herbaria. We believe these are separate species. The several southern Western Cape populations with this leaf type, here referred to *M. filifolius*, always have four or five, rarely six leaves, the blades ± 1 mm wide vs, mostly three (rarely two or four) leaves in *M. plantagineus*. These plants have flowers with a consistently shorter perianth tube ± 4 mm long and shorter tepals, also ± 4 mm long vs, both perianth tube and tepals mostly ± 6 mm long in *M. plantagineus* and often a pale blue mauve to almost white (less often deep blue) perianth. *M. filifolius* is rarely branched and we have seen no specimens with the lower flowers aborted and replaced by cormlets, both common but not universal traits of *M. plantagineus*.

Other collections with this derived leaf type are known from the northern Cedarberg and Bokkeveld Mtns and are here treated as the new *Micranthus cruciatus* Goldblatt & J.C.Manning. These plants have only four, rarely five leaves, the two basal with linear or terete, four-grooved blades, ± 1.5 mm wide, similar to but broader than those of *M. filifolius*. An important associated character is the style, which divides at the mouth of the perianth tube into unusually long branches 2.0–2.5 mm long, divided for ± one third their length. Other species of *Micranthus* have the style dividing between the base and middle of the anthers and the style branches never exceed 1.5 mm.

History: long known as *Micranthus junceus* (Lewis 1950; Goldblatt & Manning 2000), *M. plantagineus* was evidently first recognized as a distinct species, called *Phalangium spicatum* by Burman (1768), at least as to the specimen in his collection (now at the Delessert Herbarium, Geneva). Burman provided no validating description, instead merely citing Plukenet's (1694) illustration in part 3 of the *Phytogeographia*. There is no accompanying text or even polynomial identifying the illustration, plate 310, f. 1., nor does the figure constitute a validating illustration with analysis. *Phalangium spicatum* Burm.f. is thus a nomen nudum and invalid. Plukenet's illustration is of a broad-leaved plant and does not, in our opinion, represent any species of *Micranthus* but is probably *Ixia scillaris* L. Even if any text associated with this illustration is found and if the name is lectotypified on the specimen rather than the Plukenet illustration, the combination *M. spicatus* (L.) Heyn. (1847) (= *Thereianthus spicatus*) prevents the use of Burman's epithet at species rank in *Micranthus*.

Curiously, *Phalangium spicatum* Houtt. (1780), typified by a good illustration, marks this as the first valid naming of *M. plantagineus*. Although seeming to refer to Burman's *P. spicatum*, Houttuyn makes it clear this is his species (*Phalangium scapis spicatis mihi*, i.e. Houttuyn) and that the Plukenet figure cited by Burman is an entirely different plant. As noted above, Heynhold's combination *M. spicatus* (L.) Heyn. bars transfer of Houttuyn's epithet to *Micranthus.*

In Aiton's (1789) *Hortus Kewensis*, Daniel Solander, the unacknowledged author of the species in this work, described *Ixia plantaginea* based on a collection of Francis Masson. The sheet at BM includes two plants with narrow, stiffly erect, centric leaves (the Masson collection) and three specimens with shorter, plane leaves (*Nelson 1777*) that are *M. alopecuroides*. The Masson specimens conform to the diagnosis, '*foliis linearibus strictis, spica disticha imbricata* [leaves linear, straight and upright] and constitute the holotype. The name is

unfortunately superfluous as *Gladiolus alopecuroides* was cited in synonymy and, likewise, transfers of *Ixia plantaginea* to *Watsonia* (Ker Gawler 1803), and *Gladiolus* Pers. (1805), are superfluous as both authors cited *Gladiolus alopecuroides* as synonyms. Ecklon (1827), however, intended to transfer the species to *Micranthus*, where it becomes valid and is treated as a new name from that date rather than a new combination based on *I. plantaginea* Aiton. Ecklon (1827) recognized *M. alopecuroides* as a separate species, the first author to differentiate it from *M. plantagineus*, but whether deliberately or by accident is uncertain.

Baker (1892) described *Micranthus plantagineus* var. *junceus*, citing no specimens, but later listed several exsiccatae (Baker 1896), all of which were available to him in 1892. We choose a lectotype from among these, *Zeyher 1611,* a specimen in good condition and representative of the species. The taxon was raised to species rank by Brown (1929), who, at the time also identified *Phalangium spicatum* Burm.f. as the same species, at least as to the specimen in Burman's herbarium. *M. junceus*, a name used until now for this plant, becomes a synonym of *M. plantagineus*.

Additional specimens

NORTHERN CAPE.—**3119** (Calvinia): Nieuwoudtville waterfall, damp washes along stream, on sandstone, (–AC), 5 Dec. 1996, *Manning 2129* (NBG); Nieuwoudtville Escarpment, small vlei in arid fynbos, (–AC), 28 Nov. 1993, *MacGregor s.n.* (NBG153534); Oorlogskloof Nature Reserve, (–AC), 14 January 2000, *Pretorius 664* (NBG).

WESTERN CAPE.—**3118** (Vanrhynsdorp): Matsikammaberge, among sandstone rocks, (–DB), 11 Nov. 1985, *Van Jaarsveld & Bodenstein 8283* (NBG); top of Gifberg Pass, Farm Van Taakskom, (–DD), 11 Nov. 1985, *Snijman 946* (NBG). 3218 (Clanwilliam): Piketberg, road to Sun Mtn, (–DA), 16 Nov. 1993, *Manning 2093* (NBG). 3219 (Wuppertal): Pakhuis Mtns above 3500 ft [1 065 m], (–AA), 30 Dec. 1940, *Leipoldt 3596* (BOL, PRE), Nov. 1929, *Thode A2141* (PRE); Biedouw Valley, (–AA), 25 Nov. 1955, *Middlemost 1897* (MO, NBG); Wuppertal, (–AA), Oct. 1929, *Thode A2083* (NBG); Driehoek Vlei, Cedarberg, (–AC), 3 Dec. 1934, *Compton 4798* (NBG); banks of the Olifants River at Citrusdal, sandy ground, (–CA), 5 Nov. 1982, *Goldblatt 6707* (MO), Feb. 1982, *Goldblatt 6556* (fr.) (MO); Citrusdal, Farm Kleinplaas, moist hillocks in loamy clay among restios, (–CA), 11 Dec. 1997, *Hanekom 2972* (MO, NBG, PRE); Gonnafontein, seasonally damp sand, (–CB), 3 Dec. 2000, *Pond* 254 (NBG); Leeu River, Ceres, (–CD), 18 Dec. 1944, *Compton 16741* (BOL, NBG). **3318** (Cape Town): Darling Flora Reserve, (–AD), 17 Nov. 1964, *Thompson 76* (NBG); 13 Nov. 1956, (–AD), *Winkler 166* (BOL); Kenilworth Racecourse, low lying areas wet in winter, (–CD), 5 Jan. 1970 (fr.), *Esterhuysen s.n.* (MO); Devil's Peak, 300 ft [± 90 m], Dec., *Pappe s.n.* (SAM). **3319** (Worcester): Groot Winterhoek Forest Station, rocky sandstone flats, (–AA), 27 Dec. 1995. *Goldblatt 10451* (MO, NBG); Keerom hills at foot of Twenty Four Rivers Mtns, (–AA), 3 Dec. 1950, *Esterhuysen 17869* (BOL, PRE); wet flats 9.4 miles [± 14 km] NE of Hermon Station, (–CC), 18 Oct. 1959, *Acocks 20744* (MO, PRE). **3320** (Montagu): Anysberg Nature Reserve, deep loamy sand, edge of seep, 12 Oct. 1991, (BC), *Vlok 2545* (MO); Swellendam, hill below Eleven o'Clock Mtn, (–DC), 25 Nov. 1952, *Wurts 519* (mixed with *M. tubulosus*) (NBG); Langeberg between Lemoenshoek and Naauwkranz, Farm Strawberry Hill, (–DD), 11 Jan. 1957, *Stokoe s.n.* (NBG). **3321** (Ladismith): Garcias Pass, 1300 ft, (–CC), Dec. 1904, *Luyt s.n.* (BOL). **3323** (Oudtshoorn): Saasveld, George, (–DC), 1 Dec. 1985, *Vlok 1299* (MO, NBG). **3418** (Simonstown): Bergvliet Farm, E of sand pit, (–AB), 5 Dec. 1918, *Purcell s.n.* (*SAM90106*); Cirkels Vlei, Cape Peninsula, (–AB), 15 Jan. 1946, *Barker 3954* (NBG), *Lewis 1495* (SAM); Betty's Bay, (–BB), 5 Jan. 1962, *Tijmans 25B1962* (NBG); Cape Hangklip, marsh (with *M. filifolius*), (–BB), 25 Jan. 2011, *Goldblatt & Manning 13625* (MO, NBG). **3419** (Caledon): Riviersonderend Bridge, foot of Franchhoek Pass, (–AA), 1 Jan. 1936, *Barker s.n.* (*BOL45075*); Nuweberg Forest Reserve, below Forestry offices, (–AA), 31 Dec. 1989, *Goldblatt 9035* (MO); Viljoen's Pass, in marsh, (–AA), 4 May 1935, *Salter 5255* (BOL, K). Drayton siding, Caledon, near stream, (–BA), 25 Jan. 2011, *Goldblatt & Manning 13622* (MO, NBG); Fernkloof Nature Reserve, Hermanus, deep sand, (–AD), 5 Dec. 1975, *Orchard 349* (MO, NBG); Fairfield Farm, W of Napier, clay ground, (–BD), 9 Dec. 1994, *Kemper IPC750* (NBG). **3421** (Riversdale): Stilbaai, Farm Klipfontein, shale ground near water, (–AD), 26 Nov. 1990, *Bohnen 9152* (NBG). **3422** (Mossel Bay): Mossel Bay, grassy plains, (–AA), Jan. 1926, *Taylor 316* (BOL); inland of Oubaai, George, (–AB), 3 Jan. 1994, *Victor 558* (BOL); Belvedere, churchyard, (–BB), 30 Dec. 1928, *Duthie s.n. STE29795* (NBG). Without precise locality, as Stellenbosch, Somerset [West] and Hottentots Holland, without date, *Ecklon & Zeyher Irid 193* (83) (SAM).

EASTERN CAPE.—**3324** (Steytlerville): Honeyville Farm, 10 km along Humansdorp-Hankey road, (–DC), 9 Feb. 2009, Van Wyk FBG293/CR3761/ (NBG); 'Galgebosch, Uitenhage' [near Hankey], (–DD), 1935, *MacOwan s.n.* (SAM). **3325** (Port Elizabeth): Loerie Forest Reserve, (–CC), 21 Dec. 1933, *Long 1* (NBG); Uitenhage Division, between Vanstadensberg and Bethelsdorp, (–CD), 1840, *Drège 8445* (K); between Port Elizabeth and Thornhill, (–CD), 31 Dec. 1939, *Barker 604* (NBG). **3424** (Humansdorp): Witte Els Bosch, flats, (–AA), Dec. 1920, *Fourcade 1025* (BOL, NBG, SAM); Humansdorp, (–BB), Jan. 1932, *Wagner s.n. STE17114* (NBG). Without precise locality, as 'Uitenhage,' Dec., *Ecklon & Zeyher Irid 194* (MO, SAM).

Hybrids

Interspecific hybrids are not uncommon in *Micranthus* and are likely to occur when two or more species co-occur. Most striking of the hybrids is that between *M. plantagineus* and *M. tubulosus*. The two species flower together at the foot of the Elandskloof Mtns in Elandsberg Nature Reserve and present a remarkable sight. The hybrids are locally very common growing with typical *M. tubulosus* and are always slightly shorter than the parent, 100–150 cm high, and like it have a well-developed collar of fairly coarse fibres around base. The other parent is less common, but present in small clumps, recognized by its erect habit, straight leaves and pale blue flowers. The hybrid is evidently fertile (plants in fruit have well developed capsules with apparently normal seeds) and stand out in having a slightly flexuose stem and narrower leaves than either parent. Unlike *M. tubulosus*, which they otherwise most closely resemble, hybrid individuals bear small cormlets at aerial nodes and sometimes at the base of the spike. We have seen similar hybrid plants near Elim where *M. tubulosus* and *M. plantagineus* also grew side-by-side.

WESTERN CAPE.—**3319** (Worcester): Elandsberg Estate, foot of the Elandskloof Mtns, (–AC), 2 Mar. 2000 (sterile), *Goldblatt & Manning 11281* (MO, NBG), *13617*(fr.) (MO, NBG); Jan. 2011 (fr.; growing with *M. plantagineus* and *M. tubulosus*), *Goldblatt & Manning 13605* (MO, NBG), 22 Jan. 2011 (sterile), *13609* (MO, NBG, 11 Nov. 2011, *Goldblatt & Manning 13751* (MO, NBG, PRE).

Less common are hybrids between *Micranthus tubulosus* and *M. alopecuroides*, but at Elandsberg Nature Reserve we noted both species growing close to one another with apparent hybrids among them. The putative hybrids have short, plane leaves, in outline like those of *M. tubulosus* but not round in section, although the leaves have an airspace between the two surfaces and lack the visible main veins of *M. alopecuroides*.

WESTERN CAPE.—**3319** (Worcester): Elandsberg Estate, foot of the Elandskloof Mtns, Vangkraal road, (–AC), 22 Jan. 2010 (sterile), *Goldblatt & Manning 13611* (MO, NBG).

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New taxa of *Hesperantha* (Iridaceae: Crocoideae) from the southern African winter rainfall region and a review of the *H. pilosa* complex

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Keywords: Iridaceae, *Hesperantha*, new species, southern Africa, taxonomy, winter rainfall zone

ABSTRACT

The southern and tropical Africa genus *Hesperantha* Ker Gawl., now with 85 species, is distinguished in subfam. Crocoideae by the style dividing into relatively long, usually laxly spreading style branches at or shortly below the mouth of the perianth tube (rarely well within the tube or above the mouth of the tube) and, with a few exceptions, by hard, woody corm tunics. We describe three new species here. *H.* **dolomitica** Goldblatt & J.C.Manning, a narrow endemic of limestone outcrops on slopes north of the Vars River in the Knersvlakte, Western Cape, has the bell-shaped corms characteristic of the small sect. *Hesperantha* but is distinctive in the section in its pure white perianth with relatively long tube and soft-textured, falcate to distally trailing leaves. *H.* **laxifolia** Goldblatt & J.C.Manning from the Pakhuis Mtns, Western Cape, stands out in sect. *Hesperantha* in its prostate, somewhat succulent foliage leaves, and spikes of 2–5 white flowers with unusually short filaments less than 1 mm long and particularly short anthers, ± 4 mm long. The short style branches, ± 4 mm long, remain suberect rather than laxly spreading. *H.* **secunda** Goldblatt & J.C.Manning from the Roggeveld Escarpment, Northern Cape, has until now been included in *H. pilosa* but differs in its secund spike of nodding flowers with short style branches, and leaves with broadly winged margins. We also recognize a new subsp. **bracteolata** (R.C.Foster) Goldblatt & J.C.Manning of *H. pilosa* (L.f.) Ker Gawl. for populations of plants with diurnal flowers with usually blue or purple (occasionally white) tepals lacking dark pigmentation on the reverse. With additional material to hand, we reduce blue-flowered *H. ciliolata* Goldblatt to synonymy in subsp. *bracteolata* and report range extensions for *H. pilosa* subsp. *pilosa*, now recorded as far east as the Langeberg near Cloete's Pass.

INTRODUCTION

Hesperantha Ker Gawl., now with 85 species (Goldblatt 1984, 2003; Goldblatt & Manning 2007a) is one of the larger genera of Iridaceae subfam. Crocoideae Burnett. Its range extends from the southwestern Cape and Namaqualand, South Africa, through eastern southern Africa to East Africa, Ethiopia and Cameroon, but is centred in the southern African winter rainfall zone. *Hesperantha* is distinguished by the style dividing shortly below the mouth of the perianth tube (rarely within or well above the mouth of the tube) into relatively long, ± straight, usually laxly spreading style branches and, with a few exceptions, by hard, woody corm tunics (Goldblatt & Manning 2008). Here we describe three new species of the genus, two from the western half of Western Cape and one from Northern Cape. *H. dolomitica* Goldblatt & J.C.Manning, a narrow endemic of limestone outcrops in the Knersvlakte of southern Namaqualand, stands out in its long, narrow, falcate leaves, and pure white flowers with relatively long tube and tepals remaining cupped when fully expanded. *H. laxifolia* Goldblatt & J.C.Manning from the Pakhuis Mtns of northwestern Western Cape has prostrate, soft-textured basal leaves and among the smallest flowers in the genus, the perianth tube about 5 mm long, tepals 10 mm long and filaments less than 1 mm long. Both *H. dolomitica* and *H. laxifolia* have bell-shaped corms with a flat base and margins finely serrated, placing them in sect. *Hesperantha* of the genus (Goldblatt 1982). We provide a revised key to the section, now with eleven species. In the *H. pilosa* (L.f.) Ker Gawl. complex of sect. *Concentricae* Goldblatt, we recognize the new subsp. *bracteolata* (R.C.Foster) Goldblatt & J.C.Manning for populations of *H. pilosa* (L.f.) Ker Gawl. with diurnal flower phenology and mostly blue or purple (rarely white) flowers (vs. usually flowers white with dark pigmentation on the reverse of the tepals and crepuscular floral phenology). New collections of subsp. *bracteolata* have rendered the distinction between it and blue-flowered *H. ciliolata* Goldblatt untenable and we reduce the latter to synonymy. Range extensions for *H. pilosa* subsp. *pilosa* show that it occurs near Swellendam and in the eastern Langeberg near Cloete's Pass, well to the east of its recorded stations. Lastly, we recognise the new species *H. secunda* (*H.* sect. *Concentricae*) for a collection from near Middelpos until now included in *H. pilosa* but differing from that species in its secund spike of nodding flowers with curved perianth tube and relatively short style branches ± 4 mm long, and leaves with winged leaf margins and raised main vein.

NEW SPECIES OF SECT. *HESPERANTHA*

1. **Hesperantha dolomitica** *Goldblatt & J.C.Manning,* sp. nov.

TYPE.—Western Cape, 3118 (Vanrhynsdorp): Knersvlakte, Farm Varsche Rivier 260, 300 m north of Vars River, south-facing limestone crevices, ledges and moss pads, 76 m, (–BC), 25 July 2012, *Helme 7425* (NBG, holo.).

Plants mostly 180–250 mm high. *Corm* bell-shaped with flat base; tunics dark brown, softly woody, outer

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layers irregularly broken, margins minutely toothed. *Stem* unbranched, glabrous. *Leaves* 4, lower two basal, ± linear, flaccid, ± falcate, third leaf inserted shortly above ground and sheathing stem for most of its length, uppermost leaf bract-like, inserted on upper third of stem, entirely sheathing, basal leaf blades 60–80 × 3–4 mm. *Spike* 2–4-flowered, outer bract mostly 12–15 mm long, pale green, evidently becoming dry and pale straw-coloured during flowering, inner slightly shorter, with 2 green keels, narrowed distally and sometimes recurved above. *Flowers* radially symmetric, white without darker colouring on reverse, tepals remaining cupped when fully open, sweetly scented; perianth tube narrowly funnel-shaped, 12–14 mm long; tepals subequal, elliptic, 12–14 × 4 mm. *Stamens* with filaments ± 3 mm long; anthers 6–8 mm long, pale yellow; pollen yellow. *Ovary* ovoid, 2.5–3.0 mm long; style dividing at mouth of tube, branches ± 7 mm long, diverging. *Capsules* and *seeds* unknown. *Flowering time*: July, probably also August; flowers begin to open ± 12:30 and are fully open later in the day, time of closing not known.

Distribution and ecology: local in the Knersvlakte in southern Namaqualand, *Hesperantha dolomitica* is restricted to limestone outcrops north of the Vars River (Figure 1). Mostly wedged in cracks in the rocks, plants are also occasionally found in loamy, red soils at the base of the south-facing limestone cliffs. We regard the species as EN (Endangered), in light of its narrow range, very particular habitat requirements, small total population, and potential for the mining of its limestone habitat.

Diagnosis: *H. dolomitica* has the bell-shaped corms with a flat base that are characteristic of sect. *Hesperantha* (Goldblatt 2003). Within the section, *H. dolomitica* is recognized by its relatively large, pure white flowers with tepals remaining cupped even when fully expanded and without the darker pigmentation on the outside of the tepals that is a common feature in white-flowered species of the genus. The perianth tube and tepals are about the same length, 12–14 mm long, relatively large for sect. *Hesperantha*. Additional observations are needed to confirm the ultimate orientation of the tepals, which may not occur until after dark, but we believe the tepals remain cupped as they achieved this orientation by early afternoon and had remained unchanged by 17:00 (N. Helme pers. comm.).

Hesperantha dolomitica is one of a growing number of very narrow endemic plant species discovered on limestone substrates in the Knersvlakte. In Iridaceae these now include *Babiana carminea* Goldblatt & J.C.Manning (2007b), *Ixia acaulis* Goldblatt & J.C.Manning (1993) and *Moraea deserticola* Goldblatt & J.C.Manning (1986) as well as *H. dolomitica.* All these species, and up to fourteen additional endemics in other families, are endangered if plans for mining the limestone substrate on which these plants grow come to fruition.

Additional specimen seen

WESTERN CAPE—**3118** (Vanrhynsdorp): Knersvlakte, Farm Varsche Rivier Extension A 227, steep, S-facing crevices in limestone ridge, (–BC), 25 July 2012, *Helme 7424* (MO, NBG).

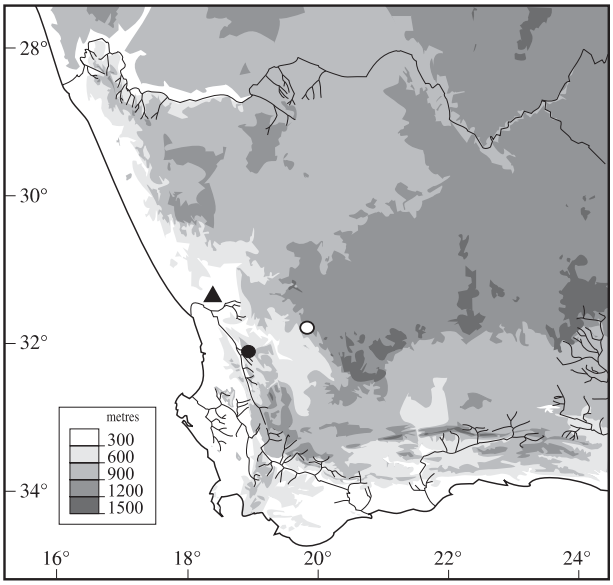


FIGURE 1.—Distribution of *Hesperantha dolomitica*, ▲; *H. laxifolia*, ●; and *H. secunda*, ○.

2. **Hesperantha laxifolia** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—Western Cape, 3219 (Wuppertal): mountains north of Pakhuis Pass, occasional among sandstone rocks on south-facing slopes and banks, (–AA), 12 Oct. 2012, *Goldblatt & Porter 13877* (NBG, holo.; K, MO, PRE, iso.).

Plants 90–160 mm high. *Corm* bell-shaped with flat, sometimes oblique base, 10–15 mm diam.; tunics dark brown, inner layers ± woody, outer layers becoming soft and broken, margins minutely serrated. *Stem* unbranched, glabrous. *Leaves* 3(4), lower 2 leaves usually prostrate (suberect in deeply shaded sites), fleshy, flaccid, obtuse, 50–70 × 4–5 mm, with main vein raised, margins pale, slightly thickened, third leaf sheathing lower 1/3 of stem, slightly inflated, fourth leaf (when present) on upper part of stem, bract-like and entirely sheathing. *Spike* mostly 2–3(5)-flowered, outer bract 8–9 mm long, green flushed red distally, inner slightly shorter to ± as long, partly membranous with 2 green keels, notched apically. *Flowers* white, outer and sometimes inner tepals red to brown outside, rose-scented; perianth tube narrowly cylindric, slightly expanded near apex, ± 5 mm long; tepals subequal, elliptic, ± 10 × 4 mm. *Stamens* with filaments ± 0.5 mm long; anthers ± 4 mm long, erect, pale yellow; pollen white. *Ovary* globose, ± 2.5 mm long; style dividing ± 1 mm below mouth of tube, branches ± 2.5 mm long, arching upward, reaching to slightly below middle of anthers. *Capsules* and *seeds* unknown. *Flowering time*: September to late October; opening ± 18:00, closing ± 21:00–21:30. Figure 2.

Distribution: so far known from a single collection in the Pakhuis Mtns (Figure 1), in peaty and loamy sand in rocky sites, mainly on shady, south-facing slopes. As far as we can determine, *Hesperantha laxifolia* has a very limited range in the ridges north of Pakhuis Pass, and has not been recorded south of the Pass, an area that has

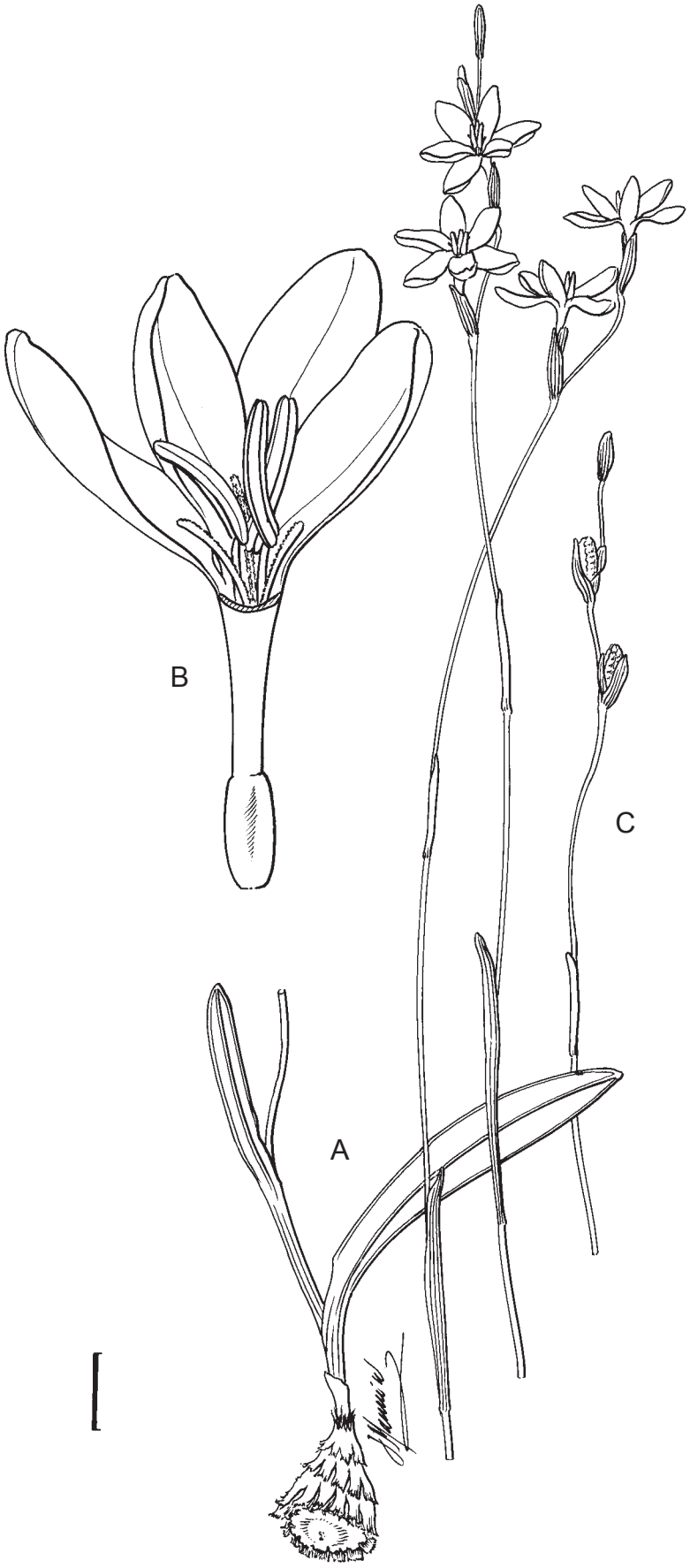


FIGURE 2.—*Hesperantha laxifolia*, *Goldblatt & Porter 13877* (NBG). A, flowering plant; B, flower detail; C, capsules. Scale bar: A, C, 10 mm; B, 2 mm. Artist: J.C. Manning.

been moderately well botanized. The narrow range of the species falls within a declared Wilderness Area.

Diagnosis: with white, crepuscular flowers typical of the genus, *Hesperantha laxifolia* can be distinguished by its usually small flowers, the tepals ± 10 mm long and the tube only half as long. Particularly unusual, the short stamens have filaments only about 0.5 long and anthers ± 4 mm long. The style divides just below the mouth of the tube into style branches only 2.5 mm long, likewise unusually small for the genus. The two basal leaves are slightly succulent and normally prostrate (the feature for which the species is named), although these leaves may be ascending to suberect in damp, shady situations. The bell-shaped corms with the tunic margins finely toothed are typical of sect. *Hesperantha* (Goldblatt 1984), but we have no hypothesis concerning the immediate relationships of *H. laxifolia.* The only other species of the genus with prostrate leaves, *H. montigena* Goldblatt, from the Hex River and Riviersonderend Mtns, has much larger flowers with a perianth tube 12–15 mm long and tepals 14–16 mm long, thus about as long as the tube, and the corms are asymmetric, placing it in sect. *Concentrica* Goldblatt.

Key to species of sect. *Hesperantha*
(species with corms triangular in outline to bell-shaped, with a flat base horizontal or obliquely oriented)

1. Corm base usually with prominent radiating spines or margins toothed; flowers diurnal, closing in late afternoon; perianth white or pink to reddish purple, rarely yellow:

2. Perianth tube 6–11 mm long. . . . . *H. pauciflora* G.J.Lewis

2’. Perianth tube 15–35 mm long:

3. Plants acaulescent; perianth white with dark markings at base of tepals, tube (15–)30–45 mm long; anthers 3–5 mm long. . . . . *H. luticola* Goldbl.

3’. Plants usually caulescent; perianth uniformly deep pink, tube 15–25 mm long; anthers (4.0–)5.5–7.0 mm long . . . . . *H. latifolia* (Klatt) M.P.deVos

1’. Corm base with small teeth or scarcely serrated and usually without prominent spines; flowers crepuscular, opening in late afternoon or after sunset; perianth white, cream or pale yellow:

4. Style dividing at or below middle of perianth tube; style branches and sometimes anthers partly or completely included in perianth tube:

5. Flowers 20–25 mm diam. with tepals 10–12 mm long; stamens and style branches fully included in perianth tube . . . . . *H. cedarmontana* Goldblatt

5’. Flowers ± 18 mm diam. with tepals 9–10 mm long; anthers exserted, but style branches reaching only to mouth of tube. . . . . .*H. saldanhae* Goldblatt

4’. Style dividing just below mouth of perianth tube; anthers and style branches fully exserted and filaments usually at least partly exserted from perianth tube:

6. Flowers small, secund on straight spike; perianth tube slightly curved, 4–6 mm long; tepals 4–7 mm long; leaves either plane and sometimes with crisped margins, or terete to ovoid in cross section and hollow; seeds with sharp angles (minute wings) and seed coat with whitish spongy cells . . . . . *H. spicata* (Burm.f.) N.E.Br.

6’. Flowers small to large, not obviously secund, on straight or flexuose spike; perianth tube straight, (5–)7–14 mm long; tepals 6–18 mm long; leaves plane with straight margins; seeds globose or sides lightly flattened by pressure, seed coat dark brown:

7. Plants with 3 basal leaves and without cauline leaves; perianth tube 12–16 mm long; tepals 6–10 mm long, always shorter than tube; flowers pale yellow. . . . . .*H. sufflava* Goldblatt

7’. Plants with 2 or more basal leaves and usually an additional 1 or 2 sub-basal or cauline, largely sheathing leaves; perianth tube 5–14 mm long; tepals (9–)12–18 mm long, usually longer than tube; flowers white, cream or yellow:

8. Foliage leaves 2, usually prostrate, semi-succulent; filaments < 1 mm long . . . . . *H. laxifolia* Goldblatt & J.C.Manning

8’. Foliage leaves 3, erect or falcate, not noticeably succulent; filaments ≥ 2 mm long:

9. Tepals uniformly white on reverse, ascending and cupped when fully open; perianth tube 12–14 mm long, ± as long as tepals; leaves falcate to trailing . . . . . .*H. dolomitica* Goldblatt & J.C.Manning

9’. Outer or all tepals flushed red to brown outside, spreading horizontally when fully open; perianth tube 4–12 mm long, shorter than tepals; leaves falcate to trailing:

10. Leaves narrow, 1–2 mm wide; perianth tube 10–12 mm; plants of shallow soils on sandstone pavement. . . . . *H. lithicola* J.C.Manning & Goldblatt

10’. Leaves broader, 4–8 mm wide; perianth tube 4–9 mm long; plants of deeper clay or sandy soils:

11. Bracts green, rounded to truncate and often with reddish margin; leaves usually at least 4; flowers usually remote from leaves, borne on upper third of the stem… . . . . . .*H. falcata* (L.f.) Ker Gawl.: typical form

11’. Bracts green or becoming membranous and dry above, and then ± acute; leaves often only 3; flowers usually borne close to leaves and from about middle of stem . . . . . .*H. falcata:pentheri* Baker and *trifolia* Baker forms (Goldblatt 2003).

NEW TAXA IN THE *HESPERANTHA PILOSA* COMPLEX (SECT. *CONCENTRICAE*)

Relatively widespread in the southern African winter-rainfall zone, *Hesperantha pilosa* was recorded by Goldblatt (1984, as subsp. *pilosa*) from the Bokkeveld Mtns in Northern Cape south to the Cape Peninsula and east to Bredasdorp and Riviersonderend in Western Cape. *H. pilosa* subsp. *latifolia* Goldblatt was raised by Goldblatt (1987) to species rank as *H. pseudopilosa* Goldblatt and is excluded from this discussion. As currently circumscribed then, *H. pilosa* consists of two distinct morphs. Those from the Bokkeveld Mtns, Roggeveld and Klein Roggeveld extending south to Touws River have diurnal flowers with a blue to purple (rarely white) perianth with the reverse of the tepals not strongly marked in contrasting colour; whereas those from the central Cedarberg south to southern Western Cape have crepuscular flowers with a white (rarely pale to deep lilac) perianth with the tepals coloured brown to dull red or purple outside.

Goldblatt (2003) drew attention to the two colour morphs and noted some minor differences; particularly that the flowers of blue to purple flowered plants

have ascending to suberect anthers and often somewhat longer style branches than those of white flowered plants, which have the anthers spreading horizontally. Although Goldblatt then suggested that the two morphs should be recognized taxonomically, he expressed uncertainty that the blue- to purple-flowered morphs were monophyletic given that some plants with pale lilac flowers had been recorded in the Darling area of Western Cape; thus nested within the range of the white-flowered plants. Differences in pigmentation patterns between the blue-flowered southern and northern populations now lead us to consider that the populations with diurnal flowers and mostly a blue or purple perianth from the Bokkeveld Mtns and Roggeveld are most likely monophyletic, and it seems useful to recognize them as a separate taxon. Two names at species rank are available for these populations, *H. puberula* Schltr. ex R.C.Foster from the Bokkeveld Mtns and *H. bracteolata* R.C.Foster from near Sutherland (Foster 1948). We now treat *H. pilosa* as comprising two subspecies, subsp. *pilosa* and subsp. *bracteolata* (R.C.Foster) Goldblatt & Manning, preferring subspecies rank because of the weak morphological differences between them.

Our review has brought to attention the morphologically similar *Hesperantha ciliolata* Goldblatt, which was distinguished from blue-flowered *H. pilosa* by its narrower, strongly ribbed leaf blades, oval in cross section, with short, spreading cilia. Typical *H. pilosa* was distinguished by its leaves with rather longer, softer cilia. New collections of what we are now calling subsp. *bracteolata* have bridged the differences between the two taxa. A collection from Driefontein-se-Berg, southwest of Calvinia [*Goldblatt & Manning 13999* (NBG)], has the ribbed leaf blades typical of *H. ciliolata* but bearing the scattered fine, long hairs typical of *H. pilosa*, and several recent collections from the Roggeveld and Bokkeveld Mtns are intermediate, with plane, weakly ribbed, shortly ciliate leaves. This expanded circumscription of *H. pilosa* makes it impossible to continue to recognize *H. ciliolata*.

Among collections identified as *Hesperantha pilosa* from the Roggeveld, one collection (*Goldblatt 5810*) from near Middelpos was noted by Goldblatt as unusual in its secund spike of nodding flowers, and leaves with winged leaf margins and raised main vein. After examining the specimens again while reviewing variation in *H. pilosa* we note that the flowers have a curved perianth tube, creamy white perianth, and style branches ± 4 mm long, thus half to two-thirds as long as other *H. pilosa* subsp. *bracteolata* in the Roggeveld and elsewhere. We describe this population as a separate species, *H. secunda*.

3. **Hesperantha pilosa** subsp**. bracteolata** *(R.C.Foster) Goldblatt & J.C.Manning*, comb. et stat. nov. *H. bracteolata* R.C.Foster in Contributions from the Gray Herbarium 166: 6 (1948). Type: South Africa, [Northern Cape], Farm Uitkyk, *Marloth 9907* (B, holo.!; PRE, iso.!).

Hesperantha puberula Schltr. ex R.C.Foster: 22 (1948). Type: South Africa, [Northern Cape], Oorlogskloof, *Schlechter 10952* (B, lecto.! designated by Goldblatt: 57 (1984); B!, BOL!, G!, GRA!, K!, PRE!, US!, iso.).

Hesperantha ciliolata Goldblatt: 59 (1984), syn. nov. Type. South Africa. Northern Cape, Roggeveld Escarpment, Farm Geelhoek, 21 Sept. 1953, *Acocks 17176* (PRE, holo.!).

Plants 70–200(–300) mm high. *Corm* ovoid, ± 6 mm diam; tunics woody, concentric. *Stem* unbranched, glabrous or sparsely hairy. *Foliage leaves* 3, lower 2 linear to narrowly sword-shaped, blades plane or with main vein and margins raised, or oval in cross section and ribbed, 1–4 mm wide, pubescent or minutely ciliate, cilia horizontal on edges of ribs or margins, margins sometimes ± winged, upper leaf partly sheathing lower half of stem, usually ribbed; with minute, scale like bract on upper 1/3 of stem. *Spike* (2)3–5-flowered, bracts subequal, 8–10 mm long, outer green or becoming ± pale and membranous, inner membranous with 2 green keels, forked at apex or entire. *Flowers* blue or purple (rarely white), without darker pigmentation on reverse, salver-shaped, unscented or with acrid, sour odour, opening 10:00 to 11:00 and closing mid to late afternoon; perianth tube 6–8 mm long; tepals (11–)12–16 × 3–5 mm, inner slightly shorter and wider than outer. *Stamens* with filaments 2.0–2.5 mm long; anthers (4)5–7 mm long, usually ascending to suberect, pale yellow or white; pollen yellow to white. *Style* dividing 1–2 mm below mouth of perianth tube, branches ultimately spreading, (7)8–9(11) mm long, reaching to upper third of anthers, sometimes exceeding them, ± white, rarely purple. *Capsules* sub-globose, 5–6 × 4.5–5.0 mm. *Seeds* angular, ± 1 mm long. *Flowering time*: mid-August to late September.

Distribution: subsp. *bracteolata* extends from the Bokkeveld Mtns northwest of Nieuwoudtville through the Roggeveld south into the Klein Roggeveld and locally into the Voetpadsberg east of Touws River (Figure 3), usually in sandy, stony ground.

Diagnosis: distinguished from subsp. *pilosa* by the blue or purple (rarely white) perianth, the outer or all tepals not or only slightly more darkly pigmented on the reverse, subsp. *bracteolata* also usually has particularly long style branches, up to 11 mm long and reaching the upper third of the anthers when lined up together, or even exceeding them. Some plants may have relatively prominently ribbed leaves, the rib edges with short cilia directed horizontally as well as long hairs on the veins, a feature not seen in subsp *pilosa*. Flowers are occasionally white or pale blue to almost white but are always diurnal, open during the morning and closing after 12:20, sometimes after 14:00. In contrast, flowers of subsp. *pilosa* are crepuscular, opening in the evening, after 17:00 or at sunset, and then strongly scented (Goldblatt *et al*. 2004) and the tepals are white (creamy-white), rarely pale mauve, with the outer or all tepals darkly pigmented red to brown or purple. Populations with pale mauve tepals occur at scattered sites in the southwestern Cape (e.g. *Barker 10653* (NBG), Swartwater Farm near Darling; *Acocks 24314* (MO, PRE), Lucasfontein, Malmesbury; *Goldblatt 2501* (MO, NBG), Theewaterskloof, Caledon). Tepals of subsp. *pilosa* are mostly 9–15 × 2–4 mm and the style branches are 5–9 mm long, these dimensions overlapping those of subsp. *bracteolata*, which has tepals (11–)12–16 × ± 3–5 and style branches (7–)8–9(–11) mm long.

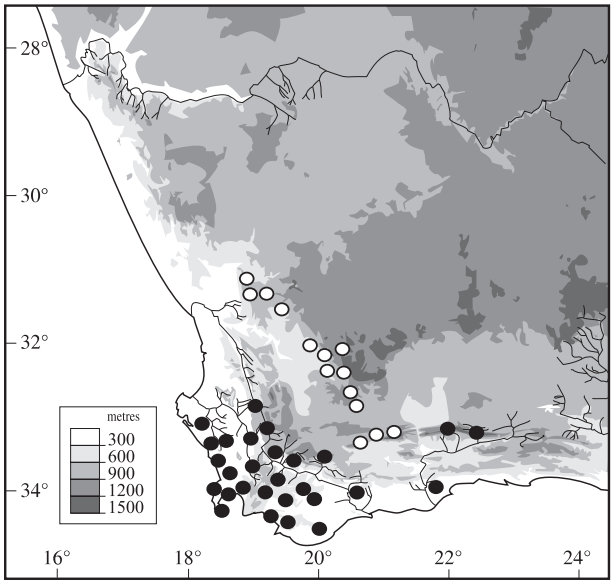


FIGURE 3.—Distribution of *Hesperantha pilosa* subsp. *pilosa*, ●; and subsp. *bracteolata*, ○.

As noted by Goldblatt (2003) the type of subsp. *bracteolata* consists of short plants about 70 mm high, but a later collection from near the type locality includes taller, more robust plants, some up to 150 mm high, evidently growing in a wetter season. Foster (1948) named the species for the tiny scale in the upper half of the stem but that feature is actually typical of *H. pilosa* and some related species. The type plants match several other collections from the southern Roggeveld in their purple perianth. The type of *H. puberula* from the Bokkeveld Mtns south of Nieuwoudtville has the blue perianth characteristic of other collections from the area. There are also a few records of white-flowered plants within the range of subsp. *bracteolata* but these, like those with blue to purple flowers, have a diurnal flower phenology and lack red to dark brown pigmentation on the outside of the outer or all tepals. Flowers of subsp. *bracteolata* are blue in the Bokkeveld Mtns and the Roggeveld as far south to Ganagga Pass, purple west of Sutherland close to the escarpment and pale blue to white in the Klein Roggeveld and nearby. Plants from sites between Matjiesfontein and Touws River have blue flowers, thus matching those from the Bokkeveld Mtns. Flowering phenology has been recorded as opening 7:30, closing 12:30 in the Bokkeveld Mtns, closing mid-afternoon west of Sutherland and after 14:00 in the Klein Roggeveld.

Additional collections seen

NORTHERN CAPE.—**3119** (Calvinia): Bokkeveld Escarpment, W of Farm Grasberg, (–AC), 1 Sept. 2005, *Goldblatt 12682* (MO, NBG); Grasberg road, NW of Nieuwoudtville, (–AC), 13 Sept. 1981, *Goldblatt 6262* (MO), 12 Oct. 1983 (fr.), *7072A* (MO); ± 5 km N of Papkuilsfontein, (–AC), 27 Aug. 2009, *Davidson 11595* (MO); Farm Driefontein, dolerite foothills at E end of Driefontein-se-Berg, (–DA), 16 Sept. 2009, *Goldblatt, Manning & Porter 13382* (MO, NBG). **3220** (Sutherland): Roggeveld Escarpment, just above top of Ganagga Pass, (–AA), 1 Sept. 1993, *Goldblatt & Manning 9680* (MO, NBG); Farm Hottentotskloof, Bo-Visrivier road, W of Sutherland, wet clay flats, (–AC), 2 Oct. 1999, *Goldblatt & Nänni 11191* (MO, NBG); Farm Voëlfontein, valley S of farmhouse, wet places, (–AD), *Goldblatt 6316* (MO); Roggeveld Escarpment, Farm Blesfontein, SW of Sutherland, (–CD), 24 Sept. 2011, *Goldblatt & Manning 13669A* (MO, NBG); top of Verlate Kloof, S of Sutherland, (–DA), 2 Oct. 1999, *Goldblatt & Nänni 11189* (MO, NBG); Klein Roggeveld, Farm De Hoop, (–DC), 30 Aug. 2007, *Goldblatt & Porter 12920* (MO, NBG).

WESTERN CAPE.—**3220** (Sutherland): top of valley N of Farm Fortuin, (–DC), 26 Aug. 2006, *Goldblatt & Porter 12707* (MO, NBG); 78 km S of Sutherland, S-slope in small valley, (–DC), *Goldblatt & Manning 9662* (MO, NBG); Klein Roggeveld, Farm De Hoop, (–DC), 30 Aug. 2007, *Goldblatt & Porter 12920* (MO). **3320** (Montagu): foot of the Voetpadsberg, 21.5 km E of Touws River, foot of sandstone slope, (–AB), 3 Oct. 1999 (fr.), *Goldblatt & Nänni 11200* (K, MO, NBG, PRE); 11 Sept. 2001, *Goldblatt & Porter 11877* (K, MO, NBG, PRE, WAG); Matjiesfontein to Touws River, sandstone outcrop, (–AB), 27 Aug. 2006, *Goldblatt & Porter 12712* (MO).

4. **Hesperantha secunda** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—[Northern Cape], 3119 (Calvinia): Roggeveld Escarpment, 56 km from Calvinia on Blomfontein road to Middelpos, (–DD), 17 Sept. 1980, *Goldblatt 5810* (NBG, holo.; K, MO, PRE, S, US, iso.).

Plants 100–180 mm high. *Corm* ovoid, 7–8 mm diam; tunics woody, concentric. *Stem* unbranched, glabrous, with minute, membranous, scale like bract up to 3 mm long on upper third of stem. *Foliage leaves* 3, lower two basal, linear to narrowly sword-shaped, falcate or straight, finely hairy, blades 2.5–4.0 mm wide, margins raised and winged at 90º to surface, main vein also raised and with narrow wings parallel to surface, uppermost leaf sheathing lower part of stem for all or part of its length, several ribbed, finely hairy. *Spike* mostly 3–7-flowered, bracts subequal, 7–10 mm long, outer green or becoming ± pale and membranous, inner membranous with 2 green keels, forked at apex. *Flowers* creamy white, nodding, tepals spreading at right angles to tube, presence of scent unknown; perianth tube cylindric, curving outward, 6–7 mm long; tepals 10–11 × 2.5–3.5 mm, inner slightly shorter and wider than outer. *Stamens* with filaments ± 3 mm long; anthers 5–6 mm long, evidently spreading, pale yellow; pollen yellow. *Style* dividing ± 1.5 mm below mouth of perianth tube; branches ascending, ± 4 mm long, reaching to base or lower quarter of anthers. *Capsules* and *seeds* unknown. *Flowering time*: September.

Distribution: known from one population from the Roggeveld Escarpment west of Middelpos (Figure 1), *Hesperantha secunda* is recorded on shallow, fine-grained soil over rocky sandstone pavement.

Diagnosis: when first collected, *Hesperantha secunda* was referred to *H. pilosa* with comments on its unusual winged leaf margins and main vein and nodding flowers on a secund spike (Goldblatt 1984). Reviewing the variation in *H. pilosa* in light of the many new collections made since then, this collection remains unique and we conclude that it represents a separate species, evidently allied to *H. pilosa* but distinguished by vegetative and floral morphology. All collections of *H. pilosa* have plane to ribbed leaves, the margins slightly thickened but rarely winged, and upright flowers with a straight perianth tube. Details of the flowers of *H. secunda* are also unusual for *H. pilosa*, including the relatively short tepals, 10–11 mm long vs. 9–15 mm in *H. pilosa* and short style branches, ± 4 mm long and reaching the base or lower quarter of the anthers when lined up together

(the style branches diverge in the open flower). In *H. pilosa* the style branches reach to the middle or upper third of the anthers or even exceed them and are 7–9(–11) mm long. An illustration of the species appears in Goldblatt (1984: 55 as *H. pilosa*).

RANGE EXTENSION

Hesperantha pilosa subsp. *pilosa*: until now the recorded range of subsp. *pilosa* is from the central Cedarberg at Middelberg and Uitkyk Pass to the Cape Peninsula and east to the Great Swartberg at Blesberg and from Caledon east to Riviersonderend and Bredasdorp (Goldblatt 1984, 1987). There are now records from near Swellendam and from Herbertsdale at the foot of Cloete's Pass in the eastern Langeberg (Figure 3). The latter represents a range extension of nearly 200 km east of Riviersonderend, previously the most easterly recorded station. Cloete's Pass specimens are consistent with subsp. *pilosa*, having crepuscular flowers with a white perianth with dark brown on the reverse of the outer tepals, a perianth tube ± 10 mm long and tepals ± 10 mm long.

WESTERN CAPE.—**3420** (Bredasdorp): S of Swellendam on road to Bontebok Reserve, (–AB), 26 Aug. 2000, *Goldblatt 11433* (MO, NBG); **3421** (Mossel Bay): 2 km from Herbertsdale to Cloete's Pass, (–BA), 26 Sept. 2003, *Goldblatt & Porter 12599* (MO, NBG); N of Herbertsdale at the foot of Cloete's Pass, (–?AB), 30 Sept. 2004, *Goldblatt & Porter 13599* (MO, NBG).

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Eight new species of *Moraea* (Iridaceae) from southern Africa with range extensions and morphological notes in the genus

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Keywords: Iridaceae, *Moraea* L., new species, range extensions, southern Africa, taxonomy

ABSTRACT

We describe eight new southern African species in the largely sub-Saharan African genus *Moraea* L., one from the winter-dry Great Karoo and the others from the winter-rainfall zone of the southwest of the subcontinent. *M.* **striata** Goldblatt & J.C.Manning (subg. *Visciramosae* Goldblatt) from the southern foothills of the Great Swartberg Mtns has khaki-green flowers with reflexed tepal limbs streaked with dark lines. The acaulescent *M.* **singularis** Goldblatt & J.C.Manning (subg. *Umbellatae* Goldblatt & J.C.Manning) with terete leaf blades is restricted to the dry, interior foothills of the Kamiesberg in Northern Cape. *M.* **filamentosa** Goldblatt & J.C.Manning, subg. *Acaules* (Baker) Goldblatt & J.C.Manning, is described from the dry interior of Namaqualand in Northern Cape. The species is closely allied to the widespread *M. falcifolia* Klatt. In subg. *Polyanthes* (Goldblatt) Goldblatt & J.C.Manning, we describe *M.* **thermarum** Goldblatt & J.C.Manning (sect. *Hexaglottis* (Vent.) Goldblatt) from southwestern Namibia, allied to *M. brevituba* (Goldblatt) Goldblatt, and *M.* **lazulina** Goldblatt & J.C.Manning (sect. *Pseudospicata* Goldblatt & J.C.Manning) from the Little Karoo, until now confused with *M. exiliflora* Goldblatt but differing in its larger flowers with strongly reflexed tepals. The new *M.* **petricola** Goldblatt & J.C.Manning (subg. *Vieusseuxia* (D.Delaroche) Goldblatt), is restricted to higher elevations of the Pakhuis Mtns of northern Western Cape. Lastly, in subg. *Homeria* (Vent.) Goldblatt & J.C.Manning, we recognize *M.* **doleritica** Goldblatt & J.C.Manning with pale yellow flowers and anthers exceeding the style branches, restricted to dolerite outcrops in the Great Karoo, and *M.* **eburnea** Goldblatt & J.C.Manning from the northern foothills of the Klein Swartberg, which has a single, basal leaf and pale yellow flowers with filaments free distally. *Moraea* now has 222 species, including 203 in southern Africa, of which 200 are endemic to the region. In addition to describing new species, the paper brings to light range extensions of a further eight species: *M. barnardii* L.Bolus, *M. elliotii* Baker, *M. exiliflora* Goldblatt, *M. falcifolia* Goldblatt & J.C.Manning, *M. fenestralis* (Goldblatt & E.G.H.Oliver) Goldblatt, *M. louisabolusiae* Goldblatt, *M. tulbaghensis* L.Bolus and *M. unguiculata* Ker Gawl. Each of the species falls into one of the subgenera mentioned for the new species except *M. fenestralis* which belongs in subg. *Galaxia.*

INTRODUCTION

The African and Eurasian *Moraea* Mill. (Iridaceae: Iridoideae) is centred in the southern African winter rainfall region in the southwest of the subcontinent where the genus is both most diverse and most species rich (Goldblatt *et al.* 2002; Schnitzler *et al*. 2011). Of the 11 subgenera recognized in a revised classification of the genus (Goldblatt *et al*. 2013), all occur in the region and all but one of them are endemic or centred there. Patterns of speciation in the winter rainfall region, an area of diverse soils and varied, but often low, rainfall, has resulted in the evolution of many extremely local endemics, several known from just one or very few populations. It is not surprising, therefore, that most of the eight new species described here are narrow endemics, and that five of them were discovered only in the past five years in spite of many years of field exploration by the authors as well as others. Just one, *M. filamentosa* Goldblatt & J.C.Manning, first collected in 1958, has been known for some time but was until now referred to *M. falcifolia* Klatt. Including these novelties, *Moraea* now comprises 222 species, all but two of them restricted to sub-Saharan Africa. The species described here are arranged following the new the classification of the genus by Goldblatt *et al*. (2013).

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NEW SPECIES

Subg. *Visciramosae* Goldblatt

Sect. *Multifolieae* Goldblatt & J.C.Manning

1. **Moraea striata** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—South Africa, Western Cape, 3322 (Oudtshoorn): foothills of the Great Swartberg, Rust-en-Vrede, road from entrance to waterfall, (–BD), 8 Oct. 2012, *Goldblatt & Porter 13858* (NBG, holo.; MO, iso.).

Plants 450–600 mm high. *Corm* including tunics 20–25 mm diam.; tunics brown, sticky internally, accumulating as coarse matted fibres forming collar around base of stem. *Stem* 2–5-branched from upper nodes, sticky below nodes; branches short, arching outward above sheathing leaf, erect distally; sheathing leaves 30–40 mm long, acute-attenuate. *Foliage leaves* 3, all basal, linear, falcate, often trailing distally, channelled, V-shaped in cross section with pronounced keel, 4–5 mm wide when opened flat. *Rhipidial spathes* grey-green, becoming dry distally, acute-attenuate, inner 30–40 mm long, outer ± half as long. *Flowers* dull khaki, tepal limbs fully reflexed, with several longitudinal dark brown-grey lines along entire length, outer tepal limbs with pale yellow nectar guides at bases;

outer tepals 25–30 × 10–11 mm, claws ± 7 mm long, with dark basal nectary; inner tepals 22–25 × ± 8 mm. *Stamens* with filaments ± 10 mm long, free but contiguous in lower 6 mm, diverging in distal 4 mm; anthers ± 4 mm long, buff-yellow, shortly exceeding stigmatic lobes; pollen orange-red. *Ovary* ± cylindric, 5–6 mm long; style branches ± 6 × 5 mm, crests erect, broadly wedge-shaped, 6–7 mm long, outer margins lightly serrated, with broad, entire petaloid stigmatic appendage ± 4 mm long. *Capsules* and *seeds* unknown. *Flowering time*: October, probably also November; flowers opening 14:00–15:00 and fading at sunset. Figure 1.

Distribution: evidently a local endemic of the Oudtshoorn section of the Great Swartberg (Figure 2), *Moraea striata* was recorded twice in 2012 on clay slopes at the southern foot of the range. There appear to be no earlier records of the species.

Diagnosis: the sticky stems, distinctive branching pattern and stigmatic appendage place *Moraea striata* in subg. *Visciramosa* where the unequal floral bracts and more than two foliage leaves correspond with sect. *Multifolieae*, one of the two sections of the subgenus. Flowers of *M. striata* are predominantly dull greyish green or dull khaki, the outer tepal limbs with pale yellow nectar guides at the base and finely streaked with dark grey longitudinal lines running almost the length of the limbs. The anthers are buff-yellow and the pollen bright orange. The tepal limbs of both whorls are fully reflexed and the filaments are contiguous in the lower half but free to the base, a feature also characteristic of subg. *Visciramosae*. A particularly unusual feature of *M. striata* is that the leaf blades are V-shaped in cross section with a sharply angled keel. Similar leaves are known in very few species of the genus, none of subg. *Visciramosae*, in which rounded keels are typical.

Moraea striata most closely resembles *M. bubalina* Goldblatt, a species of the western, winter rainfall Karoo, which also has three leaves but flowers with broad, diverging tepal claws forming a wide cup, the tepal limbs buff to brown and reflexed to about 45°. *M. bubalina* also has a short, acute stigmatic appendage up to 2 mm long, very different from the large, petaloid stigmatic appendage about 4 mm long in *M. striata*. Flowers of *M. striata* bear a superficial resemblance to those of *M. inconspicua* Goldblatt in their fully reflexed tepals but the flowers of that species are much smaller, the outer tepals 12–18 mm long (vs. 25–30 mm in *M. striata*), and it consistently has two foliage leaves and subequal, finely veined rhipidial spathes.

Additional specimen

WESTERN CAPE.—**3321** (Ladismith): foothills of the Great Swartberg, road to Calizdorp W of turnoff to Swartberg Pass, (–DB), 8 Oct. 2012, *Goldblatt & Porter 13855* (MO, NBG).

Subg. *Umbellatae* Goldblatt & J.C.Manning

2. **Moraea singularis** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—South Africa, Northern Cape, 3018 (Kamiesberg): Vaalputs, NECSA site, (–BA), Platbakkies Succulent Karoo, 2 Aug. 2011, *Van Rooyen 2827* (PRU, holo.).

Plants small, acaulescent 30–40 mm high. *Corm* spindle-shaped, ± 10 mm diam., tunics of grey-brown, wiry, reticulate fibres. *Stem* with 1–4 congested branches at ground level. *Leaves* 3, clustered at ground level, lowermost longest, inserted on stem at ground level, falcate, terete, 50–80 mm long, 0.8–1.0 mm diam., upper 2 leaves much shorter, recurved, bifacial, channelled or with short terete blade up to 20 mm long. *Rhipidial spathes* green, outer leaf-like, recurved distally, 25–30 mm long, inner ± as long. *Flowers* rotate, pale to golden yellow, limbs of all tepals with brown, spear- or lozenge-shaped nectar guide near base, tepal claws ascending, forming cup enclosing base of filament column, limbs spreading, inner usually twisted through 90° distally; tepals united for 2 mm, claws ± 1 mm long, limbs obovate-pandurate, truncate, outer ± 12 × 6 mm, inner slightly smaller. *Stamens* with filaments ± 5 mm long, connate in a smooth, cylindric column ± 4 mm long, free and diverging in upper 1 mm; anthers ± 3 mm long, yellow; pollen yellow. *Ovary* cylindric, ± 10 mm long, included; style branches divided almost to base into terete-involute arms diverging on either side of each anther, ± 1.5 mm long, stigmatic at apices, crests reduced, ± 1 mm long. *Capsules and seeds* unknown. *Flowering time*: late July to early August. Figure 3.

Distribution and ecology: known from two localities along the eastern foot of the Kamiesberg massif in central Namaqualand (Figure 2), *Moraea singularis* grows on gravel flats derived from granite bedrock. The species is too poorly known to assess its conservation status, but we provisionally suggest a listing of RARE. We see no threat to its continued existence in this remote and thinly populated area of minimal importance to farming activity. So inconspicuous is the species that it is easily overlooked unless in bloom. Plants flower for just a few days in any year and unusually early after the first rains of the season. We suspect the species has a wider range than is presently recorded.

Diagnosis: an acaulescent species, *Moraea singularis* is recognized by its underground stem and short, terete leaf blades. The yellow flowers, with both inner and outer tepals limbs bearing brown nectar guides, have tepal claws only ± 1 mm long forming a narrow cup including the base of the smooth filament column. The tepal limbs are obovate-pandurate, the inner three slightly smaller than the outer and twisted through 90°. The asymmetric corms with brown corm tunics accord best with subg. *Umbellatae* as do the outer rhipidial spathe, which sheaths the inner spathe only in the lower half and arches outward distally, and also the darkly veined tepals and brown nectar guides. Unique to the subgenus is the terete blade of the basal leaf, while the upper leaves are either channelled entirely or terete distally.

Additional specimen

NORTHERN CAPE.—**3018** (Kamiesberg): NE of Kamieskroon, near Rooifontein, (–AB), 27 Aug. 2006, *Gwynne-Evans s.n.* (NBG, photo.).

Subg. *Acaules (Baker) Goldblatt & J.C.Manning*

3. **Moraea filamentosa** *Goldblatt & J.C.Manning*, sp. nov.



FIGURE 1.—*Moraea striata* (*Goldblatt & Porter 13858*). A, flowering plant; B, androecium and style. Scale bar: A, 10 mm; B, 2 mm. Artist: John Manning.

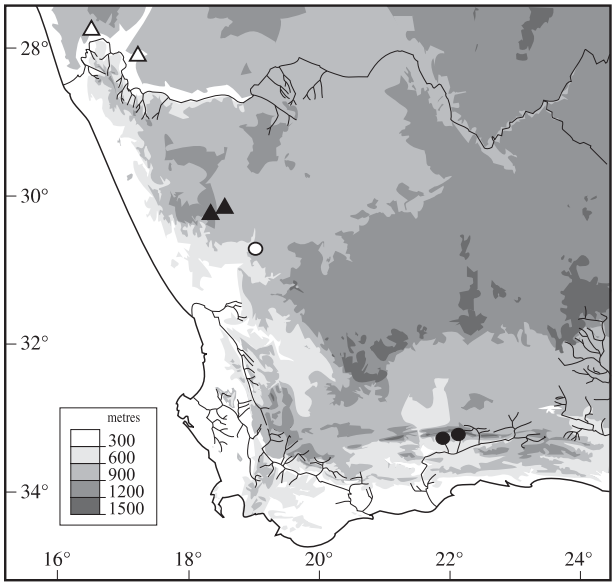


FIGURE 2.—Distribution of *Moraea filamentosa*, ○; *M. thermarum*, Δ; *M. singularis*, ▲; *M. striata*, ●.

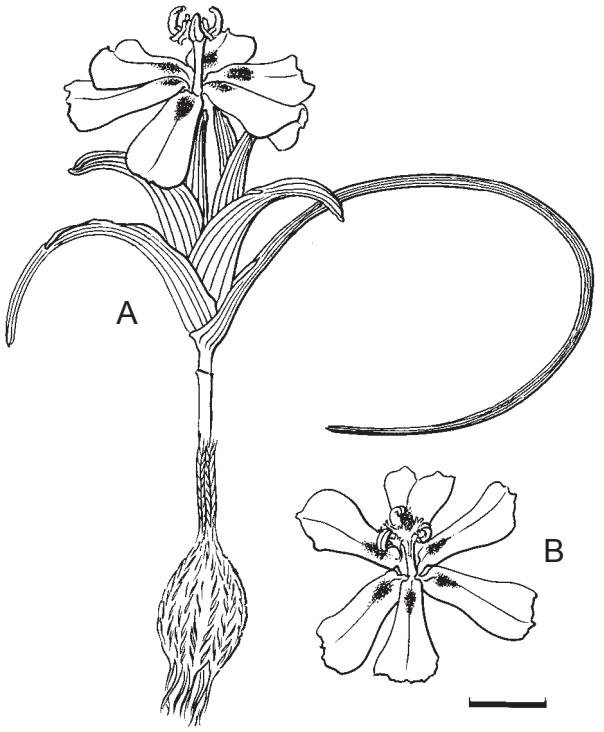


FIGURE 3.—*Moraea singularis* (*Van Rooyen 2827* and *Gwynne-Evans s.n.*). A, flowering plant; B, flower. Scale bar: 10 mm. Artist: John Manning.

TYPE.—South Africa, Northern Cape, 3019 (Loeriesfontein): 22 miles [± 34 km] N of Loeriesfontein, (–DA), May 1958, *Hall 1385* (NBG, holo.).

Plants acaulescent, ± 20 mm high including flowers. *Corm* ± 12 mm diam.; tunics of medium-textured, shaggy fibres. *Stem* with congested branches at ground level. *Foliage leaves* several, blades falcate, channelled, up to 10 mm long, up to 1.2 mm wide when opened flat, with thickened, hyaline main vein on abaxial surface, apex obtuse, margins hyaline, ciliolate. *Rhipidial spathes*: outer not distinct from leaves, with broad, membranous sheaths, inner ± membranous, floral bracts membranous, dry, elongate, often irregularly torn, ± as long as leaves. *Flowers* possibly white, markings and orientation of tepals not known; outer tepals lanceolate, ± 14 × 4 mm, claws ± 5 mm, limbs probably spreading, inner tepals ± 12 × 2 mm, possibly erect. *Stamens* with filaments ± 4.5 mm long, united in lower half; anthers ± 2.5 mm long, evidently yellow. *Ovary* elongate, fertile part club-shaped, ± 5 mm long; style branches broad, ± 4 mm long, crests triangular, ± 4 mm long, erect. *Capsules* and *seeds* unknown. *Flowering time*: May.

Distribution: known only from a single collection from north of Loeriesfontein (Figure 2). The habitat is not known.

Diagnosis: *Moraea filamentosa* is a dwarf, acaulescent species reaching no more than 20 mm high including the flowers. Despite their small size, the leaves are distinctive, having broad, membranous sheaths and falcate, channelled blades with obtuse apices, ciliolate margins, and a thickened ridge in the midline of the abaxial surface. A remarkable feature not known in any other species of *Moraea* is that the floral bracts are elongate, membranous, and about as long as the leaves, thus visible as pale filamentous threads among the leaf blades. The flowers are small, with outer tepals ± 14 mm long, but otherwise typical of *Moraea*, with filaments united in the lower half, broad style branches, and prominent erect crests. The species appears to be most closely related to *M. falcifolia,* which has a broadly similar habit but is a larger plant with larger flowers, the outer tepals mostly 18–22 mm long, and long, tapering leaves up to 100 mm long with acute tips.

Although discovered in 1958, the species has remained unnamed until now. The hope that additional material would come to hand has not been fulfilled and we have decided to describe the species from the two plants that comprise the collection, hoping its formal naming will stimulate a search for more plants.

Subgen. *Polyanthes (Goldblatt) Goldblatt & J.C.Manning*

Sect. *Hexaglottis* (Vent.) Goldblatt

4. **Moraea thermarum** *Goldblatt & J.C.Manning,* sp. nov.

TYPE.—Namibia, 2817 (Vioolsdrif): Karas, Ai-Ais Hotsprings Game Park, along Orange River, (–AA), on cliff face, 13 Sept. 2012, *A. Burke 12035* (WIND, holo.).

Plants 30–100 mm high. *Corm* 10–15 mm diam.; tunics of dark brown to black fibres, extending upward as short stiff bristles. *Stem* simple or 1- or 2-branched; branches shortly stalked; sheathing leaves 1 or 2, 11–17 mm long. *Cataphylls* reddish brown. *Foliage leaves* 3 or 4, all ± basal, trailing or pendant, 80–120 × 1–3 mm, undulate and loosely twisted, margins crisped, with 1 conspicuous lateral vein per side. *Rhipidial spathes* green or becoming dry from tips, acute, inner 15–25 mm long, outer ± half as long. *Flowers* fugaceous, yellow,

stellate, tepals connate into short cylindrical tube ± 1.5 mm long, limbs spreading, elliptic, ± 15 × 5 mm, shortly clawed, claws 0.5–1.0 mm long. *Stamens* with filaments united only at base (seeming free), ± 5 mm long; anthers ± 3 mm long, straight and suberect before dehiscence, yellow. *Ovary* included in spathes, style arms paired, filiform, spreading, 4–5 mm long. *Capsules and seeds* unknown. *Flowering time*: mid-September to October. Figure 4.

Distribution: known from two collections fringing the Huib Hoch Plateau in southern Namibia, one from the summit of the Aurusberg and the other along the Orange River near Ai-Ais (Figure 2). Plants are confined to shaded cliff faces, growing wedged in cracks in the rocks, recorded in one instance as granite.

Diagnosis: resembling *Moraea namaquana* (Goldblatt) Goldblatt in its trailing, undulate or crisped leaves and stalked lateral inflorescences, *M. thermarum* is distinguished by its narrower, linear leaves, 1–3 mm wide with a single lateral vein on each side and somewhat smaller flowers with a distinct perianth tube ± 1.5 mm long, the ovary included in the spathes. *M. namaquana*, which grows in open rocky ground, is a more robust species, with leaves 5–11 mm wide with 2 conspicuous lateral veins per side, and the tepals are free to the base.



FIGURE 4.—*Moraea thermarum* (*Burke 12035* and *Williamson & Hammer 4564*). A, flowering plant; B, flower; C, androecium and style. Scale bar: A, B, 10 mm; C, 5 mm. Artist: John Manning.

Additional specimen

NAMIBIA.—**2716** (Witpütz): Karas, summit of Aurusberg, ± 1 000 m, (–CB), rock cracks in shade on southern aspect, 2 Nov. 1992, *G. Williamson & S. Hammer 4564* (NBG).

Sect. *Pseudospicatae* Goldblatt & J.C.Manning

5. **Moraea lazulina** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—South Africa, Western Cape, 3322 (Oudtshoorn): Schoemanshoek, Kranskloof, eastern foot of rocky hill, in stony sandstone ground, (–AC), 8 Oct. 2012, *Goldblatt & Porter 13859* (NBG, holo.; MO, PRE, iso.).

Plants 160–350 mm high. *Corm* ± conical, 12–18 mm at widest diam., with numerous small cormlets around base; tunics of medium-textured, matted, dark grey fibres. *Stem* flexuose, 1–5-branched, rarely simple. *Foliage leaf* solitary, linear, longer than stem, erect to falcate, narrowly channelled, 2–3 mm wide when opened flat. *Rhipidial spathes* with brown, attenuate tips, inner 33–45 mm long, outer ± half as long. *Flowers* fugaceous, blue, outer tepal limbs with white nectar guides sometimes edged with dark blue, limbs of both whorls reflexed >45°, inner often more so than outer, unscented; outer tepals ± lanceolate, 22–27 × 8–9 mm, limbs 15–18 mm long, claws 7–8 mm long, inner tepals 17–20 × 5–7 mm. *Stamens* with filaments 8 mm long, united in lower half; anthers ± 5 mm long, grey-blue; pollen white or pale blue. *Ovary* ± cylindric, 5–6 mm long; style branches ± 7 × 5 mm, crests narrowly wedge-shaped, 7–8 mm long. *Capsules* and *seeds* unknown. *Flowering time*: mid-September to late October; flowers open ± 15:00 and collapse at dusk. Figure 5.

Distribution: relatively widespread in the Little Karoo, *Moraea lazulina* extends from near Barrydale (J.J. Vlok pers. comm.) and the Rooiberg south of Calitzdorp to De Rust, east of Oudtshoorn and Perdepoort in the upper Long Kloof (Figure 6). Plants occur in rocky sandstone ground and on limestone slopes near the Cango Caves on the lower southern slopes of the Great Swartberg.

Diagnosis: blue-flowered *Moraea lazulina* has until now usually been associated with a second Little Karoo species, *M. exiliflora* Goldblatt, which also has a solitary, narrowly channelled basal leaf, and sometimes even with multi-leaved *M. bipartita* L.Bolus. *M. lazulina* has significantly larger flowers than *M. exiliflora* and is typically a taller plant, usually with a moderately branched stem. The flowers are always blue with large, white nectar guides and outer tepals 22–27 × 8–9 mm, inner tepals 17–20 × 7 mm and filaments ± 8 mm long, whereas *M. exiliflora* has smaller, pale blue, mauve or white flowers with yellow (or white) nectar guides and outer tepals 14–17 × 4.5–6.0 mm, inner tepals 13–15 × 4.5–6.0 mm, and filaments ± 4.5 mm long. Other features of *M. lazulina* are likewise larger than in *M. exiliflora*. The form of the flowers also differs to some extent, the tepal limbs of *M. lazulina* being reflexed more than 45°, the inner sometimes more so than the outer. In contrast, the tepal limbs of *M. exiliflora* are laxly spreading to reflexed up to 30°.

Additional specimens

WESTERN CAPE.—**3321** (Ladismith): Oudshoorn–Calitzdorp road, 30.6 km E of Vanwyksdorp turnoff, (–DB), 16 Aug. 1985, *Steiner 952* (NBG). **3322** (Oudtshoorn): limestone slopes near Cango Caves, (–AC), 8 Oct. 2012, *Goldblatt & Porter 13862* (MO). Perdepoort, N of Camfer, sandstone slope burned last summer, (–CD), 28 Sept. 2004, *Goldblatt & Porter 12574* (MO).

Subg. *Vieusseuxia*

6. **Moraea petricola** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—South Africa, Western Cape, 3220 (Wuppertal): Pakhuis peaks, ± 5 km NW of Kliphuis, Rhebokskloof Extension 185, 925 m, (–AA), 25 Oct. 2008, *Helme 5726* (NBG, holo.).

Plants ± 30 mm high. *Corm* globose, ± 12–16 mm diam.; tunics of grey-brown, medium-textured, netted fibres, accumulating in fibrous collar around base of stem. *Stem* three internodes long above ground, unbranched, sheathing leaves with dry attenuate apices, 35–40 mm long. *Foliage leaf* solitary, basal, linear, narrowly channelled, 2/3 to ± as long as stem, ± 2 mm wide opened flat. *Rhipidial spathes* with dry, attenuate apices, inner ± 40 mm long, outer ± half as long. *Flowers* lasting 3 days, purple, outer tepal limbs with white, wedge-shaped nectar guides at bases, laxly spreading to weakly reflexed; outer tepals ± 20 mm long, claws 5–6 mm long, ascending; inner tepals ± 9 mm long, limbs spreading, ± 4 mm long, 3-lobed with long, tapering central cusp and short, rounded, obtuse lateral lobes, claws ± 5 mm long, ascending, tapering from narrow base to wide apex. *Stamens* with filaments ± 8 mm long, united in smooth cylindrical column in lower ± 3 mm, diverging distally; anthers ± 5 mm long, dark purple; pollen red. *Ovary* ± cylindric, ± 8 mm long, exserted; style ± 5 mm long, branches ± 8 × 2 mm long, ascending, held above subtending limbs, crests narrowly wedge-shaped, ± 4 mm long. *Capsules* and *seeds* unknown. *Flowering time*: October to mid-November.

Distribution: as far as we know, *Moraea petricola* (Latin: "growing in rocky sites" and also recalling Kliphuis [Stone house] Peak nearby) is restricted to higher elevations in the mountains to the north of Pakhuis Pass in the northern Cedarberg (Figure 6). Known from just one collection, it almost certainly has a wider range than the present record indicates but is, nevertheless, a fairly local endemic. Available information makes it impossible to accurately assess its conservation status, although its range is presently in a pristine habitat, disturbed only by occasional fires. We provisionally suggest a status of RARE.

Diagnosis: collected just once in flower in 2008 and subsequently found in vegetative state in 2012, *Moraea petricola* is a typical member of subg. *Vieusseuxia* in its solitary basal leaf, 3-lobed inner tepals and, we infer, long-lived flowers. The purple flowers have narrow, white, wedge-shaped nectar guides edged with dark purple on the outer tepal limbs. The inner tepals have unusually broad, 3-lobed limbs with a prominent, linear, reflexed central cusp and rounded lateral lobes. The flowers in general recall *M. decipiens* Goldblatt & J.C.Manning, particularly in colour and shape, but

have much longer filaments, ± 8 mm long (vs. 3.5–4.0 mm in *M. decipiens*), a style ± 5 mm long (vs. ± 2 mm) and shorter tepal claws, 5–6 mm (vs. 8–9 mm). The relatively long style branches are held well above the subtending outer tepals limbs, whereas in *M. decipiens* the style branches are appressed to the tepal claws and the inner tepals curve upward rather than having reflex limbs with the central cusp directed downward. Additional collections of this rare species are needed to confirm our current observations based on limited material.

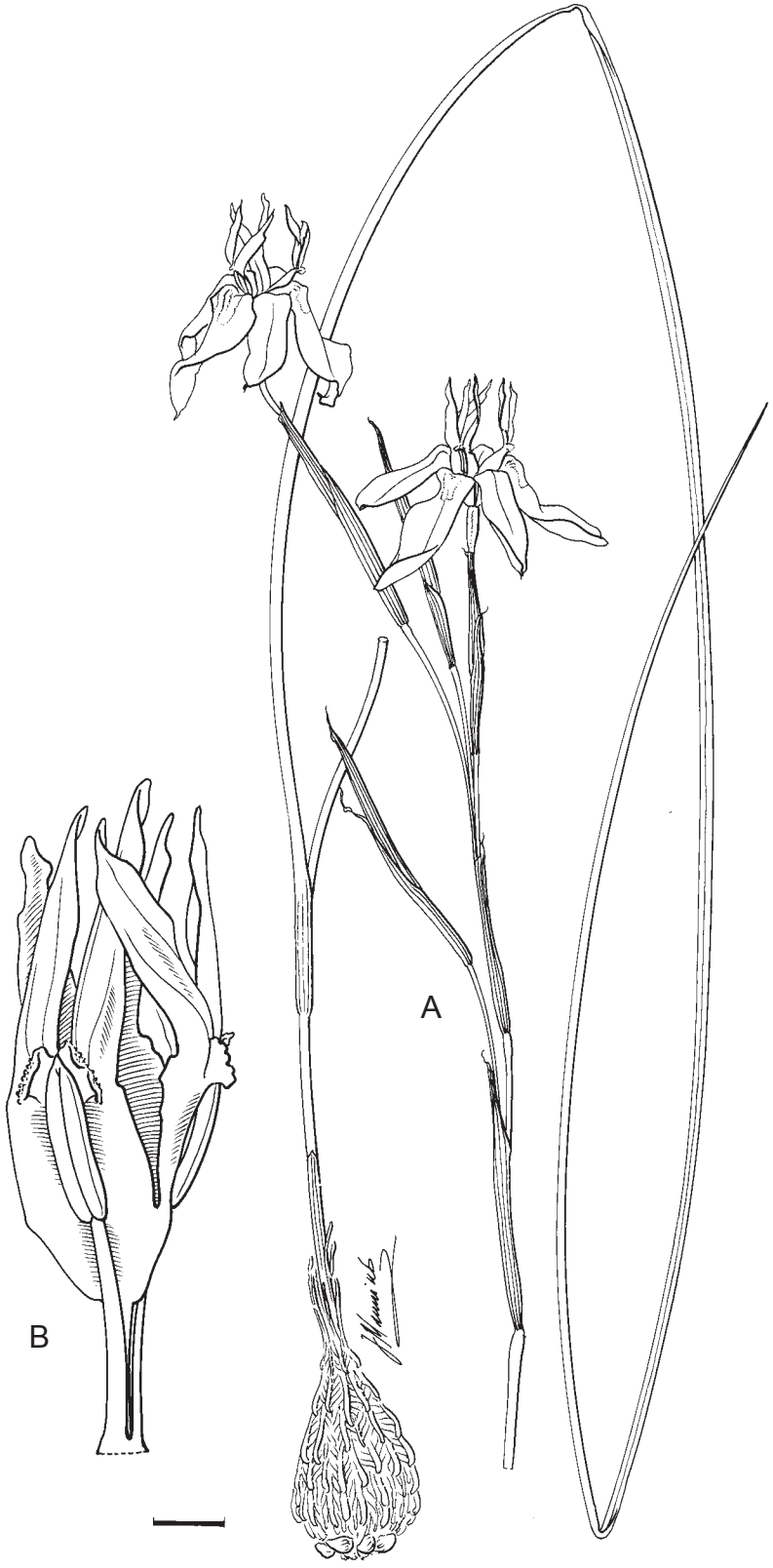


FIGURE 5.—*Moraea lazulina* (*Goldblatt & Porter 13859*). A, flowering plant; B, androecium and style. Scale bar: A, 10 mm; B, 2 mm. Artist: John Manning.

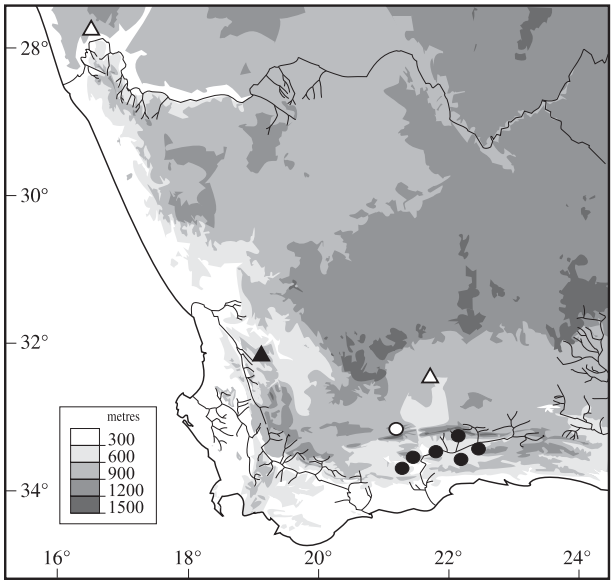


FIGURE 6.—Distribution of *Moraea doleritica*, Δ; *M. eburnea*, ○; *M. lazulina*, ●; *M. petricola*, ▲.

Subg. *Homeria* (Vent.) Goldblatt & J.C.Manning

Sect. *Stipanthera* (Goldblatt) Goldblatt & J.C.Manning

7. **Moraea doleritica** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—South Africa, Western Cape, 3221 (Merweville): Great Karoo, ± 52 km S of Fraserburg to Leeu Gamka, low dolerite outcrops below Great Escarpment, (–CB), 27 Sept. 2012, *Goldblatt & Porter 13806* (NBG, holo.; MO, PRE, iso.).

Plants 350–450 mm high. *Corm* unknown. *Stem* with (1)2 or 3 branches from penultimate node, bearing a single sheathing leaf 45–55 mm long, attenuate, ± dry and light brown midway through flowering. *Cataphylls* dry, brown and broken at flowering. *Foliage leaf* solitary, linear, fibrotic, falcate, longer than stem, narrowly channelled, 2–3 mm wide when opened flat. *Rhipidial spathes* pale grey-green, dry and light brown in upper half, attenuate, with fine white nerves evident, inner 50–65 mm long at anthesis, outer ± half as long, inner elongating after flowering to enclose ripening capsules. *Flowers* fugaceous, pale yellow, outer tepal limbs with deeper yellow nectar guides at base with fine dark dots; outer tepals obovoid-pandurate, 25–27 mm long, limbs ± 20 mm long, claws of both whorls ± 6 mm long, ascending to form narrow cup including lower half of filament column, limbs spreading and twisted through ± 45° distally, inner tepals ± 22 × 7 mm. *Stamens* with filaments 7–8 mm long, united for most of their length in smooth, cylindric column, free and diverging in upper 0.7 mm; anthers ± 8 mm long before anthesis, 5–6 mm after releasing pollen, then tips arching inward, exceeding style branches, yellow, pollen yellow. *Ovary* cylindric, usually exserted, ± 12 mm long; style branches ± 4 mm long, crests ± linear, erect, ± 1.5 mm long. *Capsules* and *seeds* unknown. *Flowering time*: mid-September and October; flowers opening early morning and collapsed by 11:00. Figure 7.

Distribution: known only from the Great Karoo between Leeu Gamka and Fraserburg in Western Cape (Figure 6), *Moraea doleritica* is evidently restricted to dolerite outcrops. Plants of both populations that we encountered grew only among large, partly buried dolerite rocks, their corms tightly wedged in crevices in the bedrock. The species is so far known from just two populations only a few kilometres apart and south of the Nuweveld Mtns that comprise this section of the Great Escarpment. It is the only Great Karoo endemic species of the genus.

Diagnosis: the pale yellow flowers with relatively well developed style branches and short, erect crests and, in particular, the filaments, free distally for a short distance, are somewhat unusual for subg. *Homeria* and recall *M. pallida* (Baker) Goldblatt and *M. cookii* (L.Bolus) Goldblatt as well as two Namaqualand species, *M. schlechteri* (L.Bolus) Goldblatt and *M. knersvlaktensis* Goldblatt. The latter two species have multiple foliage leaves whereas *M. cookii* and *M. pallida* as well as *M. doleritica* have a single foliage leaf and we suggest that *M. doleritica* may be most closely related to these two species. The spreading tepals twisted distally through about 45° of *M. doleritica* are also found in *M. cookii* and *M. pallida,* another reason to consider them related. Both *M. cookii* and *M. pallida* have a relatively broad leaf clasping the lower part of the stem, thus rather different to the particularly long, narrowly channelled, and relatively rigid, tough, fibrotic leaf of *M. doleritica*. The range of *M. doleritica* in the Great Karoo is complimentary to that of *M. cookii* and *M. pallida*. *M. cookii* is widespread in southern Africa, extending from the Cedarberg in Western Cape through the mountains of the Karoo to Lesotho and *M. pallida* occurs across the Upper Karoo through Free State to Mpumalanga.

8. **Moraea eburnea** *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—South Africa, Western Cape, 3321 (Ladismith): Seweweekspoort to Laingsburg near Farm Vleiland, northern foothills of the Klein Swartberg Mtns, (–AC), 25 Sept. 2004, *Goldblatt & Porter 12561* (NBG, holo.; K, MO, PRE, iso.).

Plants 150–200 mm high. *Corm* unknown. *Stem* mostly 2–4-branched, flexed above sheaths of basal and cauline leaves, sheathing leaves 30–40 mm long, attenuate, dry and light brown in distal half. *Cataphylls* dry, brown, ± fibrous at flowering. *Foliage leaf* solitary, basal, linear, falcate, ± twice as long as stem, narrowly channelled, ± 2 mm wide when opened flat, often dry and trailing distally. *Rhipidial spathes* dry and light brown in distal half, attenuate, inner 30–35 mm long, outer almost half as long. *Flowers* fugaceous, pale ivory-yellow, limbs of all tepals with deeper yellow nectar guides at bases, spreading; outer tepals narrowly obovate, 20–25 × 7–8 mm, limbs 18–22 mm long, claws of both whorls ± 2 mm long, ascending as a narrow cup including lower half of filament column, inner tepals 18–21 × 6–7 mm. *Stamens* with filaments ± 5 mm long, united in smooth, cylindric column 4 mm long, free and



FIGURE 7.—*Moraea doleritica* (*Goldblatt & Porter 13806*). A, flowering plant (without corm); B, androecium and style; C, style. Scale bar: A, 10 mm; B, 2 mm; C, 1 mm. Artist: John Manning.

diverging in upper 1 mm; anthers ± 3 mm long before anthesis, ± 2 mm after releasing pollen, exceeding style branches, yellow; pollen yellow. *Ovary* spindle-shaped, usually exserted, ± 5.5 mm long; style branches flattened, 2.5 × 1.5 mm long, with broad stigmatic lobes, crests ± linear, erect, ± 1 mm long. *Capsules* obovoid, ± 10 mm long. *Seeds* unknown. *Flowering time*: September to mid-October.

Distribution: known only from the Farm Vleiland north of the Klein Swartberg Mtns (Figure 6).

Diagnosis: the relatively small, pale yellow flowers of *Moraea eburnea* have moderately well developed, flattened style branches terminating in unusually broad stigmatic lobes and short, erect crests somewhat unusual in subg. *Homeria*, as are the filaments, united in a smooth, cylindric column about 4 mm long, but free and diverging on the upper 1 mm. The distally free filaments and moderately well developed style branches suggest that *M. eburnea* may be most closely related to the *M. pallida* group (sect. *Stipantherae*) as most other species of subg. *Homeria* have the filaments completely united. If this assignment is correct, *M. eburnea* is by far the smallest member of the alliance. The slender stem and narrow leaf place *M. eburnea* in an isolated position in the group. Relationships in subg. *Homeria* are difficult to assess by phenetic comparison (Goldblatt 1981) and molecular study using plastid DNA sequences have so far provided no useful insights except that the *M. pallida* group (including *M. cookii*, *M. pallida* and *M. reflexa* Goldblatt) is retrieved as a clade sister to the remaining species of subg. *Homeria* (Schnitzler *et al.* 2011; Goldblatt *et al*. 2013). Of the 37 species of subg. *Homeria*, only *M. eburnea* and *M. doleritica* remain to be included in any molecular analysis.

RANGE EXTENSIONS AND MORPHOLOGICAL NOTES

1. *Moraea barnardii* L.Bolus (subg. *Vieusseuxia*): has small, white outer tepals flecked with dark blue and undulate margins, bright red pollen and lacking inner tepals. The distinctive *M. barnardii* is known for certain from Shaw's Pass, south of Caledon (Goldblatt 1976), where it has been collected repeatedly. It is not common there but plants are scattered on the sandstone slopes east and west of the summit of the Pass and bloom well only after a veld fire. There is also an unconfirmed and somewhat doubtful record from near Gansbaai (*Gillett 4311* BOL), some distance to the southeast. Because of its narrow range, *M. barnardii* is currently regarded as Critically Rare (CR) (Raimondo *et al*. 2009). We report here a possible new locality for the species, from near the mouth of the Palmiet River, Kleinmond (*Gillett 4250* BR, MO). The collection, made by J.B. Gillett in 1938, and until now identified as *M. tripetala*, conforms closely to type of *M. barnardii*. The flowers lack inner tepals entirely, the outer tepal limbs have undulate edges and the filaments, ± 8 mm long, are united for ± 1.5 mm. The dark-coloured anthers, the original colour of which is no longer evident, are only 3 mm long, thus conforming closely to *M. barnardii*, in which the anthers are 3–4 mm long in the type population. Like Gillett's collection from Gansbaai, the Palmiet River record requires confirmation. If correct, the conservation status of the species will require revision.

2. *Moraea elliotii* Baker (subg. *Polyanthes*): as currently circumscribed, single-leaved and usually blue-flowered, *M. elliotii* extends through eastern southern Africa from the Grahamstown area of Eastern Cape through KwaZulu-Natal to Limpopo and Swaziland and with an outlying record from Malawi (Goldblatt 1986, 1993). New collections from west of Grahamstown expand the geographic range of *M. elliotii* and call into question its circumscription. Plants matching the type, which is from Mpumalanga, have ascending tepal claws and spreading to ultimately half reflexed inner and outer tepal limbs (the form is illustrated in Goldblatt 1986), filaments usually 3.5–4.5 mm long united in the lower 1.5–2.0 mm and style branches 8–10 mm long. Plants of the two Eastern Cape collections have somewhat different flowers, the inner tepals ultimately spread from the base and are somewhat twisted in propeller fashion, the filaments are united only basally and the long style branches lie appressed to the outer tepals claws for almost their entire length. The leaves are also unusual, having tightly inrolled margins and seeming terete and are inserted above ground level. Flowers of the Elandsberg population are white with purple-edged nectar guides, but those from the Suuranys Mtns have pale, grey blue flowers. The floral form in these two collections is a good match for flowers of *M. elliotii* illustrated in Pooley (1998), *Wild Flowers of KwaZulu-Natal*, which also have a white perianth. The circumscription of *M. elliotii* needs re-examination. We note here that at least the synonym *M. juncifolia* N.E.Br. (Brown 1929), based on plants from the Saddleback, Barberton, Mpumalanga, has a terete leaf inserted on the stem above ground level. We are unable to resolve the question as to whether *M. elliotii*, as presently interpreted, comprises two species, with the terete-leaved plants, often with white to pale grey-blue flowers a separate taxon, but wish to draw attention to the question.

EASTERN CAPE.—**3324** (Steytlerville): Suuranysberg, (–CC), Nov. 2011, *Smith s.n.* (NBG); Elandsberg, pass from Patensie to Melkhoutboom via Mimosa Vale, crest of hill 'white with mauve markings,' (–DB), 22 Oct. 1993, *Bean & Viviers 3057* (BOL).

3. *Moraea exiliflora* Goldblatt (subg. *Polyanthes*): when described (Goldblatt 1986) *Moraea exiliflora* was known from only two collections, both from Towerkop in the Klein Swartberg near Ladismith in the Little Karoo. New collections have expanded its range considerably: there are records from the Touwsberg, foothills of the Kammanassie Mtns, southwest of Ladismith, and from the upper Long Kloof southwest of Uniondale. Plants at the Long Kloof site are restricted to relatively dry, west-facing, rocky sandstone slopes and flower in unburned, dry fynbos vegetation dominated by Restionaceae and *Bobartia*. *M. exiliflora* is clearly not a rare endemic of the Little Karoo but is a moderately widespread, although poorly collected, species. Its apparent rarity is evidently due in part to its small flowers with for example, outer tepals 14–18 × 4.5–6.0 mm, inner tepals 13–15 × 2.5–3.5 mm and anthers 3.0–3.5 mm long. It also has an unusual flowering phenology: flowers open in the late afternoon; those of the population near Uniondale opened after 16:00 and collapsed by 18:00, a pattern that probably reflects that for the entire species. *M. exiliflora* is most easily confused with *M. lazulina*, described in this paper, which also has a single

foliage leaf and a similarly shaped flower but is a taller, more robust plant with larger flowers. The similarly proportioned flowers of *M. lazulina* have outer tepals 22–27 × 7–9 mm (limbs 14–18 mm long), inner tepals 17–20 × 7 mm and anthers ± 5 mm long. The tepals are strongly reflexed, at least to 50°, the inner tepals often more strongly reflexed than the outer, whereas tepals of *M. exiliflora* are laxly spreading to slightly reflexed, mostly < 15° below horizontal.

WESTERN CAPE.—**3321** (Ladismith): NE slopes of Touwsberg above Farm Boerboonfontein 115, (–CA), 7 Oct. 1993, *Snijman 1394* (NBG). **3322** (Oudtshoorn): roadside near Mons Ruber Winery, (–CB), 8 Sept. 2002, *Goldblatt & Porter 12556A* (MO); southern foothills of Kammanassie Mtns, between Koutjie and Scheeperskraal, (–DA), *Vlok & Schutte 274* (MO); Avontuur to Herold, sandstone slopes above Farm Kykoe, (–DD), 19 Sept. 2010, *Goldblatt & Porter 13558* (MO, NBG), 26 Sept. 2012, *13802* (MO, NBG).

4. *Moraea falcifolia* Goldblatt & J.C.Manning (subg. *Acaules*): widespread in arid and semi-arid southern Africa, *M. falcifolia* extends from southern Namibia and Namaqualand across Bushmanland and the Upper and Great Karoo to Alexandria in Eastern Cape and to Kuruman and Kimberley in Northern Cape (Goldblatt 1976, Goldblatt & Manning 2009). Here we report a significant range extension of the species from Jacobsbaai on the Atlantic coast of Western Cape near Saldanha, some 120 km north of Cape Town. The most southwesterly records until now are from Vredendal and Vanrhynsdorp, some 160 km to the north. This record is notable also for perianth colour: predominantly white with yellow nectar guides at the bases of the outer tepal limbs and large dark marks at the apices of the inner tepal claws, features typical of nearly all populations of *M. falcifolia*, but the style crests also have large dark pigmentation on the lower half, rarely present in the species.

We also draw attention to a collection of *Moraea falcifolia* from the plateau of the Kamiesberg of central Namaqualand, above 1 000 m. Plants of this population are the most robust in the species, the leaves reaching to 100 mm long and the flowers are the largest so far recorded. For example, the outer tepals are 25–26 mm long, the inner ± 24 mm long, whereas until now outer tepals have been described as 15–22 mm long, the inner 13–20 mm long; the length of the anthers and ovary, 4–5 mm long are the same as recorded for *M. falcifolia*. The inner tepals of this population lack the characteristic purple marks otherwise, as far as we know, universal in the species, and when collected the inner tepals were suberect, whereas the limbs are spreading in other populations. The features of this population significantly expand the circumscription of *M. falcifolia*. Typical *M. falcifolia* has been recorded near Kamieskroon not far distant from the unusual population we describe here but at significantly lower elevation, ± 400 m. Apart from the size of most features, the Kamiesberg population conforms in general aspect to *M. falcifolia*.

NORTHERN CAPE.—**3018** (Kamiesberg): Namaqualand, Kamiesberg, plateau above Kamieskroon, along Buffels River on road to Pedroskloof, deep sand, (–AA), 17 Sept. 2001, *Goldblatt & Porter 11907* (K, MO, NBG, PRE).

WESTERN CAPE.—**3217** (Vredenburg): Saldanha District, Jacobsbaai, limestone ridge, (–DD), July 2007, *Claassens s.n.* (NBG, photo only).

5. *Moraea fenestralis* (Goldblatt & E.G.H.Oliver) Goldblatt (subg. *Galaxia*): originally described as *Galaxia fenestralis* (Goldblatt & Oliver 1993) and transferred to *Moraea* by Goldblatt (1998), *M. fenestralis* was then known from granite outcrops in eastern Namaqualand near Kliprand in Northern Cape. A new record from the granite hills east of Okiep near Springbok (*Helme 6619*, NBG), made in July 2010, is therefore surprising. Plants from this site, flowering in July, have very pale pink flowers with yellow anthers, filaments united in a column, diverging in upper ± 2 mm and leaves with a translucent central line, and thus correspond closely to the type and other collections of the species. *M. fenestralis* is inconspicuous even in bloom and we suspect there are other populations awaiting discovery in the area between Kliprand and Springbok–Okiep area, a distance of over 125 km.

NORTHERN CAPE.—**2917** (Springbok): Namaqualand, granite ridge top 6 km E of Okiep, (–DB), 17 July 2010, *Helme 6619 (NBG).*

6. *Moraea louisabolusiae* Goldblatt (subg. *Homeria*): described in 1981 as *Homeria bolusiae* Goldblatt, *Moraea louisabolusiae* was then known from northern Western Cape in the Clanwilliam District in the hills near Kransvlei and the lower slopes of the Nardouw Mtns and from Northern Cape on the Bokkeveld escarpment at Lokenburg. Plants matching the species have now been recorded in the Kamiesberg on the slopes of Rooiberg in central Namaqualand (*Goldblatt & Manning 9767*). Plants from the Kamiesberg differ very little from those already known. They have a single foliage leaf inserted above ground level, a stem flexed above the sheaths of the foliage and sheathing leaves and yellow flowers with short, erect tepal claws and filaments largely united in a slender smooth column but free distally. The free portion of the filaments is ± 1 mm long vs. 0.5 mm in plants from elsewhere and the style crests are ± 1.5 mm long vs. 1 mm long in earlier collections. The Kamiesberg record is significant as it extends the range of *M. louisabolusiae* some 160 km to the north of its next nearest known station and outside the Core Cape flora region (Manning & Goldblatt 2013).

NORTHERN CAPE.—**3018** (Kamiesberg): Kamiesberg, Farm Karas [Welkom], low spurs of Rooiberg, (–AD), 26 Sept. 1993, *Goldblatt & Manning 9767* (MO, NBG).

7. *Moraea tulbaghensis* L.Bolus (subg. *Vieusseuxia*): the southwestern Cape *Moraea tulbaghensis*, now including *M. neopavonia* R.C.Foster (Goldblatt & Manning 2002), is allied to *M. villosa* (Ker Gawl.) Ker Gawl., the two sharing villous leaves and stems and flowers with broad, ± suborbicular to broadly ovate outer tepal limbs up to 38 mm long with prominent, contrasting, dark-coloured nectar guides (Goldblatt 1976, 1986). Most populations of *M. tulbaghensis* have bright orange or occasionally red flowers with deep blue to iridescent green nectar guides. The species differs from *M. villosa,* which has purple or mauve, rarely greenish white or even orange flowers, outer tepals 22–38 × 20–35 mm, anthers 6–10 mm long, not exceeding the relatively long style crests (2.5)5.0–8.0 mm long. In *M. tulbaghensis* the outer tepals are mostly 15–20 × 15–20 mm and the anthers, 7–10 mm long, and always exceed the short style crests, 1–2 mm long. Plants resembling these two species, discovered on the western slopes of Riebeek Kasteel Mtn, have white tepals with dark blue nectar guides, a colour combination most consistent with

M. villosa, but the anthers, ± 9 mm long, exceeding the style crests, only ± 2 mm long. These dimensions are consistent with *M. tulbaghensis* as are other features of the flower except for the somewhat broader outer tepal limbs (up to 23 mm wide vs. 15–20 mm) (Table 1). We conclude that the Riebeek Kasteel population represents a striking colour morph of *M. tulbaghensis* with slightly broader outer tepals not before recorded in the species but differing in no other taxonomically significant features. The population also represents a modest range extension for the species, which has been recorded from the Tulbagh Valley and in the Berg River Valley and adjacent hills from the outskirts of Paarl in the south to Korningberg near Piketberg.

WESTERN CAPE.—**3318** (Cape Town): western flank of Riebeek Kasteel Mtn, clay slope, (–BD), 25 Sept. 2009, *Goldblatt & Porter 13448* (MO, NBG, PRE).

8. *Moraea unguiculata* Ker Gawl. (subg. *Vieusseuxia*): across its wide range, from Steinkopf in northern Namaqualand to Graaf Reinett and Port Elizabeth, *M. unguiculata* has prominently trilobed inner tepals, the central, linear-attenuate lobe coiled inward and the lateral lobes broader, obtuse and shorter than the central (Goldblatt 1976; Goldblatt & Manning 1995). A population referred here from the top of the Langkloof in the southern Kamiesberg in Northern Cape (*Goldblatt & Manning 10425*, MO, NBG), flowering 18 Nov. 1995, stands out in having ± linear-filiform inner tepals ± 20 mm long (the tightly coiled distal half makes exact measurement impossible), with slightly wider membranous tissue in the middle. In addition, the filaments are united in a column ± 5.5 mm long but free in the upper 2.5 mm and the anthers, ± 4 mm long, have an unusually prominent apiculus ± 1 mm long. Until now we have regarded this as a local morph of the species and of trivial significance. Typical *M. unguiculata* is, however, now known to occur throughout the upper Kamiesberg including the Langkloof and the hills near Leliefontein, a short distance to the north (e.g. *Goldblatt & Porter 13576* MO, NBG: *Goldblatt & Porter 13692*, MO, NBG). These plants have the prominently trilobed inner tepals exactly conforming to the type. The filaments in these Kamiesberg populations are united in a column up to 10 mm long and free for ± 1.3 mm and the anthers are ± 6 mm long, with a short apiculus ± 0.5 mm long. Variation in populations of *M. unguiculata* in Namaqualand needs to be carefully compared with the divergent population before we can assess the significance of its discordant features. Provisionally we prefer not to expand the circumscription of *M. unguiculata* and the divergent population is not accommodated in keys to the genus.

ACKNOWLEDGEMENTS

We thank Nick Helme of Cape Town for bringing to our attention his discovery of *Moraea petricola* and the occurrence of *M. fenestralis* near Okiep; Helga Rosch of Middelpos, for alerting us to the existence of *M. singularis*; Jan Vlok of Oudtshoorn for sharing his knowledge of *Moraea* in the Little Karoo; Patrick Fraser for directing us to his discovery of the white morph of *M. tulbaghensis*; and Clare Archer for providing answers to our several questions about holdings at the Pretoria herbarium. We are also grateful to and Elizabeth Parker and Len Porter for assistance in the field.

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TABLE 1.—Comparison of critical taxonomic features of *Moraea tulbaghensis* and *M. villosa*

Taxon	Flower colour	Outer tepal limbs (mm)	Inner tepals (mm)	Style branches (mm)	Style crests (mm)	Anther length (mm)
M. villosa	Purple or mauve, rarely greenish white, even orange, with dark blue or purple nectar guides.	22–38 × 20–35	16–30	5–7 × 8	(2.5)5.0–8.0	6–10
M. tulbaghensis	Bright orange or occassionally red with deep blue to iridescent green nectar guides.	(12)15–30 × 15–20	15–25	5–7 × 3–5	1–2	7–10
Riebeek Kasteel plants	White with dark blue nectar guides.	± 21 × 23	± 16	5.5 × 2	± 2	± 9

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FSA Contribution 22: Asteraceae: Calenduleae: *Garuleum*

N. SWELANKOMO*

INTRODUCTION

The genus *Garuleum* Cass. is a member of the tribe Calenduleae in the subfamily Asteroideae of the family Asteraceae (Bremer 1994). Calenduleae comprises 12 genera, of which 11 occur naturally in southern Africa (Nordenstam 2007). Only one genus, *Calendula* L., is confined to the northern hemisphere, but some of its species are cultivated or occur as weeds in southern Africa. The tribe is economically important as some species are highly palatable to livestock and game, e.g. *Chrysanthemoides incana* (Burm.f.) Norl. (Van Breda & Barnard 1987), while others, e.g. *Dimorphotheca cuneata* DC., are poisonous to stock (Watt & Breyer-Brandwijk 1962).

Garuleum can be distinguished from other genera in the tribe by its unique style. The style of the disc florets is deeply bifurcate, with linear lobes covered with papillae to well below point of bifurcation; whereas in other genera the style of disc florets is shallowly bifid with a short apical collar of hairs (Norlindh 1943; Goldblatt & Manning 2000; Herman *et al*. 2000). In *Garuleum*, fruits develop from the ray florets only, except in *G. bipinnatum*, in which the disc florets are bisexual and the fruits that develop from these disc florets are winged, evidently as an adaptation to wind dispersal **(**Swelankomo 2010**).** The ray cypselae in this species vary in shape from obpyramidal-triangular with small acute angles to narrowly obovate or conical, and the disc cypselae are flattened and cordate*,* as in many species of *Dimorphotheca* Moench.

Garuleum currently includes eight species and two subspecies, all endemic to southern Africa (Merxmüller 1967). Although widespread in southern Africa, *Garuleum* is absent from Botswana, Swaziland and the Limpopo and North-West Provinces of South Africa (Herman *et al*. 2000, 2003).

No complete taxonomic revision exists for *Garuleum*, a situation that is rectified here with a detailed taxonomic treatment of the genus. Lectotypes are designated as required and full descriptions, a key to species, illustrations, and distributions are provided for all the species.

MATERIAL AND METHODS

Morphological characters in *Garuleum* were studied from herbarium specimens housed in PRE, NH, GRA and NBG (acronyms after Holmgren *et al*. 1990). The length of the corolla, length and width of the involucre, length of the style and ovary, number of ray florets (where possible) and length of cypselae were measured with the aid of a Bausch & Lomb StereoZoom® Series microscope. Two cypselae from each taxon (except in *G. album and G. tanacetifolium)* were examined by means of a scanning electron microscope (ISI SX 25). All samples were dry and were not chemically treated before being sputter-coated with gold-palladium. Anthers were studied under a dissecting and light microscope (Olympus Vanox-S).

TAXONOMY

Garuleum *Cass*. in Bulletin de la Société Philomatique de Paris 1819: 172 (1819); Harv.: 92 (1865); Norl.: 33 (1943); B.Nord.: 375 (1994); P.P.J.Herman *et al*.: 139 (2000). Type species: *Osteospermum caeruleum* Jacq. [= *G. pinnatifidum* (L'Hérit.) DC.], lecto., designated by Pfeiffer: 1411 (1873–1874).

Perennial herbs, shrublets or shrubs, sometimes viscid, scabrid or pilose. *Leaves* alternate, sessile, pinnatifid or toothed, sometimes pungent. *Capitula* radiate, solitary or corymbose, terminal, pedunculate. *Involucre* hemispherical-campanulate. *Involucral bracts* in 2 or 3 rows, ovate to linear, usually ciliate, sometimes reflexed and sometimes pungent. *Receptacle* convex, epaleate. *Ray florets* female, fertile; corolla blue, purple, mauve, white or yellow, lamina linear or oblong, 3-toothed, up to 3 × as long as tube. *Style* branches linear, sub-acute with stigmatic papillae along margins. *Ray cypselae* triquetrous or somewhat compressed with entire or crenate angles, glabrous. *Pappus* absent. *Disc florets* bisexual or functionally male, yellow; corolla tube sub-campanulate above, with 5 lanceolate lobes, lobes glandular, sometimes hairy on back. *Anthers* minutely caudate, with ovate apical appendages; endothecial tissue polarized. *Style* terete, deeply bifurcate with linear lobes, covered with acute papillae to well below point of bifurcation or stigmatic papillae along sides. *Disc cypselae* (developing only in *G. bipinnatum*) obovate or obcordate in outline, flattened, marginally winged with thickened rim, glabrous. *Pappus* absent.

8 spp., southern Africa

Etymology: although the derivation of the name is not explained by Cassini (1819), it is most likely a corruption of the Latin *caeruleus*, alluding to the blue ray florets, as suggested by Jackson (1990).

Key to species

1a Leaves toothed or pinnatifid, divided up to ± halfway to midrib:

2a Leaves discolorous, white-woolly beneath . . . . . 1. *G. album*

2b Leaves not strongly discolorous, green and sparsely pilose to glandular beneath:

3a Involucral bracts sub-biseriate, all ± equal in length. . . . . 2. *G. sonchifolium*

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3b Involucral bracts 3-seriate, outer much shorter than inner . . . . . 3. G. *latifolium*

1b Leaves pinnatisect or pinnate, divided to midrib:

4a Capitula borne on short, inconspicuous peduncles obscured by apical leaves. . . . . 4. *G. tanacetifolium*

4b Capitula borne on prominent, sparsely leafy peduncles:

5a. Involucral bracts ovate, apices obtuse to acute; capitula usually solitary; stem very rough with conspicuous glands. . . . . 5. *G. woodii*

5b. Involucral bracts narrowly lanceolate, apices acuminate; capitula in loose corymbs:

6a Subshrubs with annual flowering stems from gnarled woody base; disc florets female-fertile, fruit developing from both ray and disc florets . . . . . .6. *G. bipinnatum*

6b Shrublets with softly woody stems; disc florets female-sterile:

7a All leaves pinnate; stem minutely glandular; cypselae 3.0–3.5 mm long . . . . . .7. *G. pinnatifidum*

7b Lower leaves irregularly bipinnatipartite or almost tripinnatipartite; stem glandular-hispid; cypselae 4.0 mm long . . . . . .8 *G. schinzii.*

1. **Garuleum album** *S.Moore* in Journal of Botany London 16: 133 (1878); C.Claassen 40: t. 1593 (1970). Type: [Eastern Cape], 'Kaffraria, Shawbury,' 1800′ [590 m], June [without year], *Baur 226* (K000273563—ALUKA image!, lecto., designated here; K000273562—ALUKA image!, isolecto.). [K000273563 is selected as lectotype as it is the most complete specimen, with associated dissections, and bears Baur's handwritten original collecting label].

Viscid aromatic shrub, 0.6–0.9 m high, abundantly leafy and branched, with white-woolly indumentum especially on abaxial surface of leaves, on peduncles and on involucre. *Leaves* sessile, alternate, lyrato-pinnatifid, 50–95 mm long, white-woolly on abaxial surface, green and very scabrid above, margin serrate with pungent teeth. *Capitula* radiate, several clustered towards ends of branchlets, peduncles white-woolly, 15–30 mm long. *Involucre* campanulate, 10 × 12–15 mm. *Involucral bracts* 3-seriate, imbricate, oblong-linear, apices reflexed, white-woolly abaxially, especially towards apices, outer bracts 5.0–5.5 mm long, middle bracts 8.5–9.0 mm long, inner bracts 12.0–12.5 mm long. *Ray florets* ± 26–37, female-fertile, purplish-blue; corolla limb oblong-elliptic, 9–15 × 2.5 mm, somewhat glandular towards base; corolla tube 4–5 mm long, glandular. *Style* 8.5–9.0 mm long, swollen at the base, glabrous, cylindric, branched, style branches linear, ± 2 mm long, subacute. *Ovary* glabrous, obovoid, ± 3-angled, 3 mm long. *Mature cypselae* not seen. *Disc florets* functionally male, yellow, 6–7 mm long; lobes narrowly ovate, 1.5 mm long, somewhat hairy on back. *Anthers* 3 mm long, linear, minutely caudate with a small apical, ovate appendage. *Style*, 8–9 mm long, terete swollen at base; style branches 1 mm long, narrowly ovate, hairy on outer surface. *Ovary* narrowly obovate in outline, compressed, narrowly winged, 4–5 mm long, glabrous. *Flowering time:* August–February. Figure 1A.

Distribution and habitat: *Garuleum album* is a range-restricted species known only from a small area between Lusikisiki and Port St Johns in the Eastern Cape Province (Figure 3), occurring in a densely populated area where it is declining due to ongoing habitat loss and degradation. It is recorded from rocky, dolerite soils on hill-slopes at ca. 600 m.

Diagnosis: Garuleum album is distinguished by the soft, white-woolly indumentum, especially on the undersurface of the lyrato-pinnatifid leaves, the peduncle, and the involucre.

Additional specimens

EASTERN CAPE.—**3129** (Port St Johns): Tabankulu, Qala above the road to Gomo Forest, (–AB), 15 Mar. 1995, *Wopula 153* (NH); 10 miles [16 km] N of Lusikisiki, (–BC), 11 Aug. 1953, *Codd 7992* (PRE); Mlengana, between Umtata and Port St Johns, (–CA), Feb. 1896, *Flanagan 2532* (PRE); Port St Johns, Mlengana, (–CA), 18 Jan. 1910, *Pegler 1569* (PRE); Near the Khoweni Forest, Nkanga location, Libode area, (–CA), 26 Apr. 2006, *Styles 3056* (NH).

2. **Garuleum sonchifolium** (*DC*.) *Norl*. in Studies in the Calenduleae 1: 425 (1943) (and cf. p. 30); Hilliard: 518 (1977). *Osteospermum sonchifolium* DC.: 465 (1838); Harv.: 440 (1865); Type: Eastern Cape, between the Umtata and Umzimvubu Rivers, *Drège 5109* (G-DC—microfiche! [PRE—photo.!], holo.; E, K, iso.)

Osteospermum sonchifolium var. *subpetiolatum* Harv.: 440 (1865), syn. nov. Type: [Eastern Cape], 'Keiskammahoek', *Cooper* 227 (TCD—ALUKA image!, lecto., designated here; K—ALUKA image!, NH!, PRE!, isolecto. [The TCD collection is more complete and plentiful and includes dissected capitula attached (in the capsule). The specimen also includes a good drawing of a disc floret]. [*Syntype:* [Eastern Cape], Kreili's country', *Bowker* 337 (TCD—digital image!)].

Glandular-pubescent, viscidulous, aromatic, perennial herb, suffrutex or dwarf-shrub, 0.3–1.2 m high. *Leaves* alternate, sessile, ear clasping at bases, membranous, netted-veined, inciso-pinnatifid; the lobes short, sharply few-toothed, all teeth acuminate. *Capitula* pedunculate, radiate. *Peduncle* mostly solitary, rarely in a corymb. *Involucre* campanulate, 9–10 × 3 mm. *Involucral bracts* sub-biseriate, lanceolate-acuminate, 8.0–10.0 × 2–3 mm. *Ray florets* ± 15–20, female, fertile, purple-blue, violet-blue, blue; corolla limb oblong-elliptic, 8–10 × 4 mm; corolla tube cylindric, up to 3 mm long, glandular. *Style* up to 4 mm long, linear branched, style branches ± 2.2 mm long. *Ovary* up to 2 mm long, glabrous, obovate in outline. *Disc florets* functionally male, yellow; lobes ovate, 0.2 mm long; corolla limb 5 mm long. *Style* 5 mm long, branched, style branches 0.2 mm long, linear with pollen sweeping hairs, which cover style below the point of bifurcation, for same length as that of branches. *Anthers* linear, minutely caudate with ovate apical appendages. *Ovary* up to 3 mm long. *Cypselae* 5.5 mm long, glabrous, three-angles, obpyramidial, strongly rugose. *Flowering time*: December– July. Figure 1B, 2A.

Distribution and habitat: *Garuleum sonchifolium* occurs in KwaZulu-Natal from around Underberg and Mooi River southwards to Kokstad and Fort Beaufort Division in Eastern Cape, (Figure 4), between altitudes of 450–1 860 m. *G. sonchifolium* has been recorded along river banks and on hillsides, mountain slopes and

ridges, along the road, and along forest margins, on stony soils, rocky outcrops and grassland.

Diagnosis: resembling *G. latifolium* in its alternate, sessile, membranous leaves, coarsely toothed or more deeply cut halfway to midrib but distinguished by the sub-biseriate vs. 3-seriate involucre.

Additional specimens

KWAZULU-NATAL.—**2929** (Underberg): Lundy's Hill, (–DB), 26 Mar. 1901, *Wood 8116* (PRE); Tillietudlem, (–DB), 9 Feb. 1947, *Huntley 131* (NH). **2930** (Pietermaritzburg): Mooi River, Warley Common, (–AA), 17 Mar. 1920, *Mogg 7179* (PRE); Mooi River, near Mooi River, (–AA), 19 Dec. 1885, *Wood PRE 44110* (PRE); Nottingham road, (–AC), Mar. 1939, *McClean 922* (PRE); Richmond, Byrne,



FIGURE 1.—Variation in shape and size of the leaves of *Garuleum* species. A, *G. album*, *Codd 7992*; B, *G. sonchifolium*, *McClean 922;* C, *G. latifolium*, *Hitchins 54*; D, *G. bipinnatum*, *Esterhuysen 5286*; E, *G. tanacetifolium*, *Acocks 16812;* F, *G. woodii*, *Devenish 491;* G, *G. pinnatifidum*, *Hanekom 908*; H, *G. schinzii* subsp. *schinzii*, *Giess, Volk & Bleissner 7176* ; I, *G. schinzii* subsp. *crinitum*, *Mexmüller 826*. Scale bars: A–I, 20 mm.

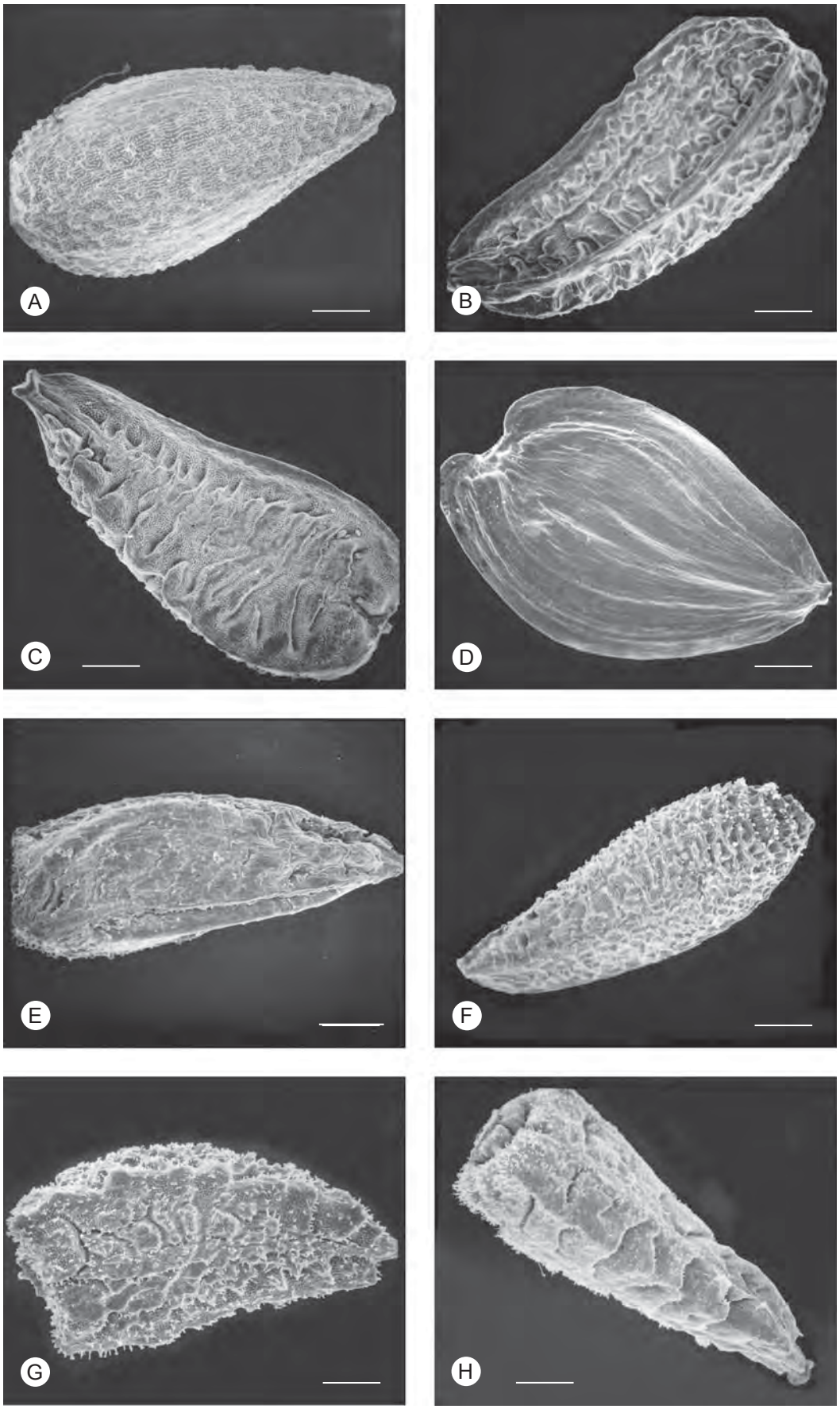


FIGURE 2.—SEM micrographs of the cypselae of *Garuleum* species. A, *G. sonchifolium*, *Flanagan 599,* ray cypsela; B, *G. latifolium, Galpin 13374,* ray cypsela; C, *G. bipinnatum*, *Rodriguez-Oubina & Cruces 2107*, ray cypsela; D, *G. bipinnatum*, *Rodriguez-Oubina & Cruces 2107*, disc cypsela; E. *G.woodii, Jordaan 2763,* ray cypsela; F, *G. pinnatifidum*, *Hanekom 1954*, ray cypsela; G, *G. schinzii* subsp. *schinzii*, *Oliver & Steenkamp 6306*, ray cypsela; H, *G. schinzii* subsp. *crinitum*, *Merxmuller 826*, ray cypsela. Scale bars: A, B, E, H, 491.512 µm; C, 385.238 µm; D, G, 509.065 µm; F,475.128 µm.

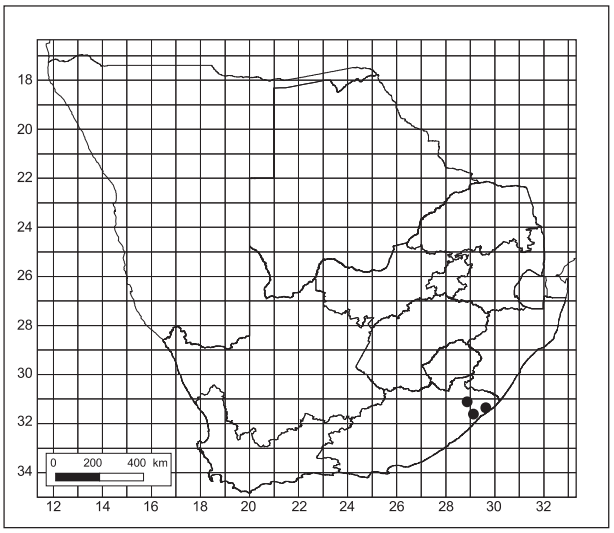


FIGURE 3.—Distribution of *Garuleum album.*

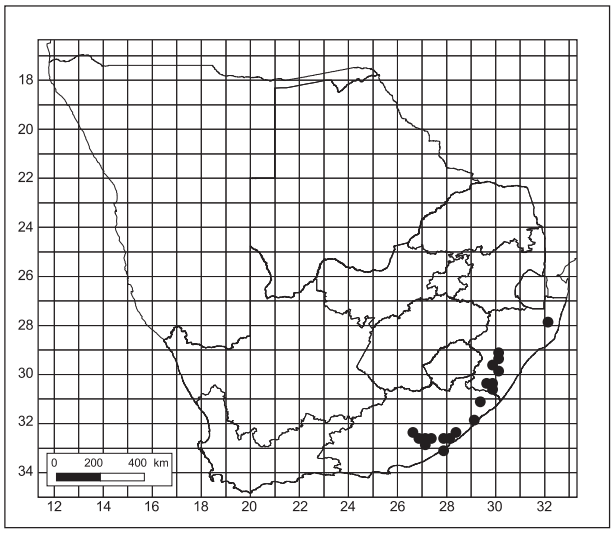


FIGURE 4.—Distribution of *Garuleum sonchifolium*.

(–CC), 24 Apr. 1932, *Galpin 11913* (PRE). **3029** (Kokstad): Alfred, Weza, Zuurberg, (–BC), 3 Mar. 1974, *Hilliard 5465* (PRE); Alfred, Harding, Rooval Farm, (–DB), 2 Mar. 1983, *Hilliard & Burtt 16754* (PRE).

EASTERN CAPE.—**3029** (Kokstad): Griqualand East, Malowe Mountain, (–BD), Feb. 1885, *Tyson 1047* (PRE). **3129** (Port St Johns): Umtakatyi River, head of Umtakatyi River N of Libode, (–CC), 16 Sept. 1947, *Acocks 13809* (PRE); On road from Tabankulu to Lusikisiki, near the Horseshoe, (–AB), 22 June 1995, *Phillipson, Dold & Cloete 4326* (PRE). **3226** (Fort Beaufort): Stockenstromm, Katberg, (–BC), 1898, *Sim 19812* (PRE); Seymour, Hogsback, Auckland Forest, (–DB), 14 Aug. 1943, *Giffen 838* (PRE); Amatole Mountains, bottom of Hogsback Pass, (–DB), 13 Aug. 1984, *Phillipson 874* (PRE). **3227** (Stutterheim): Keiskammahoek, Keiskamma River, Boma Pass, (–CA), 20 Sept. 1942, *Acocks 9098* (PRE); King Williams Town, Pirie, (–CB), 24 Jan. 1936, *Taylor 1753* (PRE); Stutterheim, 8.4 miles [13.4 km] from Stutterheim on Keiskamma Hoek road, (–CB), 22 Sept. 1954, *Marais 526* (PRE); Keiskammahoek, 11.5 miles [18.4 km] from Keiskammahoek bridge on road to Debe Nek, (–CC), 18 Mar. 1948, *Story 3374* (PRE); Isedenga Forest near King William's Town, (–CD), 9 Mar. 1964, *Batten, A.U. 1 Plate 54* (NBG); Komga, Valley near Komga, (–DB), Feb. 1891, *Flanagan 599* (PRE). **3228** (Butterworth): Willowvale, Ngqaqini, (–AD), Nov. 1983, *Van Eeden B369* (PRE); Kei River near Kei River, (–CA), *Flanagan 599A* (PRE). **3327** (Peddie): East London, (–BB), 28 Sept. 1909, *Rattray 7878* (PRE).

3. **Garuleum latifolium** *Harv*. in Flora Capensis 3: 92 (1865); Hilliard: 516 (1977). Type: [Kwazulu-Natal], 'Natal, Tongaat River', *Gerrard s.n. K000273564*.—ALUKA image!, lecto., designated here; *TCD0002908* (TCD.—ALUKA image!, isolecto.). [*K000273564* was selected as the lectotype over the available syntype, *TCD0002908* as it is of better quality and this specimen closely resembles *G. latifolium* compared to the TCD specimen].

Osteospermum calendulaceum Harv. in Flora Capensis 3: 440 (1865), hom. illegit. non L.f. (1782). Type: [KwaZulu-Natal], 'Port Natal' *Gueinzius s.n. MEL2357571* (MEL—digital image!, holo.).

Slender, leafy, soft-wooded sub-shrub up to 1.2 m tall; stem and leaves minutely glandular-pubescent, aromatic. *Leaves* alternate, membranous, sessile or sometimes narrowed to a petiole-like base often with a pair of stipule-like basal auricles, up to 60 × 30 mm, oblanceolate or oblong in outline, coarsely toothed or more deeply cut halfway to midrib, lobes toothed, teeth subulate. *Capitula* radiate, pedunculate. *Peduncles* up to 15 mm long arranged in lax terminal corymbs. Involucre and upper part of peduncle loosely woolly at first, later glandular-hispid. *Involucre* campanulate. *Involucral bracts* in 3 rows, imbricate, ovate-linear, pungent, outer 2.5–3.0 × 1.5 mm, inner 8.5–9.0 × 1.1 mm. *Ray florets* numerous, female, fertile, ± 10 mm long, blue or white; corolla limb up to 6 mm long; corolla tube up to 4 mm long, glandular. *Style* up to 4 mm long, branched, linear, style branches 2 mm long, subacute. *Ovary* up to 1.8 mm long, glabrous, obovate in outline, angled. *Disc florets* functionally male, yellow; the corolla limb 3.0–3.5 mm long, glandular, 5-lobed; the lobes ovate 0.2 mm long; lower part of corolla 1 mm long. *Anthers* linear, minutely caudate, with an ovate apical appendage. *Style* up to 5 mm long, branched, linear, style branches 0.1 mm long with stigmatic papillae along margins. *Ovary* 2 mm long. *Cypselae* 4–5 mm long, glabrous, narrowly obovate, somewhat 3-angled, obscurely winged, strongly transversely wrinkled and warty, reddish-brown. *Flowering time*: February–July. Figure 1C, 2B.

Distribution and habitat: *Garuleum latifolium* is recorded from the Lebombo Mountain in the north, down to Pietermaritzburg in Inanda District, (Figure 5), up to 656 m. It grows in sandy-loam soil, outcrops, on the margins of bush clumps, Natal Group Sandstone.

Diagnosis: resembling *G. sonchifolium* in the alternate, membranous, coarsely toothed or more deeply cut leaves, but distinguished by the involucral bracts in 3 series, ovate-linear, with the outer bracts much shorter than the inner.

Hilliard (1977) synonymised *Osteospermum calendulaceum* under *Garuleum latifolium*.

Additional specimens

KWAZULU-NATAL.—**2732** (Ubombo): Mkuze, top of Mtn, (–CA), 27 Aug. 1932, *Galpin 13374* (PRE); Hlabisa, Makhowe, (–CC), 29 May 1971, *Lavranos 8690* (PRE). **2831** (Nkandla): Mhlabatini, Townlands, (–AB), 1 May 1942, *Gerstner 4669* (PRE, NBG). **2832**

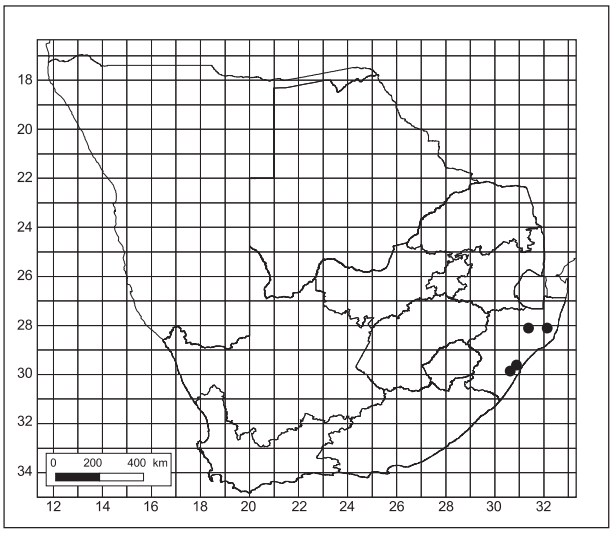


FIGURE 5.—Distribution of *Garuleum latifolium.*

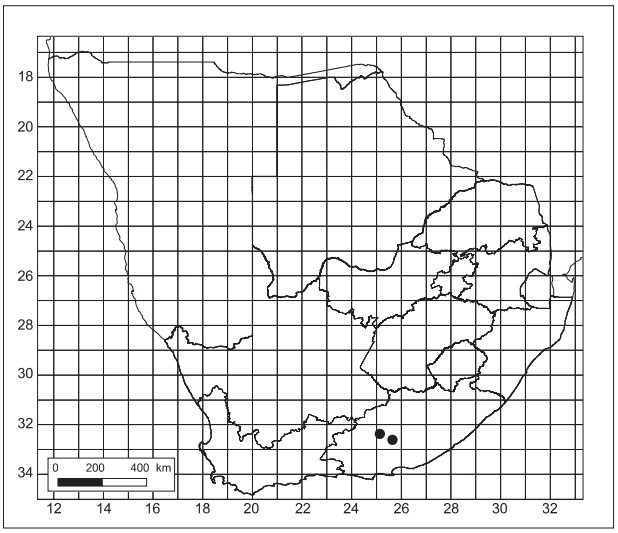


FIGURE 6.—Distribution of *Garuleum tanacetifolium.*

(Matubatuba): Hlabisa, Hluhluwe Game Reserve, (–AA), 20 July 1961, *Hitchins 54* (PRE). **2930** (Pietermaritzburg): Greater Durban Metropolitan Area, Hammarsdale area, Hector (ESKOM) Substation Site, (–DC), 29 Mar. 1995, *Ward 12972* (PRE); Inanda, (–DB), Nov. 1883, *Wood 160* (PRE).

4. **Garuleum tanacetifolium** *(MacOwan) Norl*. in Studies in the Calenduleae 1: 30 (1943). *Osteospermum tanacetifolium* MacOwan: t. 1839 (1889). Type: [Eastern Cape], 'Kagaberg and Boschberg', *MacOwan 1382* (GRA—ALUKA image!, holo.; K—ALUKA image!, PRE!, iso.).

Shrub with simple and leafless stem at the base, branched above. *Leaves* alternate, scabrid-glandular, sessile, very densely crowded at ends of branches, recurved-spreading, interruptedly bipinnatipartite with sharply incised lobes, and pectinate rachis on both sides. *Capitula* radiate, solitary, shortly pedunculate. *Involucre* campanulate, 10 mm in diam. *Involucral bracts* in 2-series, more-or-less equal, oblong, slightly acute with membranous margins; outer ± 7.0 mm long; inner ± 7.5 mm long. *Ray florets* (10–)12, female, fertile, dark purple, mauve, pale lilac or white, oblong-elliptic; corolla limb 12.0–12.5 mm long, narrowly linear; corolla tube up to 4 mm long, glandular. *Style* up to 5.5 mm long, linear, branched, style branches ± 2 mm long. *Ovary* up to 2.2 mm long, glabrous, obovate in outline. Mature cypselae not seen. *Disc florets* functionally male, yellow, 5-lobed; lobes ovate, 0.2 mm long; corolla limb 2.5–3.0 mm long, glandular; corolla tube 1.2 mm long, glandular. *Style* 3.0–3.2 mm long, branched, style branches ± 1 mm long, linear with pollen sweeping hairs. *Anthers* linear, minutely caudate, with ovate apical appendages. *Ovary* up to 2.5 mm long. *Flowering time*: May to June. Figure 1E.

Distribution and habitat: *Garuleum tanacetifolium* is endemic to the Sneeuberg Centre of Endemism, (Figure 6), 1 200 to 1 800 m. It was found along edges of forests and on mountain ridges, abundant on sandstone soils. Until now *Garuleum tanacetifolium* was known from just two collections on the Boschberg and was treated as DDT (Data Deficient-Taxonomically problematic) in conservation assessments (Raimondo *et al*. 2009). Recent collections by R. Clark, during field work for a checklist of Boschberg, have shown that the species is in fact abundant in the Nardousberg area of the Sneeuberg, certain south-facing slopes above 1 600 m, and occurs locally on the Boschberg in montane fynbos. It also apparently occurs on the Great Winterberg-Amatolas but has not been collected from there (R. Clark pers. comm., January 2013).

Diagnosis: Garuleum tanacetifolium is distinguished from other species by recurved-spreading, bipinnatipartite leaves with sharply incised, pectinate lobes, and heads borne on a short, inconspicuous peduncle.

Additional specimens

EASTERN CAPE.—**3225** (Somerset East); Sneeuberg, Asante Sana Private Game Reserve, on the mountains behind old town of Petersburg (–AC), 6 Oct. 2008, *Clark & Coombs 703*, (GRA, NBG); Boschberg, edge of forest, (–DA), 1 May 1953, *Acocks 16812* (PRE); Boschberg Nature Reserve, upper slopes of Boschberg along path, in forest, (–DA), 5 Dec. 2008, *Clark, Daniels, Fabricus & le Roux 243* (GRA); Groot-Bruintjieshoogte, Labuschagne's Kraal, 57 Farm, summit, (–CB), 11 Dec. 2008, *Clark, Daniels, Fabricus & le Roux 452* (GRA).

5. **Garuleum woodii** *Schinz* in Bulletin de L'Herbier Boissier 3: 440 (1895); Hilliard 518 (1977). Type: [KwaZulu-Natal], valley of Buffalo River near Charlestown, [1 525–1 830 m], 6 Dec. 1892, *Wood 4840* (Z, lecto., designated here; BOL, K, PRE!, isolecto.). [*Wood 4840* was selected as the lectotype over the available syntype, *Wood 4496* as it is of better quality.]

Viscid, aromatic, well-branched shrublet, up to 600 mm high; stems and leaves rough with glandular hairs. *Leaves* sessile, alternate, oblong in outline, up to 50 × 20 mm, once or twice pinnatisect, the segments very narrow, sometimes lobulate, sub-acute, base half-clasping. *Capitula* solitary, showy, on long remotely leafy or bracteate peduncles terminating upper branches. *Involucre* campanulate. *Involucral bracts* in ± 4 series, imbricate; outer shorter 3.5–4.0 mm long; middle up to 5 mm long; inner 5.5–6.0 mm long, all ovate, gland-dotted, apices obtuse to acute. *Ray florets* female, fertile, blue or white; corolla limb 6.5–7.0 × 2 mm, oblong-elliptic; corolla

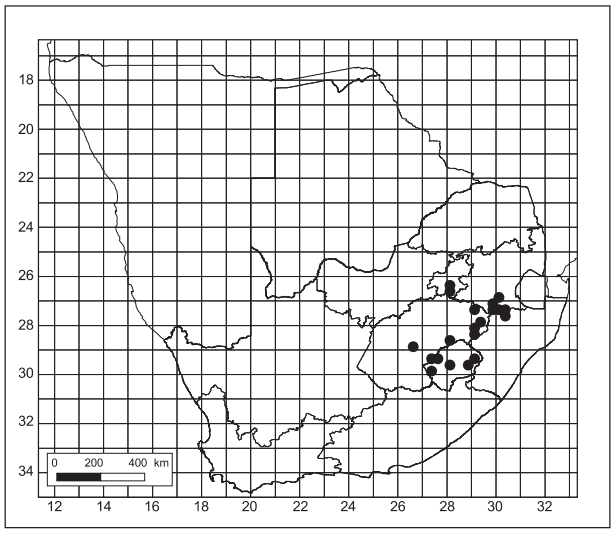


FIGURE 7.—Distribution of *Garuleum woodii.*

tube up to 2.8 mm long, glandular, cylindric. *Style* up to 2.8 mm long, branched, linear, style branches 2.2 mm long. *Ovary* up to 2 mm long, glabrous, obovate in outline. *Disc florets* functionally male, yellow, 5-lobed; lobes ovate, 0.2 mm long; corolla limb glandular, 2.5–3.0 mm long; corolla tube 1 mm long, glandular. *Style* 4.0–4.5 mm long, branched, style branches 0.2 mm long, linear with pollen sweeping hairs, which cover style below point of bifurcation. *Anthers* linear, minutely caudate, with ovate apical appendages. *Ovary* up to 2.5 mm long. *Cypselae* ± 6 mm long, glabrous, narrowly obovate, somewhat 3-angled, obscurely winged, obscurely transversely wrinkled, light yellowing-brown. *Flowering time*: January–May. Figure 1F, 2E.

Diagnosis: distinguished from other species by the stem and leaves that are rough with glandular hairs, and ovate involucral bracts.

Distribution and habitat: *Garuleum woodii* is recorded from Lesotho to Ficksburg and Platberg outside Harrismith, northwards along the Drakensberg to Wakkerstroom, and inland to Suikerbosrand Nature Reserve in Gauteng, (Figure 7), 1 645–2 745 m. It occurs on hillsides and mountain slopes along streams and rivers, on cliff faces and along roads and ridges, on sandstone or clay soils in stony or rocky situations.

Additional specimens

GAUTENG.—**2628** (Johannesburg): Klipriviersberg, S of Rosettenville, (–AC), 8 Apr. 1945, *Wasserfall 912* (PRE); Suikerbosrand Nature Reserve, Kareekloof, (–CA), 16 Oct. 1971, *Bredenkamp 154* (PRE).

MPUMALANGA.—**2630** (Carolina): Kalkoenkrantz, Elandsberg Farm, (–CC), 6 Nov. 1984, *Turner 342* (PRE). **2729** (Volksrust): Ermelo, Amersfoort, Maquiabe Farm of Koos Wessels, (–BB), 8 Jan. 2000, *Siebert & Du Plessis 1225* (PRE); Amersfoort, Sterkfontein Farm, (–BB), 30 Mar. 1987, *Turner 1597* (PRE); Volksrust Highlands, (–BD), 7 May 1920, *Mogg 7504* (PRE). **2730** (Vryheid): Wakkerstroom, (–AC), Feb. 1917, *Beeton HWB 204* (PRE); Wakkerstroom, Tafelkop Farm, (–AC), 3 Feb. 1994, *Jordaan 2763* (PRE).

KWAZULU-NATAL.—**2729** (Volksrust): Charlestown, near Charlestown, (–BD), 25 Feb. 1895, *Wood 5542* (PRE); Charlestown, near Charlestown, (–BD), 10 Jan. 1894, *Wood 5185* (NH). **2730** (Vryheid): Utrecht, Naauwhoek, (–AD), 19 Jan. 1961, *Devenish 491* (PRE); Wakkerstroom, Oshoek Farm, on edge of escarpment, (–AD), 21 Feb. 1978, *Smook 1209* (PRE).

FREE STATE.—**2729** (Volksrust): Vrede, Berlin Farm, at Slang River en route to ascent 16 km NW of Vrede, (–AC), 12 Mar. 1991, *Eckhardt 12* (PRE); Driekoppe Darm; 42 km SE of Vrede on road to Verkykerskop, base of Aasvoëlkop, beginning of kloof, (–CD), 4 Feb. 1987, *Retief 1987* (PRE); Verkykerskop, Nonpareil Farm, at foot of hill, (–CD), 14 Mar. 1990, *Saaiman 664* (PRE). **2826** (Brandfort): Near Roodepoort boundary, Syferfontein Farm, ± 2 miles [3.2 km] SSW of Greylingstad on road to Rooiwal and Leeuwspruit, northwestern slopes of koppie, (–DC), 20 Mar. 1967, *Scheepers 1591* (PRE). **2828** (Bethlehem): Ficksburg, Moolman's Hoek Peak, summit of peak, (–CA), 30 Oct. 1934, *Galpin 13924* (PRE). **2829** (Harrismith): Loskop, (–AA), 18 Mar. 1970, *Stam 420* (PRE); Platberg, (–AC), 14 Dec. 1976, *Jacobsz 3054* (PRE); Platberg, (–AC), 8 Sept. 1983, *Roux 1262* (PRE, NBG); Platberg, One Man Pass, (–AC), 13 Dec. 1976, *Hilliard & Burtt 9507* (PRE); Harrismith, (–AC), Dec. 1912, *Thode 2895* (PRE).

LESOTHO.—**2927** (Maseru): E of Maseru, (–AD), 25 Oct. 1963, *Cooley & Kofler 10926* (PRE); Makheka, Roma Valley, on top of Makheka, (–BC), Sept. 1974, *Schmitz 4190* (PRE); Mafeteng, Thaba Tsoeu, (–CD), 10 Mar. 1917, *Dieterlen 1273* (PRE). **2928** (Marakabeis): Monia Hania, hillslope, (–CA), 10 Jan. 1954, *Jacot-Guillarmod 1711* (PRE); Orange River Valley, 26 km from Taung between Mashai and Sehonghong, (–DB), 1 Dec. 1977, *Killick 4294* (PRE). **2929** (Underberg): Mokhotlong, (–AC), Mar. 1949, *Jacot-Guillarmod 1136* (PRE); Mokhotlong, (–AC), 27 Feb. 1949, *Compton 21539* (PRE, NBG).

6. **Garuleum bipinnatum** (*Thunb.*) *Less.*, Synopsis generum compositarum: 194 (1832); DC.: 309 (1836); Harv.: 92 (1865); Norl.: 377 (1977). *Osteospermum bipinnatum* Thunb: 167 (1800); Thunb.: 717 (1825); Juel: 717 (1918). Type: [Northern Cape], Hantam, *Thunberg s.n. UPS-THUNB20814* (UPS-THUNB—microfiche!, holo.).

Dimorphotheca multifida DC.: 73 (1838); Harv.: 422 (1865). Type: [Eastern Cape], 'Albany', *Ecklon & Zeyher* (G-DC—microfiche!, lecto., designated by Norlindh: 378 (1977).

Aromatic, viscid, subshrub, 0.6–1.5 m tall. *Stems* arising from woody rootstock, up to 3 cm in diam., erect, usually branched, striate or slightly furrowed, glandular. *Leaves* alternate, glandular, about 10–40 mm long, bipinnatipartite. *Capitula* radiate, pedunculate, solitary at ends of stem and branches or arranged in loose corymbs. *Peduncles* vary greatly in length, up to 120 mm long, and have a few small, dentate or entire bracts. *Involucre* campanulate 5–8 mm high, ± 10 mm broad when pressed. *Involucral bracts* in 2 or 3 series, imbricate, ± glandular, outer bracts narrowly lanceolate, ± 3.0–4.0 mm long, inner bracts narrowly oblong-lanceolate, ± 5.0–6.0 mm long, with whitish-scarious margins and often violet tips. *Ray florets* female, fertile, strap shaped, varying a lot in colour, including white, blue, mauve, purple and violet, and are about as long as involucres; corolla limb up to 10–15 × 3 mm, elliptic; corolla tube up to 3 mm long, glandular, cylindric. *Style* up to 3 mm long, branched, linear, style branches 2 mm long, subacute. *Ovary* up to 2.1 mm long, glabrous, obovate in outline, angled. *Cypselae*: compressed triangular-obpyramidal, ± 4.0–5.0 mm long, glabrous. *Disc florets* bisexual, yellow and about same size as involucres; corolla limb 3 mm long, widening upwards, glandular, 5-lobed; lobes ovate, 0.2 mm long; lower part of corolla tubular, 1.8 mm long, glandular. *Style* up to 5 mm long, branched, curved, bulbous at the base, style branches 2.5 mm long with stigmatic papillae along sides. *Anthers* 2

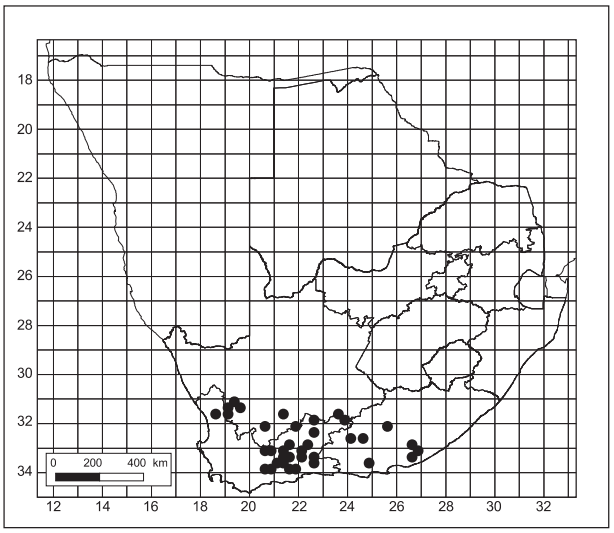


FIGURE 8—Distribution of *Garuleum bipinnatum.*

mm long, linear, with an ovate apical appendage, caudate. *Ovary* 3 mm long. *Cypselae*: outer fertile, obovate and slightly emarginate at the tip or almost obcordate, marginal wing with stiff, thickened margin, up to 5.0 × 3.5 mm, inner sterile narrowly obovate, 5–6 × 2 mm, pellucid. *Flowering time*: throughout the year. Figure 1D, 2C, 6.

*Distribution and habitat***:** *Garuleum bipinnatum* occurs from Fort Beaufort Division in Eastern Cape westwards through the Little Karoo to Montagu in Western Cape and Vanrhynsdorp in Northern Cape (Figure 8), at altitudes of 305–1 220 m. The species grows in various substrates and habitats, including dolerite rocks, clay soil, shale soil, stony sandy loam soil, stony loam soil, sandy clay gravel on shale soil, on dry stony *koppies* [hillocks], mountain slopes and rocky outcrops, in dry stream-beds, on floodplains, Karoo plains and river banks, in xeric succulent thicket, false *macchia*, *spekboom* veld and broken karroid veld.

This species is palatable to livestock and is aromatic. The flowers have a range of colours from white to blue, mauve, purple and violet and has horticultural potential as it is easily cultivated (Swelankomo 2010). The roots were used as snake bite remedy among early settlers. Farmers have also used a decoction or a tincture of it in various diseases of the chest, and in the Cape the root has been used in preparing a mouth wash (Watt & Breyer-Brandwijk 1962).

Diagnosis: *Garuleum bipinnatum* is the only species where both ray and outer disc florets develop fertile cypselae; the leaves are twice-pinnate, decreasing in size and degree of lobing towards the inflorescence; inner bracts have whitish-scarious margins and often violet tips, and the plant is glabrous. It can be easily confused with *Garuleum schinzii*, but in *G. schinzii* the fruits develop from ray florets only, and the plant is glandular-hispid.

Additional specimens

NORTHERN CAPE.—**3118** (Vanrhynsdorp): Vanrhynsdorp, (–DA), 25 July 1941, *Esterhuysen 5286* (PRE). **3119** (Calvinia): Kokerboomkop, (–AB), 24 Aug. 1926, *Acocks 18969* (PRE); Vanrhynsdorp, Van Rhyns Pass, (–AC), 25 July 1941, *Compton 11124* (PRE); Nieuwoudtville Reserve, (–AC) 25 July 1983, *Perry & Snijman 2171* (PRE); Vanrhynsdorp, Van Rhyns Pass, (–AC), 25 July 1941, *Esterhuysen 5286* (PRE); Hantam Mountains, (–BC), *Thunberg PRE 44089* (PRE); Niewoudtville Wildflower Reserve, W-facing hill at circle route hiking trail, (–AC), 3 Sept. 2007, *Hitchcock, Cowell & Bennett MSBP 3418* (NBG); Vanrhynsdorp, halfway down Vanrhyn's Pass, (–AC), 8 Sept. 2006, *Helme 4250* (NBG). **3220** (Sutherland): 17 km N of Matjiesfontein next to national road, (–BA), 13 Mar. 1981, *Van Wyk 513* (PRE). **3221** (Merweville): Fraserburg, Layton, Springbok camp, (–BB), 20 June 1985, *Shearing 1033* (PRE).

WESTERN CAPE.—**3123** (Victoria West): Richmond, 36 km from Richmond to Beaufort West, on N1 road near Rietfontein West, (–DA), 28 Aug. 1995, *Rodriguez-Oubina & Cruces 2115* (PRE); Murraysburg, (–DD), *Dugmore 2060* (PRE). **3221** (Merweville): Fraserburg, Layton, Eselrand, SE of mountain, (–BB), 28 May 1967, *Shearing 89* (PRE); Prince Albert, 10 km beyond Prince Albert road on road to Merweville, (–DC), 7 Dec. 1976, *Venter 1430* (PRE). **3222** (Beaufort West): Bulwater P.O.; 20 miles [32 km] NW of Bulwater P.O., (–BC), 17 Mar. 1948, *Acocks 14148* (PRE); Karoo National Park, (–BC), 6 Sept. 1983, *Braack 63* (PRE); Prince Albert, Klein-Waterval farm, ± 2 km before farmhouse on road from Seekoegat, (–CD), 7 Oct. 1983, *Retief & Reid 193* (PRE). **3320** (Montagu): Laingsburg, Whitehill ridge, (–BA), 20 Sept. 1943, *Compton 14904* (PRE); Josephskraal, (–BA), 7 July 1966, *Van Breda 2127* (PRE); 17 km N of Matjiesfontein next to national road, (–BA), 13 Mar. 1981, *Van Wyk 513* (NBG); Laingsburg, 7 km from Matjiesfontein on N1 road to Laingsburg, (–BB), 27 Aug. 1995, *Rodriguez-Oubina & Cruces 2107* (PRE); Swellendam, Barrydale near Barrydale at Meintjes Kraal, (–DC), Sept. 1913, *Muir 1037* (PRE); Swellendam, Barrydale, Meinjieskraal, (–DC), 20 Sept. 1913, *Muir 9426* (PRE); Warmwatersberg, 1 mile [1.6 km] NE of Warmwatersberg Hot Springs, (–DD), 29 June 1948, *Acocks 14564* (PRE). **3321** (Ladismith): Laingsburg, (–AB), 24 Jan. 1941, *Esterhuysen PRE 44105* (PRE); Seweweekspoort to Laingsburg near Vleiland farm, (–AC), 25 Sept. 2004, *Goldblatt & Porter* 12560 (NBG); Prince Albert, Bosluiskloof, between 7 Weeks Poort & Prince Albert, (–AD), 16 July 1954, *Lewis SAM 68695* (PRE); Laingsburg, Bosluiskloof Pass, (–BC), 14 Sept. 1955, *Leistner 246* (PRE); Karoo South, Gamkapoort Nature Reserve, Witpoort, (–BC), 4 Nov. 1982, *Cattell & Cattell 220* (PRE); Rietfontein Farm, N slope of hill 2.4 km S of barn taking right turn just before second gate, (–CA), 26 Aug. 1982, *Laidler 339* (PRE, NBG); Little Karoo, Noukloof Nature Reserve, 1.9 km from dam on circular drive, (–CA), 6 July 1982, *Laidler 59* (PRE, NBG); Ladismith, (–CB), 22 Mar. 1976, *Hugo 193* (PRE, NBG); Oudtshoorn, Gamka Mountain Reservoir, (–CB), 17 May 1982, *Cattell & Cattell 19* (PRE); George, Gouritzrivier; (–DC), Dec., *Ecklon & Zeyher 232* (PRE); Little Karoo, Kleinfontein Farm, mid-slope 30 miles [48 km] N of road near top of small pass, (–DD), 8 Aug. 1984, *Laidler 576* (PRE). **3322** (Oudtshoorn): Prince Albert, (–AA), Sept. 1921, *Marloth 10588* (PRE); Prince Albert Road, (–AA), June 1921, *Marloth 10142* (PRE); Prince Albert in hills, (–AA), Dec. 1905, *Bolus 11525* (PRE); Prince Albert near cemetery to Weltevrede hill N of road, (–AA), 5 July 1975, *Wisura 3396* (NBG); Swartberg Pass, (–AC), Dec. 1943, *Stokoe PRE 44094* (PRE); De Rust; P.M.K. le Roux's Farm, 3 miles [4.8 km] E of De Rust, (–DA), 19 Oct. 1970, *Dahlstrand, 1461* (PRE).

EASTERN CAPE.—**3224** (Graaff-Reinet): Aberdeen, S of Arberdeen, (–CA), Mar. 1929, *Dyer 1940* (PRE); Kendrew, (–DA), Mar. 1929, *Dyer 1953* (PRE); between Graaff-Reinet and Jansenville, ± 50 km N of Jansenville, (–DA), 1 June 2005, *Meyer 4451* (PRE); Graaff-Reinet, (–DA), 15 Mar. 1930, *Galpin 1151* (PRE); Jansenville, (–DC), 5 Dec. 1947, *Compton 20320* (NBG). **3225** (Somerset East): Cradock, Cradock Mountains, (–BA), 19 Nov. 1953, *Henrici 4575* (PRE). **3226** (Fort Beaufort): between Fort Beaufort & Grahamstown, (–DC), 18 July 2001, *Koekemoer 2077* (PRE); Fort Beaufort, (–DC), 21 Feb. 1938, *Britten 6632* (PRE). **3326** (Grahamstown): Albany, Fish River, between Breakfast Vlei & Grahamstown, (–BB), 1 May 1955, *Lewis SAM 68531* (PRE); Albany, (–BC), May 1928, *Dyer 1536* (PRE).

7. **Garuleum pinnatifidum** (*L'Hérit.*) *DC.*, Prodromus 5: 309 (1836); Harv.: 92 (1865). *Osteospermum pinnatifidum* L'Hér.: 11 (1785); Thunb.: 167 (1800); Thunb.: 717 (1825). *G. viscosum* Cass.: 172 (1819), nom. illegit. pro *O. pinnatifidum* L'Hér. Type: 'Cap. Bonae Spei', without precise locality or collector (G-DC—microfiche!, lecto., designated here). [L'Héritier's herbarium was acquired by A.P. de Can-

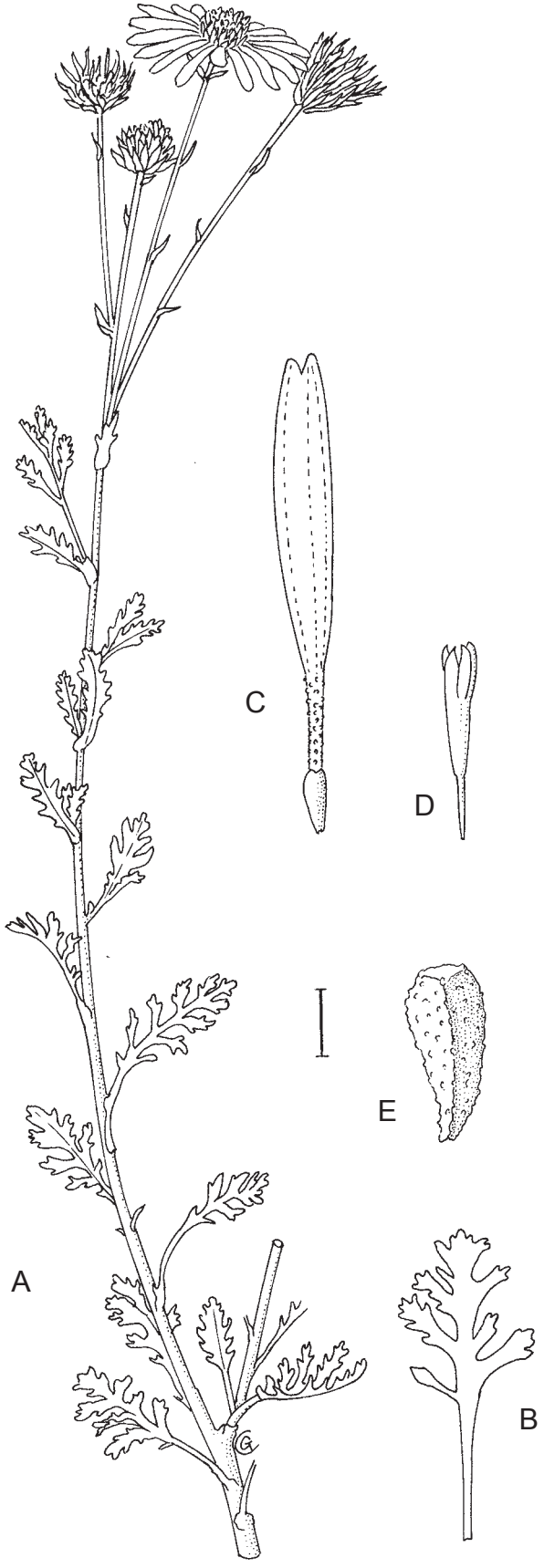


FIGURE 9.—Line drawing of *Garuleum pinnatifidum*. A, habit; B, leaf; C, ray floret; D, disc floret, *Hanekom 1954*; E, fruit, *Zietsman* & *Zietsman 329*. Scale bar: A, 1 cm; B, 0.5 cm; C–E, 0.25 cm. Artist: Gillian Condy.

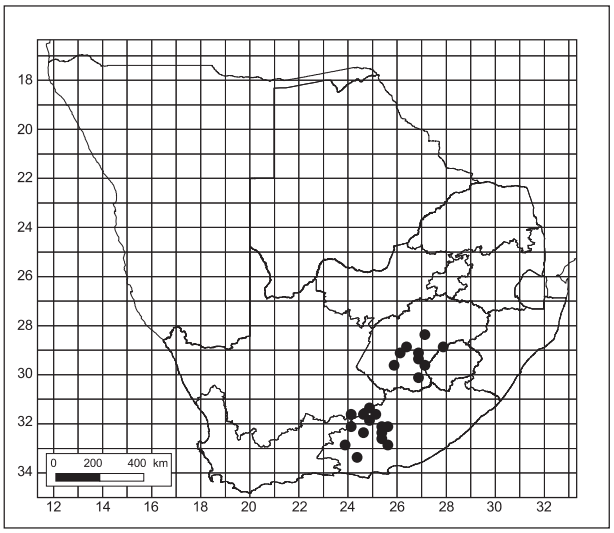


FIGURE 10.—Distribution of *Garuleum pinnatifidum.*

dolle after his death (Stafleu & Cowan 1981). Of the four specimens labeled *O. pinnatifidum* in De Candolle's herbarium, the two left hand specimens are from L'Héritier's herbarium: the first bears a label to that effect and the second the appropriate locality label. Both are thus syntypes. We designate the right hand specimen as lectotype as it bears the correct locality label, is the most complete, and closely matches the illustration of the species published by L'Héritier (1785) in the protologue.

Osteospermum caeruleum Jacq.: 78 (1786); Aiton: 275 (1789); Harv.: 92 (1865) [as *O. coeruleum* Aiton]. Lecto: Illustration in Jacq. Icones plantatum rariorum 1: plate 179 (1781–1786), designated here.

Aromatic, viscid, much branched shrub, 0.3–1.5 m tall. *Stem* thick, terete, leafy throughout, dividing into flower-bearing peduncles above. *Leaves* alternate, sessile, pinnate, minutely villous and ciliate ± 50 mm long; pinnae oblong, irregularly serrate, somewhat obtuse, diminishing in size. *Capitula* radiate, pedunculate. *Peduncle* solitary. *Involucre* campanulate, up to 10 mm long. *Involucral bracts* in 2-series, more-or-less equal, thick, acute; outer 3.5–4.0 × 1 mm; inner 4.0–5.0 × 1 mm. *Ray florets* ± 18, female, fertile, strap-shaped, blue, mauve; corolla limb up to 9 × 3 mm, elliptic; corolla tube 2.8–3.0 mm long, glandular, cylindric. *Style* up to 3 mm long, linear, branched, style branches 2.2 mm long, sub-acute. *Ovary* up to 2.1 mm long, glabrous, obovate in outline. *Disc florets* functionally male, yellow, 5-lobed; lobes ovate, 0.2 mm long; corolla tube very hairy. *Style* 3.5–4.0 mm long, branched, style branches 0.2 mm long, linear with pollen sweeping hairs, which cover the style below the point of bifurcation for the same length as that of the branches. *Anthers* minutely caudate, linear with ovate apical appendages. *Ovary* up to 2 mm long. *Cypselae* 3.0–3.5 mm long, glabrous, 3-ribbed, narrowly obovate and the surface is rugose and papillate. *Flowering time*: October–May. Figure 1G, 2F & 9.

Distribution and habitat: *Garuleum pinnatifidum* is recorded throughout the Great Karoo, from Graaff-Reinet to Cradock and into the Free State as far north as Bloemfontein, Thaba Nchu and Rouxville (Figure 10), 765–1 705 m. The species grows on mountain and hill slopes, along the road, in loamy and sandy soils in grassland and False Karoo.

Diagnosis: distinguished from other species by having 1-pinnate leaves and firm involucral bracts; covered in glandular-scabrid hairs.

Additional specimens

FREE STATE.—**2826** (Brandfort); Bloemfontein, Glen Agriculture College, (–CD), 22 Mar. 1951, *Mostert 9* (PRE); Bloemfontein, Glen Agriculture College, (–CD), 18 Mar. 1985, *Zietsman & Zietsman 329* (PRE). **2827** (Senekal): Winburg, Willem Pretorius Game Reserve, (–AC), 10 Apr. 1962, *Leistner 2998* (PRE); Willem Pretorius Game Reserve, (–AC), 20 Jan. 1972, *Muller 835* (PRE); Doornkop, (–DD), 2 Dec. 1931, *Goossens 730* (PRE). **2925** (Jagersfontein): Edenburg, Bethanië, (–DB), 1 Feb. 1996, *Peyper 2013* (PRE). **2926** Wintervalley, N of Bloemfontein underneath trees below S slope of koppie, (–AA), 26 Mar. 1968, *Muller 204* (PRE); Thaba Nchu, Adelaide, (–BB), 4 Dec. 1963, *Roberts 2911* (PRE); Thaba Nchu, Dakpoort Flats, (–BD), 4 Dec. 1963, *Roberts 2923* (PRE); Dewetsdorp, (–DA), 15 Apr. 1950, *Steyn 926* (NBG). **2927** (Maseru): Wepener, (–CA), 29 Jan. 1945, *Acocks 11169* (PRE). **3026** (Aliwal North): Gryskop, 24 km N of Rouxville on slope of hill, (–BB), 8 Feb. 1986, *Welman 719* (PRE).

EASTERN CAPE.—**3124** (Hanover): Middelburg, Carlton hills, (–BD), 27 Mar. 1947, *Acocks 13541* (PRE); Richmond, Rhenosterfontein, S of Richmond, (–CA), 27 Apr. 1950, *Acocks 15835* (PRE); Richmond, Roelofsfontein, (–DA), 25 Nov. 1972, *Hanekom 1954* (PRE); Graaff-Reinet, Blue Gum House Farm, in front of house, (–DD), 14 Oct. 1983, *Retief & Reid 533* (PRE). **3223** (Rietbron): Willowmore,Van Rooyenskraal Farm, along tributary of Hopsrivier, (–DD), 11 Oct. 1983, *Retief & Reid 441* (PRE). **3224** (Graaff-Reinet): Moordenaarsrivier; Houd Constant Pass S of farm to river, (–AA), 7 Nov. 1974, *Oliver 5268* (PRE); Graaff-Reinet, Wimbledon, (–BC), 8 May 1954, *Henrici 4991* (PRE); Graaff-Reinet, 9 miles [14.4 km] N of Graaff-Reinet, (–BC), 10 Feb. 1955, *Adamson D.211* (PRE). **3225** (Somerset East): Cradock, Mountain Zebra National Park, (–AB), 26 Mar. 1952, *Brynard 13* (PRE); Cradock, Mountain Zebra National Park, near dam at house, (–AB), 4 May 1963, *Liebenberg 7239* (PRE); Cradock; Mountain Zebra National Park, (–AB), 21 Apr. 1969, *Müller 628* (PRE); Cradock, Mountain Zebra National Park, (–AB), 25 Jan. 1966, *Liebenberg 7635* (PRE); Cradock, Mountain Zebra National Park, (–AD), 30 Oct. 1985, *Zietsman & Zietsman 1286* (PRE); Mountain Zebra National Park, (–AD), 12 Dec. 2005, *Bester 6309* (PRE); Uniondale, 7 miles [11.2 km] from Uniondale along road from Uniondale to Willowmore, (–CB), 23 June 1961, *Van Breda 1190* (PRE). **3324** (Steytlerville): Steytlerville, (–AD), 9 Nov. 1950, *Theron 908* (PRE).

8. **Garuleum schinzii** *O.Hoffm*. in Bulletin de L'Herbier Boisseir 1: 74 (1893); Merxm. 139: 71 (1967); Merxm.: 34 (1954). Type: Namibia, Tiras, 21 Apr. 1875, *Schinz 698* (Z—digital image!, holo.).

Viscid, aromatic, much branched subshrub from a woody stem, 0.2–1.0 m high. *Stem* 3–5 mm thick, glandular-hispid, ribbed. *Leaves* alternate, sessile, globose glands, lower leaves irregularly bipinnatipartite or almost tripinnatipartite with short linear segments, upper ones reduced, simply pinnatifid. *Capitula* radiate, pedunculate. *Peduncles* up to 90 mm long, mostly solitary, ribbed, shortly hirsute, bracteate, some hairs with glandular tips. *Involucre* hemispherical, up to 15 mm diameter when pressed. *Involucral bracts* in 2-series, imbricate, finely pubescent, narrowly lanceolate, acuminate; outer ones 4.5–5.0 × 1.0 mm; inner ones 6.0–7.0 × 1.1 mm with coloured apex. *Ray florets* female, fertile, blue; corolla limb up to 15.0 × 1.5 mm, narrowly lin-

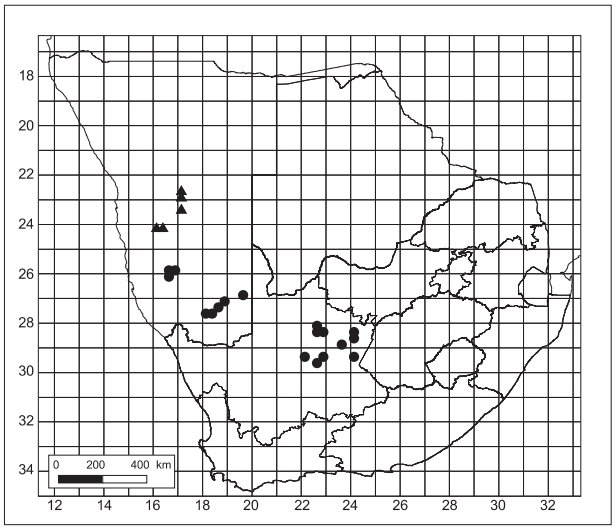


FIGURE 11.—Distribution of *Garuleum schinzii* subsp. *schinzii* ●, *G schinzii* subsp. *crinitum* ▲.

ear; corolla tube up to 4 mm long, glandular, cylindric. *Style* 4.5–5.0 mm long, branched, linear, style branches 2.2 mm long. *Ovary* up to 2.2 mm long, glabrous, obovate in outline. *Disc florets* functionally male, yellow, 5-lobed; lobes ovate, 0.2 mm long; corolla limb 4.0–4.2 mm long; corolla tube 2.5–3.0 mm long, glandular. *Style* 3.8–4.0 mm long, bifid bearing sweeping hairs all way to below division but lacking papillae, linear. *Anthers* minutely caudate, linear with ovate apical appendages. *Ovary* up to 2.0 mm long. *Cypselae* 4.0 mm long, glabrous, slightly curved, three-angled, obpyramidial, strongly rugose. *Flowering time*: throughout the year.

Diagnosis: distinguished from other *Garuleum* species by its bipinnate leaves and loose involucral bracts covered with glandular-pilose hairs.

Merxmüller (1967) separated *schinzii* in into two subspecies. In *Garuleum schinzii* subsp. *schinzii*, the ray florets are blue, this species prefers limestone, shale and calcareous soils. It occurs from Bethanien District, Aus down to Klein Karas (Namibia) and from Langeberg Range to Barkly West as far south as Belmont (Northern Cape Province). In *Garuleum schinzii* subsp. *crinitum*, the ray florets are white; this species prefers dolomite soils and it occurs from Windhoek and Rehobot as far south as Bullesport Mountains (Namibia).

Key to subspecies:

1a. Ray florets blue; peduncles up to 90 mm long . . . . . 8a subsp. *schinzii*

1b. Ray florets white; peduncles 40–60 mm long . . . . . 8b. subsp. *crinitum*

8a. subsp. **schinzii**

Lower leaves irregularly bipinnatipartite or almost tripinnatipartite with short linear segments, upper leaves reduced, simply pinnatifid. *Peduncles* up to 90 mm long. *Ray florets* blue. *Cypselae* 4.0 mm long, glabrous, slightly curved, three-angled, obpyramidial, strongly rugose. *Flowering time:* throughout the year (Figure 1H & 2G).

Distribution and habitat: found in Namibia (Bethanien District, Aus down to Klein Karas) and Northern Cape Province, from Langeberg Range to Barkly West as far south as Belmont, (Figure 11), 1 069–1 145 m, occurring on hill slopes, along roads, in valleys, on limestone, shale, calcareous sands and dry riverbeds.

Additional specimens

NAMIBIA.—**2217** (–CC), Windhoek, hills between Windhoek & Rehoboth, 14 Mar. 1988, *Goldblatt & Manning* 8797. **2516** (Helmeringhausen): Kunjas, W of Helmeringhausen, (–DC), 9 May 1976, *Oliver, Muller & Steenkamp 6478* (PRE); Maltahohe, dry riverbed near road to Maltahohe, (–DD), 16 Apr. 1949, *Kinges 2103* (PRE); Bethanien, Goais, (–DD), 19 May 1965, *Giess 8816* (PRE). **2616** (Aus): Frisgewaagd, (–BA), 3 Apr. 1968, *Giess 10274*; Keetmanshoop, Aroab 3 miles [4.8 km] W of Aroab, (–DC), 2 May 1955, *De Winter 3368* (PRE). **2718** (Grüna): Great Karasberg, Genadendal, S end of the Great Karasberg slopes in main kloof, (–BC), 5 May 1976, *Oliver & Steenkamp 6306* (PRE); Great Namaqualand, Klein Karas, (–CA), 8 Apr. 1931, *Ortendahl 34* (PRE); Klein Karas, (–CA), 2 Aug. 1923, *Dinter 4810* (PRE).

NORTHERN CAPE.—**2822** (Glen Lyon): about 24.8 km west of Olifantshoek on Pearson's Hunt road in a poort in Langeberge, (–BA), 10 Aug. 2000, *Smook 10965* (PRE); Olifantshoek, 24.8 km NW of town on road to Pearson's Hunt, (–BA), 10 Aug. 2000, *Meyer 2887* (PRE); Langeberg Range, Dunmurray; W slopes of Langeberg Range, (–BC), 22 Mar. 1920, *Pole Evans 87* (PRE); Hay, Floradale, foot of hills, (–BD), Apr. 1940, *Esterhuysen 2325* (PRE); Postmasburg, Klipbank, (–BD), 17 Jan. 1958, *Repton 4777* (PRE). **2823** (Griekwastad): Hay, Swartkop, Black Jasper Hills, (–CD), 31 July 1936, *Acocks 544* (PRE); Herbert, Campbell, 8.5 miles [13.6 km] NE of Campbell, (–DC), 27 Sept. 1957, *Leistner 914* (PRE). **2824** (Kimberley): Barkly West, Kransfontein, (–AC), Aug. 1936, *Paton MCG.M.3737* (PRE); Herbert, Schmidtsdrift, 9 miles NW of Schmidtsdrift slopes, (–CA), 25 Aug. 1961, *Leistner & Joynt 693* (PRE); Caerwinning, (–DA), 7 Oct. 1937, *Ferrar 31884* (NH). **2922** (Prieska): Marydale, 6.5 miles [10.4 km] S of Marydale, (–AC), 10 May 1946, *Story 1224* (PRE); Niekerkshoop, (–BD), *Vermeulen TRV 23453* (PRE); 15 miles NW of Prieska, (–DA), 13 May 1961, *Schlieben 8793* (PRE); 60 km from Marydale on Prieska road, (–DA), 8 June 1977, *Smook & Harding 719* (PRE); Prieska valley and lower hills, (–DA), 18 Feb. 1920, *Bryant J40* (PRE). **2924** (Hopetown): Kimberley, Belmont, Fort Richmond, (–AC), Sept. 1950, *Waylands PRE 44121* (PRE).

8b. subsp. **crinitum** (*Dinter*) *Merxm.* in Mitteilungen der Botanischen Staatssammlung München 2: 34. (1954); Merxm. 139: 71 (1967). *G. crinitum* Dinter in Feddes Repertorium 30: 184 (1932); Merxm. 139: 71 (1967). Type: Namibia, (Hereroland), Auas Mountain, *Dinter 4654* (B, lecto., designated by Merxmüller: 34 (1954); PRE!, isolecto).

G. bipinnatum auct. Dinter: 308 (1921), non (Thunb.) Less. (1832).

Leaves pinnatifid, 8–12 × 3–4 cm long. *Peduncles* 40–60 mm long. *Ray florets* white. *Cypselae* 3.5 mm long, glabrous, obpyramidial, bluntly triangular and the surface is glandular and rugose. *Flowering time*: February–May. Figure 1I, 2H.

Distribution and habitat: *Garuleum schinzii* subsp. *crinitum* is endemic to Namibia, from Windhoek and Rehobot as far south as Bullesport Mountains (Figure 11), preferring mountain slopes, dolomite soils.

Additional specimens

NAMIBIA.—**2217** (Windhoek): Avis Dam near Windhoek, (–CA), 21 Feb. 1959, *Seydel 1715* (PRE). **2317** (Rehoboth): Bergland, Farm 264, (–AC), 19 Dec. 1957, *Merxmüller 826* (PRE). **2416** (Maltahohe): Naukluft plateau, W of Kapokvlakte, track to Beacon 1949, (–AA), 23 Mar. 1995, *Burke 9564* (PRE); Naukluft, (–AB), 16 May 1978, *Muller*

& Tilson 860 (PRE); Rehoboth, Buellsport Mtn, (–AB), 26 Mar. 1948, *Strey 2305* (PRE).

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The native and naturalised species of *Peltocalathos* and *Ranunculus* (Ranunculaceae: Ranunculeae) in southern Africa

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Keywords: *Peltocalathos* Tamaru, Ranunculaceae, *Ranunculus* L., southern Africa, taxonomy

ABSTRACT

The five native and naturalised species of *Ranunculus* L. and *Peltocalathos* Tamaru (Ranunculaceae: Ranunculeae) from southern Africa are reviewed, with full descriptions and nomenclature, taxonomic history, ecological notes, and distribution data. All species are illustrated. *Peltocalathos*, a monotypic genus based on *R. baurii* MacOwan, has been overlooked in the regional literature until now. The new name *R.* **dregei** *J.C.Manning & Goldblatt* is proposed as a replacement name for the later homonym *R. meyeri* Harv., non Lowe. We conclude that the poorly known *R. capensis* Thunb. represents juvenile forms of the widespread and variable *R. multifidus* Forssk. and we synonymise the name, along with the three trivial epithets *R. pinnatus* var. *hermannii* DC., *R. pubescens* var. *glabrescens* Burtt Davy and *R. pubescens* var. *harveyanus* Burtt Davy, which have been overlooked in the recent literature. Based on number (mostly < 40 achenes per head) and size (mostly 1.2–1.8 mm long) of achenes, we conclude that the southern African material of the aquatic species recently re-identified as *R. rionii* Lagger is more appropriately treated as *R. trichophyllus* Chaix.

INTRODUCTION

Ranuculaceae are a large family of ± 2 150 spp. in ± 60 genera distributed worldwide, showing a diversity of floral organisations and fruit types (Tamaru 1993). Several classifications of the family have been proposed over the years, most recently by Tamaru (1995), who recognised three subfamilies and eleven tribes, based largely on chromosome base number and carpel and fruit types, including placentation. Tribe Ranuculeae DC. of subfamily Ranuculoideae Hutch. includes ± 650 spp. occurring on all continents, and is diagnosed by carpels with a solitary, unitegmic and usually ascending ovule, and petals with at least one nectary near the base (Tamaru 1993, Emadzade *et al.* 2010). Molecular phylogenetic studies suggest that the tribe is monophyletic but that parallel, adaptive and convergent evolution of morphological characters is rife, hindering the development of a morphology-based classification of the tribe. The recent generic classification of Ranunculeae derived by Emadzade *et al.* (2010) from their molecular analysis largely corroborates the narrow generic circumscriptions proposed by Tamaru (1995) [exceptions are the inclusion of *Aphanostemma* A.St.-Hil. and *Gamsoceras* Steven in *Ranunculus* but the exclusion of *Coptidium* (Prantl.) Beurl. ex Rydb. and *Ficaria* Guett. as separate genera], ultimately recognizing 18 genera in the tribe, of which *Ranunculus* L. (500–550 spp.) is by far the largest. This phylogeny also establishes that the aquatic members of *R.* sect. *Batrachium* DC. are deeply nested in the genus in a clade that includes wetland species such as *R. repens* L., affirming that their segregation at the higher taxonomic levels of genus (Gray 1821) or subgenus (Gray 1886) is not justified.

Rancunculeae are poorly represented in sub-Saharan Africa, with only a handful of species of *Ranunculus* recorded as native, mainly from the temperate eastern highlands of the continent (Oliver 1868; Milne-Redhead & Turrill 1952; Exell & Milne-Redhead 1960). The generic diversity is higher in southern Africa, with two indigenous genera. In addition to *Ranunculus* itself, the subcontinent is home to the recently described endemic monotypic genus *Peltocalathos* Tamaru (1992), based on *R. baurii* MacOwan and separated from *Ranunculus* by its peltate leaves and longitudinally ribbed achenes lacking a sclerenchyma layer in the carpel wall, the ribs corresponding to the vascularisation of the carpel walls. In addition to the native taxa, the European *Myosurus minimus* L. is naturalised in parts of Western and Northern Cape.

The last regional revision of *Ranunculus* in southern Africa is that of Harvey (1860), in which six species were recognised. The application of three of these names is now known to have been incorrect. Current checklists for the subcontinent list seven species (including *R. baurii*, now *P. baurii*), with *R. capensis* Thunb. regarded as a doubtful species and *R. plebeius* R.Br. ex DC. as a doubtful determination (Winter 2006). The description of the monotypic *Peltocalathos* for *R. baurii* has been overlooked in all of the regional literature.

A modern review of the southern African species is clearly overdue, both to establish the taxonomic and nomenclatural status of the native species as well as the distribution and identification of all species recorded for the region. Here we review the genera *Peltocalathos* and *Ranunculus* in southern Africa, providing full descriptions and nomenclature, taxonomic history, ecological notes, and distributions for the five native and naturalised species that we recognise in the region.

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MATERIALS AND METHODS

All relevant types were examined, as well as all herbarium material from BOL, GRA, NBG, PRE and SAM (acronyms after Holmgren *et al.* 1990), the primary collections of southern African material. All species with the exception of *Ranunculus muricatus* were also studied in the field.

TAXONOMY

Key to genera of Ranunculeae in southern Africa

1a. Scapose annuals with linear or linear-oblong leaves; sepals with spur-like projection at base; petals long-clawed; receptacle greatly elongated and tail-like in fruit; achenes with strong dorsal ridge; ovule pendant, anatropous. . . . . *Myosurus* [not treated further here]

1b. Annuals or perennials with peltate or variously lobed leaves; sepals without spur-like projection; petals short-clawed; receptacle not greatly elongated in fruit; achenes with or without inconspicuous dorsal ridge; ovule ascendant:

2a. Leaves peltate, with finely toothed, reddish margins and hollow petioles; inflorescence a subscapose cyme; petals 11–17; achenes ellipsoid, longitudinally ribbed . . . . . *Peltocalathos*

2b. Leaves not peltate, coarsely toothed to pinnate; petals 5 or 6(–10); inflorescence various; achenes ellipsoid or compressed, smooth, tuberculate or transversely rugose . . . . . *Ranunculus*

Peltocalathos *Tamaru* in Acta Phytotaxa Geobotanica 43: 139 (1992). Type species: *Peltocalathos baurii* (MacOwan) Tamaru (= *Ranunculus baurii* MacOwan).

Perennial, rhizomatous herbs, subglabrous. *Roots* fleshy, without a taproot. *Stems* erect. *Leaves* spiral, basal, petiolate, stipules adnate to base of petiole and sheathing; blades simple, peltate, finely toothed. *Flowers* usually in a scapose, paniculate cyme, rarely solitary and terminal, bisexual, actinomorphic, all parts spiral. *Sepals* 5, reflexed, caducous. *Petals* 11–17, yellow, glossy adaxially, narrowed at base into short claw, with lunate, nectar-secreting pit on adaxial surface at top of claw. *Stamens* numerous. *Carpels* free, numerous, with 1 basal ovule. *Achenes* broadly ellipsoid, longitudinally ribbed, shortly beaked, glabrous, leathery; pericarp without inner sclerenchyma layer.

1 sp., endemic to the eastern highlands of South Africa, Lesotho and Swaziland.

Ranunculus baurii was established as the monotypic genus *Peltocalathos* by Tamaru (1992) on the basis of its peltate leaves and longitudinally veined and ribbed achenes lacking a sclerenchymatous inner layer to the carpel wall. Phylogenetic analysis of plastid and nuclear gene sequence data of tribe Ranunculeae supports this decision, placing the species well outside of *Ranunculus* s. str. in a clade of small, mainly New World genera, where it is resolved as sister to the southern South American genus *Hamadryas* Comm. ex Juss. (Emadzade *et al.* 2010). The strong geographical isolation of the genera in this clade is presumed to have fostered the evolution of distinct autapomorphies among its members, which must be regarded as either relictual survivors of ancient radiations or as lineages that have failed to diversify (Emadzade *et al.* 2010).

1. **Peltocalathos baurii** *(MacOwan) Tamaru* in Acta Phytotaxa Geobotanica 43: 139 (1992). *Ranunculus baurii* MacOwan in MacOwan & Bolus: 390 (1881); Oliv.: t. 1503 (1886b); Tölken: t. 1508 (1965). Type: South Africa, Eastern Cape, 'in graminosis subhumidus summi montis Bazija in Terra Kaffrorum (Ngangelizwe)', 4000′ [1 200m], [Nov.], *R. Baur* [*No. 544*] (SAM, lecto.!, designated here; K, isolecto. [2 sheets *K000076103 & 5*]—Aluka images!]. [The SAM collection is chosen as lectotype as being most likely the specimen on which MacOwan based his description and in displaying insect damage (to the foliage) as reported in the protologue].

Ranunculus cooperi Oliv.: t. 1502 (1886a). Type: Lesotho, 'Basutoland', 1861, *T. Cooper 928* (K, syn. [2 sheets *K00076106 & 7*]—Aluka images!].

Tufted, rhizomatous perennial to 600 mm; stems condensed, covered with brown fibrous remains of old leaf sheaths. *Roots* few–several, thong-like. *Leaves* radical, usually 3 or 4, peltate, glabrous or sparsely villous when young, petiole 10–450 mm long with stipules adnate and sheathing for 20–40 mm, hollow, blade orbicular, leathery, laterally folded when young, (5–)30–150(–300) mm diam., crenulate-dentate with apical tooth largest, dull dark green adaxially with irregular pale markings along veins, margins reddish and cartilaginous with callus at apex of each serration. *Flowers* (1)2–18 in a pedunculate cyme, (18–)20–30 mm diam.; peduncle 2–3 × as long as leaves, (30–)100–600 mm long, 1.5–10.0 mm diam. at base, hollow, usually with apical fringe of short, obtuse hairs at base of sepals; bracts ovate-suborbicular, cucullate, finely or irregularly toothed with reddish, cartilaginous margins, rarely lowermost leaf-like and amplexicaul. *Sepals* (4)5, reflexed, caducous, ovate to suborbicular, cucullate, 4–6 mm long, glabrous or obtusely hispidulous beneath towards base, margins irregularly toothed, yellowish or with reddish margins. *Petals* (11)12–15(–17), narrowly obovate-cuneate, 8–15 × 2.5–4.0 mm, varnished bright yellow adaxially but dull and paler beneath, narrowed into short fleshy claw in basal ± 1 mm, truncate to acute, veins branched, nectary lunate. *Stamens* ± 50 in ± 6 series, filaments ± 5 mm long, anthers ± 0.5 mm long. *Carpels* ± 50–100, glabrous. *Achenes* in subglobose head, broadly ellipsoid, 5–7 × 1.5–2.5 mm, longitudinally ribbed, shortly beaked; receptacle pubescent. *Flowering time*: (Sept.–) Oct.–Dec.(–Jan.). Figure 1.

Distribution and ecology: a montane species endemic to the southern African Drakensberg, ranging from the Katberg in Eastern Cape through KwaZulu-Natal, Lesotho, Swaziland and Mpumalanga, with a single collection from the headwaters of the Olifants River in Limpopo (Figure 2).

Peltocalathos baurii is restricted to damp gullies, streamsides and the base of wet cliffs, from 1 000–3 000 m.

Diagnosis: a distinctive species recognised by its peltate leaves with hollow petioles and scapose inflorescence of moderately large flowers with numerous petals and caducous sepals. The leaf blades are suborbicular

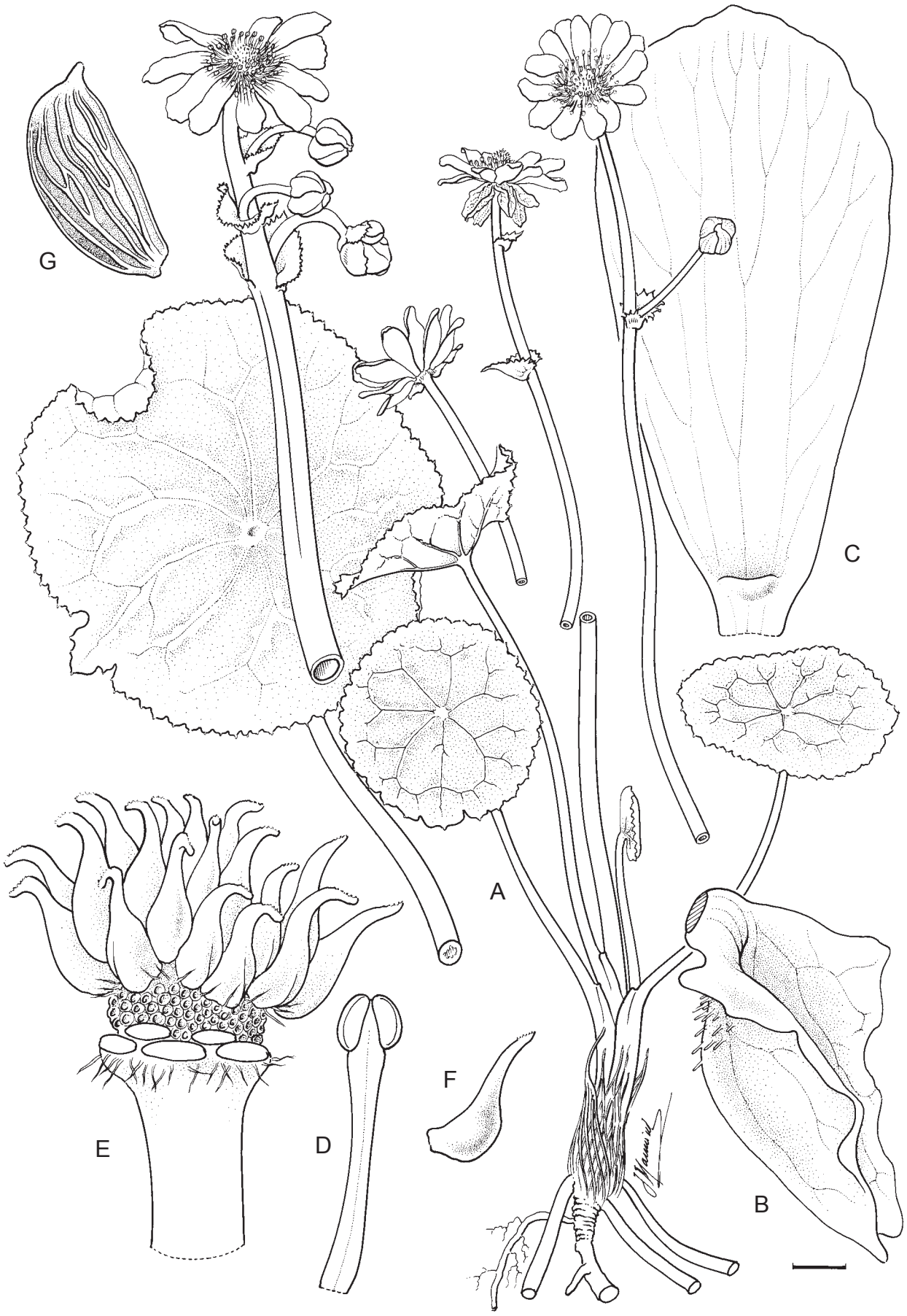


FIGURE 1.—*Peltocalathos baurii*, Naude's Nek, no voucher. A, flowering plant plus detached leaf and inflorescences; B, sepal; C, petal; D, stamen; E, pistil; F, carpel; G, achene [*Dieterlen 883*]. Scale bar: A, 10 mm; B–G, 1 mm. Artist: John Manning.

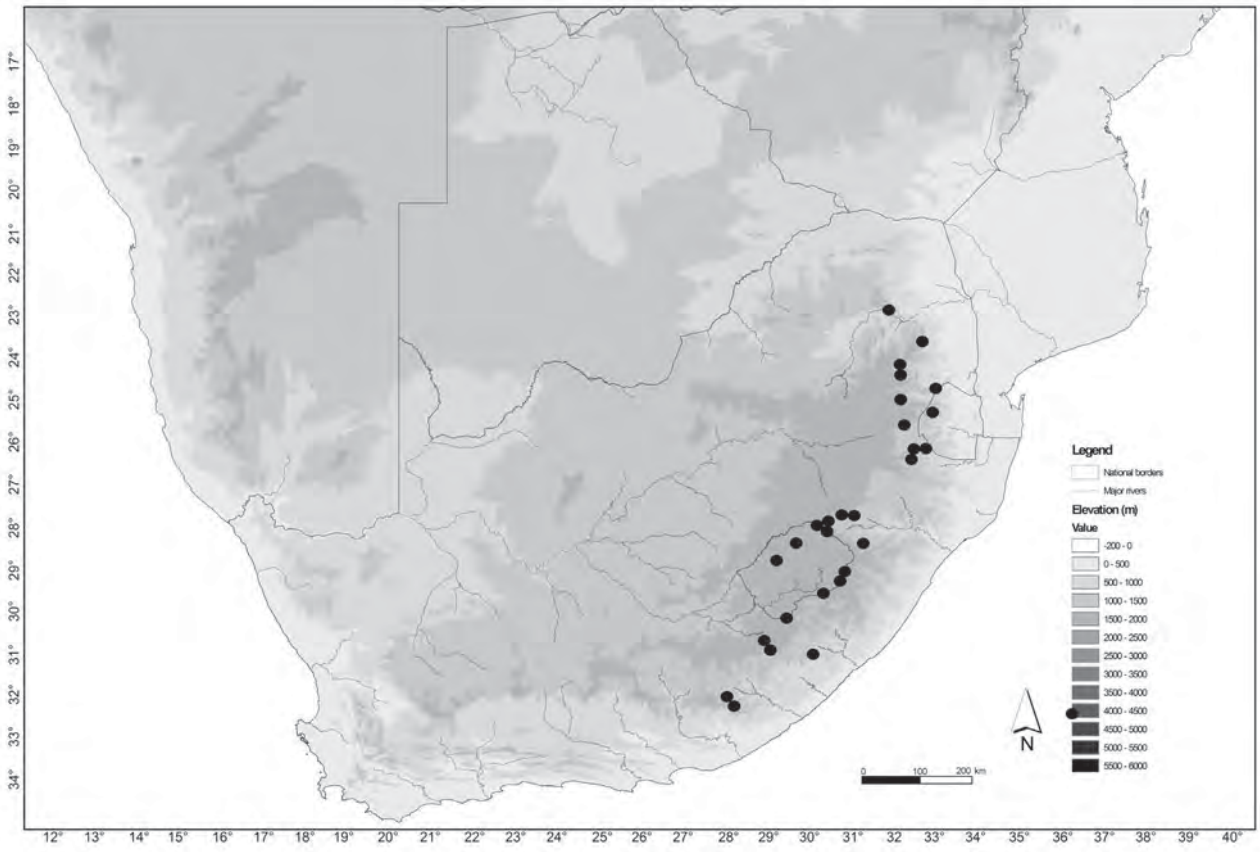


FIGURE 2.—Distribution of *Peltocalathos baurii*.

and finely toothed with attractive pale green markings along the primary veins, conspicuous against the dull, dark green upper surface.

Plants in sheltered situations tend to be much larger than those growing in shallower soils or in more exposed conditions on banks or in alpine seepages. Although the two extremes are striking, we have encountered a complete range of variants on wet banks and seepages on Naude's Nek in the southern Drakensberg, ranging from small, solitary-flowered plants with leaves less than 30 mm in diameter to well-grown individuals over 300 mm high with multiple flowers and leaves to 80 mm diam.

Plants collected early in the season at high altitudes around 3 000 m in the Drakensberg Mtns, most commonly on the summit plateau of Mt aux Sources, are exceptionally dwarfed, with solitary (rarely two) flowers on scapes 30–70 mm long and leaves either just emergent or with reduced blades 5–20 mm diam. Tölken (1965), who also remarked on this form, was uncertain how to treat it. Although these populations may represent a distinct alpine ecotype, the species as a whole exhibits such marked phenotypic plasticity that they are more likely merely extreme morphotypes, especially since early-flowering individuals from lower altitudes elsewhere may be similarly diminutive.

History: The species was described in 1881 by Peter MacOwan (1830–1909), principal of Shaw College in Grahamstown and expert on the regional flora, from a collection made near Baziya, west of Umtata, by the missionary Leopold Richard Baur (1825–1889). The collection is undated but was presumably made after 1873 since it was during this year that Port Elizabeth businessman and amateur botanist Russell Hallack (1824–1903) visited Baur and encouraged him to botanise the area and send his collections to MacOwan. MacOwan associated Baur's plants with a collection from Lesotho made in 1861 by the professional plant collector Thomas Cooper (1815–1913), who had recognised that his find represented a new species. This collection (BOL, SAM) is the voucher for seeds and rhizomes that Cooper despatched to his employer, W.W. Saunders of Reigate, for cultivation, where they were successfully grown and flowered. A brief description by Kew botanist D. Oliver of the herbarium specimens pressed from these cultivated plants formed a footnote to MacOwan's description of *R. baurii.*

With the arrival of a duplicate of Baur's collection at Kew in 1885, Oliver lost no time in having both it and Cooper's specimens lithographed for *Hooker's Icones plantarum* (Oliver 1886a, b), and in describing the latter under the name *R. cooperii*. The differences between the two were slight, 'chiefly in dimensions and number of flowers' (Oliver 1886a) and were followed by the caveat, or presentiment, that the two taxa might later have to be reduced to a single species as it was 'not improbable that connecting forms may be found'. Both names [the former sometimes misspelled as '*bauerii*'] continued to be applied to plants from KwaZulu-Natal

for some time (Wood 1907; Bews 1921), but the two were eventually united (Tölken 1965).

Additional specimens seen

LIMPOPO.—**2430** (Pilgrim's Rest): Olifants River, 5400′ [1 650 m], (–AA), *R. Schlechter 3819* (BOL).

MPUMALANGA.—**2430** (Pilgrim's Rest): Graskop Spruit, (–DD), 16 Dec. 1937, *E. Galpin s.n.* (BOL, PRE); Graskop, marshy slopes, (–DD), 22 Nov. 1951, *L. Codd 6739* (PRE). **2530** (Lydenburg): Dullstroom, Caravan Park, (–AC), 21 Nov. 1985, *B. Clarke 1460* (PRE); Dullstroom, Farm Driehoek, (–AC), 8 Nov. 2001, *A. Hankey 1428* (PRE); Belfast, (–CA), Dec. 1909, *J. Williams s.n.* (BOL); 7 Dec. 1909, *R. Leendertz 7961* (PRE). **2531** (Komatipoort): White River, Mr Kay's Farm, (–CC), Oct. 1931, *L. Liebenberg 2815* (PRE). **2630** (Carolina): near Carolina, 5600′ [1 707 m], (–AA), Dec. 1905, *H. Bolus 11678* (BOL); Ermelo, Nooitgedacht, (–CB), Jan. 1928, *M. Henrici 1739* (PRE); Ermelo, Spitskop, (–CB), Nov. 1915, *R. Pott 5125* (PRE). **2730** (Vryheid): Wakkerstroom, Farm Oshoek, (–AD), 24 Nov. 1960, *N. Devenish 268* (PRE); Kwa-Mandlangampisis, Farm Groothoek, (–BA), 26 Nov. 1980, *L. du Toit 68* (PRE); Piet Retief, (–BB), Dec. 1911, *T. Jenkins 10972* (PRE).

FREE STATE.—**2828** (Bethlehem): gully behind Three Witches, (–DB), 20 Dec. 1983, *Dove 54* (NBG). **2829** (Harrismith): Swinburne, Rensburgskop, (–AC), 10 Dec. 1962, *M. Jacobsz 15* (PRE)

SWAZILAND.—**2631** (Mbabane): Mbabane, Forbes Reef road, 4500′ [1 400m], swamp, (–AC), 6 Nov. 1958, *R.Compton 28280* (NBG, PRE); Mbabane, Kirkhill, 3500′, [1 070m], (–AC), moist streamsides, 12 Oct. 1956, *R. Compton 26067* (NBG, PRE).

KWAZULU-NATAL.—**2828** (Bethlehem): Natal National Park, (–DB), 13 Dec. 1928, *E. Galpin 10164* (PRE). **2829** (Harrismith): Van Reenen's Pass, 5–6000′ [1 500–1 800 m] (–AD), 18 Dec. 1891, *J.M.Wood 955* (BOL, GRA, PRE, SAM); Van Reenen, waterfall, (–AD), 25 Nov. 1941, *E. Dillon s.n. NBG402/39* (NBG). **2929** (Underberg): Highmoor Forest Station, (–BB), stream bank, 15 Jan. 1966, *D. Killick 3628* (PRE); [Kamberg] Farm Culvers, (–BC), Dec. 1923 [?1925], *F.A. Rogers 28264* (GRA); Giant's Castle, (–CB), Nov. 1914, *R. Symons 173* (PRE); Bushman's River Pass, 9000′ [2 750m], moist places on summit, (–CD), Dec. 1891, *J. Thode* s.n. (NBG); Bushman's River Valley, (–CD), 23 Oct. 1907, *J. Wylie com. J. Medley Wood 10654* (PRE).

LESOTHO.—**2828** (Bethlehem): Mamalapi, S-slopes, 9000′ [2 750m], (–CD), 28 Dec. 1948, *R. Compton 21329* (NBG); Leribe, slope Mechachaneng, 5–6000′ [1 500–1 800 m], (–DA), Jan. 1913, *A. Dieterlen 883* (PRE, SAM); slopes of Mt aux Sources, 7–8000′ [2 100–2 400 m], (–DD), 1894, *H. Flanagan 2124* (PRE), *2125* (BOL, SAM); Mt aux Sources, 3 100 m, (–DD), Oct. 1897, *G. Mann sub Marloth 2880* (BOL); 9500′ [3 000 m], 25 Oct. 1897, *A. Bolus sub Guthrie 4770* (BOL); 21 Nov. 1930, *H. Schweickerdt 689* (PRE); 10500′ [3 200 m], 3 Oct. 1950, *Sidey 2013* (PRE); Sept. 1963, *Trauseld 53* (PRE); Mothae Mtns, (–DD), 8 Jan. 1958, *J. Coetzee 816* (PRE). **2927** (Maseru): Maluti Mtns, Makheke's Pass, (–DB), without date, *R. Staples 179* (PRE). **2928** (Marakabei): Little Bokong Valley, (–AA), 5 Jan. 1947, *A. Guillarmod 317* (GRA, PRE). *Imprecise locality:* 'Basutoland', *T. Cooper s.n.* (BOL, SAM).

EASTERN CAPE.—**3027** (Lady Grey): Witteberg, Ben MacDhui, damp ground under rocks, 9200–9600′ [2 800–2 900 m], (–DB), 11 Mar. 1904 (fruiting/sterile), *E.E. Galpin 6567* (BOL, GRA, PRE, SAM). **3028** (Matatiele): Ramatsiliso's Beacon, moist cliffs, 2 325 m, (–BB), 12 Oct. 1976, *M. Boardman 134* (PRE). **3127** (Lady Frere): Saalboom Nek, (–BA), 15 Jan. 1959, *J. Acocks 20205* (PRE); R56 ± 17 km from Elliot to Ugie, moist slopes, (–BD), 3 Nov. 2000, *E. Nienaber 986* (PRE). **3128** (Umtata): Mjika, above Mhlahlane Forestry Station, 1 300 m, (–BC), 8 Sept. 1984, *A. Hutchings 1228* (PRE). **3226** (Fort Beaufort): under krantzes, summit of Great Katberg Mtn, (–BC), Nov. 1884, *W.C. Scully 143* (SAM); top of Katberg Pass, 1 720 m, wet places at base of cliff, (–BC), *T. Dold 1246* (GRA); Amatole Mtns, Elandsberg, 5000′ [1 500 m], S-facing cliffs, (–DB), 28 Oct. 1981, *P. Phillipson 432* (PRE).

Ranunculus *L.* in Species plantarum 1: 548 (1753). Type species: *Ranunculus acris* L. (Jarvis 2007).

Ranunculus sect. *Batrachium* DC.: 232 (1817). *Batrachium* (DC.) S.F.Gray: 270 (1821). *R.* subg. *Batrachium* (DC.) A.Gray: 363 (1886). Type species: *Ranunculus hederaceum* L.

Annual or perennial herbs, sometimes aquatic, glabrous or pubescent. *Roots* fibrous to fleshy, usually without a taproot. *Stems* erect or creeping, sometimes stoloniferous. *Leaves* spiral, cauline and/or basal, petiolate, stipules adnate to base of petiole and sheathing; blades simple and usually palmately lobed or pinnatisect (rarely peltate in *R. lyallii* from New Zealand), or compound, trifoliolate or imparipinnate, in aquatic species often decompound into filiform or linear segments. *Flowers* solitary and terminal or in cymes, bisexual, actinomorphic, all parts spiral. *Sepals* usually 5(3), spreading or reflexed. *Petals* [also termed honey-leaves] 5 or 6 (–10), yellow or white, often glossy adaxially, narrowed at base into short claw, with nectar-secreting pit on adaxial surface at top of claw often covered by laterally adnate scale or flap forming nectary-pocket. *Stamens* numerous, rarely 5 or less. *Carpels* free, usually numerous, with 1 basal ovule. *Achenes* smooth, tuberculate or transversely rugose, glabrous or pubescent, with or without persistent style-beak; pericarp with inner sclerenchyma layer present.

500–550 spp., cosmopolitan but mainly temperate Northern Hemisphere; 4 spp. in southern Africa, with 3 spp. native and 1 sp. naturalised. Some species are reported to be poisonous to livestock when fresh (Eichler & Walsh 2007) but Burtt Davy (1926) reported that the leaves of *R. multifidus* are eaten in spring and at other times when grass is scarce.

Key to species

1a. Submerged and floating aquatic; leaf blades finely dissected into linear or hair-like segments; petals white with yellow claw; achenes transversely rugose, not beaked . . . . . *R. trichophyllus*

1b. Terrestrial but often growing in damp places; leaves variously simple or compound but never finely dissected; petals yellow; achenes smooth, ribbed or tuberculate/muricate, beaked:

2a. Dwarf, creeping, stoloniferous perennial rooting from nodes; leaf blades cordate-reniform and crenate-dentate, mostly 5–20 mm diam.; flowers solitary, scapose; petals ligulate, acute-attenuate, ± 1 mm wide, veins unbranched. . . . . *R. dregei*

2b. Erect or sprawling, tufted annuals or perennials; flowers mostly in cymes; leaf blades variously lobed or parted, 15–70 mm long; petals obovate, obtuse, 3–4 mm wide, veins branched:

3a. Perennial, ± pubescent; leaves ternately pinnate or bipinnate; achenes smooth or tuberculate, 2.0–2.5 mm long, shortly beaked with beak ± 0.5 mm long . . . . . *R. multifidus*

3b. Annual, ± glabrous; leaves simple or 3–5-parted; achenes muricate, 5–8 mm long, strongly beaked with blade-like beak 2–3 mm long. . . . . *R. muricatus*

Sect. *Ranunculus*

1. **Ranunculus muricatus** *L.* in Species plantarum 1: 555 (1753); Eichler & Walsh: 347 (2007). Type: 'Habitat in Europae australis fossis & humentibus', *LINN715.66* [LINN—digital image!, lecto., designated by Lourteig:

487 (1951)].

[?*R. sceleratus* sensu Harv.: 6 (1860), non L. (1753)]

Erect or sprawling annual, mostly 100–200(–500) mm tall, stems simple or branched in upper parts, glabrous or pilose with hairs to 2 mm long. *Roots* fibrous or narrowly thong-like. *Leaves* basal and cauline, petioles of basal leaves 50–150 mm long with stipules adnate and sheathing for 5–30 mm, glabrous or thinly pilose, blade suborbicular in outline, unlobed or 3–5-lobed to ± midway, 15–50 mm diam., base truncate to cordate, coarsely crenate-toothed with callus at tip of each serration, usually glabrous but sometimes thinly adpressed-pilose on both surfaces, cauline leaves ± cuneate. *Flowers* in simple or compound cymes, 10–15 mm diam. *Sepals* 5, strongly reflexed, ovate, cucullate, ± 5 mm long, pilose beneath, yellowish. *Petals* 5, obovate, 5–8 × 3–4 mm, varnished bright yellow above, dull and paler beneath, narrowed into short claw in basal ± 1 mm, obtuse, veins branched, nectary pocket-like. *Stamens* 15–20 in 2 or 3 series, filaments ± 3 mm long, anthers ± 1 mm long. *Carpels* 8–20, glabrous. *Achenes* in a globose or hemispherical head, broadly obovoid or subcircular, 5–8 mm long (incl. beak), muricate with numerous acute tubercles, margin keeled and grooved, beak stout, blade-like, 2–3 mm long; receptacle pubescent. *Flowering time*: Sept.–Nov. Figure 3.

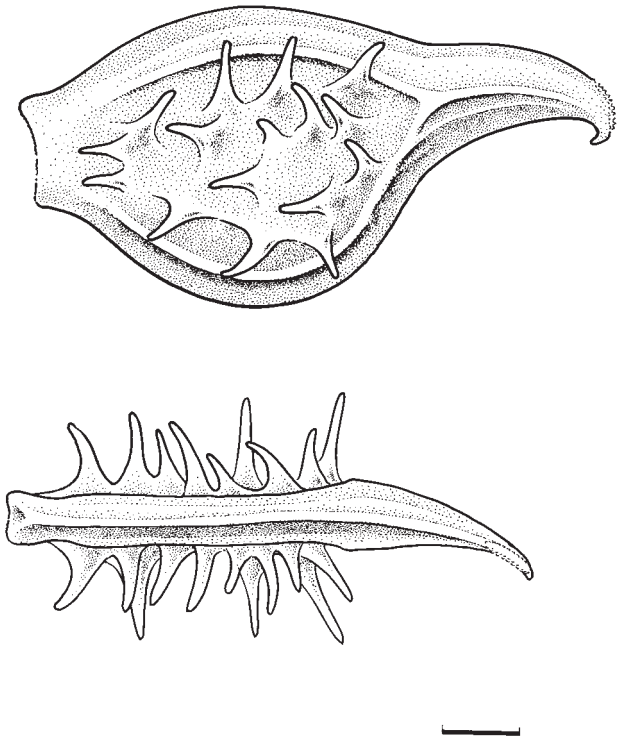


FIGURE 3.—*Ranunculus muricatus*, Camp's Bay, *Saxton 135* (NBG). Achene, lateral and dorsal view. Scale bar: 1 mm. Artist: John Manning.

Distribution and ecology: native to the Mediterranean region but adventive in the southwestern Cape, where it has been recorded from the Cape Peninsula to Kleinmond and Swellendam (Figure 4), in marshy ground and riverbanks. It has been collected so far only near settlements and has not been recorded in undisturbed vegetation. The species is widely naturalised in Australia and parts of the continental United States, mainly as a weed of damp waste places and croplands but occasionally along lake and stream margins in native vegetation (DiTomaso & Healy 2007; Eichler & Walsh 2007).

Diagnosis: readily distinguished by the mostly subglabrous, simple or 3–5-lobed, orbicular leaves and echinate achenes, 5–8 mm long, with a stout, blade-like or hooked beak 2–3 mm long.

Ranunculus muricatus was not mentioned by Harvey (1860) by name [but see discussion below] and the first documented South African records are almost contemporaneous collections from the late nineteenth century, from Rondebosch on the Cape Peninsula and from Zuurbraak [Suurbraak], a mission station near Swellendam established in 1812 by the London Missionary Society. The species has been collected only sporadically since then, initially from elsewhere on and around the Peninsula but by the middle of the century from Stellenbosch and Somerset West, and most recently from Kleinmond and Caledon. It has not been recollected on the Cape Peninsula since 1942 and does not appear to be invasive.

It is possible that Harvey's (1860) reference to *Ranunculus sceleratus* L. is relevant here. In his account of the genus in southern Africa, he reported the occurrence of *R. sceleratus* in ditches near Cape Town but neglected to preserve any specimens. Native to Europe, *R. sclereratus* is a subglabrous annual with lobed and crenate basal leaves, deflexed sepals, and elongate-conical receptacles bearing numerous small, ± 1 mm long, ovoid, faintly rugose achenes (Cook 1964). No plants of *R. sceleratus* have ever been collected in southern Africa and the identity of Harvey's plants remains unclear. A collection by Ecklon and Zeyher from the banks of the Zwartkops River listed by them under this name is in fact *R. multifidus* and although it is possible that Harvey (1860) made a similar error we consider this to be unlikely given his familiarity with that species on the Cape Peninsula. *R. sceleratus* is vegetatively much more similar to *R. muricatus* than to *R. multifidus* and if confusion occurred, it is more likely to have been between the former two species, especially without fruits.

Additional specimens seen

WESTERN CAPE.—**3318** (Cape Town): railway at Rondebosch, (–CD), 5 Sept. 1896, *Wolley-Dod 1604* (BOL); Rondebosch, (–CD), Sept. 1898, *H. Bolus 7991* (BOL); Rondebosch Common, (–CD), 9 Oct. 1938, *R.S. Adamson 2122* (PRE); Maitland, (–CD), Nov, 1904, *H. Bolus s.n.* (BOL); Camps Bay, (–CD), Nov. 1907, *W.T. Saxton 135* (NBG); Lion's Rump, (–CD), Nov. 1924, *R. Marloth 6305* (NBG); Klipfontein Road, 4 mi [6.4 km] E of Mowbray, (–CD), 12 Oct. 1913, *N.S. Pillans 2157* (BOL); Mowbray, (–CD), Oct. 1915, *R. Marloth 7247* (PRE); Camp Ground, (–CD), 16 Oct. 1942, *R.H. Compton 13909* (NBG); Tygerberg Nature Reserve, under trees near stream, (–DC), 2 Oct. 1975, *J.W. Loubser 3416* (NBG); Stellenbosch, Elsenburg Agricultural College, (–DD), without date, *P. le Roux s.n.* (PRE); Stellenbosch, Goedvertrouw, riverbank, (–DD), 23 Sept. 1994, *P. Nel & C. Boucher 414* (NBG, PRE); Banhoekweg, marshy ground, (–DD), 19 Sept. 1946, *D.J. Louw s.n.* (NBG). **3418** (Simonstown): Youngsfield, (–AB), 5 Nov. 1935, *R.H. Compton 5955* (NBG); Cape Flats, (–BA), 25 Oct. 1925, *R. Young 26414* (PRE); Somerset Strand, (–BB), 14 Nov. 1946, *R. Strey 737* (PRE); Somerset West, garden weed, (–BB),

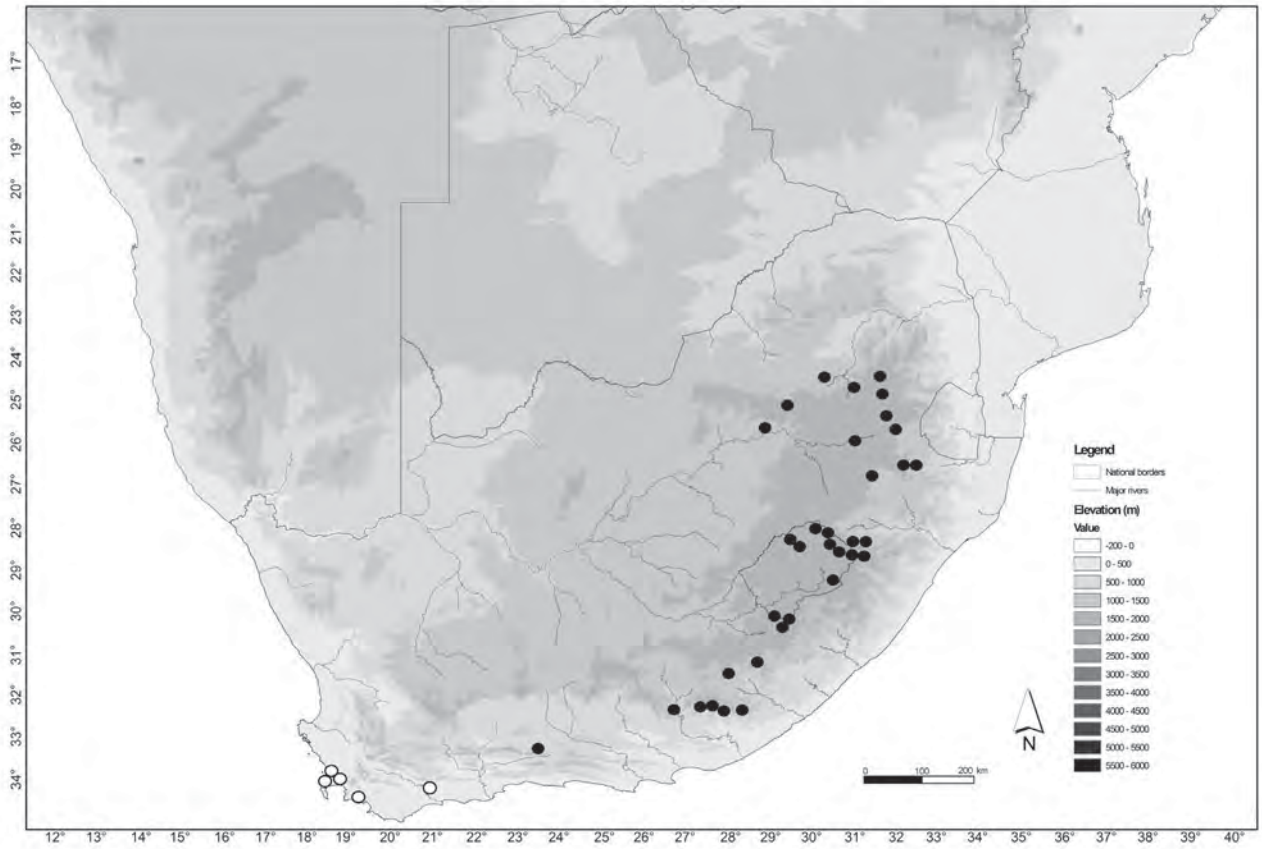


FIGURE 4.—Distribution of *Ranunculus muricatus*, ○; *R. dregei*, ●, in southern Africa.

5 Nov. 1949, *R.N. Parker 4464* (BOL, NBG). **3419** (Caledon): 1 km S of Caledon, just E of rifle range, marshy area, 245 m, (–AB), 13 Oct. 2001, *N.A. Helme 2300* (NBG); Kleinmond, (–AC), without date, M.*P. de Vos 12* (NBG). **3420** (Swellendam): Zuurbraak [Suurbraak], near watermill, (–BA), 12 Oct. 1897, *E. Galpin 3738* (PRE).

2. **Ranunculus multifidus** *Forssk*. in Flora aegyptiaco-arabica: 102 (1775), non Pursh: 736 (1813), hom. illegit.; Milne-Redhead & Turrill: 19 (1952); Exell & Milne-Redhead: 97 (1960); Cook: 241 (2004). *R. forskoehlii* DC.: 303 (1817), nom. illegit superfl. Type: Arabia, near Taäs, *Forsskål s.n.* (C, holo., not seen).

R. capensis Thunb.: 94 (1800), syn. nov. Type: South Africa, precise without locality, *Thunberg UPS-THUNB 13126* (UPS-THUNB—microfiche!, holo.).

R. pubescens Thunb.: 94 (1800). Type: South Africa , without precise locality, *Thunberg s.n. UPS-THUNB 13186* (UPS-THUNB—microfiche!, holo.).

R. pinnatus Poir. in Lam.: 126 (1804). Type: 'Les Indes', *Sonnerat s.n.* (P-LAM, holo., not seen).

R. pinnatus var. *hermannii* DC.: 42 (1824), syn. nov. Type: 'Cap. Bonae Spei', *Hermann s.n.* (G-DC [*000130084*], holo.—digital image!).

R. pubescens var. *glabrescens* Burtt Davy: 342 (1921), syn. nov. Type: South Africa, [Gauteng], 'Vereeniging Dist., Burttholm, Uitgevallen 197', 25 Apr. 1918, *Burtt Davy 17682* (K [*K000076092*]—Aluka image!, holo.).

R. pubescens var. *harveyanus* [as '*harveianus*'] Burtt Davy: 109 (1926), syn. nov. Type: South Africa, [Eastern Cape], 'Graaf Reinet Div., southern slopes of the Schneeuwberg [Sneeuberg], *Burke s.n.* (PRE [*PRE0418732-0*]—Aluka image!, holo.).

[*R. plebeius* sensu Harv.: 6 (1860), non DC. (1817).]

[See Perrier de la Bâthie (1950) and Exell & Milne Readhead (1960) for additional synonyms from tropical Africa]

Tufted perennial, mostly 100–500 but much dwarfed in exposed situations and up to 1 000 mm in protected places, developing new shoots at base; flowering stems erect or sprawling, simple or well-branched in upper parts, densely or sparsely patent- or adpressed-hirsute or -pilose below with hairs to 2 mm long and adpressed-pubescent above, rarely glabrescent or subglabrous. *Roots* several to many, thong-like. *Leaves* basal and cauline, petioles of basal leaves 20–150(–300) mm long with stipules adnate and sheathing for 5–30(–40) mm, usually pilose, sometimes subglabrous, blade ovate in outline, ternate or ternately pinnate to bipinnatisect (rarely tripinnatisect) with 1 or 2 lateral pairs of leaflets, (20–)30–90(–130) × (15–)20–70(–100) mm, ultimate segments coarsely and irregularly toothed, with callus at tip of each serration, usually adpressed-pilose on both surfaces, rarely glabrescent, cauline leaves progressively smaller, ultimately subsessile and lanceolate;

juvenile leaves suborbicular and lobed to ternate. *Flowers* in simple or compound cymes, 10–18 mm diam. *Sepals* 5, strongly reflexed, ovate, cucullate, 2.5–5.0 mm long, hispid beneath, yellowish. *Petals* 5, obovate, 4–9 × 3–7 mm, varnished bright yellow above, dull and paler beneath, narrowed into short claw in basal ± 1 mm, obtuse, veins branched, nectary pocket-like. *Stamens* ± 30 in 2 or 3 series, filaments 1–3 mm long, anthers ± 1.5 mm long. *Carpels* 30–50(–70), glabrous. *Achenes* in an ovoid head, broadly obovoid or subcircular, 2.0–2.5 mm diam., usually verrucose or tuberculate but sometimes ± smooth, margin keeled and grooved, shortly beaked, beak acute, ± 0.5–0.8 mm long; receptacle 2–5mm long, pubescent. *Flowering time*: Aug.–Jan. Figure 5.

Distribution and ecology: widespread through southern and east tropical Africa to Ethiopia, Arabia and Madagascar. In southern Africa, *Ranunculus multifidus* is largely restricted to the more mesic southern and eastern parts (Figure 6), from near sea level to 3 000 m, and is largely absent from the western half of the subcontinent apart from some isolated populations in higher or locally moist situations.

Plants typically occur in moist or damp, open grassy habitats and floodplains, along streams and bogs, sometimes partially submerged, and in open patches in temperate forest; it is sometimes ruderal in gardens or along ditches and around dams. The species is self-fertile; producing numerous fruits, and has a tendency to become weedy in damp waste places, suburban gardens and parklands, especially in the southern and southwestern Cape, where it is commonly associated with human activity. Local variants are readily established.

Diagnosis: a widespread and variable species, especially in the degree of dissection of the leaves, which range from ternate to tripinnatisect, development and density of the vestiture on the stems and leaves, size of the flowers, and development of tubercles on the fruits, which vary from scarcely evident to almost spinulate. Plants from high altitudes and exposed or trampled situations are typically dwarfed and compact or almost prostrate and those from sheltered locations larger and more lush, but the species is always readily distinguished from other sub-Saharan species by its ± appressed pubescent, ternately pinnate or bipinnate leaves with one or two pairs of lateral leaflets, and ± tuberculate achenes. The flowers are small to moderately sized, with reflexed, hispid sepals and 5 obovate petals, 4–9 mm long.

History: The correct identification of the South African material of this species took some time to establish. The first collections of the species on the subcontinent were made in the late eighteenth century by Carl Thunberg (1743–1828), who described them under the names *R. capensis* Thunb. (1800) and *R. pubescens* Thunb. (1800). Subsequently Harvey (1860), in his account of the genus for *Flora capensis*, segregated the material available to him among three different names: typical plants with pinnate or bipinnate leaves, including *R. pubescens* Thunb., were treated by him, and later by Oliver (1868), under the name *R. pinnatus* Poir.; smaller plants with subsimple radical leaves were treated as *R. capensis* Thunb.; and a collection from the Sneeuberg with ternate leaves and smooth achenes was referred to the Australian species *R. plebeius* DC., a mistake that was later corrected by Exell & Milne-Redhead (1960). The priority of the name *R. multifidus* Forssk. (1775) over *R. pinnatus* Poir. (Lamarck 1804), under which name the species was better known in southern Africa, was established by Milne-Redhead & Turrill (1952).

Collections of subglabrous plants from Mpumalanga were described as var. *glabrescens* by Burtt Davy (1921). The protologue clearly designates *Burtt Davy 17682* (K) as the [holo] type, with *Burtt Davy 17164* included among the paratypes, but this was somewhat confused when Burtt Davy (1926) later identified both collections as types [syntypes]. This is incorrect. He also segregated Burke's Sneeuberg collection [previously treated as *R. plebeius* by Harvey (1860)] plus some others as his new var. *harveyanus* Burtt Davy (1926). Both variants fall within the range of variation of *Ranunculus multifidus* and we see no justification for upholding them. We have seen no authentic material of *R. plebeius* from southern Africa.

The identity of *Ranunculus capensis* Thunb. (1800), based on a collection of three small plants—two of them just coming into flower and the third sterile—deserves further consideration and it was treated as a doubtful species by Winter (2006). The name was associated by Harvey (1860) with two or three additional collections from the Cape Peninsula and Clanwilliam, notably *Ecklon & Zeyh. En. No. 13* (SAM) from Green Point and the latter is indeed a perfect match with Thunberg's type. After close study we conclude that the species represents a seedling variant of *R. multifidus* with juvenile, ternate leaves. This conclusion was also reached by Adamson (1950), who suggested that the taxon was a dwarf state of the variable *R. pubescens* (now *R. multifidus*). The pubescent stems and petioles, the hirsute leaf blades, the relatively small flowers with reflexed, hispid sepals, and the pubescent receptacle with small, compressed achenes with short beak are all consistent with *R. multifidus*. Additional collections from Green Point (*Ecklon s.n. SAM13992* and *Thode s.n. SAM9260*) are perfectly intermediate with more typical *R. multifidus* and we accordingly formally synonymise the name here.

The relationship between *Ranunculus multifidus* and *R. pinnatus* has proven remarkably troublesome to resolve. Following Harvey (1860), the South African material was treated under the name *R. pinnatus* (e.g. *Wood 1909*, *Bews 1921*) until Burtt Davy (1921) queried the conspecificity of *R. pubescens* with *R. pinnatus*. Although evidently of the opinion that the two were probably the same, the type locality of *R. pinnatus*, given by Poiret (1804) as 'Les Indes', was problematical to him and he therefore elected to treat the southern African material under the name *R. pubescens* until this could be resolved. Certainly, both Milne-Redhead & Turrill (1952) and Exell & Milne-Redhead (1960) considered that the tropical African material was not conspecific with *R. pinnatus* Poir., although without explicit justification, and this opinion is still followed by some authors (Teketay & Edwards 2000). Perrier de la Bâthie (1950), in his account of the genus in Madagascar, however, treated the two as conspecific under the name *R. pinnatus* Poir. This remains the current situation until formally reversed.

Additional specimens seen

NAMIBIA.—**1820** (Tarikora): swampy area below Tamso Camp in Omuramba Khaudum, (–DA), 16 Feb. 1956, *B, de Winter & W. Marais 4687* (PRE). **1917** (Tsumeb): Otavi, (–CB), 30 Nov. 1908, *Dinter 909* (SAM); Otavifontein, (–CB), 3 Feb. 1960, *Giess & Smook 10620* (PRE). **1918** (Grootfontein): Grootfontein, (–CA), without date, *Schoenfelder 293* (PRE); Grootfontein, (–CA), 3 Mar. 1960, *R. Seydel 2066* (NBG). **2017** (Waterberg): Waterberg Plateau, (–CA), Dec. 1935, *J. Boss s.n.* (PRE); Gross Waterberg, (–CA), 12 Nov. 1947, *R.J. Rodin 2590* (BOL, PRE); Okosongomingo, (–CA), 4 Feb. 1911, *Dinter 1766* (SAM). Uncertain locality: Okasewa, alluvium along Nossob, 24 Jan. 1913, *Dinter 2739* (SAM).

BOTSWANA.—**2525** (Mafeking): Kanye, Majana village along banks of Kolobeng River, (–BA), 16 Nov. 1948, *Hillary & Robertson 572* (PRE).

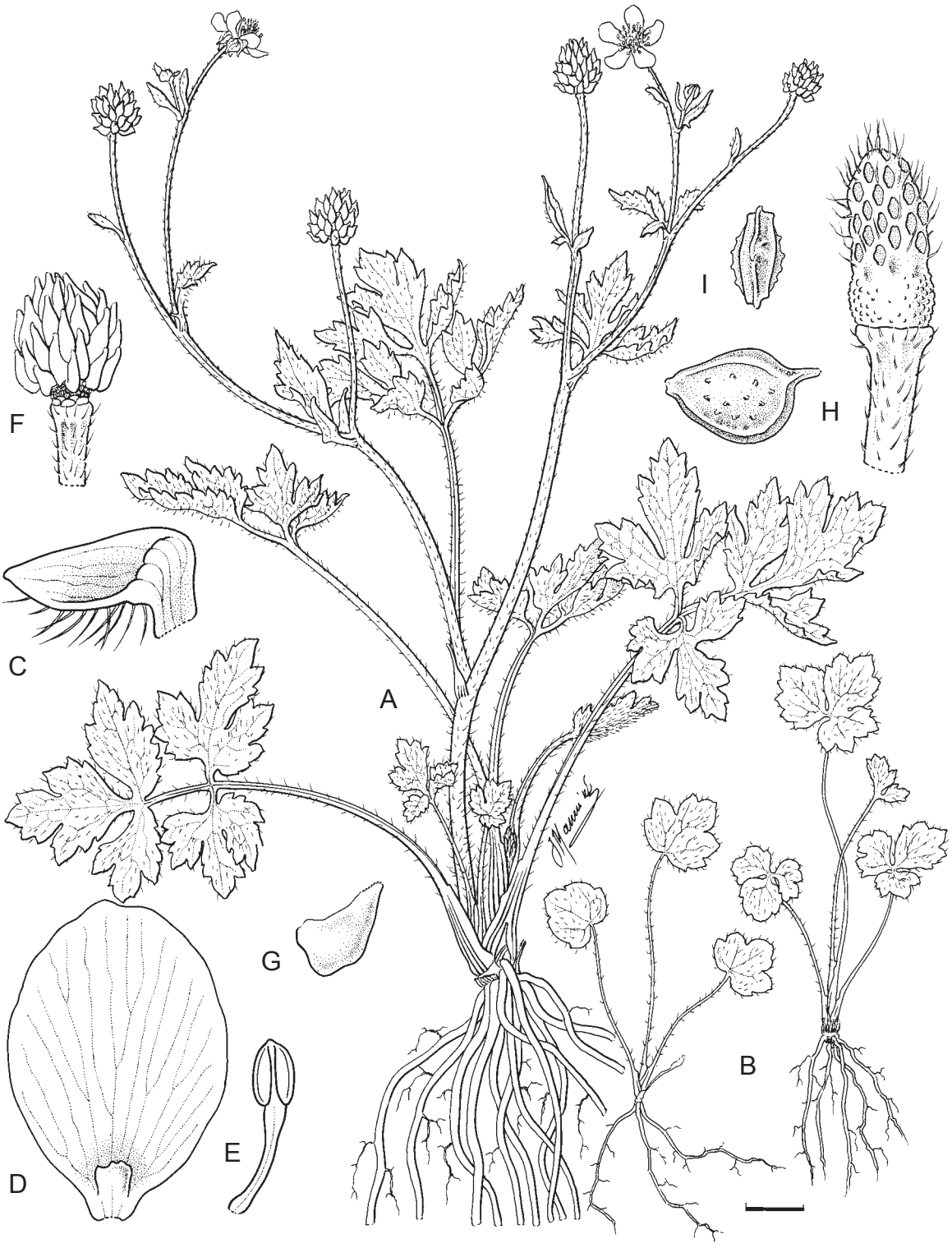


FIGURE 5.—*Ranunculus multifidus*, Cape Town, *Manning 3405* (NBG). A, flowering plant; B, seedlings; C, sepal; D, petal; E, stamen; F, pistil; G, carpel; H, receptacle; I, achene, lateral and frontal view. Scale bar: A, B, 10 mm; C–E, G–I, 1 mm; F, 2 mm. Artist: John Manning.

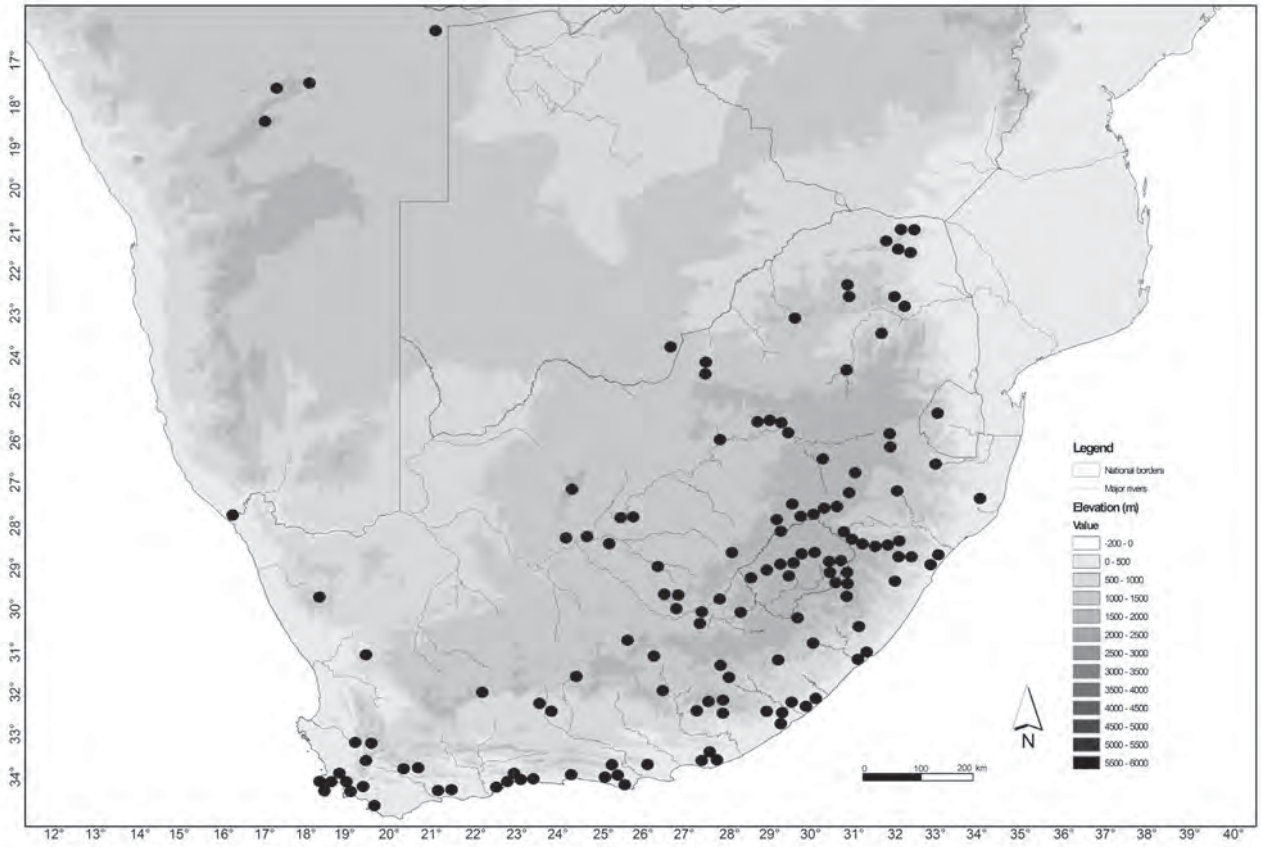


FIGURE 6.—Distribution of *Ranunculus multifidus* in southern Africa.

LIMPOPO.—**2229** (Waterpoort): N of Fogwells, (–DD), 23 Dec. 1935, *Smuts & Gillett 3162* (PRE). **2230** (Messina): Venda, Smokey Irrigation Scheme, Nzhelele (Dzanani), (–CB), *E. Netsgingane 632* (PRE); Schikunda-Milema, along Mutail River, (–DA), 7 Oct. 1981, *A. Van Wyk & G. Theron 4963* (PRE). **2329** (Polokwane): Pietersburg [Polokwane], (–CD), Feb. 1904, *H. Bolus 11035* (BOL). **2330** (Tzaneen): 5 km from Elim on road to Bandolierskop, (–AA), 6 Nov. 1985, *G. Germishuizen 2446* (PRE); Zoutpansberg, Tshakoma, (–AB), Nov. 1931, *A. Obermeyer 993* (PRE); Woodbush, (–CC), without date, *T. Jenkins 10450* (PRE). Woodbush, Pypkop, (–CC), 29 Dec. 1944, *A. Mogg 17449* (PRE). **2428** (Nylstroom): Naboomspruit, Mosdene, Nylsvlei, (–DA), 29 Oct. 1919, *E. Galpin 465* (PRE). **2429** (Zebediela): Potgietersrust, (–AA), 2 Nov. 1908, *R. Lendertz 6207* (PRE); Sekukuniland, Motoka, Farm Ironstone, (–DD), 9 Jan. 1939, *Mogg & Barnard 808* (PRE); Farm Schoonraad, along water furrows and vleis, (–DD), without date, *W. Barnard 14* (PRE).

NORTH-WEST.—**2526** (Zeerust): Zeerust, (–CA), Jan. 1912, *R. Pott 4186* (PRE); Marico Dist., Wonderfontein, (–CC), 18 Nov. 1907, *J. Burtt-Davy 7239* (PRE). **2527** (Rustenburg): Beestkraal, (–AD), Dec. 1908, *T. Jenkins 6946* (PRE); Rustenburg, (–CA), Dec. 1918, *F. Rogers 22354* (PRE); Rustenburg Kloof, (–CA), 27 Dec. 1949, *M. Steyn 879* (NBG). **2625** (Delareyville): Mafeking Dist., Setlagoli, (–AC), 13 Nov. 1911, *J. Burtt-Davy 11047* (PRE). **2626** (Klerksdorp): Klerksdorp, (–DC), Feb. 1918, *L. Kretzschmar s.n.* (PRE). **2627** (Potchefstroom): Potchefstroom, (–CA), 21 Mar. 1910, *R. Leendertz 7993* (PRE); abandoned park near Mooivallei suburb, (–CA), 31 Oct. 2011, *D.M. Komape, L.I. Mabe & S.J. Siebert KMS125* (NBG); Klipdrift E of Potchefstroom, (–CB), 4 Jan. 1935, *J. Theron 1115* (PRE); Vereeninging, (–CB), 20 Feb. 1917, *J. Burtt Davy 17164* (BOL). **2724** (Taung): Taung, Kaap Plateau, 1 200 m, riverine, (–DA), 16 Dec. 1977, *Peeters, Gericke & Burelli 448* (PRE). **2725** (Bloemhof): Wolmaransstad, Boskuil, (–BD), 9 July 1929, *J. Sutton 173* (PRE); Bultfontein, Oppermansdrif Dam, 1 220 m, (–CB), 14 Dec. 1974, *T. O'Connor 88* (PRE); Christiana, (–CC), 22 Dec. 1911, *J. Burtt-Davy s.n.* (PRE).

GAUTENG.—**2527** (Rustenburg): Hennops River, (–DD), 10 Nov. 1951, *L. Prosser 1628* (PRE). **2528** (Pretoria): Koedoespoort, (–CA), 19 Oct. 1905, *R. Leendertz 646* (BOL, PRE); Groenkloof Valley, (–CA), 1 Nov. 1917, *I. Pole-Evans 167* (PRE); Fountains Valley, (–CA), 22 Oct. 1928, *I. Verdoorn 514* (PRE); Muckleneuk, (–CA), 10 Oct. 1930, *A. Goossens 27* (PRE); Colbyn Nature Reserve, (–CA), 14 Nov. 2000, *J. Meyer 3084* (PRE); Pretoria, Silverton, Moreleta River, (–CB), 6 Nov. 1980, *A. Balsinhas 3494* (PRE). **2627** (Potchefstroom): Roodepoort, Botanic Garden, (–BB), 19 Nov. 1982, *C.M. Behr 149* (NBG); Vereeniging, Leeuwkuil Pasture Research Station, (–DB), 5 Nov. 1935, *R. Story 44* (PRE). **2628** (Johannesburg): near Kempton, (–AA), Nov. 1926, *C. Smith 3505* (PRE); Crown Mines, (–AA), 14 Nov. 1961, *A. Lucas 35242* (PRE). Without exact locality: Johannesburg, Dec. 1908, *R. Leendertz 6856* (PRE).

MPUMALANGA.—**2430** (Pilgrims Rest): Shiluvane, (–AB), withou date, *H. Junod 25202* (PRE); Mount Sheba, damp forest floor along streamlet, 6400′ [1 900 m], (–DC), 29 Nov. 1980, *J.P. Kluge 2319* (NBG, PRE). **2431** (Acornhoek): near river at Skukuza, (–DC), Nov. 1833, *E. Cholmondeley s.n.* (PRE). **2529** (Witbank): Middelburg, Doornkop, (–CB), 23 Oct. 1968, *C. du plessis 819* (PRE). **2530** (Lydenburg): Spekboom River, 4 mi [6.4 km] N of Lydenburg, stream bank, (–AB), 19 Nov. 1933, *R. Young 464* (PRE); Dullstroom, (–AC), 27 Nov. 1980, *B. Drews 175* (PRE); 16 Nov. 1984, *H. Cameron 390* (PRE); Schoemann's Kloof, (–AD), 14 Nov. 1933, *R. Young 319* (PRE); Mt Anderson, W of Anderson Pass, (–BA), 25 Dec. 1932, *Smuts & Gillett 2447* (PRE); Schagen, (–BD), Dec. 1934, *L. Liebenberg 3279* (PRE); Rosehaugh, (–BD), 10 Jan. 1938, *A. Mogg 13670* (PRE); Witklip, in vlei, (–BD), 3 Jan. 1974, *J. Kluge 405* (PRE); 15.5 mi [25 km] N of Belfast, (–CA), 16 dec. 1956, *L. Prosser 2035* (PRE). **2531** (Komatipoort): Barberton, Plaston, (–AC), Nov. 1931, *W. Holt 123* (PRE); Moodies, (–CC), Sept./Oct. 1889, *E. Galpin 587* (PRE); Barberton, (–CC), Nov. 1909, *A. Williams 10446* (PRE). **2629** (Bethal): Bethal, (–AD), Dec. 1910, *R. Pott s.n.* (BOL); Ermelo, (–DB), 18 Dec. 1949, *M. Steyn 848* (NBG). **2630** (Carolina): Ermelo, (–CD), 2 Nov. 1926, *M. Henrici 111* (PRE). **2729** (Volksrust): Volkstrust, (–BD), Jan. 1911, *T. Jenkins 10687* (PRE). **2730** (Vryheid): Utrecht, (–AB), Dec. 1915, *A. Wahl 15387* (PRE); Wakkerstroom, (–AB), 20 Nov. 1926, *Watt & Brandwijk 1617* (PRE).

FREE STATE.—**2627** (Potchefstroom): Sasolburg, 1 463 m, (–DD), 14 Oct. 1977, *N. Kroon 43* (PRE). **2727** (Kroonstad): Hillbrow,

(–BD), 21 Jan. 1931, *A. Goossens 492* (PRE); Kroonstad, (–CA), without date, *D. Chennells 81* (BOL); Kroonstad, near Vals River and Bloemspruit, (–CA), Oct.–Nov. 1927, *J. Pont 201* (PRE). **2728** (Frankfort): Farm Rietspruit, 29 km from Frankfort on road to Vrede, (–BC), 28 Jan. 1983, *E. Retief 1095* (PRE). **2828** (Bethlehem): Bethlehem, (–AB), 3 Dec. 1919, *E. Phillips 3080* (GRA, PRE); Fouriesburg, (–CA), 8 Jan. 1918, *G. Potts 3245* (PRE); Golden Gate National Park, Oshoek, (–DA), 10 Dec. 1988, *Gertenbach & Groenewald 8838* (PRE); Witzieshoek, (–DB), Oct. 1909, *J. Thode s.n.* (PRE). **2829** (Harrismith): Harrismith Botanic Garden, 1 880 m, (–AC), 30 Oct. 1970, *A. van der Zeyde 459* (NBG); small dam E of garden estate, (–AC), 2 Dec. 1974, *A. van der Laarse s.n.* (NBG); Van Reenen's Pass, (–AD), 13 Dec. 1931, *M. van Wyk 107* (PRE); Swinburne, (–AD), Nov. 1961, *M. Jacobsz 20* (PRE). **2925** (Jagersfontein): Fauresmith, (–CB), 25 Nov. 1931, *I. Verdoorn 910* (PRE). **2926** (Bloemfontein): Wintervalley, N of Bloemfontein, (–AA), 8 Oct. 1968, *D. Muller 339* (PRE). **2927** (Maseru): Thaba'Nchu, 1 650 m, (–AA), 12 Dec. 1977, *Peeters, Gericke & Burelli 319* (PRE). **3025** (Colesberg): Phillipolis Road Station, (–AB), 5 Jan. 1928, *C. Smith 5219* (PRE); Trompsberg, Rietpoort Noord, (–BA), 30 Oct. 1943, *P. Kies 269* (PRE); Colesberg, (–DA), 13 Dec. 1971, *Anderson 210* (PRE). **3026** (Aliwal North): Haasfontein Farm, 40 km W of Smithfield, (–AC), 24 Jan. 1990, *T. Saaiman 555* (PRE); Cliftonvale Farm ± 12 km SE of Bethulie, 1 280 m, (–CA), 18 Dec. 1983, *H. Burrows 2219* (PRE); Bergplaas Farm ± 12 km SE of Bethulie, 1 280 m, damp places near stream, (–CA), 21 Apr. 1984, *H. Burrows 2401* (PRE). **3027** (Lady Grey): Zastron, (–AC), Apr. 1926, *J. Maree 62* (PRE).

SWAZILAND.—**2631** (Mbabane): Mbabane, Poliniane River, (–AC), 11 Oct. 1963, *B. Dlamini s.n.* (PRE).

KWAZULU-NATAL.—**2731** (Ubombo): Mkuzi, 150′ [46 m], (–CA), 4 Sept. 1932, *E. Galpin 13329* (PRE). **2828** (Bethlehem): Tugela Valley, Natal National Park, (–DB), 26 Aug. 1950, *B.E. Martin 467* (NBG). **2829** (Harrismith): Fort Mistake, (–BB), 25 Oct. 1977, *H. Nicolson 1793* (PRE). **2830** (Dundee): Dundee, (–AB), 21 Mar. 1926, *D. Gordon Truscott 52* (PRE). **2832** (Mtubatuba): Hluhluwe Game Reserve, (–AA), 31 Oct. 1961, *P. Hitchins 117* (PRE). **2929** (Underburg): Bergville, (–AB), 16 Dec. 1928, *E. Galpin 10791* (PRE); 20 Oct. 1950, *D. Killick 1052* (PRE); Tabamhlope, (–BA), 9 Dec. 1937, *O. West 481* (PRE); Estcourt, 5000[1 500 m], (–BB), 26 Nov. 1937, *O. West 445* (BOL, GRA); Biggarsberg, (–BD), 12 Oct. 1990, *W. Vos 141* (PRE); top of Sani Pass, 9500′ [2 900 m], (–CB), 6 Nov. 1973, *O. Hilliard & B. Burtt 7105* (PRE); Underburg, (–CD), Mar. 1938, *A. McClean 737* (PRE); Giant's Castle, (–DD), Nov. 1914, *R. Symons 157* (PRE). **2930** (Pietemaritzburg): Mooi River, (–AA), 1 Nov. 1918, *A. Mogg 3195* (PRE); Pietermaritzburg, Town Hill, (–CA), 20 Oct. 1952, *R.H. Compton 23725* (NBG); Taylor's Halt, (–CB), 19 Oct. 1939, *A.R. Fairall 54* (NBG). **2931** (Stanger): Umhloti, (–CA), 14 Mar. 1972, *C. Musil 80* (PRE); Durban, (–CC), Aug. 1883, *J. Medley Wood 36* (BOL, PRE). **3030** (Port Shepstone): Ixopo, (–AA), 7 Oct. 1918, *A. Mogg 2319* (PRE).

LESOTHO.—**2828** (Bethlehem): Leribe, (–CC), without date, *A. Dieterlen 141* (PRE). **2927** (Maseru): Mafeteng, (–CD), 9 Aug. 1926, *Watt & Brandwijk 1226* (PRE); Morija, 5500′ [1 700 m], (–DA), April 1919, *M. Page s.n.* (BOL). **2928** (Marakabei): Mamalapi, (–AC), 27 Dec. 1948, *A. Jacot Guillarmod 648* (GRA, PRE); Ntibokho Valey, (–AD), 2 Jan. 1947, *A. Jacot Guillarmod 301* (PRE); Senqunyane River near Marakabei, (–CA), 24 Nov. 1997, *C. Boucher 6199* (PRE); Cheche's Pass, 2 500 m, common in bog, (–CB), 30 Nov. 1977, *D. Killick 4243* (PRE); Sehlabathebe, (–CC), *Jacot Guillarmod, Getliffe & Mzamane 212* (GRA, PRE). **2929** (Underberg): Mokhotlong, (–AC), Jan. 1953, *L. Liebenberg 5753* (PRE); Sani Valley, 2 740 m, abundant in sponges, (–CB), 14 Jan. 1977, *D. Killick 4112* (PRE).

NORTHERN CAPE.—**2816** (Oranjemund): S bank of Orange River 1.5 km from coast, (–CB), 12 Sept. 1984, *O'Callaghan & Van Wyk 51* (NBG, PRE). **2823** (Griekwastad): Danielskuil, (–BA), 24 Mar. 1939, *G.J. Lewis 434* (SAM); Griquatown Commonage, 4100′ [1 250 m], (–CC), moist calcareous ground around spring, 22 Jan. 1960, *O. Leistner 1623* (BOL); banks of Riet River near Blaauwkrantz, (–DD), 10 Oct. 1935, *A. Hafström 887* (PRE). **2824** (Kimberley): Barkly West, Holpan, (–DA), 7 May 1936, *J. Acocks 373* (PRE); Kimberley, along Vaal River, (–DB), Dec. 1885, *R. Marloth 820* (PRE); Riverton, (–DB), Oct. 1918, *J. Moran 19230* (PRE). **2924** (Hopetown): Modder River, (–BA), 4 Aug. 1908, *H.H.W. Pearson 1655* (NBG, SAM); Modder River at Ritchie, (–BA), 13 Feb. 1926, *C. Smith 2353* (PRE). **3018** (Kamiesberg): Kamiesberg, stream bank ± 10 km N of Leliefontein, (–AC), 4 Nov. 1982, *P. Goldblatt 6681* (MO, NBG), *Rourke 1789* (NBG). **3024** (De Aar): Colesberg, Doornkloof Nature Reserve, (–BD), 10 Nov. 1982, *A. Hahndiek 83* (GRA). **3025** (Colesberg): near Colesberg, (–CA), Nov. 1939, *C. Thorne s.n. SAM54456* (SAM). **3026** (Aliwal North): Burgersdorp, (–CD), 1892, *H. Flanagan 1539* (PRE). **3119** (Calvinia): Oorlogskloof Nature Reserve, 578 m, (–AC), 8 Oct. 2000, *W.A.J. Pretorius 609* (NBG). **3124** (Hanover): Vlakplaats [Vlakplaas], (–BA), Oct. 1914, *H. Bolus 13766* (BOL). **3125** (Steynsburg): Middelburg Dist., Grootfontein Farm, (–AC), 20 Feb. 1947, *G. Theron 177* (PRE).

WESTERN CAPE.—**3123** (Victoria West): Murraysburg, (–DC), Sept. 1879, *W. Tyson 90* (SAM); July 1954, *D.M. van Heerden s.n.* (NBG). **3221** (Merweville): Nuweveldberg, ± 60 km S of Fraserburg, Bok se Plaas, seepages, 1 620 m, (–BA), 26 Feb. 1986, *Moffett & Steensma 3983* (NBG). **3222** (Beaufort West): foot of Nuweveld Mtns, along stream, 1 000m, (–BD), 15 Feb. 1978, *Gibsb Russell, Robinson, Herman & Downing 238* (PRE). **3318** (Cape Town): Green Point flats, (–CD), Aug. 1887, *J. Thode s.n. SAM9260* (SAM); Devil's Peak, E Buttress, (–CD), 5 Jan. 1978, *B. Durand 344* (NBG); Devil's Peak, (–CD), 26 Sept. 2004, *F. Forest, P. Goldblatt, L. Porter & I. Nänni 600* (NBG); above Camp's Bay, (–CD), 28 Oct. 1943, *R. Adamson 3537* (BOL); Orange Kloof, (–CD), 24 Oct. 2000, *C.N. Cupido 91* (NBG); Fisantekraal, Mosselbank River floodplain, 69 m, (–DA), 29 Oct. 2008, *C. Boucher 7567* (NBG); field by Maitland, (–DC), 2 Oct. 1897, *Wolley Dod 3163* (BOL); Jonkershoek, Biesiesvlei, 1100′ [340 m], (–DD), 10 Sept. 1945, *H.B. Rycroft 908* (NBG); Assegaaibosch, by damme, (–DD), Oct. 1969, *C. van der Merwe 1241* (PRE). **3319** (Worcester): Tulbagh, Grootwinterhoek, Sneeugat Valley, (–AA), Nov. 1916, *E.P. Phillips 1699* (SAM); Ceres, Baviaansberg, 5000′ [1 500 m], (–BA), 2 Jan. 1942, *R.H. Compton 12861* (NBG); Botha, below dam near Groenrivier, (–CB), 26 Jan. 1982, *I.B. Walters 2526* (NBG); Franschhoek, (–CD), 30 Oct. 1913, *E.P. Phillips 8266* (SAM). **3320** (Montagu): Montagu–Barrydale Rd, (–CC), Sept. 1923, *M. Levyns 530* (BOL); Tradouw Pass, river bank at old farm, (–DC), 28 Jan. 1969, *J. Marsh 1124* (NBG). **3322** (Oudshoorn): Wilderness, (–DC), 3 Nov. 1929, *A. Mogg 11623* (PRE); Knysna Dist., Karatora Village, (–DD), Dec. 1922, *J. Keet 1164* (PRE). **3418** (Simonstown): Raapenberg Vlei, (–AB), 10 Nov. 1897, *A. Wolley Dod 3612* (BOL); Raapenberg, (–AB), 1898, *Guthrie 423* (BOL); Mowbray, garden weed, (–AB), 20 Dec. 2012, *J. Manning 3405* (NBG); stream between Retreat and Muizenburg vlei, (–AB), 14 Nov. 1897, *Wolley Dod 3689* (BOL); Table Mt slopes N of Kirstenbosch, (–AB), 12 Sept. 1928, *J.B. Gillett 396* (NBG); Rondebosch, (–AB), Nov. 1885, *H. Bolus 7020* (BOL); Rondebosch, University grounds, (–AB), 12 Oct. 1931, *M. Levyns 3452* (BOL); Constantia, (–AB), 3 Nov. 2011, *Ramjukadh C-LR103* (NBG); Constantiaberg, shade of forest, (–AB), 8 Mar. 1940, *R.H. Compton 8560* (BOL); Buffels Bay, damp places, (–AD), 23 Aug. 1943, *R.H. Compton 14668* (NBG, PRE); Somerset West, (–DA), 20 Nov. 1947, *R.N. Parker s.n.* (BOL). **3419** (Caledon): Kleinmond, bank of vlei, (–AC), 15 Oct. 1949, *M.P. de Vos 1492* (NBG); Oudebos, Riviersonderend, (–BA), Dec. 1928, *C. Thorne s.n. SAM45749* (SAM); Gansbaai, Baviaansfontein, (–CA), Aug. 1940, *T.P. Stokoe 7603* (BOL). **3420** (Bredasdorp): Heidelberg, Grootvadersbosch, ground layer in moist or wet forest, (–BB), 6 Dec. 1953, *B. Maguire 1037a* (NBG); Bredasdorp, Nachtwacht, (–CA), Nov. 1926, *C. Smith 3048* (PRE). **3421** (Riversdale): 8 mi [13 km], W of Riversdale, (–AA), 7 Oct. 1928, *J.B. Gillett 1165* (NBG); bank of Kafferkuilsrivier, 80 m, (–AD), 22 Dec. 1980, *P. Bohnen 7785* (NBG, PRE). **3423** (Knysna): Brenton, shady places, (–AA), 5 Jan. 1922, *A. Duthie 722* (NBG). **3423** (Knysna): Keurbooms River Bridge, disused forest track, (–AB), 27 Sept. 1967, *J.H. Marsh 619* (NBG, PRE).

EASTERN CAPE.—**3026** (Aliwal North): Elandshoek, (–CC), Oct. 1903, *H. Bolus 152* (BOL). **3028** (Matatiele): Rhodes Dist., Naude's Nek, 2 610 m, (–CB), 11 Dec. 1999, *M. Mothogoane 185* (PRE). **3029** (Kokstad): Kokstad, Palmiet, (–AB), 21 Jan. 1957, *L.E. Taylor 5524* (NBG); between Flagstaff and Kokstad, (–CB), 4 Dec. 1928, *J. Hutchinson 1789* (PRE); Fort Donald, (–DC), forest, summer 1915, *Sr. Stephany 635* (BOL). **3126** (Queenstown); Sterkstroom, Penhoek, (–BC), 21 Dec. 1942, *W.F. Barker 2139* (NBG); Queenstown, river banks, (–DD), Oct. 1895, *E. Galpin 1937* (PRE); Andriesberg, (–DD), Dec. 1896, *E. Galpin 2223* (GRA, PRE). **3127** (Lady Frere): 25 km from Cala tunoff on Engcobo road, (–DB), 12 Jan. 1997, *C. Bredenkamp 1149* (PRE). **3128** (Umtata): Baziya, (–BB), without date, *R. Baur 277* (SAM). **3129** (Port St Johns): Goss Point, bog, (–BD), 10 Nov. 1970, *R. Strey 10146* (PRE); Port St Johns, (–DA), Oct. 1909, *H. Swinny & F. Baker 25124* (PRE). **3223** (Rietbron): Richmond Dist., Vlakplaats, (–CA), Oct. 1914, *H. Bolus 15292* (PRE). **3225** (Somerset East): 21 mi [34 km], W of Cradock, Chalmers, (–AB), 2 Dec. 1950, *S.M. Johnson 691* (BOL), *B. Maguire 691* (NBG); Mountain Zebra National Park, (–AD), 12 Dec. 2005, *S. Bester 6319* (GRA). **3226**

(Fort Beaufort): Katberg, (–BC), *Drège 10/1132* (BOL); Buffelshoek Nek on road to Cradock, (–CA), 27 Oct. 1945, *R. Story 82* (PRE); Hogsback, (–DB), Jan. 1919, *G. Rattray 15736* (BOL); Hogsback Forest Reserve, ± 800 m, (–DB), 25 Nov. 1969, *K. Dahlstrand 1832* (GRA, NBG); University of Fort Hare, Sandile's Kop, (–DD), 5 Nov. 1936, *M. Giffen 592* (PRE). **3227** (Stutterheim): Dohne Research Station, (–CB), 23 Oct. 1942, *J. Acocks 9228* (PRE); grassy valleys near Komgha, (–DB), Nov. 1891, *H. Flanagan 1109* (BOL, GRA, PRE); East London, (–DD), 1888, *J. Thode s.n.* (PRE); East London, damp places, (–DB), Aug. 1963, *A. Batten 4-Pl. 98* (NBG). **3228** (Butterworth): near Butterworth, (–AC), 26 Nov. 1945, *R.H. Compton 17705* (NBG); Qora River Mouth near Mazeppa Bay, (–BC), without date, *C. Hilner 419* (PRE); Dwessa Nature Reserve, (–BD), 24 Nov. 1978, *H. Linder 1890* (PRE); Morgan's Bay, (–CB), 17 Jan. 1951, *A.M. Wilman 1084* (BOL, PRE). **3323** (Willowmore): Deepwalls, (–CC), 1924, *J. Phillips s.n.* (GRA, PRE); Gouna, Lilyvlei Nature Reserve, ± 1000′ [300m], (–CC), 19 Oct. 1971, *H.C. Taylor 8000* (NBG); Lilyvleibush, wet places, (–CC), 22 Nov. 1977, *C.J. Geldenhuys 413* (NBG); Knysna, forest near Blaauwkranz River, (–DC), 20 Oct. 1959, *T.M. Wurts 2007* (NBG). **3324** (Steytlerville): Baviaanskloof 3 km from Geelhoutbos, (–CB), 23 Sept. 2004, *P. Goldblatt & L.J. Porter 12537* (MO, NBG); E of Gamtoos River drift, (–CD), (BOL). **3325** (Port Elizabeth): Winterhoek Mtns, (–CA), 12 Sept. 1930, *C. Fires, T. Norlindh & H, Weimarck 790* (GRA, PRE); Walmer, (–DC), Oct. 1909, *T. Paterson 817* (GRA). **3326** (Grahamstown): Belmont Valley, near Clarke's Farm, (–BC), 13 Sept. 1961, *M. Wells 2802* (GRA, PRE); Alexandria Forest, Forester's Cottage, (–CB), 9 Dec. 1953, *S. Johnson 831* (PRE); top end of Howieson's Poort, (–DA), swampy place, 28 Feb. 1932, *J. & B. Rennie 577* (BOL); Kowie Dist., road to Three Sisters, (–DB), 25 Sept. 1918, *L. Britten 730* (PRE). **3424** (Humansdorp): Oudebos Flats, (–AA), Oct. 1920, *H. Fourcade 959* (BOL); Tsitsikamma Strand, (–AA), 30 Jan. 1982, *H. Venter 8653* (PRE); Clarkson, (–AB), Oct. 1926, *Thode 737* (PRE).

Sect. *Hecatonia* (Lour.) DC. in Prodromus systematis naturalis regni vegetabilis 1: 30 (1824).

3. **Ranunculus dregei** *J.C.Manning & Goldblatt*, nom. nov. pro. *Ranunculus meyeri* Harv. in Harvey & Sonder in *Flora capensis* 1: 7 (1860), hom. illegit., non Lowe: 74 (1857), nom illegit. superfl. pro *R. grandifolius* E.Mey. in Ledebour (1830); Cook: 240 (2004). Type: South Africa, [Eastern Cape], 'Katberg', Nov. [1832], *Drège s.n.* (K [*K000076101*]—Aluka image!, lecto., designated here; BM, K, P, PRE, TCD, iso.—Aluka images!). [Harvey cited duplicates at K and TCD in the protologue and we select the K specimen as lectotype as being the more complete. This specimen has the collecting date 1838 inscribed on it but this is impossible as Drège left South Africa in 1834. Drège collections of the species in P are dated 9 Nov. 1832, which corresponds with the date of his arrival at the Katberg Pass on 12 November 1832 (Glen & Germishuizen 2010) and this evidently represents the true collection date.]

R. meyeri var. *transvaalensis* Szyszyl.: 102 (1887). Type: South Africa, [Gauteng], 'Hohes feld prope Henopsriver', *Rehmann* (?Z, holo., not located). [*fide* Exell & Milne-Redhead (1960)].

[*R. meyeri* var. *rogersii* Burtt Davy *nom. nud.* in Burtt Davy: 109 (1926). Specimen: *Rogers 19591* (Herb. Rogers)].

[*Ficaria radicans* E.Mey. *nom. nud*. in Drège: 184 (1843–1844). Specimen: *Drège s.n.* (*K000076101, TCD0001712*)].

[*Ranunculus volkensii* var. *meyeri* (Harv.) T.Duncan *ms.* on *Dieterlen s.n.* (*BM 0005615516*)]

Prostrate, mat-forming, perennial; stems condensed, corm-like, covered with fibrous remains of old leaf sheaths, producing creeping runners rooting at nodes, runners glabrous, 0.5–1.5(–2.0) mm diam., internodes 10–140 mm long. *Roots* few, thong-like. *Leaves* all basal, in distant tufts of 2–5 along runners, petiole (5–)10–100(–200) mm long with stipules adnate and sheathing for 2–10 mm, glabrous or thinly villous with hairs to 1 mm long, blade ovate to cordate or reniform, (2–)5–20(–25) mm diam., weakly or strongly 4–12(–16)-crenate or dentate (rarely ± entire), with reddish callus at the tip of each serration, leathery, glabrous but usually with scattered hairs on margins, or adpressed-pilose adaxially. *Flowers* solitary at nodes, (5–)8–14 mm diam.; peduncle naked, scapose, ± as long as leaves, (5–)10–60 mm long, 0.5–1.0 mm diam. *Sepals* 5, weakly to strongly reflexed, ovate to suborbicular, cucullate, (2–)3–4 mm long, glabrous, yellowish. *Petals* 5–10, linear-lanceolate or ligulate, (3–)4–7 × 1.0–1.5 mm, pale yellow, narrowed into short claw in basal ± 1 mm, acute or attenuate, veins 3, unbranched, nectary pocket-like with acute flap. *Stamens* 11–30 in ± 2 series, filaments 0.5–2.0 mm long, anthers ± 0.5 mm long. *Carpels* 6–20(–30), glabrous. *Achenes* in subglobose head, broadly ellipsoid, ± 2 × 1.5 mm, smooth, keeled, shortly beaked; receptacle glabrous. *Flowering time*: Nov.–Jan. (–Mar.). Figure 7.

Distribution and ecology: distributed mainly along the eastern escarpment, from Gaika's Kop in the Amatola Mtns in Eastern Cape through KwaZulu-Natal and Lesotho to Standerton and Vaalbank in Mpumalanga and the Leolo Mountains in Limpopo (Figure 4), extending north of South Africa into the eastern highlands of Zimbabwe and Mozambique (Exell & Milne-Redhead 1960), with a remarkable southern outlying station near the summit of the Swartberg Mtns in Western Cape. Although there are early records further inland, from Parys in the Free State, Pretoria and Johannesburg in Gauteng, and Potchefstroom in North-West, the species has not been collected there since the first half of the twentieth century and is presumably extinct here.

Ranunculus dregei restricted to peaty seeps or boggy places at higher altitudes, 1 500–3 000m, where it forms mats in open spaces.

Diagnosis: a distinctive species, readily recognised by its dwarf, creeping habit, simple leaves with solitary flower per leaf tuft, and narrow, ligulate petals with unbranched veins.

The species was first recorded from north of the Limpopo River Valley, in the highlands of Mozambique and Zimbabwe, in 1956 (Exell & Milne-Redhead 1960) and annotations on some herbarium specimens by T. Duncan indicate an intention to reduce it to a variety of the tropical African *Ranunculus volkensii* Engl. Although the two taxa are similar in habit, *R. volkensii* has noticeably thicker stolons, ± 2–3 mm diam., often lanceolate leaves, and more critically, obovate petals with branching venation, quite unlike the ligulate, 3-nerved petals of *R. dregei*. It also has mostly ± twice as many carpels as *R. dregei*.

History: first collected in Eastern Cape by J.F. Drège (1794–1881) sometime in the early summer of 1832, the specimens themselves are not localised, *Ranunculus dregei* was listed as being collected on the Katberg

in Drège's *Zwei pflanzengeographische Documente*. These collections were annotated with the manuscript name *Ficaria radicans* by Ernst Meyer, who contributed the botanical text to the *Documente*, but the species was only formally described by Harvey (1860), who named it after Meyer. Harvey (1860) unfortunately overlooked the fact that the name *R. meyeri* had already been proposed by R.T. Lowe (1857) as a replacement name for the East-Central Asian *R. grandifolius* E.Mey. (1830) under the misapprehension that the latter was synchronous with his *R. grandifolius* Lowe (1831) from Madeira. In fact it is *R. grandifolius* Lowe that is the illegtimate later homonym and thus requires a new name, and *R. meyeri* Lowe becomes an illegitimate superfluous name for *R. grandifolius* E.Mey. This renders *R. meyeri* Harv. an illegitimate later homonym requiring a new name, for which we propose *R. dregei* in honour of the original collector of the species.

A collection by Anton Rehmann (1840–1917) from Hennopsrivier, west of Pretoria, with glabrous petioles was distinguished as var. *transvaalensis* by Szyszylowicz (1887), but the name was synonymised by Exell & Milne-Redhead (1960). We have been unable to trace the type specimen in the Schinz herbarium in Zurich (H.P. Linder, pers. com. 3 Jan. 2013) but have no reason to question this decision. Other collections from Gauteng, viz. *Repton 3430* from Rietvlei Reserve near Pretoria and *Gilfillan 162* from near Johannesburg probably represent the same variant, being almost entirely glabrous, with scattered hairs only on the sheathing leaf bases.

Additional specimens seen

LIMPOPO.—**2430** (Pilgrim's Rest): Sekhukuniland, Leolo Mtns, 18 km from Schoonoord Police Station, (–CA), seepage area, (–CA), 4 Dec. 1999, *A.E van Wyk & S.J. Siebert 13459* (PRE).

NORTH-WEST.—**2627** (Potchefstroom): Potchefstroom, common in marshes bordering Mooi River, (–CA), 26 Dec, 1903, *J. Burtt Davy 1029* (BOL, PRE); Gerhardusminnebron Eye, (–CA), 26 Oct. 1946, *W. Louw 1520* (PRE).

GAUTENG.—**2528** (Pretoria): Rietvlei Reserve, (–CA), 4 Oct. 1947, *J. Repton 3430* (PRE). **2628** (Johannesburg): vleis near Johannesburg, (–AA), Nov./Dec. 1898, *D. Gilfillan 162* (GRA, PRE).

MPUMALANGA.—**2529** (Witbank): Middelburg, Wonderhoek, pond borders, (–CD), 15 Nov. 1922, *H. Rudatis 2647* (PRE); Vaalbank, between Middelburg and Pretoria, (–CD), 4500′ [1 400 m], Sept. 1886, *H. Bolus 7639* (BOL). **2530** (Lydenburg): 15 km from Belfast on road to Dullstroom, Farm Pineglades, along dam, 2 000m, (–CA), 17 Apr. 1981, *L. du Toit 333* (PRE). **2629** (Bethal): Standerton, (–CD), 16 Oct. 1893, *R. Schlechter 3469* (BOL, GRA, PRE). **2630** (Carolina): Carolina, (–AA), 20 Oct. 1932, *E. Galpin s.n.* (BOL); Ermelo, Spitskop, (–CB), Dec. 1915, *R. Pott-Leendertz s.n.* (PRE). **2730** (Vryheid): Wakkerstroom, 6200′ [1 900 m], (–AD), Nov. 1916, *H.W. Beeton 35*

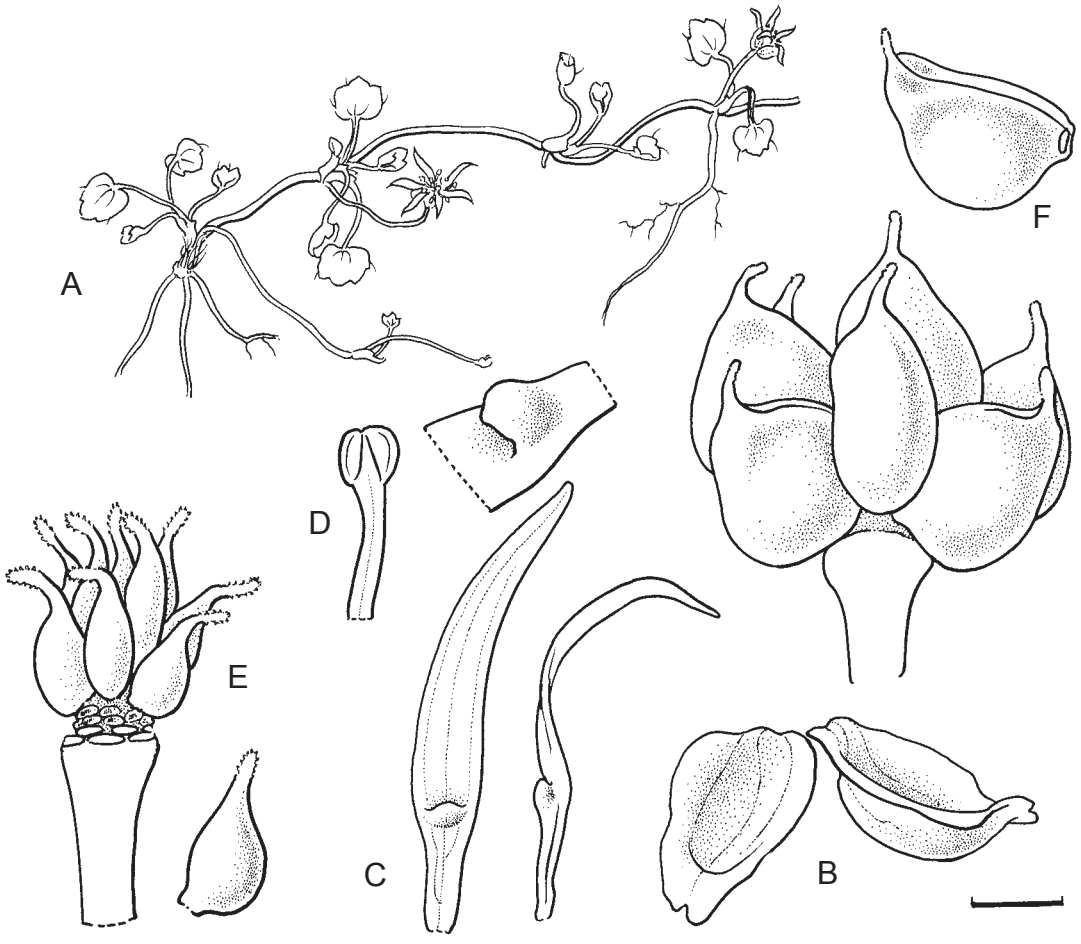


FIGURE 7.—*Ranunculus dregei*, Naude's Nek, no voucher. A, flowering plant; B, two sepals; C, petal, dorsal and lateral view; D, stamen; E, pistil and detached carpel; F, fruit and detached achene. Scale bar: A, 10 mm; B, C, E, F, 1 mm; D, 0.5 mm. Artist: John Manning.

(SAM); Pongola Bush Nature Reserve, vlei in stream, 1 400m, (–BC), 9 Oct. 1990, *H. Glen 2360* (PRE).

FREE STATE.—**2828** (Bethlehem): Bestersvlei, near Wotzieshoek, (–BD), 1893, *H. Flanagan 2093* (PRE). **2925** (Jagersfontein): Parys, (–CC), 20 Oct. 1906, *F. Rogers 5074* (PRE).

KWAZULU-NATAL.—**2729** (Volksrust): Charlestown, (–DB), 6 Dec. 1892, *J. Medley-Wood 4690* (PRE). **2929** (Underberg): Estcourt, Ntabamhlope Pasture Reserve, vlei, (–BA), 9 Nov. 1939, *O. West 1513* (PRE); Mooi River, (–BB), 26 Oct. 1918, *A. Mogg 3203* (PRE); Polela, near Underberg, in stream, (–CB), 6 Dec. 1935, *R.A. Dyer 3289* (PRE); 13 mi. [21 km] from Dargle to Mpendhle, vlei, (–DB), 26 Feb. 1964, *E.J. Moll 673* (PRE); Underberg, Watermead Farm, (–DB), 23 Sept. 1989, *R. Williams 333* (PRE).

LESOTHO.—**2828** (Bethlehem): Leribe, (–CC), 5–6000′ [1 500–1 800 m], Feb. 1913, *E.P. Phillips 786* (SAM); Butha-Buthe, 9 500′ [2 900 m], (–CD), 2 Feb. 1954, *B. Maguire 399* (NBG). **2928** (Marakarei): Little Bokong at Mosalamane Pass crossing, (–AA), 22 Dec. 1946, *A. Jacot-Gullarmod 99* (GRA, PRE); headwaters of Bakong River, wet fen, (–AB), 14 Jan. 1996, *P. Phillipson 4645* (GRA); Mamalapi, (–AC), 28 Dec. 1948, *G.D. Morris 21429* (NBG); Mamathes, (–BB), 14 Nov. 1948, *A. Jacot-Guillarmod 389* (PRE). **2929** (Underberg): Mokhotlong, bog near Thabana Ntlenyana, (–AC), 20 Jan. 1955, *J. Coetzee 582* (PRE); 2 Feb. 1988, *C. Schwabe 13b* (PRE); Sehlabathebe, 2 300–2 500m, (–CC), 4–14 Jan. 1973, *Jacot-Guillarmod, Getliffe & Mzamane 255a* (GRA, PRE). *Imprecise locality*: 'Basutoland, swampy ground near Buffels River Waterfall', 15 Mar. 1904, *E.E. Galpin 6565* (BOL, GRA, SAM).

WESTERN CAPE.—**3322** (Oudshoorn): Swartberg, 8 miles W of top of Swartberg Pass, (–BC), 5000′ [1 500 m], 20 Nov. 1954, *T.P. Stokoe s.n. SAM70133* (SAM); Swartberg, marsh at head of stream E of pass, (–BC), 19 Jan. 1961, *E. Esterhuysen 28836* (BOL, PRE); upper slopes of Blesberg, (–BC), 5950′ [1 800m], 15 Dec. 1986, *J.H.J. Vlok 1778* (NBG).

EASTERN CAPE.—**3027** (Lady Grey): Witteberg, Beddgelert, (–DA), 2 Dec. 1981, *O. Hilliard & B. Burtt 14631* (PRE); S slopes of Ben MacDhui Mtn, Tiffendell Ski resort, 2 730 m, (–DB), 6 Jan. 1997 [fruiting], *T. Dold 3483* (GRA). **3028** (Matatiele): Barkly East, 3 km SE of Cairntoul Police Hut, wet places, (–CA), 19 Dec. 1982, *P. Phillipson 709* (PRE); Maclear, Woodcliffe Trails, riverine grassland, 2 300 m, (–CC), 15 Nov. 1992, *A. Abbott 5865* (PRE). **3126** (Queenstown): 19 km from Dordrecht to Queenstown, 1 311m, (–DB), 13 Jan. 1997, *G. Germishuizen 8915* (PRE). **3127** (Lady Frere): Dordrecht, 5300′ [1 600 m], swampy ground, (–AD), Jan. 1899, *T.R. Sim s.n.* (SAM). **3225** (Somerset East): Boschberg, (–DA), Feb. without year, *MacOwan 1555* (BOL, GRA). **3226** (Fort Beaufort): summit of Great Winterberg, locally common in seeps on dolerite, 2 250 m, (–AD), 17 Feb 2013, *N.A. Helme 7715* (NBG); Katberg, Effingham, (–BC), 26 Dec. 1912, *E. Galpin 8337* (PRE); Hogsback, foot of Gaika's Kop (–DB), Jan. 1919, *G. Rattray s.n.* (BOL); Hogsback, Hunterstown, (–DB), 9 Apr. 1944, *M. Giffen s.n.* (PRE). **3227** (Stutterheim): Keiskammahoek, Gxulu Mtn [Cata Peak], (–CA), 26 Jan. 1949, *R. Story 3734* (GRA); small river near Kologha Forest, (–CB), 28 Nov. 1956, *G. Theron 2126* (PRE).

Sect. *Batrachium* DC. in Regni vegetabilis systema naturale 1: 323 (1817).

4. **Ranunculus trichophyllus** *Chaix* in Villars: 335 (1786); Cook: 126 (1966). *Batrachium trichophyllus* (Chaix.) Bosch: 5 (1850); Eichler & Walsh: 312 (2007). Type: 'Frequentissimus in rivulis quietis, fossisque aqua plenis', *Haller 1162* (G, neo., designated by Lourteig (1951), not seen).

R. drouetii F.W.Schultz ex Godron: 10 (1842). Type: *Flora Galliae et Germaniea exsicattae n. 404* (not seen).

[*R. aquatilis* sensu Harvey: 6 (1860), non L. (1753)]

[See Cook (1966) for additional synonyms.]

Submerged aquatic annual (?or perennial), rooted in water up to 500 mm deep; stems hollow, 2–3 mm diam., rooting at lower nodes. *Roots* fibrous. *Leaves* cauline, petiole 25–40 mm long with stipules adnate and forming oblong to ovate sheath 3–6 mm long, glabrous, blade globose or obconical in outline, 15–45 mm diam., repeatedly tri- or dichotomously divided into rigid or flaccid capillary segments spreading in three dimensions. *Flowers* solitary at nodes, emergent, (4–)8–15 mm diam.; peduncle naked, scapose, 10–50 mm long, 0.5–1.0 mm diam., usually recurved in fruit. *Sepals* 5, spreading, ovate, cucullate, 2.5–3.5 mm long, glabrous. *Petals* 5, obovate, (3.0)3.5–5.5(–6.0) × 2–5 mm, white with yellow claw, narrowed into short claw in basal ± 1 mm, obtuse or truncate, veins branched, nectary lunate. *Stamens* 9–15 in ± 2 series, filaments 1.0–1.5 mm long, anthers ± 0.75 mm long. *Carpels* 16–35, hispid. *Achenes* in subglobose head, ovoid to obovoid, not compressed, 1.20–1.50(–1.75) mm long, transversely rugose, mostly sparsely hispid subapically along lower keel, rarely glabrous, not beaked; receptacle densely hispid. *Flowering time*: dependent on rainfall and coinciding with the wet season, mainly Aug.–Sept. in the winter-rainfall zone and Oct.– Jan. in the summer rainfall zone. Figure 8.

Distribution and ecology: distributed widely through Eurasia and North Africa, North America, Australia, Tasmania, and southern (but not tropical) Africa, where it is recorded so far only from Lesotho and South Africa (Figure 9), and reportedly also Botswana (Cook 2004) but not Namibia (Craven 1999). In South Africa the species is scattered through the southern and eastern interior of the county along the Vaal/Orange Rivers and tributaries, and along the southern escarpment from Calvinia to Queenstown, with a few coastal stations in the southwestern and southern Cape around Velddrif, Cape Town, Bredasdorp and Uitenhage.

Plants grow submerged in freshwater seasonal pools and ponds and in slow, intermittent or perennial streams, furrows or irrigation ditches up to 50 cm deep, persisting only briefly along the muddy edges as the water dries up. It has been recorded from sea level to well over 2 000 m. In southern Africa *R. trichophyllus* has occasionally been regarded as troublesome in the past, viz. as a 'serious impediment in the irrigation canals' near Cradock in the 1950s [*Barnes s.n.* (GRA)].

The natural occurrence of the species in the Southern Hemisphere is worth closer examination given the large disjunction to Eurasia and North America. The early collection of the species in pristine habitats in Australia suggests that it is probably native there (Eichler & Walsh 2007), and similar considerations apply in southern Africa, where it was first documented (under the name *Ranunculus aquatilis* L.) in the early 1800s from the Eastern Cape, around Uitenhage and Graaff Reinet, by C.F. Ecklon (1795–1868), C.L. Zeyher (1799–1858) and I.L. Drège (1853–1921). Documentation of *R. trichophyllus* on the Cape Peninsula only dates from the end of the 19th century, which is unusually late for such a distinctive species.

Diagnosis: the only aquatic species in the subregion, distinguished at once by its habit, finely dissected leaves, white petals with yellow claws, and small, ovoid,

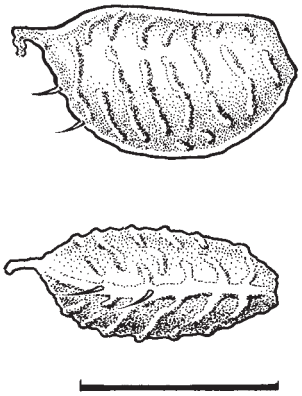


FIGURE 8.—*Ranunculus trichophyllus*, Kareehoutrivier, *Snijman 771* (NBG). Achene, lateral and dorsal view. Scale bar: 1 mm. Artist: John Manning.

transversely rugose achenes, usually with a few, scattered bristles along the lower keel below the remains of the style but sometimes glabrous or ± densely bristly. The transverse folds on the mature achenes are due to the presence of styloid crystals in the carpel walls (Cook 1966).

History: The recent determination of the southern African material as *Ranunculus rionii* (Glen 2003; Winter 2006) follows the identifications of the southern African material by C.D.K. Cook (1966, 2004), a specialist in the taxonomy of *Ranunculus* sect. *Batrachium*. Prior to this, the South African collections had been identified as *R. trichophyllus* (Adamson 1950) or its synonym *R. drouetii* (Burtt Davy 1926). The two species *R. rionii* and *R. trichophyllus* are sympatric in Europe and differ solely in the number and size of their achenes, with *R. rionii* characterised by smaller, more numerous achenes (Cook 1964, 1966, 1993; Pizarro 1995). The number of achenes per fruiting head ranges from 60–90 in *R. rionii* and from 16–35 in *R. trichophyllus* (Cook 1966). Dimensions for the achenes in *R. rionii* have been variously given as up to 1 mm long (Cook 1964, 1966, 1993) or 1.0–1.2 mm long (Pizarro 1995) and for *R. trichophyllus* as more than 2 mm long (Cook 1964), more than 1.5 mm long (Cook 1966, 1993), or 1.20–1.75 mm long (Pizarro 1995). *R. trichophyllus* is a very widespread species, occurring throughout Eurasia, including the Mediterranean Basin, North America and Australia, where it is probably also native, but *R. rionii* has a more restricted distribution in Central and Eastern Europe and the eastern Mediterranean into Asia Minor (Cook 1966).

The illustration of the fruiting head of *Ranunculus rionii* given by Cook (2004) in his guide to *Aquatic and wetland plants of southern Africa* certainly conforms to that species in its numerous achenes, as does the illustration of the individual achene, with a length of less than 1 mm, but the source of the original material for these drawings is not given. The majority of the southern African material that we have examined has fewer than 40 achenes per fruiting head, with individual mature achenes measuring 1.2–1.8 mm long, excluding the stylar remnants (immature achenes are smaller), thus consistent with *R. trichophyllus* and not *R. rionii*. Some specimens, however, including *Comins 800* (BOL) from Tarkastad and others from along the Vaal River, have heads of 40–60 achenes, each achene ± 1 mm long, thus potentially *R. rionii*. Although the difference between the two taxa in achene number and size as initially treated by Cook (1963) was absolute, the ranges of variation in the two characters have gradually converged (Cook 1966, 1993; Pizarro 1995) to the stage where it is difficult to assign 'intermediate' specimens. It may also be relevant here that *R. rionii* has been treated as conspecific with *R. trichophyllus* in the past at subspecific or varietal rank (Cook 1963). The size of the achenes may bear relation to the number of (developing) carpels, as seen in *Wilman 21494* (PRE), in which heads with over 40 ripened carpels have the individual achenes ± 1 mm long whereas those with few fertilised carpels have achenes ± 1.3 mm long. Significantly, no authors have as yet proposed that more than one aquatic species occurs in the subcontinent, although it is not impossible that there has been more than one introduction from Europe. The matter deserves attention but until then we adopt a conservative approach and provisionally treat all of the southern African material under the older name *R. trichophyllus*. This name has also been applied to the material from Ethiopia (Teketay & Edwards 2000).

Additional specimens seen

GAUTENG.—**2627** (Potchefstroom): Vereeniging, Vaal River, (–CB), Nov. 1911, *R. Leendertz 3892* (PRE).

MPUMALANGA.—**2629** (Bethal): near Ermelo, still pools in river, (–DB), 25 Aug. 1904, *J. Burtt Davy 1875* (BOL, PRE).

FREE STATE.—**2627** (Potchefstroom): Parys, irrigation ditch along Vaal opposite the 'Small Island', (–CD), Sept. 1932, *C. Smith 6309* (PRE). **2727** (Kroonstad): Kroonstad, Vals River, (–CC), Dec. 1927, *J. Pont 268* (PRE). **2827** (Senekal): Ficksburg, at Gansfontein, (–DD), 24 Oct. 1884, *E. Galpin s.n.* (BOL, PRE). **2828** (Bethlehem): 'Kroonspruit', (–AD), 22 Sept. 1976, *J. Blom 305* (PRE). **2925** (Jagersfontein): 12 mi [19 km] E of Fauresmith, (–CC), 3 Sept. 1925, *C. Smith 479* (PRE); Farm 'Driefontein West', in Kaffirrivier, (–DB), 6 Oct. 1972, *R. Marshall M72/053/C* (PRE); Fauresmith, Boomplaats, in spruit, (–DC), 3 May 1934, *I. Verdoorn 1383* (BOL). **3026** (Aliwal North): ¼ mi [0.4 km] S of Loftes Siding, (–BA), 15 Nov. 1969, *D. Edwards 4163* (PRE).

LESOTHO.—**2828** (Bethlehem): Hlotse River at Makokoane, (–BC), 23 Oct. 1909, *A. Dieterlen 808* (BOL, PRE, SAM). **2928** (Marakabei): Semongkong, (–CC), 12 Jan. 1954, *A. Jacot-Guillarmod 1754* (PRE). **2929** (Underberg): Maluti Mtns, near Mokhotlong, 2 300 m, (–AC), 22 Feb. 1987, *M. Panagos 87* (PRE).

NORTHERN CAPE.—**2824** (Kimberley): Riverton, (–DA), Nov. 1919, *M. Wilman 21494* (PRE). **2922** (Prieska): Prieska, Orange River, (–DA), Oct. 1933, *E.G. Bisach 963* (NBG). **2923** (Douglas): Griqualand West, [Douglas], Mazelsfontein, (–BA), Oct. 1919, *E. Anderson 609* (BOL). **2924** (Hopetown): Modder River, (–BA), 4 Aug. 1908, *H.H.W. Pearson 1650* (NBG). **3024** (De Aar): 40 km from Philipstown on road to Colesberg, pool in small stream, (–DB), 19 May 1989, *H. Burrows 2991* (GRA). **3025** (Colesberg): near Colesberg, (–CA), Nov. 1939, *C. Thorne s.n. SAM54455* (SAM). **3119** (Calvinia): along Kareehoutrivier, 24 km S of Bo-Downes homestead, (–DD), 27 Oct. 1983, *D. Snijman 771* (NBG). **3220** (Sutherland): Roggeveld, Soekop, Witfontein, (–AA), permanent free water, 16 Sept. 2006, *H. Rösch 552* (NBG); Roggeveld Escarpment, pools on Farm Blesfontein, (–AD), 4 Nov. 2012, *P. Goldblatt & J. Porter 13715* (NBG); Verlatekloof Pass, pools in stream, (–DA), 7 Sept. 1926, *M. Levyns 1587* (BOL); 8 Sept. 1988, *M. Crosby 988* (PRE); 4 km from Klein Roggeveld via Komsberg on way down pass, (–DA), 1 300 m, 6 Sept. 1986, *I. Cloete & W. Haselau 245* (NBG); road to Komsberg Pass, ± 4–5 km SE of Farm Tonteldoosfontein, (–DB), 15 Sept. 2004, *D.A. Snijman 1946* (NBG). **3221** (Merweville): Phisante River, in stream, (–AC), 11 May. 1976, *M.F. Thompson 3015* (NBG, PRE); Bok se Plaas, ± 60 km S of

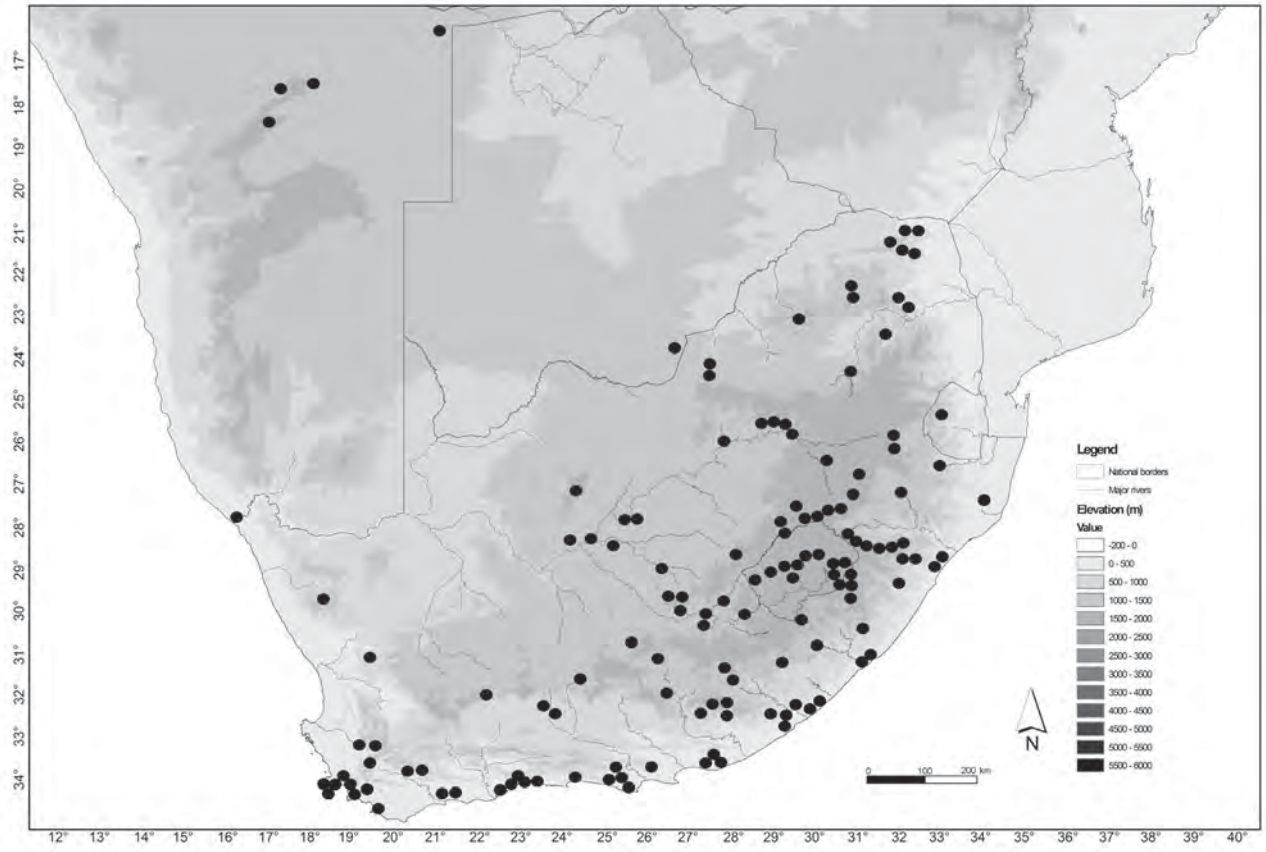


FIGURE 9.—Distribution of *R. trichophyllus* in southern Africa.

Fraserburg, 1 530 m, (–BA), *Moffett & Steersma 4022* (NBG); Layton, Rietvlei, (–BB), 914 m, *D. Shearing 187* (PRE).

WESTERN CAPE.—**3218** (Clanwilliam): Velddrift, (–CA), without date, *C. Gaigher 5* (NBG). **3318** (Cape Town): Sea Point, (–CD), July 1895, *MacOwan 1701* (SAM); pools near Salt River junction, (–CD), 3 Nov. 1891, *Wolley-Dod 3659* (BOL); Vygekraal River, (–CD), 30 Nov. 1891, A. *Wolley-Dod 3623* (BOL, PRE); Rietvlei, (–CD), 10 Oct. 1965, *A. Mauve 4384* (PRE); Bellville, pool in granite outcrop, (–DC), 8 Sept. 1938, *E. Cohen s.n.* (NBG). **3321** (Ladismith): Prince Albert, Gamka Poort, (–BC), Nov. 1935, *C. Thorne s.n. SAM51869* (SAM). **3418** (Simonstown): Noordhoek, salt pan, (–AB), 31 Jan. 1971, *I. Waher 45* (BOL); Ottery, (–BA), 18 Oct. 1935, *R. Adamson 2170* (BOL, SAM); Cape Flats, (–BA), no date, *E. Stephens s.n.* (BOL); Cape Flats near Phillipi, Edith Stevens Reserve, (–BA), in temporary pools up to 0.5 m deep, 26 Sept. 1994, *J.P. Rourke 2065* (NBG, PRE). **3420** (Bredasdorp): Bredasdorp, Nachtwacht, vlei, (–CA), Nov. 1926, *C. Smith 3047* (PRE).

EASTERN CAPE.—**3124** (Hanover): Wapadsberg Pass, running stream, (–DD), 26 Nov. 1977, *O. Hilliard & B. Burtt 10679* (NU, PRE). **3126** (Queenstown): Broughton, near Molteno, 6300′ [1 900 m], (–BC), Dec. 1892, *H.G. Flanagan 1563* (PRE, GRA, SAM). **3222** (Beaufort West): Beaufort West, Nieuweveld Mtns, 1 676 m, (–BA), 16 Apr. 1978, *B. Gibbs Russell, Robinson & Herman 448* (PRE); Mountain View Farm, (–BD), 16 Apr. 1978, *Gibbs Russell, Robinson & Herman 448* (GRA). **3223** (Rietbron): Murraysburg, Roode Poort [Rooipoort], (–BC), Sept. 1879, 4500′, *W. Tyson 66* (SAM). **3224** (Graaff Reinet): Graaff Reinet, near Zontag's River [Sondagsrivier], (–BA), Nov. 1865, *H. Bolus s.n.* (GRA). **3225** (Somerset East): Cradock, Junction Farm. (–AA), Dec. 1952, *H. Barnes s.n.* (GRA); Cradock, Farm Zuurfontein near Nardouwsberg, (–AA), 1 550 m, local in permanent stream, 14 Jan. 1990, *H.P. Linder 5085* (NBG). **3226** (Fort Beaufort): Great Winterberg, S of Tarkastad, Fairfield Farm, 5500′, [1 700 m], (–AD), 24 March 1954, *D. Comins 800* (BOL); Shiloh prope Queenstown, (–BB), without date, *R. Baur 919* (SAM). **3325** (Port Elizabeth): in stagnis prope Uitenhage, (–CD), *Ecklon 1766* (SAM). **3326** (Grahamstown): Grahamstown, Stowan Farm, (–AD), 17 Apr. 1934, *L. Britten 5978* (GRA).

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A new infrageneric classification for *Mesembryanthemum* (Aizoaceae: Mesembryanthemoideae)

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ABSTRACT

We present a new infrageneric classification for *Mesembryanthemum* L. (Aizoaceae: Mesembryanthemoideae), based on a phylogeny of the genus published in 2007. We re-affirm that a broad generic circumscription for *Mesembryanthemum* (including all 103 species of the Mesembryanthemoideae) is the only group in the subfamily that can be recognized unambiguously by synapomorphies. We divide *Mesembryanthemum* into five subgenera, of which two are new: *M.* subg. *Mesembryanthemum*, *M.* subg. *Cryophytum* (N.E. Br.) Bittrich, *M.* subg. *Opophytum* (N.E. Br.) Bittrich, *M.* subg. **Phyllobolus** (N.E. Br.) Klak and *M.* subg. **Volkeranthus** (Gerbaulet) Klak. Furthermore, we recognize five sections in subg. *Mesembryanthemum*, six sections in subg. *Phyllobolus* and two sections in *M.* subg. *Cryophytum*. Descriptions and keys to all infrageneric taxa are provided.

INTRODUCTION

The Mesembryanthemoideae is one of four subfamilies currently recognized in Aizoaceae (Klak *et al.* 2003) and includes 103 species (Klak *et al.* 2007). The Mesembryanthemoideae include both annuals and perennials, leaf- as well as stem-succulents, geophytes, highly compact, dwarf shrubs as well as woody shrubs that may exceed 1 m in height. Many members of this subfamily have flattened, mesomorphic leaves and, in many of them, both the leaves and the stems are covered with conspicuous bladder cells. The defining features of the subfamily are koilomorphic nectaries, axile placentation and the presence in the fruits of purely septal expanding keels that reach from the central columella to the tips of the valves (e.g. Bittrich & Hartmann 1988; Hartmann 1991).

Most of the genera in the Mesembryanthemoideae have been revised (e.g. Gerbaulet 1996a, 1996b, 1996c, 1997; Klak & Linder 1998; Klak *et al.* 2006) and several were re-circumscribed on the basis of morphological characters (e.g. Ihlenfeldt & Bittrich 1985; Bittrich 1986; Gerbaulet 1995). Over the last 40 years, generic concepts have been modified frequently within the subfamily (Table 1). Bittrich (1986) was the first to consider the relationships between the genera and species in detail and this led him to put forward broad generic concepts for *Phyllobolus* and *Mesembryanthemum*, in which he incorporated several of the previously recognized genera (Table 1). Although he made no formal taxonomic changes, he proposed subdivision of the enlarged genus *Phyllobolus* into five subgenera (*P.* subg. *Aridaria*, *Phyllobolus, Prenia*, *Sceletium,* and *Sphalmanthus*). Since Gerbaulet (1995) was unable to find a synapomorphy for Bittrich's broad concept of *Phyllobolus*, she recognized the genera *Aridaria, Phyllobolus, Prenia* and *Sceletium* and provided putative synapomorphies for each. In addition, she modified the generic concepts of *Aridaria* and *Prenia* and included the monotypic genera *Amoebophyllum* and *Dactylopsis* N.E.Br. in *Phyllobolus* (Gerbaulet 1995). More recent investigations showed that *Dactylopsis,* together with *Aspazoma,* is sister to *Brownanthus* (Klak *et al.* 2003), so that it is not closely allied to *Phyllobolu*s. Consequently it was reinstated as a monotypic genus (Klak *et al*. 2006).

In *Mesembryanthemum,* Bittrich (1986) included all the annual species of the Mesembryanthemoideae (apart from *Synaptophyllum*) and recognized several of the earlier genera as subgenera (*M*. subg. *Cryophytum* and subg. *Opophytum*), but he was not able to find synapomorphies for *Mesembryanthemum*.

A preliminary molecular study by Klak *et al.* (2003), which included 16 species of the Mesembryanthemoideae, showed that *Mesembryanthemum* was polyphyletic and that the generic limits needed re-investigation. This was followed by a densely sampled molecular assessment of the Mesembryanthemoideae, which confirmed the polyphyly of *Mesembryanthemum* (Klak *et al.* 2007). It showed, in addition, that *Phyllobolus* was not monophyletic and that one of its species, *P. splendens* (= *Mesembryanthemum splendens*), was much more closely related to the *Aptenia*- and *Sceletium*-groups than to the remainder of *Phyllobolus* (Klak *et al.* 2007).

Klak *et al.* (2007) found that there were exceptionally high levels of homoplasy among the Mesembryanthemoideae. In particular, the *M. aitonis*-clade (*M. aitonis* and *M. longistylum* DC.) and the *P. splendens*-clade (*P. splendens* only) were new entities that can only be circumscribed using homoplasious characters (as discussed in detail by Klak *et al.* 2007). Placing these clades in separate genera would have made them extremely difficult to identify and any newly discovered species may be placed in such a generic framework only using molecular techniques. Consequently, a new classification of the Mesembryanthemoideae was proposed by Klak *et al.* (2007) with only the single genus *Mesembryanthemum*. Although not all relationships between the species were resolved, many of the clades in the Mesembryanthemoideae were well supported and these clades were

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TABLE 1.—Classification of Mesembryanthemoideae over the last four decades showing the fluctuation in the number of genera recognized (in bold)

Herre (1971): 18 genera	Bittrich (1986): 9 genera	Gerbaulet (2001): 11 genera	Gerbaulet (2012): 16 genera
Aptenia *N.E.Br.*	**Aptenia** *N.E.Br. (incl. Platythyra)*	**Aptenia** *N.E.Br. (incl. Platythyra)*	**Aptenia** *N.E.Br. (incl. Platythyra)*
Platythyra *N.E.Br.*			
Aspazoma *N.E.Br.*	**Aspazoma** *N.E.Br.*	**Aspazoma** *N.E.Br.*	**Aspazoma** *N.E.Br.*
Brownanthus *Schwantes*	**Brownanthus** *Schwantes*	**Brownanthus** *Schwantes (incl. Pseudobrownanthus)*	**Brownanthus** *Schwantes (incl. Pseudobrownanthus)*
	Pseudobrownanthus *Ihlenf.&Bittrich*		
Mesembryanthemum *L. (incl. Callistigma, Cryophytum)*	**Mesembryanthemum** *L. (incl. Cryophytum, Callistigma, Eurystigma, Halenbergia, Hydrodea, Opophytum)*	**Mesembryanthemum** *L. (incl. Callistigma, Cryophytum, Eurystigma, Halenbergia, Hydrodea, Opophytum)*	**Mesembryanthemum** *L.*
Eurystigma *L.Bolus*			**Callistigma** *Dinter & Schwantes*
Halenbergia *Dinter*			**Cryophytum** *N.E.Br.*
Hydrodea *N.E.Br.*			**Eurystigma** *L.Bolus*
Opophytum *N.E.Br.*			**Opophytum** *N.E.Br. (incl. Halenbergia, Hydrodea)*
Dactylopsis *N.E.Br.*	**Dactylopsis** *N.E.Br.*	**Phyllobolus** *N.E.Br. (incl. Amoebophyllum, Dactylopsis, Sphalmanthus)*	**Dactylopsis** *N.E.Br.*
Aridaria *N.E.Br.*		**Aridaria** *N.E.Br.*	**Aridaria** *N.E.Br.*
Phyllobolus *N.E.Br.*	**Phyllobolus** *(incl. Amoebophyllum, Aridaria, Prenia, Sceletium, Sphalmanthus)*		**Phyllobolus** *N.E.Br. (incl. Sphalmanthus, Amoebophyllum)*
Prenia *N.E.Br.*		**Prenia** *N.E.Br.*	**Prenia** *N.E.Br.*
Sceletium *N.E.Br.*		**Sceletium** *N.E.Br.*	**Sceletium** *N.E.Br.*
Amoebophyllum *N.E.Br.*			
Sphalmanthus *N.E.Br.*			
Psilocaulon *N.E.Br.*	**Psilocaulon** *N.E.Br.*	**Psilocaulon** *N.E.Br.* **Caulipsolon** *Klak*	**Psilocaulon** *N.E.Br. (incl. Caulipsolon)*
Synaptophyllum *N.E.Br.*	**Synaptophyllum** *N.E.Br.*	**Synaptophyllum** *N.E.Br.*	**Synaptophyllum** *N.E.Br.*
			Volkeranthus *Gerbaulet*

also recovered in an analysis including both molecular and morphological characters (Klak *et al.* 2007) so that they were recognized as informal groups.

Recently, these changes have been challenged and it has been claimed that the results of Klak *et al.* (2007) can easily be accommodated within the 'traditional classification' by reinstating a couple of older genera and describing one new genus, *Volkeranthus*, for the clade consisting of *M. aitonis* and *M. longistylum* (Gerbaulet 2012). This resulted in a new classification for the Mesembryanthemoideae involving 16 genera and reverting to a generic system similar to that of Herre (1971, Table 1).

Gerbaulet (2012: 189) based much of her discussion and conclusions on a 'new' and 'simplified cladogram derived from Klak *et al.* (2007) and with new assessments of character states'. The data and methods used to generate this cladogram are not given, nor is it clear on what material the new assessments of characters are based. The new cladogram differs from that in Klak *et al.* (2007) in that the *Aptenia-, Aridaria-*, *Phyllobolus-*, *Prenia-* and *Sceletium*-groups form a polytomy, whereas in Klak *et al.* (2007), *M. splendens* (= *Phyllobolus splendens*) was much more closely related (with high statistical support) to the *Aptenia-* and *Sceletium*-groups than to the *Phyllobolus*-group. Gerbaulet (2012: 191) erroneously interprets *Phyllobolus* as 'unresolved', since she was not able to find any synapomorphy to support the position of *M. splendens* (= *Phyllobolus splendens*) as sister to the *Aptenia-* and *Sceletium*-groups.

Apart from our objections to the use of this 'cladogram', we are unable to accept Gerbaulet's conclusions for several other reasons:

(1) The arguments for the creation of a new genus, *Volkeranthus*, for *M. aitonis* and *M. longistylum*, are flawed. Firstly, Gerbaulet (2012: 188) claimed that Bittrich (1986) had already identified these two species as the '*M. aitonis* group'. Bittrich (1986) had principally distinguished two groups in *M.* subg. *Mesembryanthemum* and provided morphological circumscriptions of these two groups, citing a 'primitive leaf shape and brown papillate seeds' as characterstic of the *M. aitonis*-group and 'slender, cylindrical leaves with a central water-storing tissue and smooth seeds' as characteristic of the *M. nodiflorum*-group. However, he never explicitly stated which other species belonged to the *M. aitonis*-group and which belonged to the *M. nodiflorum*-group. *M. longistylum* is intermediate between the two groups, since it possesses almost cylindrical, slightly chan-

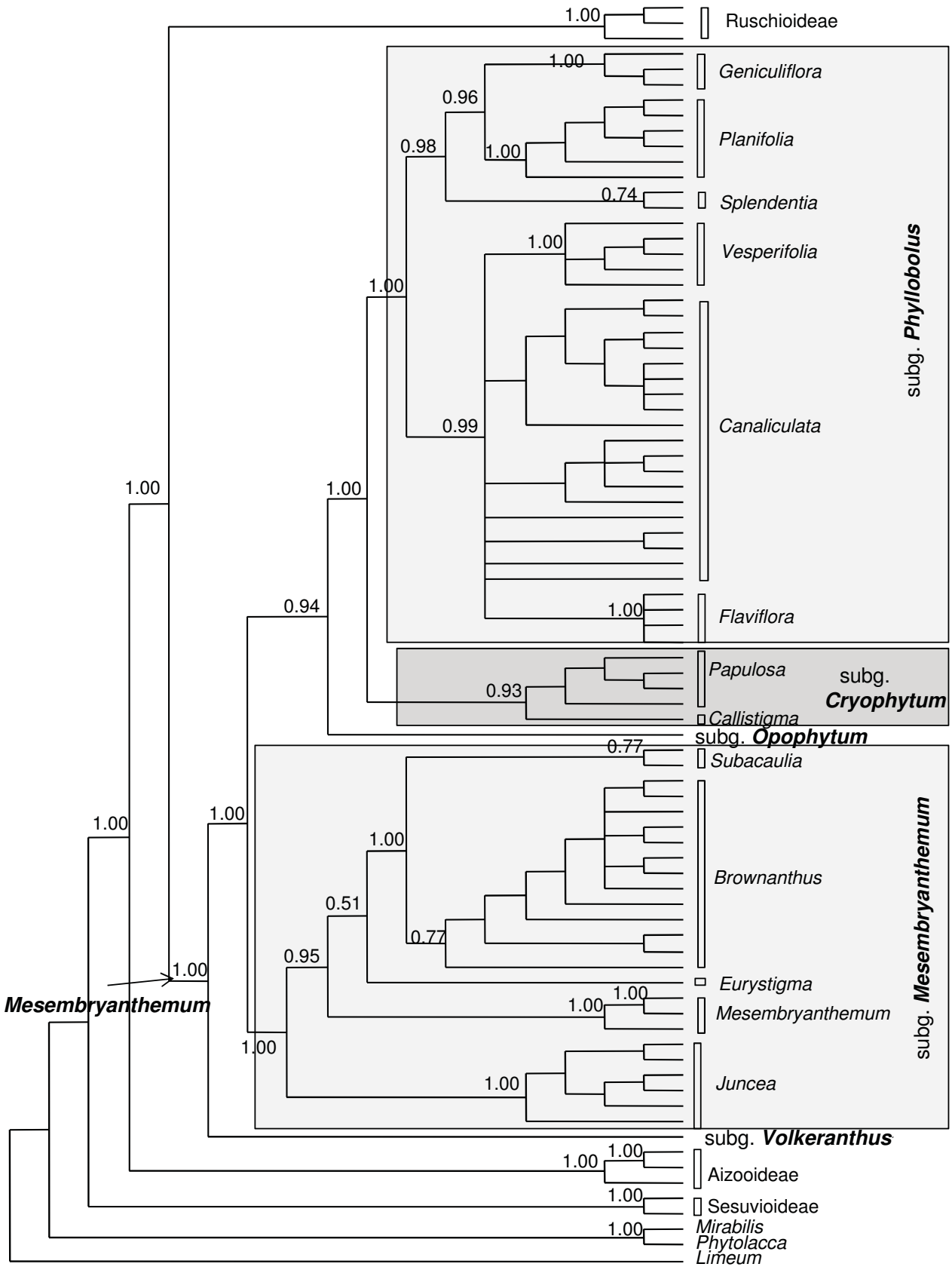


FIGURE 1.—Subgenera and sections mapped onto a simplified version of the Baysian tree by Klak *et al.* (2007: Figure 3) based on combined chloroplast, nuclear and morphology data. The support for the relationships between the subgenera and sections in *Mesembryanthemum* are indicated (numbers indicate Posterior Probability values).

nelled leaves with central water-storing tissue and papillate seeds (Gerbaulet 2001b). Thus, Gerbaulet's (2012) reference to Bittrich's '*M. aitonis*-group' as consisting of *M. aitonis* and *M. longistylum* is incorrect. Secondly, Gerbaulet (2012: 194) claimed that 'epidermal cells with a central papilla at the base of the stamens' characterizes the new genus *Volkeranthus* (*M. aitonis* and *M. longistylum*). She referred to Bittrich (1986) for evidence of this synapomorphy. However, Bittrich (1986: 26) did not state in which species this feature is present, apart from *M. aitonis*. Gerbaulet (2012) presented no new data and consequently her claim that 'epidermal cells with a central papilla at the base of the stamens are unique to *M. aitonis* and *M. longistylum*' is not justified. The failure to present such data is particularly problematic, since this was the only feature that characterized *M. aitonis* and *M. longistylum* as a distinct genus.

(2) A further example of a hypothesis for which no data were provided is the character 'bladder cells very large, especially on the receptacle' (Gerbaulet 2012: 194), which is given as a synapomorphy for *Cryophytum*. However, no evidence for it exists either in Bittrich (1986) or in any other paper by Gerbaulet.

(3) By placing *M. splendens* once more in *Phyllobolus*, Gerbaulet (2012) created a paraphyletic *Phyllobolus*. This contradicts the principles of Backlund & Bremer (1998), who argued that only monophyletic groups should be recognized as genera.

We therefore maintain that a broad generic circumscription for *Mesembryanthemum* (including all 103 species of the Mesembryanthemoideae) is the only arrangement that accurately reflects the most recently acquired information on the subfamily and is the only group that can be recognized unambiguously by synapomorphies. The aim of this paper is therefore to formalize the arrangement of species into groups by Klak *et al.* (2007) as an infrageneric classification for *Mesembryanthemum*. The major lineages within *Mesembryanthemum* are recognized as subgenera, while the clades within these lineages are recognized as sections. The subgenera and sections have been created here for ease of reference but, due to the high levels of homoplasy in the Mesembryanthemoideae, not all are easy to recognize. This applies particularly to *M.* subg. *Volkeranthus* and *M.* sect. *Splendentia*. Therefore, the keys to the subgenera and sections provided below are not easy to use and often have exceptions. Nevertheless they provide a first step in the identification of groups of species in the Mesembryanthemoideae. Where possible, the sections consist of groups that were previously recognized as genera. All of the subgenera and sections are monophyletic, except for *M.* sect. *Canaliculata*, which forms a polytomy together with sections *Vesperifolia* (monophyletic) and *Flaviflora* (monophyletic). Resolution obtained so far is inadequate to argue for or against the monophyly of sect. *Canaliculata*, but we recognize this group of taxa at the rank of section for ease of identification. The subgenera and sections have been mapped onto a simplified version of the cladogram of Klak *et al.* (2007: Figure 3), which shows the support for and relationships between them.

Haworth (1795) appears to have been the first to split up the large Linnaean genus *Mesembryanthemum* (which then already included 162 species) into groups, but without assigning them a formal rank. He intended to provide 'a numerical index of the species and varieties, arranged after [my] own method' (Haworth 1795: 473). Several years later, Haworth (1803) arranged the species into 13 sections and provided short diagnoses ('*characteres sectionum'*) for each of them. Most of the 13 sections were further subdivided but without an indication of the rank of these segregates. Salm-Dyck (1820:13) refined Haworth's system and further subdivided *Mesembryanthemum* ('*subdivisionis generis*'), providing names and diagnoses for his divisions. Although Haworth (1821:71) refered to Salm-Dyck's subdivisions as 'the Prince's divisions and sections', Salm-Dyck (1820) assigned no formal rank to them. Due to the growing number of species in *Mesembryanthemum*, Haworth (1821) considered it necessary to modify the divisions and he recognized eight sections, which were further broken into 69 numbered but unranked subdivisions. Haworth (1821:79) noted at the end of his sections that several of his groups could be regarded as 'true and natural genera'. Since his 69 subdivisions were unranked, their names need not to be taken into consideration for nomenclatural purposes.

The species currently placed in the Mesembryanthemoideae were included in five of the 13 sections of Haworth (1803), namely *Subacaulia*, *Planifolia*, *Canaliculata*, *Vesperifolia* and *Flaviflora*. Whereas sections *Subacaulia* and *Flaviflora* each included only a single species from the Mesembryanthemoideae, most species of the Mesembryanthemoideae were placed in sections *Planifolia* and *Canaliculata*. All five sections had many subdivisions, except for section *Vesperifolia*, which included only *M. defoliatum* Haw., *M. noctiflorum* L. and *M. stramineum* Haw. Haworth (1821) placed all species of the Mesembryanthemoideae in section *Papulosa* ('*foliis fere semper plus minus papulosis*'), except for the more-or-less stemless, clump-forming, highly succulent *M. digitatum*, which he included in section *Acaulia*. However, section *Papulosa* also included many taxa which belong to the Ruschioideae, such as various species of *Delosperma* and *Cleretum*.

Candolle (1828) based his classification on the earlier works of Haworth and Salm-Dyck, and used many of Haworth's 'sections' at the rank of 'subdivision' and Haworth's groupings within a section at the rank of 'sections'. He recognized eight 'subdivisions' and 54 'sections', including some new sections. Candolle (1828) made many changes to the membership and circumscription of the groupings of Haworth and Salm-Dyck, but regarded two species, i.e. *M. ciliatum* Ait. (= *M. vaginatum* Lam.) and *M. corallinum* Thunb. as insufficiently known and did not place them in any section (1828: 451). These two species were later included by Sonder (1862) in sect. *Juncea*.

Most sections listed below were thus previously validly published, but not typified. As their membership has changed repeatedly since they were set up, they are typified below and are more accurately circumscribed.

TAXONOMIC TREATMENT

Mesembryanthemum *L.*, Species plantarum 1: 480 (1753), nom. cons. Type: *Mesembryanthemum nodiflorum* L., typ. cons.

Key to subgenera of *Mesembryanthemum*

1. Seeds whitish to light brown, rarely dark brown and sculptured . . . 2

1.' Seeds dark brown, much sculptured (whitish and smooth in *M. inachabense* but then stigmas red) 3

2.(1) Annuals; leaves highly succulent, cylindrical and 7–15 mm diam. . . . . 3. *M.* subg. *Opophytum*

2'. Annuals or perennials, if annuals then leaves flat or if ± cylindrical then 2–5 mm diam. . . . . 2. *M.* subg. *Mesembryanthemum*

3.(1') Plants perennial; testa cells convex or with central raised papillae . . . . . 4. *M.* subg. *Phyllobolus*

3'. Plants annual or short-lived perennials; testa cells with central raised papillae 4

4.(3') Petaloid staminodes free, filamentous staminodes absent . . . . . 5. *M.* subg. *Volkeranthus*

4.' Petaloid staminodes fused into tube, filamentous staminodes present (rarely absent) . . . . . 1. *M.* subg. *Cryophytum*

1. **M.** subg. **Cryophytum** *(N.E.Br.) Bittrich* in Mitteilungen aus dem Institut für allgemeine Botanik Hamburg 21: 72 (1986). *Cryophytum* N.E.Br.: 412 (1925). Lectotype (Bittrich 1986: 72): *M. crystallinum* L.

Callistigma Dinter & Schwantes in Schwantes: 644 (1928). Type: *Callistigma inachabense* (Engler) Dinter & Schwantes (= *Mesembryanthemum inachabense* Engler).

Prostrate to ascending or erect annuals or short-lived perennials, stems often angled or winged, epidermis of stems with conspicuously raised bladder cells, roots fibrous. *Leaves* flat and often very broad, decussate and shortly connate at the base or becoming alternate in the inflorescences, margins often undulating, epidermis with conspicuous bladder idioblasts, without enlarged central water storing cells. *Flowers* in cymes, 10–60 mm diam., cream to pale or rarely dark yellow, petaloid staminodes fused into tube, petaloid and filamentous staminodes and stamens very numerous and filiform, rarely filamentous staminodes absent and petaloid staminodes and stamens few (*M. inachabense*); stigmas free or rarely basally connate and red (*M. inachabense*), nectaries shell-shaped, often deep. *Fruits* 5-locular, valve wings erect or inflexed over valves. *Seeds* brown, rarely whithish, rough with testa cells central papillose, rarely smooth.

Key to sections of *M.* subg. *Cryophytum*

1. Margins of leaves not undulate; flowers 10–20 mm diam.; filamentous staminodes absent, petaloid staminodes and stamens few . . . . . 1.1. *M.* sect. *Callistigma*

1.' Margins of leaves undulate; flowers 15–60 mm diam.; petaloid staminodes, filamentous staminodes and stamens numerous . . . . . 1.2. *M.* sect. *Papulosa*

1.1. **M.** sect. **Callistigma** *(Dinter & Schwantes) Klak*, comb. et stat. nov. *Callistigma* Dinter & Schwantes in Schwantes in Gartenwelt 32: 644 (1928). Type: *Mesembryanthemum inachabense* Engler (= *Callistigma inachabense* (Engler) Dinter & Schwantes).

Decumbent annuals, stems terete or 2-edged. *Leaves* flat, oblong, margins not undulate, epidermis with conspicuous bladder idioblasts. Flowers 10–20 mm diam., petaloid staminodes pale to dark yellow, filamentous staminodes absent, petaloid staminodes and stamens few; stigmas basally connate and red, nectaries deep. *Fruits* 5-locular, valve wings erect or inflexed over the valves. *Seeds* whitish, testa smooth.

Species (1): *Mesembryanthemum inachabense* Engler

1.2. **M.** sect. **Papulosa** *Haw*., Revisiones plantarum succulentarum : 79 (1821). Type (designated here): *Mesembryanthemum crystallinum* L.

Prostrate to ascending or erect annuals or short-lived perennials, stems often angled or winged. *Leaves* flat and often very broad, margins usually undulate, decussate and shortly connate at the base or becoming alternate in inflorescences, epidermis with conspicuous bladder idioblasts. *Flowers* 15–60 mm diam., cream to pale yellow, with numerous filiform petaloid staminodes, filamentous staminodes and stamens; stigmas free, greenish-yellow, nectaries shell-shaped. *Fruits* 5-locular, valve wings inflexed over valves. *Seeds* dark or light brown, rough, testa cells with central papillae.

Typification: Haworth (1803) included all species of Mesembryanthemoideae and Ruschioideae with flat leaves and a prostrate to decumbent habit in section *Planifolia*, including *M. crystallinum* (*Cryophytum*-group), *M. cordifolium* (*Aptenia*-group), *M. expansum* (*Sceletium*-group) and *M. pallens* (*Prenia*-group) (see also typification for sections *Planifolia* and *Flaviflora*). In a subsequent publication, however, all species of Mesembryanthemoideae (except *M. digitatum*) were accommodated in section *Papulosa* (Haworth 1821). Section *Papulosa* included annuals, biennials and perennials, with more-or-less papillate leaves ('*Suffrutices; annua, biennia, perenniave: foliis fere semper plus minus papulosis*' (Haworth 1821). Although most members of the Mesembryanthemoideae have distinctly papillate leaves, the size of the papillae are most striking in the *Cryophytum*-group. We therefore selected section *Papulosa* to accommodate all those members of subgenus *Cryophytum* that have particularly large and striking bladder cells. Since *M. crystallinum* was the only species from this group to be known and included in section *Papulosa* by Haworth, we chose this species as the type of section *Papulosa*.

Species (6): *M. barklyi* N.E.Br*., M. crystallinum* L., *M. gariusanum* Dinter, *M. guerichianum* Pax, *M. longipapillosum* Dinter, *M. pellitum* Friedrich

2. **M.** subg. **Mesembryanthemum**

Annuals or perennials, prostrate, decumbent or erect shrubs, rarely geophytes, stems cylindrical, often with ephemeral leaves and surface remaining green and photosynthetic, roots fibrous or rarely thickened, epidermis of stems with conspicuously raised bladder cells, or bladder cells reduced and flattened. *Leaves* deciduous or marcescent, epidermal bladder cells distinct or flattened, without or with central enlarged water storing cells. *Flowers* in cymes or solitary, 5–20(–30) mm diam., sepals remaining erect during anthesis or spreading, pet-

aloid staminodes, filamentous staminodes and stamens not particularly numerous, with or without filamentous staminodes, petaloid staminodes white, cream, pink or pale yellow, rarely much reduced, nectaries shell-shaped or tubular, rarely absent. *Fruits* (3)4 or 5-locular, rarely nut-like, valve wings inflexed over valves or reflexed and fused in pairs, locules deep or shallow. *Seeds* smooth or testal cells with central raised papillae, light coloured (rarely brown), rarely with crest.

Key to the sections of *M.* subg. *Mesembryanthemum*

1.Annuals 2

1.'Perennials. 4

2.(1) Flowers 5–30 mm diam.; filamentous staminodes absent; petaloid staminodes and stamens not particularly numerous . . . . . 2.4. *M.* sect. *Mesembryanthemum*

2.' Flowers ± 60 mm diam.; petaloid staminodes, filamentous staminodes and stamens very numerous . . . . . 2.2. *M.* sect. *Eurystigma*

3.(1') Leaves free, with tubular stem-clasping sheath . . . . . 2.5. *M.* sect. *Subacaulia*

3.' Leaves free or shortly connate, without tubular stem-clasping sheath 4

4.(3') Epidermis of stems with cylindrical, closely packed, xeromorphic bladder cells resembling cobblestones . . . . . 2.1. *M.* sect. *Brownanthus*

4.' Epidermis of stems with much flattened epidermal bladder cells, smooth, sometimes with widely-spaced, rounded or hair-like bladder cells . . . . . 2.3. *M.* sect. *Juncea*

2.1. **M.** sect. **Brownanthus** *(Schwantes) Klak*, comb. et stat. nov. *Brownanthus* Schwantes in Zeitschrift für Sukkulentenkunde 3: 20 (1927). Type: *Mesembryanthemum vaginatum* Lam. (= *Brownanthus vaginatus* (Lam.) Chesselet & M.Pignal.

Pseudobrownanthus Ihlenf. & Bittrich: 319 (1985). Type: *Pseudobrownanthus nucifer* Ihlenf.&Bittrich. (= *Mesembryanthemum nucifer* (Ihlenf. & Bittrich) Klak).

Decumbent to erect perennial shrubs, at least youngest stems succulent and green, articulate, epidermis of stems with closely packed, xeromophic bladder cells. *Leaves* decussate, deciduous or marcescent, epidermal bladder cells mesomorphic, with central enlarged water storing cells. *Flowers* solitary or in cymes, 5–10(–20) mm diam., sepals remaining erect during anthesis, petaloid staminodes cream to white, free, filamentous staminodes absent, nectaries narrow. *Fruits* 3–5-locular, valve wings inflexed over valves, lower part of fruit shallow, occasionally with seed bags, rarely nut-like. *Seeds* brown to cream, testa rough or ± smooth, rarely with crest.

Typification: Mesembryanthemum vaginatum is the type of *Brownanthus* and thus the type for section *Brownanthus*.

Species (14): *M. arenosum* Schinz, *M. corallinum* Thunb., *M. glareicola* (Klak) Klak, *M. kuntzei* Schinz, *M. marlothii* Pax, *M. namibense* Marloth, *M. napierense* Klak, *M. neglectum* (Pierce & Gerbaulet) Klak, *M. nucifer* (Ihlenf. & Bittrich) Klak, *M. pseudoschlichtianum* (Pierce & Gerbaulet) Klak, *M. schenckii* Schinz, *M. springbokense* Klak, *M. tomentosum* Klak, *M. vaginatum* Lam.

2.2. **M.** sect. **Eurystigma** *(L.Bolus) Klak,* comb. et stat. nov. *Eurystigma* L.Bolus in Notes on Mesembrianthemum and allied genera 2: 179 (1930). Type: *Mesembryanthemum eurystigmatum* Gerbaulet (= *Eurystigma clavatum* L.Bolus).

Decumbent annuals to 20 cm tall, internodes terete, to 4 mm diam. *Leaves* cylindrical, to 70 × 10 mm, bladder cells flattened, with central enlarged water storing cells. *Flowers* in cymes, deeply funnel-shaped, to 60 mm diam., petaloid staminodes straw-coloured to yellow, very narrow, connate into tube, petaloid staminodes, filamentous staminodes and stamens very numerous; stigmas basally shortly connate with ovary, thick and broad, subulate, or rather filiform, yellow, nectaries tubular. *Fruits* 5-locular, valve wings inflexed over valves. *Seeds* whitish to light brown, testa smooth.

Species (1): *M. eurystigmatum* Gerbaulet

2.3. **M.** sect. **Juncea** Haw. ex DC., Prodromus systematis naturalis regni vegetabilis 3: 446 (1828). [Unranked] *Juncea* Haw.: 175 (1821). Lectotype (designated here): *Mesembryanthemum juceum* Haw.

Psilocaulon N.E.Br.: 433 (1925). Type: *Psilocaulon articulatum* (Thunb.) N.E.Br. (= *Mesembryanthemum articulatum* Thunb.).

Caulipsolon Klak: 364 (1998). Type: *Caulipsolon rapaceum* (Jacq.) Klak (= *Mesembryanthemum rapaceum* Jacq.).

Synaptophyllum N.E.Br.: 412 (1925). Type: *Synaptophyllum juttae* (Dinter & A.Berger) N.E.Br. (= *Mesembryanthemum juttae* Dinter & A.Berger).

[Unranked] *Articulata* Salm-Dyck: 24 (1820).

Small to large prostrate to erect shrubby perennials or rarely annuals or geophytes (*M. rapaceum*), at least youngest stems succulent and green, usually articulate, epidermis of stems and leaves similar, with much flattened bladder cells. *Leaves* cylindrical to slightly trigonous, rarely flat and broad, deciduous, without central enlarged water storing cells. *Flowers* in cymes, rarely solitary, 5–25 mm diam., petaloid staminodes free or very shortly connate at base, filamentous staminodes and stamens conically collected, rarely petaloid staminodes or filamentous staminodes absent, nectaries narrowly shell-shaped or absent. *Fruits* 4 or 5-locular, valve wings inflexed over valves, rarely reflexed and fused in pairs, usually with deep locules. *Seeds* usually light brown to ochre, rarely whitish, testa slightly sculptured, with central raised papillae, rarely smooth.

Typification: Salm-Dyck (1820) created subdivision '*Articulata*' (without formal rank) to include three species from the *Psilocaulon*-group, which Haworth (1821) placed in his subdivision '*Juncea*' (without formal rank) within section *Papulosa*: *M. junceum*, *M. parviflorum* (=*M. micranthon* Haw., =*M. tenue* Haw.) and *M. rapaceum*. Constricted green stems and deciduous leaves were mentioned by both authors in the diagnoses

of their respective subdivision, although these characteristics are also found in sections *Brownanthus* and *Geniculiflora*. Candolle (1828) treated Haworth's subdivision '*Juncea*' as a section, thereby validating it for the first time at this rank. In addition, he only included taxa currenly placed in the *Psilocaulon*-group, making it the correct name for this group at the rank of section. Since *M. junceum* is the eponymous species of this group we selected it as the type of sect. *Juncea*.

Species (15): *M. articulatum* Thunb., *M. bicorne* Sonder, *M. coriarium* Burch. ex N.E.Br., *M. dimorphum* Welw. ex Oliver, *M. dinteri* Engler, *M. gessertianum* Dinter & A.Berger, *M. granulicaule* Haw., *M. junceum* Haw., *M. juttae* Dinter & A.Berger, *M. leptarthron* A.Berger, *M. neofoliosum* Klak, *M. parviflorum* Jacq., *M. rapaceum* Jacq., *M. salicornioides* Pax, *M. subnodosum* A.Berger

2.4. **M.** sect. **Mesembryanthemum**

Annual, prostrate or erect shrublets, internodes terete. *Leaves* ± cylindrical or somewhat channelled to narrowly obovate or oblong or almost truncate, epidermal bladder cells distinct or inconspicuous, with enlarged central water storing cells. *Flowers* in cymes, petaloid staminodes free or connate into short tube, 5–30 mm diam., petaloid staminodes yellow, white to pale pink or pink, filamentous staminodes absent, nectaries tubular. *Fruits* 5-locular, valve wings reflexed and fused in pairs. *Seeds* whitish to light brown, testa smooth.

Species (4): *M. excavatum* L.Bolus, *M. nodiflorum* L., *M. stenandrum* (L.Bolus) L.Bolus, *M. subtruncatum* L.Bolus

2.5. **M.** sect. **Subacaulia** *Haw.* in Miscellanea naturalia: 17 (1803): Lectotype (designated here): *Mesembryanthemum digitatum* Aiton

Aspazoma N.E.Br.: 413 (1925). Type: *Aspazoma amplectens* (L.Bolus) N.E.Br.

Dactylopsis N.E.Br.: 413 (1925). Type: *Dactylopsis digitata* (Aiton) N.E.Br.

Dwarf, clump-forming or bushily branched, erect shrublets, epidermis of stem with closely packed bladder cells. *Leaves* cylindrical or slightly flattened, alternating, with tubular sheaths clasping one another, drying up completely during resting period, bladder cells much flattened or somewhat flattened, with central enlarged water storing cells. *Flowers* solitary, sepals and petaloid staminodes basally fused into short tube, petaloid staminodes white to cream, filamentous staminodes absent or present, if absent then reproductive parts conceiled, nectaries shell-shaped. *Fruits* 4 or 5-locular, valve wings inflexed over valves or reflexed and fused in pairs. *Seeds* light brown to whitish, testa smooth.

Typification: Among several species of Ruschioideae, only a single species of Mesembryanthemoideae was included in section *Subacaulia* (Haworth 1803), which Haworth characterized as lacking stems or with very short stems and perennial roots ('*caulibus nullis vel brevissimus, radice perenni*'). Among the species of Mesembryanthemoideae currently known a seemingly stem-less habit is still unique to *M. digitatum*. The closely related *M. amplectens* is a shrubby plant but shares the unique leaf morphology with *M. digitatum*.

Species (2): *M. amplectens* L.Bolus, *M. digitatum* Aiton subsp. *digitatum*, *M. digitatum* subsp. *littlewoodii* (L.Bolus) Klak

3. **M.** subg. **Opophytum** *(N.E.Br.) Bittrich* in Mitteilungen aus dem Institut für allgemeine Botanik Hamburg 21: 73 (1986). *Opophytum* N.E.Br.: 412 (1925). Lectotype (Bittrich 1986: 73): *Mesembryanthemum fastigiatum* Thunb.

Halenbergia Dinter ex H. Jacobsen: 158, 200 (1937). Type: *Halenbergia hypertrophica* (Dinter) Dinter ex H. Jacobsen (= *M. hypertrophicum* Dinter).

Hydrodea N.E.Br.: 412 (1925). Type: *Hydrodea cryptantha* (Hook.f.) N.E.Br. (= *M. cryptanthum* Hook.f.).

Prostrate annuals, internodes terete, roots fibrous, epidermis of stems with much flattened bladder cells. *Leaves* highly succulent, cylindrical or globular, decussate and shortly connate at base or sometimes alternate in inflorescence, becoming dry while plants are still in flower, with much flattened epidermal bladder cells, with enlarged central water storing cells. *Flowers* 20–60(–80) mm diam., rarely much reduced and only 10 mm diam., petaloid staminodes filiform, sepals and petaloid staminodes connate into short tube, petaloid staminodes, filamentous staminodes and stamens numerous, nectaries tubular. *Fruits* 5-locular, valve wings reflexed and fused in pairs. *Seeds* ochre, smooth.

Species (3): *M. cryptanthum* Hook.f., *M. fastigiatum* Thunb., *M. hypertrophicum* Dinter

4. **M.** subg. **Phyllobolus** *(N.E.Br.) Klak*, comb. et stat. nov. *Phyllobolus* N.E.Br. in Gardener's Chronicle 78: 413 (1925). Type: *Mesembryanthemum resurgens* Kensit (= *Phyllobolus resurgens* (Kensit) Schwantes).

Prostrate or erect shrubs or geophytes, stems herbaceous or corky or woody, roots fibrous or thickened, epidermis of stems with mesomorphic bladder cells, mostly distinct. *Leaves* subcylindrical to somewhat flattened or flat, decussate and shortly connate at base or becoming alternate in inflorescence, or alternate throughout, deciduous or marcescent or old dry leaves 'skeletonized', ± retaining shape through lignified veins, epidermal bladder cells distinct or flattened. *Flowers* in cymes or solitary, white, yellow, pink, greenish or greenish-blue, 10–40 mm diam, sepals spreading during anthesis, petaloid staminodes, filamentous staminodes and stamens not particularly numerous, with or without filamentous staminodes, reproductive parts sometimes concealed, nectaries shell-shaped. *Fruits* 4 or 5-locular, valve wings inflexed over valves or reflexed and fused in pairs, rarely absent, locules deep or shallow. *Seeds* dark brown, with testa cells convex or testa with central raised papillae, with or without a crest.

Key to the sections of *M.* subg. *Phyllobolus*

1. Old dry leaves 'sceletonized' (retaining their shape ± fully through lignified veins) . . . . . .4.4. sect. *Planifolia*

1.’ Old dry leaves sometimes becoming spiny, but not ‘sceletonized’. 2

2.(1’)Epidermis of stems with tall, cylindrical, closely packed, xeromorphic bladder cells. . . . . .4.5.sect. *Geniculiflora*

2.’ Epidermis of stems with much flattened bladder cells 3

3.(2’) Epidermis of leaves with thick wax layer, bladder cells flattened 4

3.’ Epidermis of leaves with inconspicuous wax layer, bladder cells rarely flattened. 5

4. Stems herbaceous or only weakly lignified; lower part of fruits conspicuously longer than upper part . . . . . .4.2. sect. *Flaviflora*

4.’Stems woody, leaves strictly decussate; lower part of fruit ± as long as upper part . . . . . 4.3. sect. *Vesperifolia*

5.(3’) Large woody shrubs, to 1 m tall, rarely cushion–like, leaves persistent, never marcescent or spiny, decussate becoming alternate in the inflorescences . . .4.1. sect. *Splendentia*

5.’ Decumbent or erect shrubs or prostrate to decumbent geophytes, if decumbent or erect shrubs, leaves usually deciduous, marcescent or spiny, rarely persistent, if persistent, new leaves tufted in old and dry leaves . . . . . 4.6. sect. *Canaliculata*

4.1. **M.** sect. **Splendentia** DC., Prodromus systematis naturalis regni vegetabilis 3: 445 (1828). Lectotype (designated here): *Mesembryanthemum splendens* L.

Erect perennial shrubs to 1 m tall, stems woody, roots not thickened. *Leaves* variable in shape, from subcylindrical to narrowly ovate, persistent, epidermal bladder cells small, central water storing cells indistinct. *Flowers* in cymes, 30–40 mm diam., petaloid staminodes cream, pale pink, pale salmon or pale yellow, filamentous staminodes present, reproductive parts not concealed. *Fruits* 5-locular, valve wings inflexed over valves. *Seeds* black or dark brown, with rough testa, crest distinct, indistinct or absent.

Typification: Most taxa included in sect. *Splendentia* by Candolle (1828) are now considered to be conspecific with *M. splendens*, but the section also included *M. longistylum* (now placed in subg. *Volkeranthus*) and two species of *Delosperma* (Ruschioideae).

Species (1): *M. splendens* L. subsp. *splendens*, *M. splendens* subsp. *pentagonum* (L.Bolus) Klak

4.2. **M.** sect. **Flaviflora** *Haw.* in Miscellanea naturalia: 19 (1803). Lectotype (designated here): *Mesembryanthemum tetragonum* Thunb.

Prenia N.E.Br.: 412 (1925). Type: *Prenia pallens* (Aiton) N.E.Br. (= *M. pallens* Aiton).

Prostrate to rarely ascending (*M. tetragonum*) perennials, stems weakly lignified, roots fibrous. *Leaves* ± flat and obscurely triquetrous, obtusely trigonous or almost cylindrical, persistent, epidermal bladder cells much flattened, without enlarged central water storing cells. *Flowers* in cymes, 20–40 mm diam., petaloid staminodes white yellow or pink, sepals and petaloid staminodes connate into short tube, filamentous staminodes present, nectaries shell-shaped. *Fruits* 4 or 5 locular, locules deep, valve wings inflexed over valves. *Seeds* black, rough, testa cells central papillose, with or without indistinct crest.

Typification: Haworth (1803) included several species of Ruschioideae and only one species of Mesembryanthemoideae in section *Flaviflora*, i.e. *M. tetragonum* Thunb. We take this species as the type of this section. It was included by Haworth on the ‘authority of Thunberg’, who thought it was related to *M. molle* Aiton (= *Malephora mollis* (Aiton) N.E.Br.). Section *Flaviflora* was characterized by slightly woody, often erect stems, triquetrous leaves and yellow, orange, or deep red petaloid staminodes (‘*caulibus suffrutescentibus saepe erectis, foliis triquetris saepe brevissimis, petalis flavis, aurantiis, vel coccineis*’) (Haworth 1803: 19).

Species (6): *M. englishiae* L.Bolus, *M. pallens* subsp. *lanceum* (Thunb.) Klak, *M. pallens* subsp. *luteum* (L.Bolus) Klak, *M. pallens* subsp. *namaquense* (Gerbaulet) Klak, *M. pallens* Aiton subsp. *pallens*, *M. radicans* (L.Bolus) Klak, *M. sladenianum* L.Bolus, *M. tetragonum* Thunb., *M. vanrensburgii* (L.Bolus) Klak

4.3. **M.** sect. **Vesperifolia** *Haw*. in Miscellanea naturalia: 18 (1803). Type : *Mesembryanthemum noctiflorum* L.

Aridaria N.E.Br.: 433 (1925). Type: *Aridaria noctiflora* (L.) Schwantes (= *M. noctiflorum* L.).

Low to tall erect shrubs to 1 m high, roots thickened. *Leaves* subcylindrical, decussate, deciduous, bladder cells small and much flattened, with enlarged central water storing cells. *Flowers* in cymes, large (to 40 mm diam.), diurnal or nocturnal, petaloid staminodes white or pink inside, suffused with various shades of yellow, copper, pink, or red on reverse, sepals and petaloid staminodes connate into short tube, filamentous staminodes absent, nectaries shell-shaped. *Fruits* 4-locular, valve wings inflexed over valves, breaking off easily with stalks becoming spiny. *Seeds* brown or dark brown, rough, testa cells central papillose, with or without crest.

Typification: Haworth (1803) included three species in sect. *Vesperifolia* (i.e. *M. noctiflorum*, *M. stramineum* and *M. defoliatum*). The last two are now subspecies of *M. noctiflorum*, which therefore becomes the type of the section.

Species (4): *M. brevicarpum* (L.Bolus) Klak, *M. noctiflorum* subsp. *defoliatum* (Haw.) Klak, *M. noctiflorum* L. subsp. *noctiflorum*, *M. noctiflorum* subsp. *stramineum* (Haw.) Klak, *M. occidentale* Klak, *M. serotinum* (L.Bolus) Klak

4.4. **M.** sect. **Planifolia** *Haw.* in Miscellanea naturalia: 18 (1803). Lectotype (designated here): *Mesembryanthemum tortuosum* L.

Sceletium N.E.Br.: 412 (1925). Type: *Sceletium tortuosum* (L.) N.E.Br. (= *M. tortuosum* L.).

Prostrate to erect small perennials, often scrambling in other bushes, roots fibrous. *Leaves* flat, ovate, dry leaves persistent and ‘skeletonized’ through lignified veins, without enlarged central water storing cells. *Flowers* in few-flowered cymes, more rarely solitary, stalked or sessile, 20–40 mm diam., petaloid staminodes white, various shades of yellow, pale pink, or pale salmon, sepals and petaloid staminodes basally connate

into short tube, filamentous staminodes present, sometimes concealing reproductive parts. *Fruits* 4–6-locular, with or without valve wings, valve wings inflexed over valves, breaking off easily to be dispersed by wind. Seeds rough, testa cells convex and arranged in concentric rows, with distinct or indistinct crest.

Typification: Haworth (1803) placed all species of Mesembryanthemoideae and Ruschioideae with flat leaves and a prostrate to decumbent habit in sect. *Planifolia* (‘*foliis planis saepe subcarinatis, caulibus saepe decumbenti—prostrates effusis*’. From Mesembryanthemoideae, he included *M. crystallinum*, *M. cordifolium*, *M. expansum*, *M. emarcidum*, *M. tortuosum*, *M. varians* and *M. pallens*. Although all of these species fit the description of the section well, they are unrelated and cannot be placed in the same section. Since most species listed fall into the *Sceletium*-group we elected to associate sect. *Planifolia* with this group, by selecting *M. tortuosum* as the type of the section.

Species (8): *M. archeri* Klak, *M. crassicaule* Haw., *M. emarcidum* Thunb., *M. exalatum* (Gerbaulet) Klak, *M. expansum* L., *M. ladismithiense* Klak, *M. tortuosum* L., *M. varians* Haw.

4.5. **M.** sect. **Geniculiflora** DC. in Prodromus systematis naturalis regni vegetabilis 3: 445 (1828). Type: *Mesembryanthemum geniculiflorum* L.

Aptenia N.E.Br.: 412 (1925), Type: *Aptenia cordifolia* (L.f.) Schwantes (= *M. cordifolium* L.f.).

Platythyra N.E.Br.: 412 (1925), Type: *Platythyra haeckeliana* (A.Berger) N.E.Br. (= *M. haeckelianum* A.Berger).

M. sect. *Cordifolia* DC.: 449 (1828). Type: *Mesembryanthemum cordifolium* L.f.

Prostrate to scandent or climbing perennials, stems with persistent green succulent cortex, internodes 4-angled or terete, with closely packed, xeromorphic bladder cells, roots fibrous, rarely fleshy. *Leaves* flat or rarely almost cylindrical, cordate, ovate, lanceolate or linear, petiolate or sessile, bladder cells mesomorphic and loosely arranged, without enlarged central water storing cells. *Flowers* solitary or in few-flowered cymes, shortly stalked, 15–35 mm diam., petaloid staminodes white, pale yellow or pink, basally connate into short tube, with or without filamentous staminodes, nectaries shell-shaped. *Fruits* 4-locular, with or without valve wings, valve wings inflexed over valves. *Seeds* rough, testa cells central papillose, without a crest.

Typification: Candolle (1828) included only a single species in sect. *Geniculiflora*, thus its type. Sect. *Cordifoliae* DC. (1828), described only a few pages after section *Geniculiflora*, is included here in sect. *Geniculiflora*. Four sepals and papillate leaves are among the diagnostic characters for sect. *Geniculiflora* (Candolle 1828) and his mention of 5 sepals for sect. *Cordifoliae* is evidently incorrect (Gerbaulet, 2001a).

Species (4): *M. cordifolium* L.f., *M. geniculiflorum* L., *M. haeckelianum* A.Berger, *M. lancifolium* (L.Bolus) Klak.

4.6. **M.** sect. **Canaliculata** *Haw.* in Miscellanea naturalia: 18 (1803). Lectotype (designated here): *Mesembryanthemum canaliculatum* Haw.

Amoebophyllum N.E.Br.: 433 (1925). Type: *Amoebophyllum angustum* N.E.Br. (= *M. vanheerdei* (L.Bolus) Klak).

Phyllobolus N.E.Br.: 413 (1925). Type: *Phyllobolus resurgens* (Kensit) Schwantes (= *M. resurgens* Kensit).

Sphalmanthus N.E.Br.: 433 (1925). Type: *Sphalmanthus canaliculatus* (Haw.) N.E.Br. (= *M. canaliculatum* Haw.).

[Unranked] *Canaliculata. Spinulifera* Haw.: 56 (1803).

[Unranked] *Spinulifera* Haw.: 176 (1821).

Perennials, prostrate to erect shrubs to minute geophytes, stems corky or woody, long or much shortened, roots often thickened. *Leaves* subcylindrical or flattened, deciduous, marcescent or persistent, epidermal bladder cells mostly distinct, central water storing cells indistinct. *Flowers* in cymes or solitary, petaloid staminodes in various shades of green, yellow, orange, red, or pink or almost white, (10–)20–40 mm diam., sepals and petaloid staminodes basally fused into short tube, filamentous staminodes present and reproductive parts not concealed or filamentous staminodes absent and reproductive parts concealed, nectaries shell-shaped. *Fruits* 4- or 5-locular, valve wings inflexed over valves. *Seeds* rough, testa cells convex and arranged in concentric rows, with or withour crest, sometimes with additional crests on sides.

Typification: Whereas sect. *Planifolia* included taxa with flat, often broad leaves, sect. *Canaliculata* (Haw. 1803: 18) accommodated taxa with more slender leaves (‘*foliis linearibus, junioribus canaliculatis subtus convexis*’). Taxa with slender leaves are found in unrelated clades within Mesembryanthemoideae. Section *Canaliculata* had been subdivided further into the unranked subdivisions ‘*Canaliculata. Spinulifera*’ (Haw. 1803:56) and ‘*Canaliculata. Varia*’ (Haw. 1803:58). Of these two groups, ‘*Canaliculata. Spinulifera*’ incorporated several species previously placed in *Phyllobolus*, whereas ‘*Canaliculata. Varia*’ included taxa that fall into various unrelated clades. We therefore elected that sect. *Canaliculata* should correspond to the group of taxa previously placed in *Phyllobolus*. Surprisingly many species from this group were already known to Haworth, including *M. canaliculatum*, *M. grossum*, *M. nitidum*, *M. spinuliferum* and *M. viridiflorum*. Since slightly channelled leaves are common to all of these species, we chose *M. canaliculatum* as the type of the section.

Species (32): *M. amabile* (Gerbaulet & Struck) Klak, *M. baylissii* Klak, *M. bulletrapense* Klak, *M. canaliculatum* Haw., *M. caudatum* L.Bolus, *M. chrysophthalmum* (Gerbaulet & Struck) Klak, *M. deciduum* (L.Bolus) Klak, *M. decurvatum* (L.Bolus) Klak, *M. delum* L.Bolus, *M. flavidum* Klak, *M. gariepense* (Gerbaulet & Struck) Klak, *M. grossum* Aiton, *M. holense* Klak, *M. knolfonteinense* Klak, *M. latipetalum* (L.Bolus) Klak, *M. lignes-*

cens (L.Bolus) Klak, *M. ligneum* (L.Bolus) Klak, *M. lilliputanum* Klak, *M. nitidum* Haw., *M. oculatum* N.E.Br., *M. oubergense* (L.Bolus) Klak, *M. prasinum* (L.Bolus) Klak, *M. quartziticola* Klak, *M. rabiei* (L.Bolus) Klak, *M. resurgens* Kensit, *M. sinuosum* L.Bolus, *M. spinuliferum* Haw., *M. suffruticosum* (L.Bolus) Klak, *M. tenuiflorum* Jacq., *M. trichotomum* Thunb., *M. vanheerdei* (L.Bolus) Klak, *M. viridiflorum* Aiton.

5. **M.** subg. **Volkeranthus** *(Gerbaulet) Klak*, comb. et stat. nov. *Volkeranthus* Gerbaulet in Bradleya 30: 196 (2013). Type: *Volkeranthus aitonis* (Jacq.) Gerbaulet (= *Mesembryanthemum aitonis* Jacq.).

Prostrate to ascending, annual to biennial, herbaceous plants, epidermis of stems with mesomorphic, rounded bladder cells, roots fibrous. *Leaves* flat and broad or almost cylindrical to flattened, slightly channelled, linear to narrowly oblong, decussate and shortly connate at base or becoming alternate in inflorescences, epidermis with mesomorphic, rounded bladder cells, with or without enlarged central water storing cells. *Flowers* in cymes, to 25 mm diam., white, sometimes suffused pink or yellowish, sepals shortly connate, petaloid staminodes narrowly lanceolate, filamentous staminodes absent, petaloid staminodes and stamens free, nectaries as deep as locules and tubular. *Fruits* 5-locular, valve wings reflexed and fused in pairs or free and incurved over valves. *Seeds* brown with rough testa, without crest.

Species (2): *M. aitonis* Jacq., *M. longistylum* DC.

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Notes on African plants

VARIOUS AUTHORS

IRIDACEAE

TAXONOMIC NOTES ON *ARISTEA* (ARISTEOIDEAE) IN TROPICAL AND EASTERN SOUTHERN AFRICA

The Afro-Madagascan *Aristea* Ait., only genus of Iridaceae subfam. Aristeoideae Goldblatt, comprises some 58 species of rhizomatous, evergreen perennials. The genus is currently subdivided into three subgenera: two of them, subg. *Aristea* (18 spp.) and subg. *Pseudaristea* (Pax) Goldblatt (9 spp.) are restricted to the southern African winter-rainfall zone in the southwest of the subcontinent (Goldblatt 2012), whereas subg. *Eucapsulares* (Goldblatt) Goldblatt (31 spp.) occurs widely across sub-Saharan Africa, where we now recognize 24 species. There are also eight species in Madagascar, one of them, *A. goetzei* Harms, shared with highlands of southern Tanzania (Goldblatt *et al.* 2013). Five species are shared between tropical and southern Africa, five are exclusively tropical African, and 13 species are restricted to southern Africa, three of them restricted to the southern African winter rainfall zone (Table 1).

The systematics of *Aristea* is relatively well understood in tropical Africa as a result of accounts of the genus for *Flora Zambesiaca* (Goldblatt 1993), *Flora of East Tropical Africa* (Goldblatt 1996a), *Flora of Ethiopia* (Goldblatt 1997) and *Flore d'Afrique Centrale* (Geerinck 2005). Nevertheless, some taxa require comment and clarification. *Aristea djalonis* Hutch., from the West African highlands, has been confused with *A. angolensis* Baker (e.g. Hepper 1968), but we consider it quite distinct from that species and most likely more closely related to the eastern and southern African *A. torulosa* Klatt (better known by its later synonym *A. woodii* N.E.Br.).

The taxonomy of a second species, *A. abyssinica* Pax, requires modification: *A. bequaertii* De Wild. was treated as a subspecies of *A. alata* Baker by Weimarck (1940) in a revision of the genus, but Geerinck (2005) included it without comment in *A. abyssinica.* We agree that *A. bequaertii* is more closely related to *A. abyssinica* than to the East African *A. alata*, but some features of the taxon suggest it is better treated as a separate species. The types of *A. bequaertii* and of *A. homblei* De Wild. share with *A. abyssinca* and *A. alata* a stem consisting of a long basal internode, but whereas the latter two species have a single subterminal leaf subtending the single or pair of inflorescences (always binate rhipidia in the genus but called flower clusters here), *A. bequaertii* consistently has two cauline leaves, one inserted a short distance below the upper. This feature is not seen in *A. abyssinica* and in conjunction with some unusual floral features indicates to us that these plants represent a separate species.

Lastly, *Aristea gerrardii* Weim. (Weimarck 1940), recognized by Goldblatt (1993) in his account of the genus in *Flora Zambesiaca*, is, we now conclude, a later name for *A. compressa* Baker (1877), and we accordingly reduce it to synonymy under that species. The two taxa share a multi-branched compound inflores-

TABLE 1.—Distribution of species of *Aristea* occurring in tropical Africa with ranges by country

***Aristea* species**	**Countries in tropical Africa**	**Countries outside tropical Africa**
abyssinica Pax	Burundi, Cameroon, Congo, Ethiopia, Kenya, Malawi, Nigeria, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe	Lesotho, South Africa, Swaziland
alata Baker	Ethiopia, Kenya, Tanzania, Uganda	
angolensis Baker	Angola, Burundi, Congo, Ethiopia, Kenya, Malawi, Nigeria, Tanzania, Uganda, Zambia, Zimbabwe	Lesotho, South Africa, Swaziland
bequaertii De Wild.	Congo (only southern Shaba)	
compressa Buching. ex Baker	Mozambique	South Africa, Swaziland
djalonis A.Chev. ex Hutch.	Guinea, Nigeria, Sierra Leone	
ecklonii Baker	Burundi, Cameroon, Congo, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe	South Africa, Swaziland
goetzei Harms	Tanzania	Madagascar
nyikensis	Congo, Malawi, Tanzania, Zambia	
polycephala Harms	Malawi, Mozambique, Tanzania	
torulosa Klatt	Angola, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe	Lesotho, South Africa, Swaziland

cence and compressed, 2-winged stems, and cited differences between them, especially in spathe and bract size, seem to us negligible once features of a third species, *A. parviflora* Baker, which was mistakenly included in *A. compressa* by Weimarck (1940) and Vincent (1985), are removed from consideration. After examining the type and other material of *A. parviflora,* a montane, local endemic of Eastern Cape, we conclude it is correctly a separate species and we provide a description of the species below, raising it from synonymy in *A. compressa.*

1. *Aristea djalonis*: the West African *Aristea djalonis*, named for the Fouta Djalon highlands in Guinea and southern Senegal, was first collected by Auguste Chevalier, the French botanist and plant explorer. Chevalier gave his collection the manuscript name *Anthericum djalonis* and published just the name in 1920 in a list of his plant collections (Chevalier 1920). The species was treated as *Aristea djalonis* in a brief (and taxonomically invalid) entry in *Flora of West Tropical Africa* (Hutchinson & Dalziel 1936), where it was diagnosed in the key with Hutchinson listed as author. A valid, extended description was provided later (Hutchinson 1939). Superficially, collections of the species from Guinea, Nigeria and Sierra Leone resemble the widespread *A. angolensis*, and *A. djalonis* was included in that species by Weimarck (1940) and subsequently by Hepper (1968) in the second edition of *Flora of West Tropical Africa.*

One of four species of the genus that occur in West Africa (Table 1), *Aristea djalonis* can readily be distinguished by the flowering stem, which is simple or few-branched and compressed, conspicuously so below the middle of the inflorescence and about 4 mm wide, and sharply angular to narrowly winged. In *A. angolensis*, the stem is slender and oval to terete in section. The inflorescence spathes and bracts also differ, those of *A. djalonis* being oblong, 9–11 mm long, and dark green or brown in the centre, becoming membranous toward the edges and light, translucent brown. Bracts of *A. angolensis* are slightly shorter, dark green to blackish (black when dry) in the center and translucent white on the edges. The bracts of *A. djalonis* recall those of the south tropical and eastern southern African *A. torulosa*, and it is to this species that *A. djalonis* is probably most closely related. A species of *Aristea* endemic to West Africa is surprising, but there are at least five other endemic Iridaceae there, including two species of *Zygotritonia* and three of *Gladiolus* (Goldblatt 1989, 1996b).

Aristea djalonis *A.Chev. ex Hutch.* in Bulletin of Miscellaneous Information, Royal Botanical Gardens, Kew 1939: 246 (1939). [Hutch. in Hutch. & Dalziel, Flora of West Tropical Africa 2: 376 (1936) nom. inval. *Anthericum djalonis* A.Chev.: 648 (1920), nom. nud.]. Type: Guinea, Fouta Djalon, Plateau de Dalaba, '*Anthericum djalonis,*' Sept.–Oct. 1907 (fr.), *Chevalier 18859* (P, holo.!).

Plants 400–600 mm high. *Stem* compressed and 2-angled to narrowly winged, ± 4 mm wide in middle, ± 3 mm wide below first flower cluster, often simple or 1–3-branched. *Leaves* 4–6, narrowly sword-shaped, mostly 6–10 mm wide, firm, basal and cauline, decreasing in size above. *Flower clusters* several per axis in lax spicate arrangement, sessile except terminal; terminal mostly 4-flowered, laterals mostly 2-flowered; spathes and bracts 8–10 mm long, dark brown in center, membranous and translucent brown toward edges, becoming torn and fringed with age. *Flowers* pale blue (or white), tepals ± 12 mm long. *Filaments* ± 6 mm long; anthers ± 2 mm long. *Ovary* subglobose, ± 3 mm long; style ± 6 mm long, 3-lobed at apex, lobes fringed. *Capsules* sessile, ovoid, 8–11 mm long. *Seeds* unknown. *Flowering time*: December and January.

Distribution: Guinea, Sierra Leone, Nigeria, in highland grassland.

Diagnosis and relationships: Aristea djalonis is distinguished from the other tropical African species of the genus by the compressed stem, about 4 mm wide in the middle, slightly angled to narrowly winged, bearing sessile lateral flower-clusters on the main axis, which is usually unbranched and the short, partly transparent, entire or lightly torn spathes, 9–11 mm long. When the stem is branched, the one to three branches are comparatively short and unusually slender. The several leaves are mostly 6–10 mm wide, whereas leaves of *A. angolensis* are usually narrower, often less than 5 mm wide.

Representative specimens

GUINEA.—Fouta Djalon, Diaguissa, 1 300–1 400 m, 18 Apr. 1905 (fr.), *Chevalier 12652* (P); environs of Kindia, Benna, 1 000 m, June 1937, *Jacques-Felix 1756* (P); Mt Loma, env. de Mali, Oct. 1937 (fr.), *Jacques-Felix 1973* (P); Dalaba, roadside near Forestry House, 23 June 1962, *Adames 277* (K).

SIERRA LEONE.—Lome Mtns, 16 Aug. 1945, *Jaeger 985* (K, MO). Loma Mtns, grassland at 5000 ft, 17 June 1966, *Morton 3587* (K); Loma Mtns, Bintumane Peak, 6000 ft, 2 May, 1949, *Deighton 5099* (K); Loma Mtns, Bintumane, grassland at summit of peak, 14 Aug. 1945 (fr.), *Jaeger 985* (MO); Kabala, Loma Mtns, 8 Aug. 1964 (fr.), *Adam 26716* (MO).

NIGERIA.—Northern: between Bukuru and Hepham, 4300 ft [1 310 m], 4 July 1921, *Lely 342* (K).

2. *Aristea bequaertii*: first collected in 1912, *Aristea bequaertii* remains a puzzling plant. Restricted to southern Shaba Province of the Democratic Republic of Congo (DRC), it is obviously closely allied to *A. abyssinica* and *A. alata*, with which it shares a flowering stem consisting of a long, basal internode, but unlike these species it bears two (sometimes three) cauline leaves, the uppermost of these not inserted at the base of the terminal flower cluster. Plants bear a terminal flower cluster distant for the uppermost cauline leaf and sometimes one in each cauline leaf axil, the lower of these more often stalked and the upper sessile. The pale blue to almost white flowers have blue anthers and pollen (verified from photos provided by M. Séleck), unique in subg. *Eucapsulares*, in which yellow anthers and pollen are the rule. Also unusual are the erect stamens surrounding the style. In other species of the subgenus, the stamens diverge and the style is eccentric.

Elsewhere in Shaba and further north in the highlands of eastern DRC, and in Burundi, Rwanda and adjacent Zambia, typical *A. abyssinica* seems to be common and can easily be distinguished from *A. bequaertii*. The species was treated by Weimarck (1940) as *A. alata* subsp. *bequaertii*, with *A. abyssinica* as a second subspecies of *A. alata.* As currently circumscribed, *A. alata* is restricted to Kenya, Uganda and Ethiopia and is as tall

as some collections of *A. bequaertii* but it has a single (rarely two) cauline leaves, always close to the stem apex, the uppermost subtending the terminal flower cluster. The broader leaves and prominently stalked capsules on pedicels up to 25 mm render *A. alata* unmistakable. Geerinck (2005), in *Flore d'Afrique Centrale* included *A. bequartii* in *A. abyssinica* without comment. Additional collections of *A. bequaertii* with well preserved flowers and with ripe capsules are needed to amplify our knowledge of the species.

We provisionally include *Aristea homblei*, described by De Wildeman (1913) at the same time as *A. bequaertii*, in synonymy as did Weimarck, but note that the type consists of rather different plants. Much shorter, the specimens range in height from as little as 80 mm to 120 mm, bear two cauline leaves and the flattened stems are somewhat contracted. In some plants of the collection, the terminal flower cluster is sessile, but in others they are stalked and distant from the uppermost cauline leaf. More collections of *Aristea* in Shaba are needed to better understand the variation in *A. bequaertii* and its possible synonym, *A. homblei.*

Aristea bequaertii *De Wild.* in Repertorium specierum novarum regni vegetabilis 11: 509 (1913). *A. alata* Baker subsp. *bequaertii* (De Wild.) Weim.: 46 (1940). Type: Congo, [Shaba], Lubumbashi [Elisabethville], 3 Apr. 1912, *Bequaert 303* [BR, lecto.!, designated by Weimarck: 36 (1940)].

Aristea homblei De Wild.: 509 (1913). Type: Congo, [Shaba], Welgelegen, 1912, *Corbusier sub Homblé 615* (BR, syn.! [3 sheets]).

Plants (80–)180–400 mm high. *Stem* compressed, 2-winged, 2–4 mm wide, consisting of 1 long basal internode and 2 or 3 shorter internodes in upper 1/3, bearing 2 or 3 short leaves, these often subtending a sessile or stalked flower cluster. *Leaves* several, ± linear, lower 3 or 4 basal, reaching to ± middle of stem, 2.0–3.5 mm wide, cauline leaves 2 or 3, progressively shorter above. *Flower clusters* 1–2(–4), lateral clusters if present sessile or on short branches, the terminal remote from uppermost leaf, each 2–4-flowered; spathes 7–10 mm long, green with broad membranous margins, keel sharply angled and hyaline, bracts membranous, becoming ± dry, translucent light brown, slightly shorter than spathes. *Flowers* blue to white, ± sessile, tepals subequal, spreading, ovate, 9–12 mm long. *Stamens* erect and remaining contiguous, enclosing style; filaments 4–5 mm long, purple; anthers 1.2–1.5 mm long, pale to deep blue. *Ovary* ± ellipsoid, ± 5 mm long before pollination, rapidly enlarging later; style slightly exceeding anthers, blue-purple, terminating in 3-stalked stigmatic lobes. *Capsules* ovoid-ellipsoid, 7–8 mm long. *Seeds* unknown. *Flowering time*: mostly December and January.

Distribution: Congo, Shaba, restricted to southern Shaba, mostly (always?) in copper enriched soils, in grassland, woodland and marshy sites. With just a handful of collections and from a small portion of Shaba, the conservation status of *Aristea bequaertii* should perhaps be regarded as RARE and possibly EN, Endangered, given its occurrence in copper-rich soils and close to areas under intensive mining activity.

Representative specimens

CONGO.—Shaba. Kitimbi, in swamp, Jan. 1908, *Kassner 2326* (B, K); 14 km N of Mitwaba, 16 Jan 1960, *Duvigneaud 5075* (BRLU); Welgelegen, *Corbisier 615b* (BR); Keyberg, open forest, 9 Jan. 1957, *Detilleux 370* (BR); collines de cuivre [copper hills] de Tenke, Kachimilumbe (2), 10 Jan. 2012, *Séleck, Delhaye & Ilunga 210* (BR), Kachimilumbe (3), 11 Jan. 2012, *Séleck, Delhaye & Ilunga 210* (BR).

3. *Aristea compressa*: both *A. compressa* Baker (1877) and the newly described *A. gerrardii* Weimarck were recognized by Weimarck (1940) in his account of the genus and both were also recognized by Vincent (1985) in his treatment of *Aristea* for eastern southern Africa. Goldblatt (1993) accordingly recognized *A. gerrardii* in coastal Mozambique in *Flora Zambesiaca*. Weimarck, and later Vincent, distinguished the two species by their inflorescence spathes, on the spurious grounds that those of *A. compressa* were significantly smaller. They are in fact virtually the same size in the type material of both species. Part of the problem was that several specimens included in *A. compressa* by both authors are a second species, *A. parviflora* Baker (1906), which has a comparably branched flowering stem to that of *A. compressa* but shorter inflorescence spathes, significantly smaller flowers and does not have a flattened flowering stem. Restricted to northeastern Eastern Cape, *A. parviflora* is a montane species, evidently allied to *A. angolensis*.

The types of *Aristea compressa* and *A. gerrardii*, both of which are from coastal KwaZulu-Natal, South Africa, share a compressed flowering stem, sharply 2-angled or narrowly 2-winged, flower clusters arranged in a compound pseudopanicle with the central axis dominant, and lanceolate spathes and floral bracts ± 5–8 mm long, green or brown in the midline, transparent and becoming torn along the edges. The small, blue flowers differ hardly at all from those of other tropical African and several eastern southern African species. We provide revised descriptions of *A. compressa* and *A. parviflora* below with adjusted nomenclature of *A. compressa.*

Aristea compressa *Buching. ex Baker* in Journal of the Linnean Society, Botany 16: 111 (1877) [*A. compressa* Buching. in Krauss, Flora 28: 309 (1845), nom. nud.]. Type: South Africa, [KwaZulu-Natal], forest margins near Umlaas River, 1840, *Krauss 358* (K, holo.!, MO [2 sheets], iso.!).

Aristea gerrardii Weim.: 17 (1940), syn. nov. Type: South Africa, [KwaZulu-Natal], without precise locality or date, *Gerrard 393* (K, holo.!; P, iso.!).

Plants 300–750 mm long. *Stem* flattened almost to apex, narrowly winged, several- to many branched (one order), but never dichotomously. *Leaves* narrowly sword-shaped to linear, leathery, sometimes weakly pleated, mostly 8–12 mm wide, ± 1/2 as long as stem. *Flower clusters* many in compound pseudopaniculate arrangement, lateral clusters sessile, each 2–4-flowered; spathes and bracts lanceolate, mostly 5–8 mm long, green or brown in midline, transparent along margins and upper half, becoming torn. *Flowers* blue, outer tepals 10–11 × 6–7 mm, inner ± 9 × 4 mm. *Stamens*: filaments ± 4 mm long, anthers 1.7–2.0 mm long. *Ovary* broadly conical, ± 2 mm long, on short stalk ± 1 mm long; style ± 5 mm long, broadly 3-lobed, reaching

mid-anther level. *Capsules* ovoid, ± 5 mm long, ± sessile. *Seeds* angular-prismatic, reticulate. *Flowering time*: August to January.

Distribution: *Aristea compressa* extends from Pebane in coastal northern Mozambique through KwaZulu-Natal to Port St Johns in Eastern Cape, South Africa, occurring mainly in coastal sites, often in marshy habitats, but locally inland, as at Drummond (KwaZulu-Natal) and Mbabane (Swaziland), then often in areas with sandstone or quartzite substrates (Figure 1). The species is naturalized in Hawai'i.

Representative specimens

MOZAMBIQUE.—Maputo: Matutuíne, between Zitundo and Manhoca, 29 Nov. 1979, *De Koning 7706* (BR, MO, NBG). Pebane: Pebane, Aug. 1950, *Munch 261* (SRGH).

SWAZILAND.—**2631** (Mbabane): Mbabane, (–AC), 14 Jan. 1951, *Compton 22366* (NBG), 'near houses, ?garden escape', *27221* (NBG, PRE); Mbabane, Poliniane River, (–AC), 6 Nov. 1956, *Compton 26198* (PRE).

EASTERN CAPE.—**3129** (Port St Johns): Mkambati Nature Reserve, hills N of airstrip, (–BD), 9 Dec. 1986, *Nicholas & Smook 2335* (MO, PRE); Port St. Johns, (–DA), 10 Dec. 1938, *Prance s.n.* (NBG), Nov. 1928, *Dyer 1817* (GRA).

KWAZULU-NATAL.—**2632** (Bella Vista): Kosi Bay, National Parks Board Camp, (–DD), *Moll & Strey 3819* (NH, PRE). **2831** (Nkandla): Hlabisa, Palm Ridge Farm, (–BB), *Harrison 216* (NH, PRE). **2832** (Mtubatuba): St. Lucia, eastern Shores State Forest, (BA), 13 Oct. 1983, *Nicholas 1602* (MO). **2930** (Pietermaritzburg): Drummond, (–DA), 22 Oct. 1963, *Bayliss 1729* (NBG); Clairmont, (–DD), Oct. 1896, *Wood 6139* (PRE); Pinetown, (–DD), *Hafstrom & Acocks 267* (PRE), Oct. 1942, *Fisher 351* (MO). **3030** (Port Shepstone): Isipingo Beach, (–BB), *Ward 527* (NU); Port Shepstone, (–CB), Nov. 1905, *Rogers 494* (GRA). **3130** (Port Edward): Port Edward, (–AA), *Moss 19194* (J).

Aristea parviflora *Baker* in Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew: 25 (1906). Type: South Africa, [Eastern Cape], Insizwe Mtns, 28 Jan. 1895, *Krook in Herb. Penther 556* (K, holo.!)

Plants 400–600 mm high. *Stem* slightly compressed, oval in section, with low raised angles decurrent on cauline leaves, repeatedly branched (one or two orders), main axis remaining dominant, branches ascending. *Leaves* ± linear, leathery, basal ± 1/2 as long as stem, mostly 4–6 mm wide, cauline leaves progressively shorter above. *Flower clusters* many in paniculate arrangement, sessile or stalked**,** each (1)2–4-flowered; spathes and bracts ovate to lanceolate, mostly 3.5–4.5 mm long, evidently translucent membranous with brown keels and shading brown near bases, becoming torn with age. *Flowers* blue, tepals ± 6 mm long, filaments ± 2.5 mm long; anthers ± 1.5 mm long. *Ovary* globose-truncate, ± 2 mm diam., ± sessile; style unknown. *Capsules* globose, ± 3.5 mm diam., sessile. *Seeds* unknown. *Flowering time*: January and February, probably also March. Figure 1.

Distribution: a narrow endemic, *Aristea parviflora* is known only from the Insizwe and Mt. Ayliff ranges of the southern Drakensberg of northeastern Eastern Cape. One of the collections was made along forest margins (Figure 1).

Diagnosis: described by J.G. Baker in 1906, the distinctive *Aristea parviflora* was included by both Weimarck (1940) and Vincent (1985) in *A. compressa* on spurious grounds. This narrow endemic has the smallest flowers in the genus, the tepals about 6 mm long and the flower thus about 12 mm in diameter, and correspondingly short filaments, about 2.5 mm long. Also distinctive are the globose capsules up to 3.5 mm in diameter and the stems are only slightly compressed with narrow raised angles; whereas the stems of *A. compressa* are flattened with the longer axis twice as long as the short axis and the stems are more-or-less winged. The tepals of *A. compressa* are 10–12 mm long, filaments 3.5–4.0 mm long and the capsules are ovoid and about 5 mm long

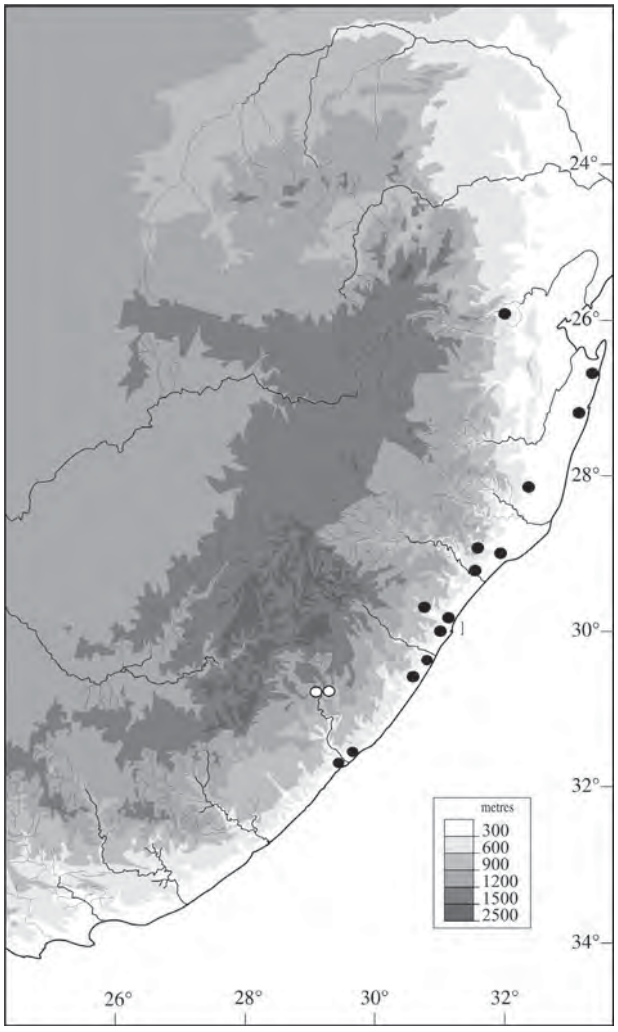


FIGURE 1.—Distribution of *Aristea compressa* (●) [excluding a record from Pebane, north of Beira in Mozambique] and *A. parviflora* (○).

Selected specimens

EASTERN CAPE.—**3029** (Kokstad): Griqualand East, near Clydesdale, ± 915 m, (–BD), Feb. 1884, *Tyson 2872* (BOL, K, PRE, SAM); forest margins near Mt Ayliff, (–BD), Feb. 1884, *Tyson 1741* (BOL, SAM); Insizwa, Jan. 1895, *Schlechter 6470* (BOL, GRA).

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IRIDACEAE

A NEW SPECIES OF *HESPERANTHA* FROM THE OVERBERG, WESTERN CAPE, AND OBSERVATIONS ON A NOVEL MODE FOR POLLEN TRANSFER IN THE GENUS AND FAMILY BY A HESPERID BUTTERFLY

INTRODUCTION

Plants of an unknown species of *Hesperantha* Ker Gawl., discovered in the Rûens Hills northeast of Bredasdorp, Western Cape, South Africa, present some unusual features in the genus. *Hesperantha*, a sub-Saharan African genus of some 85 species of Iridaceae subfamily Crocoideae Burnett, extends from Western Cape to Ethiopia and Cameroon (Goldblatt 2003; Goldblatt & Manning 2007; Goldblatt & Manning *in prep*.). The genus is recognized by ± woody corm tunics and a spicate inflorescence of radially symmetric flowers with the style branches dividing close to the mouth of the perianth tube into long, spreading style branches. The new species, *H. kiarataylorae*, has diurnal, small pink, salver-shaped flowers that are remarkable for the erect stamens tightly enclosing the exserted style. The style divides well above the mouth of the perianth tube near the apices of the anthers, thus unlike any other species in the genus, and the three style branches, which are loosely twisted or coiled around one another, are held well above the mouth of the perianth tube. Although the exserted style and erect style branches are unique for the genus, the bell-shaped corms, with an oblique flat base and floral bracts united basally around the spike, are consistent with sect. *Radiatae* Goldblatt. Three days of observation for pollinators have shown that the flowers, which begin to open at about 6:00 and close after 12:30, are visited and pollinated by the small butterfly *Tsitana tulbagha* (Hesperidae), not before recorded as an agent for pollen transfer in any sub-Saharan species of Iridaceae (Goldblatt & Manning 2006). We describe the new species here, discuss its relationships within *Hesperantha*, and present evidence for this novel pollination system within Iridaceae.

TAXONOMY

Hesperantha kiarataylorae *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—Western Cape, 3420 (Bredasdorp): Rûens Hills, northeast of Bredasdorp, Farm Plaatjieskraal, upper slopes of ridge in stony quartzite gravel over shale, (–AC), 8 Nov. 2011, *Goldblatt & Porter 13729* (NBG, holo.; K, MO, PRE, iso.).

Plants mostly 150–200 mm high, rarely to 300 mm, erect, unbranched. *Corm* obliquely bell-shaped, 6–8 mm diam. at base, tunics ± woody, dark grey, fragmenting from lower margins into tile-like segments. *Leaves* several, dry at flowering time, sheaths imbricate, blades

linear, mostly 10–60 × 1.0–1.5 mm, margins smooth, uppermost 2 or 3 leaves sheathing for entire length. *Spike* 2–4(–7)-flowered, flexuose; bracts dry and pale brown at flowering, outer mostly 12–15 mm long with margins connate near base for 1–2 mm and sheathing spike axis, inner slightly shorter than outer and forked apically. *Flowers* diurnal, pink with white throat, unscented, anthers bright yellow and prominently displayed; perianth tube cylindric, slightly expanded at apex, 13–16 mm long, distal half exserted from bracts; tepals subequal, spreading horizontally, elliptic, ± 12 × 4–5 mm, outer slightly larger than inner. *Stamens* symmetrically disposed, erect; filaments 2.5 mm long, exserted ± 1 mm from mouth of tube; anthers ± 5 mm long, dehiscing longitudinally, yellow, remaining coherent around style. *Ovary* ovoid-oblong, ± 6 mm long; style exserted and dividing just below anther apices, branches ± 5 mm long, remaining erect, slightly twisted and often interlaced, papillate and stigmatic in upper 2/3. *Capsules* subcylindric, 7–8 mm long. *Seeds* angular, ± 0.7 × 0.4 mm, with membranous raphal ridge expanded into a wing at micropylar end, surface cells colliculate. *Flowering time*: (late October) November. Figure 1.

Distribution & ecology: known from a single south-facing ridge in Eastern Rûens Shale Renosterveld (Mucina & Rutherford 2006), ± 40 km northeast of Bredasdorp (Figure 2), *Hesperantha kiarataylorae* grows among silcrete-quartzite stones over a shale substrate among tufts of the graminoids *Pentachistis* and *Merxmuellera* (Poaceae) and *Bobartia* (Iridaceae), and the shrubs *Elytropappus rhinocerotis* (L.f.) Less. (Asteraceae), *Amphithalea violacea* (E.Mey.) Benth and *Aspalathus mundiana* Eckl. & Zeyh. (Fabaceae). It shares this unique habitat with several threatened quartz-specialists, including *Gibbaeum haagei* Schwantes (Aizoaceae: *Endangered*), *Elegia verreauxii* Mast. (Restionaceae: *Vulnerable*), *Notobubon striatum* (Thunb.) Magee (Apiaceae: *Near Threatened*), *Otholobium curtisiae* C.H.Stirt. & Muasya *ined.* (Fabaceae, proposed status *Endangered*), as well as the recently described *Xiphotheca rosemarinifolia* A.L.Schutte (Fabaceae: *Critically Endangered*), which is known only from this single locality. We estimate that the population comprises about 90 plants of flowering size. The site was not examined for juveniles.

Although there is thus a good probability that *H. kiarataylorae* may likewise be restricted to this single locality, additional surveys are required to establish this. Silcrete-quartz outcrops are restricted to Eastern Rûens Shale Renosterveld, a *Critically Endangered* vegetation type, with < 12% remaining (SANBI & DEAT 2009). Renosterveld remnants are vulnerable to mismanagement, including inappropriate use of fire and over-grazing and trampling by livestock (Schutte-Vlok 2011; O. Curtis pers. obs.). Given the evident rarity of the species and the threats from agriculture to the single known locality, which remains unprotected, we propose a conservation status of *Critically Endangered* (CE). To date, no seeds have been collected for seed-banking.

The leaves of *Hesperantha kiarataylorae* are dry and withered at flowering, a feature not known elsewhere in the genus and evidently associated with its late spring / early summer flowering. The pink, unscented flowers last three days (determined by maintaining cut stems in water in the laboratory), and open early in the morning each day, ± 06:00, beginning to close after 12:30 and are fully closed by 13:30.

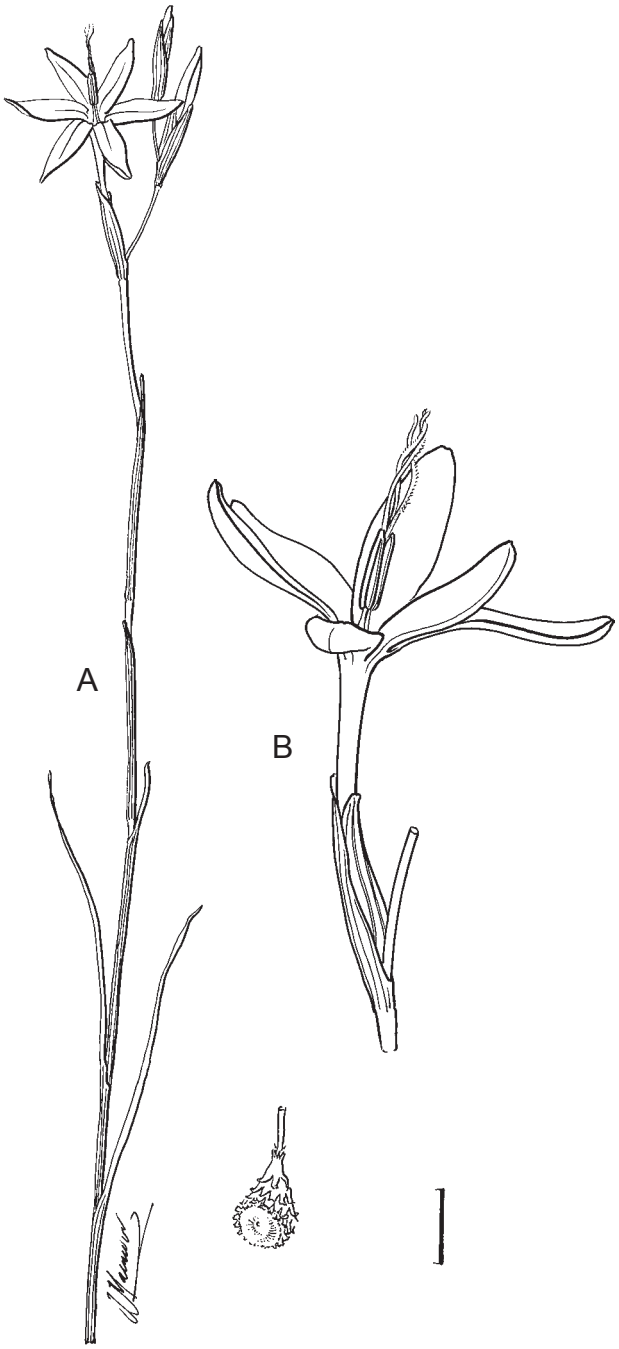


FIGURE 1.—*Hesperantha kiarataylorae, Goldblatt & Porter 13729*. A, flowering plant; B, detail of stamens and stigma. Scale bar: A, 10 mm; B, 2 mm. Artist: John Manning.

Diagnosis and relationships: a small plant, *Hesperantha kiarataylorae* has small pink flowers with a relatively long perianth tube, 13–16 mm long and slightly longer than the tepals, erect stamens with the anthers connate around the style, and an erect style that divides opposite the anther apices into three erect, slightly twisted branches. The short, linear leaves are ± dry at flowering and the floral bracts are united for 1–2 mm

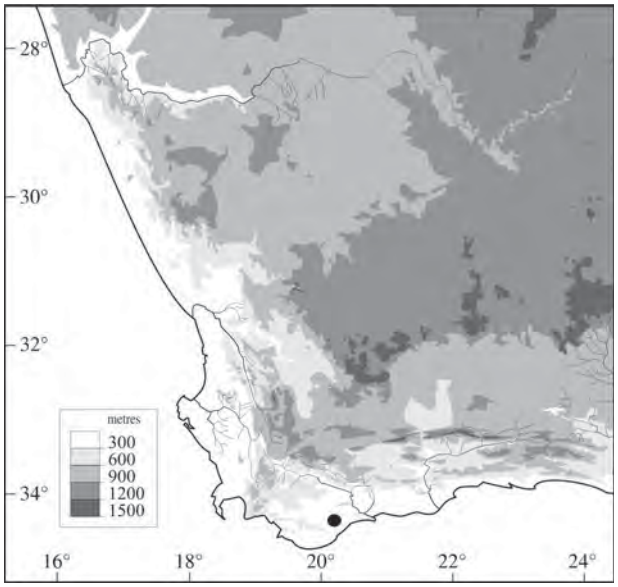


FIGURE 2.—Distribution of *Hesperantha kiarataylorae*.

around the spike axis. The general aspect of *H. kiarataylorae* is that of sect. *Radiata*, diagnosed by the flat-based corms with hard tunics fragmented at the base and the partial union of the outer floral bract margins around the spike axis (Goldblatt 2003). A well developed perianth tube is common in the genus and not unusual in sect. *Radiata*, but pink flowers are otherwise known in the section only in *H. elsiae* Goldblatt from the southern Cedarberg, which in other features, including a long perianth tube, is very different to *H. kiarataylorae* (Goldblatt 1984). The southern Cape *H. muirii* (L.Bolus) G.J.Lewis is most like *H. kiarataylorae* in the twisted style branches (although spreading in the former) and we see the two as a species pair within the section. The relatively long style enclosed by the erect stamens and dividing well above the mouth of the perianth tube close to the anther apices significantly expands the circumscription of *Hesperantha.*

The species is named for Kiara May-Leen Taylor in honour of the generous donation to renosterveld conservation by her father, Oren Taylor.

POLLINATION

Only a single insect species, the skipper butterfly *Tsitana*, cf. *T. tulbagha* (Hesperidae), a relatively common species of southern Africa, was seen visiting flowers of *Hesperantha kiarataylorae* over three days of observations, for three to four hours each day. The bright pink flowers evidently lack floral odour as determined from open flowers held indoors in a warm, still room. Several (< 10 individuals) *Tsitana* butterflies (sexes not established) were observed visiting the flowers after 6:30, soon after the perianth expanded fully, moving directly from one opened flower to another. On alighting on a flower, the frons of the insect first contacted the style branches, the upper two thirds of which are ciliate, sticky and stigmatic throughout the lifespan of a flower. The insect then inserted its proboscis into the floral tube, evidently foraging for nectar present in the lower part of the perianth tube (nectar concentration and chemistry not examined, but we confirm the presence of nectar, sweet to the taste). Nectar in *Hesperantha*, as in other genera of Iridaceae: Crocoideae, is secreted from septal nectaries, but we did not confirm presence of these nectaries in this species. During foraging activity, the frons of the insects (but not other body parts) became visibly covered with a dense accumulation of bright orange pollen from contact with the anthers. Butterflies were seen flying from one open flower to another and stigmas that were devoid of pollen before visits by *T.* cf. *tulbagha* were seen to bear heavy deposits of pollen after visits by the butterfly. The butterfly was identified by entomologists, M. Picker and D. Edge, from photographs. No insects were trapped and killed for vouchers.

Our observations show that this butterfly is an active and effective agent for pollen transfer for *Hesperantha kiarataylorae.* We also note that we observed no other insect visitors to the flowers either in the early morning or later (three to four hours of observation on different days). From this we then infer that *Tsitana* cf. *tulbagha* is at least one, but possibly the sole, pollinator of the species at this locality. The possibility of autogamy in this species can be eliminated because the flowers are herkogamous, the pollen and stigmatic part of the style branches are physically separated from one another; the latter held about 1.5 mm above the anthers and exposed pollen. The species may also be self-incompatible, but this was not determined for our study.

Butterfly pollination is evidently rare among southern African Iridaceae apart from the guild of species with large red flowers, mostly species of *Gladiolus* and *Tritoniopsis*, pollinated predominantly by *Meneris tulbaghia* (Satyridae) (Goldblatt & Manning 2002, 2006), a very different system to that reported here. Pollination by the painted lady, *Cynthia cardui* (Pieridae), has been observed in yellow-flowered *Ixia acaulis* Goldblatt & J.C.Manning and *Nivenia parviflora* Goldblatt & J.C.Manning, and this butterfly is the only recorded visitor to *I. acaulis* (Goldblatt & Manning 1993, 2006, 2011). Several other species of Iridaceae are visited by butterflies as part of a generalist pollination system also involving nectar-feeding bees and sometimes hopliine beetles (Sarabaeidae: Hopliini). These include *I. orientalis* L.Bolus*,* reported as pollinated by the butterfly *Colias electo* (Pieridae) (Goldblatt *et al*. 2000), and *Micranthus* spp., visited by *Cynthia cardui*, *Pieris helice* (Pieridae) and *Colias electo*, but these plants are generalists and are also visited and pollinated by hopliine beetles and large anthophorine bees (Goldblatt & Manning 2006). *Colias electo* has also been captured while visiting flowers of *Geissorhiza foliosa* Baker and *G. heterostyla* L.Bolus, but its role in the pollination of these relatively short-tubed species is uncertain (Goldblatt & Manning 2009). Other *Hesperantha* species are pollinated by settling moths (mostly Noctuidae), long-proboscid flies (mostly species of *Prosoeca*) or large-bodied bees and *Apis* (Goldblatt *et al.* 2004). Just one species is known to be pollinated by hopliine beetles. Pollination of *H. kiarataylorae* thus represents a novel pollination strategy in the genus.

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SANTALACEAE

THE MINOR GENERA *KUNKELIELLA* AND *THESIDIUM* INCLUDED IN *THESIUM*

Santalaceae (sensu APG III 2009: including Viscaceae) comprise ± 1 100 species of hemiparasites or aerial parasites assigned to ± 47 genera distributed worldwide (Der & Nickrent 2008). The southern African representatives include ± 300 species in six genera, of which *Thesium* L. (± 180 spp.) and *Viscum* L. (17 spp.) are the largest (Germishuizen 2000; Jordaan & Burgoyne 2000). Phylogenetic relationships in the family were analysed by Der & Nickrent (2008) using a multigene data set. Eight clades were identified with strong support. One of these, the *Thesium* clade, included the genus *Osyridocarpos* A.DC. as sister to a clade comprising *Kunkeliellia* W.T.Stearn, *Thesidium* Sond. and *Thesium* L. This clade, treated as the segregate family Thesiaceae by Nickrent *et al.* (2010), is predominantly African, with the monotypic *Osyridocarpos* widespread through the continent; *Kunkeliella*, with just four species, endemic to the Canary Islands; *Thesidium*, with eight species, endemic to the Western and Eastern Cape; and the large genus *Thesium* (± 340 spp: www.parasiticplants.siu.edu) distributed widely through the Old World but most diverse in southern Africa and with two species in South America. Previously segregated as the genus *Austroamericium* Heyndrich (1963), the South American species were included in *Thesium* by Der & Nickrent (2008).

A subsequent molecular phylogenetic analysis focussed on investigating the phylogenetic relationships within *Thesium* and allied species (Moore *et al.* 2010). It confirmed that the segregate *Austroamericium* was deeply embedded in the tropical clade of *Thesium*, affirming its inclusion in *Thesium* accepted earlier by Der & Nickrent (2008). More relevantly in the southern African context, *Thesidium* was confirmed as monophyletic but also nested within the genus *Thesium* as sister to the Eurasian species, with the remaining species of *Thesium* forming a clade sister to this. In order to render

Thesium monophyletic, it is thus necessary either to subsume *Thesidium* in *Thesium* or to restrict the circumscription of *Thesium* to the Eurasian clade and to treat the remaining species, which comprise the majority of the genus, in another genus. Aside from the nomenclatural disruption that such a step would occasion, Moore *et al.* (2010) could identify no morphological basis for separating the Eurasian species of *Thesium* from the rest of the genus, and therefore proposed that the first option be adopted.

The taxonomy of the genus *Thesidium* was bedevilled by the almost simultaneous publication of reviews of the group by both Candolle (1857a) and Sonder (1857a), with Candolle's work appearing while Solander's was in press (see Sonder 1857a). The species of *Thesidium* were originally treated in *Thesium* as sect. *Hagnothesium* by Candolle (1857a), defined by their monoecious habit and mostly 4-merous flowers. Sonder (1857a) initially segregated them as the separate genus *Thesidium* but almost immediately Sonder (1857b) reverted to Candolle's treatment. The genus was later resuscitated by Hill (1915a, b), a decision accepted by later authors.

The characters defining *Thesidium* bear closer examination. The number of floral parts is variable in both *Thesium* and *Thesidium*. *Thesidium* is mostly 4-merous but 5-merous flowers do occur (Candolle 1858a, b; Hill 1915b), and although southern African *Thesium* are invariably 5-merous, the Eurasian species immediately allied to *Thesidium* are variable for the character, with *T. alpinum* L. usually 4-merous and *T. arvense* Horvátovszky occasionally 4-merous (Hendrych 1964). The difference between the two genera thus lies solely in the breeding system, namely monoecious vs. bisexual flowers. Although potentially significant at first sight, breeding systems within Santalaceae are highly variable. Approximately half of the genera have strictly bisexual flowers, but the remaining half have mostly unisexual flowers in various sexual systems that include dioecy, monoecy, androdioecy and trioecy (Der & Nickrent 2008). There is thus a clear precedent in Santalaceae for including both bisexual and unisexual taxa within a single genus. In the absence of any morphological impediment to enlarging the circumscription of *Thesium* to include *Thesidium*, and in view of the obvious nomenclatural advantages, we implement the recommendation of Moore *et al.* (2010) that *Thesidium* be included in *Thesium*, placing it in the separate sect. *Hagnothesium* as originally proposed by Candolle (1857a) and followed by Sonder (1857b).

Following on from this conclusion it is apparent that the small Canary Island endemic genus *Kunkeliella*, which is placed between *Thesium* and *Thesidium* in the molecular phylogeny of Der & Nickrent (2008), must also be included in *Thesium*. Although its exact relationships within *Thesium* have not yet been established (no species of *Kunkeliella* were included in the study of Moore *et al.* 2010), the genus is clearly nested within the enlarged circumscription of *Thesium* adopted here. This is not surprising: at the time that Stearn (1972) established *Kunkeliella* for the species previously treated as *Thesium psilotocladum* Svent. plus a second allied species, which differed from *Thesium* in their drupaceous fruits and isopolar pollen, he suggested that it might in fact represent a new section in *Thesium*. We accordingly reduce the genus to *Thesium* as sect. *Kunkeliella*.

Thesium *L.* in Species plantarum: 207 (1753). Type: *Thesium alpinum* L., lecto., designated by Hitchcock: 135 (1929).

Kunkeliella W.T.Stearn: 17 (1972), syn. nov. Type: *Kunkeliella canariensis* W.T.Stearn (= *Thesium canariensis* (W.T.Stearn) J.C.Manning & F.Forest).

Thesidium Sond.: 364 (1857a). Type: *T. thunbergii* Sond. (= *Thesium fragile* L.f.), lecto., designated by Pilger: 85 (1935).

sect. **Hagnothesium** *DC.* in Espèces nouvelles du genre *Thesium*: 4 (1857a); Sond.: 405 (1857b). Type: *Thesium fragile* L.f., lecto., designated here.

Thesidium Sond.: 364 (1857a). Type: *T. thunbergii* Sond. (= *Thesium fragile* L.f.), lecto., designated by Pilger: 85 (1935).

Thesium confusum *J.C.Manning & F.Forest*, nom. nov. pro. *Thesidium fragile* Sond. in Flora: 364 (1857a), non *Thesium fragile* L.f. (1782).

Thesium fragile *L.f.* in Supplementarum plantarum: 162 (1782).

Thesium podocarpum A.DC. in Espèces nouvelles du genre *Thesium*: 5 (1857a). *Thesidium podocarpum* (A.DC.) A.DC.: 674 (1857b). *Thesidium thunbergii* Sond.: 364 (1857a), nom. illegit. superfl. [*T. podocarpum* was treated as conspecific with *T. fragile* L.f. by Sonder (1857a) under the illegtimate superfluous name *Thesidium thunbergii.*]

Thesium fruticulosum *(A.W.Hill) J.C.Manning & F.Forest*, comb. nov. *Thesidium fruticulosum* A.W.Hill in Kew Bulletin 1915: 99 (1915).

Thesidium longifolium A.W.Hill: 99 (1915). [This was identified as the shade-form of *T. fruticulosum* by Levyns (1950).]

Thesium leptostachyum *A.DC.* in Espèces nouvelles du genre *Thesium*: 5 (1857a). *Thesidium leptostachyum* (A.DC.) Sond.: 405 (1857b).

Thesium microcarpum *A.DC.* in Espèces nouvelles du genre *Thesium*: 5 (1857a). *Thesidium microcarpum* (A.DC.) A.DC.: 674 (1857b). *Thesidium exocarpaeoides* Sond.: 365 (1857a), nom. illegit. superfl.

Thesium minus *(A.W.Hill) J.C.Manning & F.Forest*, comb. nov. *Thesidium minus* A.W.Hill in Kew Bulletin 1915: 98 (1915).

Thesium strigulosum *A.DC.* in Espèces nouvelles du genre *Thesium*: 4 (1857a). *Thesidium strigulosum* (A.DC.) A.DC.: 673 (1857b). [*T. globosum*, based on male plants, and *T. strigulosum*, based on female plants, were both included under the illegitimate superfluous name *Thesidium hirtum* by Sonder (1857a). His conclusion as to their taxonomic status was confirmed by Hill (1915) and we follow it here, selecting *T. strigulosum* as the name for the taxon.]

Thesium globosum A.DC.: 4 (1857a), syn. nov. *Thesidium globosum* (A.DC.) A.DC.: 673 (1857b).

Thesidium hirtum Sond.: 365 (1857a), nom. illegit superfl. pro *Thesium globosum* A.DC. et *T. strigulosum* A.DC.

sect. **Kunkeliella** *(W.T.Stearn) J.C.Manning & F.Forest*, stat. et comb. nov. *Kunkeliella* W.T.Stearn in *Cuaderno Botanica Canariensis* 16: 17 (1972). Type: *Thesium canariensis* (W.T.Stearn) J.C.Manning & F.Forest.

Thesium canariensis *(W.T.Stearn) J.C.Manning & F.Forest*, comb. nov. *Kunkeliella canariensis* W.T.Stearn in Cuaderno Botanica Canariensis 16: 18 (1972).

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POLYGALACEAE

THE REINSTATEMENT OF *POLYGALA AFFINIS* AND THE IDENTITY OF *POLYGALA SCABRA*

INTRODUCTION

Polygala affinis DC. was generally accepted as a species endemic to South Africa and Namibia, occurring from the Western Cape in the south and extending northwards to Namibia and eastwards to the Eastern Cape (see e.g. Harvey 1860 and Levyns 1955) until Paiva (1998), in his treatment of the genus *Polygala* L. in Africa, considered it to be a synonym of *Polygala scabra* L., a name that was not listed in the main regional revisions of the genus (Harvey 1860; Levyns 1955).

This synonymy (Paiva 1998) was based on the assumption that the holotype of *Polygala scabra* was a specimen kept at G (Herbarium of the Conservatoire et Jardin botaniques de la Ville de Genève) and that this specimen was also the holotype of *P. affinis*. If the two names were indeed based on the same type, the earlier one would have priority, and *P. scabra* L. (1753) would take precedence over *P. affinis* DC. (1824). Recent literature has accepted Paiva's use of the name *P. scabra* (e.g. Goldblatt & Manning 2000).



FIGURE 1.—Illustration in Plukenet (1705: 153, t. 440, f.6), that we designate as lectotype of the name *Polygala scabra* L.

However, as shown by Jarvis (2007), the specimen at G cannot be the holotype of *Polygala scabra* because it is not part of the original material and was not examined by Linnaeus when he described the species. The original material of *P. scabra* consists of two illustrations and one reference only. No specimens are known to be part of the original material. An examination of the illustrations reveals a misinterpretation of the identity of *P. scabra*. The illustrations show a plant with terminal inflorescences, while in *P. affinis* the inflorescence is lateral and leaf-opposed, a diagnostic character. Therefore the two taxa are not conspecific. The name *Polygala affinis* is thus reinstated here as the accepted name for the species.

The original material for *Polygala scabra* is listed by Jarvis (2007) and comprises:

1. An illustration in Plukenet (1705: 153, t. 440, f. 6).
2. A reference in Plukenet (1700: 153).
3. An illustration in Burman (1739: 204, t.73, f.4) imaged and accessible at http://books.google.co.za/books/about/Rariorum_Africanarum_plantarum_decas_pri.html?id=z5lWBmJncwMC&redir_esc=y.

As there are no known specimens among the original material, the illustration in Plukenet (1705: 153, t. 440, f.6), showing more detail, is here designated as lectotype (Figure 1).

The illustrations in Plukenet's work were mostly based on specimens that are now kept in the Sloane Herbarium, at The Natural History Museum, in London. One of the specimens of *Polygala* in that Herbarium (HS 94: 108) closely resembles the illustration designated here as lectotype and appears to be the one that was used to draw that figure. However, the specimen cannot be considered as original material since it was not examined by Linnaeus.

Based on the illustrations, *Polygala scabra* could arguably be a synonym of *Polygala bowkerae* Harv., Fl. Cap. (Harvey) 1: 92 (1860) and would have priority over that name. It is our opinion that the type is too poor to enable definite and unambiguous identification, therefore this name is left as unplaced.

Polygala affinis *DC.*, Prodromus systematis naturalis regni vegetabilis 1: 322 (1824). Type: South Africa, without precise locality or collector (G holo.).

Polygala burmanii DC. : 322 (1824) [as '*burmanni*']. Type: South Africa, [Mossel Bay area] on dry hills on the Eastern side of Gouritz River, *Burchell 6437* (K000231663, lecto.!, designated by Paiva 1998: 268 as 'holo-'; G00210296!, PRE0259681-0!, isolecto.).

Polygala agnipila Gand.: 455 (1913). Type: South Africa, Western Cape, Saron, *Schlechter 4879* (PRE,lecto.!, designated here).

Polygala scabra *L.*, Species plantarum 2: 703 (1753). Type: Illustration in Plukenet: 153, t. 440, f. 6 (1705), lecto., designated here.

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ISOËTACEAE

ISOËTES AEMULANS, A NEW SPECIES FROM SOUTH AFRICA

Isoëtes L. is a genus of ± 130 (Jermy 1990) to ± 150 (Taylor *et al.* 1993) species and is cosmopolitan in distribution. The species are generally associated with seasonal or permanent water bodies and may be amphibious, aquatic, or terrestrial. *Isoëtes* is represented in South Africa by 11 species from the summer and winter rainfall regions of the country. Most of the species are local endemics, (Roux 2009) often with restricted distributions.

Due to the cryptic stature of most *Isoëtes* species, they are mostly not well represented in herbaria and the species are poorly understood. During a review of *Isoëtes* in sub-Saharan Africa that was undertaken by the author, a new species was identified and is described here as *I. aemulans*.

Isoëtes aemulans *J.P.Roux*, sp. nov.

TYPE.—South Africa, 2828 (Bethlehem) Free State. Phuthaditjhaba, in shallow seasonal pan (–DD), 14 Jan. 1987, *J.P. Roux 1911* (NBG0143672-0, holo.).

Plants amphibious or aquatic. *Rhizomorphs* buried to 20 mm below substrate, dark brown, globose, to 5 mm tall, to 14 mm in diameter, 3-lobed, lobes weakly developed, with a large number of simple or dichotomously branched roots borne along rhizomorph fossae, roots pale to dark brown, with or without root hairs, root hairs borne on trichoblasts, if phyllopodia present then mostly less than 3 mm long, dark brown to black, glossy, centrally thinly crustaceous, marginally thinly chartaceous, arrested lycophyll primordia not observed. *Lycophylls* caespitose, herbaceous, erect, to 50 per plant, acicular, to 130 mm long, to 4.5 mm wide at spathulate base, with dorsilateral hyaline alae to 1 mm wide extending to 30 mm along the base of lycophyll, alae decrescent to obtuse; *subulae* pale to dark green, subulate, to 105 mm long, terete higher up, to 2.5 mm in diameter above the alae, convex abaxially, shallowly sulcate adaxially, gradually tapering to an acicular apex; *epidermal cells* at basal part of lycophylls oblong with near straight anticlinal walls, cells towards the lycophyll apices oblong to square, with near straight to slightly curved anticlinal walls, regularly with a single or more rows of narrower and longer epidermal cells above peripheral fibre strands; *stomata* absent or present, if present then in up to 4 rows along lacunae, often confined to the lycophyll apex, guard cells (40–)53(–70) µm long, mostly surrounded by small, irregularly shaped epidermal cells; *hypodermal collenchyma* absent; *peripheral fibre strands* present, mostly 3 in abaxial part of lamina, opposite lacuna walls, more numerous and smaller towards lycophyll apices; *cuticle* thin, faintly longitudinally striate; *translacunar septae* more than one cell layer thick, aerenchyma cells with short arms, pores triangular; *intrastelar canals* 1 to 3; *lacunae* without idioblasts; *ligules* membranous, hyaline, ovate-auriculate to deltoid, to 2.6 × 1.8 mm, central cushion papillate, margins fimbriate; *labia* acute; *velae* complete, or rarely with an opening < 0.5 mm in diameter at lycophyll base, cells polygonal in outline, with near straight to strongly curved anticlinal walls. *Sporangium sack cells* oblong to rectangular, near straight to gently curved, the anticlinal walls gently curved. *Sporangia* with brown walls, without strengthening cells, cells stacked, elongate, with near-straight to gently curved transverse walls; *megasporangia* elliptic in frontal view, to 4 × 2.5 mm, frontal face margins rounded; *microsporangia* unknown. *Megaspores* dimorphic, chalk-white to pale grey when dry, blackish when wet, tetrahederal-globose, with a broad equatorial ridge and laesura, the proximal and distal faces with low verrucae, the larger spores (472–)492(–536) µm in equatorial diameter, the smaller spores (296–)339(–424) µm in equatorial diameter; *microspores* unknown. *Chromosome number*: unknown. Figures 1–3.

Etymology: *aemulans*—more-or-less equal, or similar, with reference to the similar appearance of this species

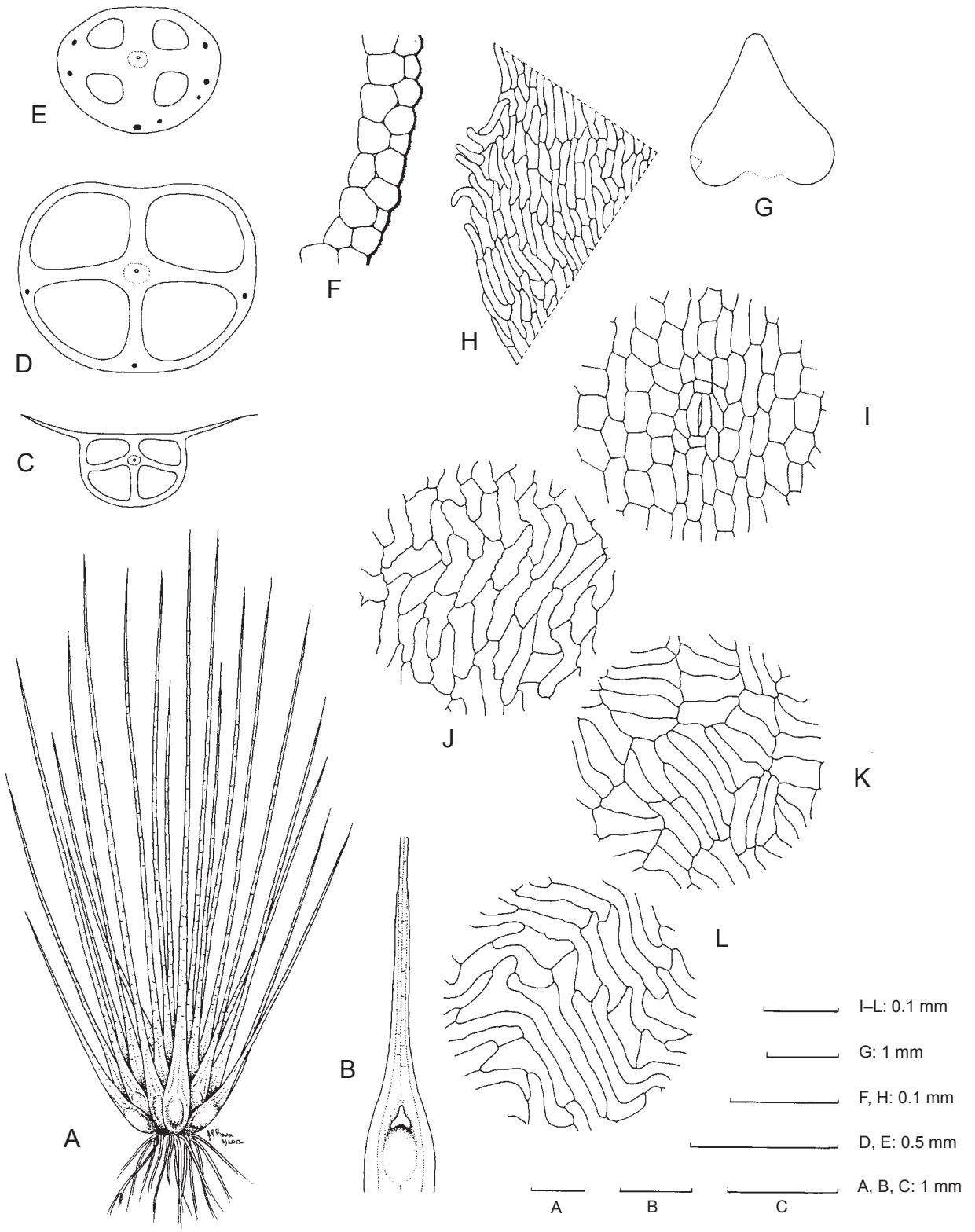


FIGURE 1.—*Isoëtes aemulans* J.P.Roux, sp. nov., *Roux 1191* (NBG). A, habit; B, adaxial view of fertile lycophyll base; C–E, sections through lycophyll; C, section above sporangium; D, section above alae; E, section near apex; F, section of lycophyll wall; G, ligule; H, section of lycophyll showing cellular structure; I, epidermis above lacuna showing stoma; J, cellular structure of velum; K, cellular structure of sporangium wall; L, cellular structure of sporangium sack. Artist: J.P. Roux.

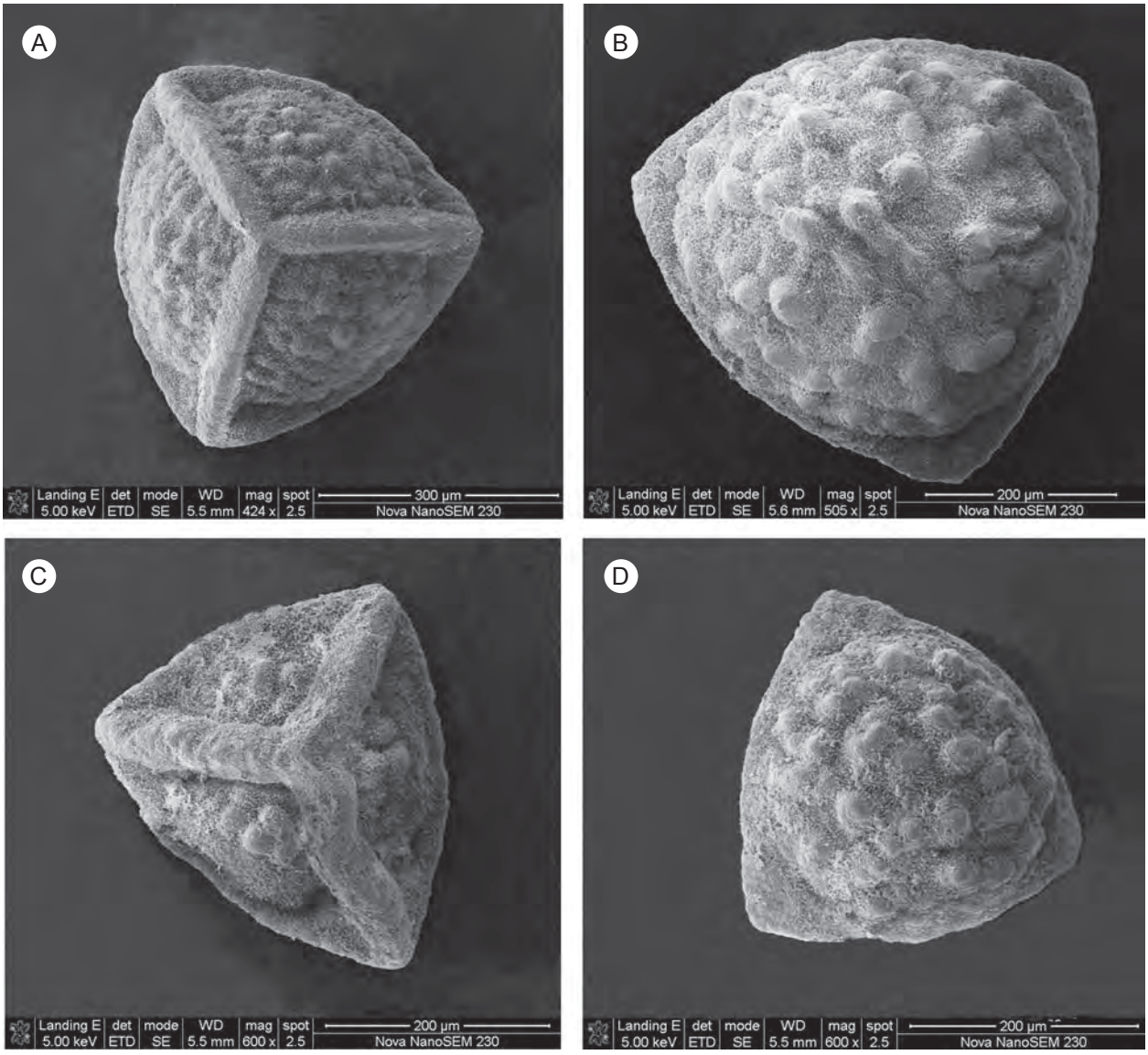


FIGURE 2.—Megaspores of *Isoëtes aemulans*, *Roux 5278* (NBG). A, proximal view of larger spore; B, distal view of larger spore; C, proximal view of smaller spore; D, distal view of smaller spore.

and *I. labri-draconis* N.R.Crouch, with which it is partly sympatric.

Distribution and ecology: *Isoëtes aemulans* occurs in the eastern summer rainfall region of South Africa. The species is known from Mpumalanga, Free State and KwaZulu-Natal from 1 300–2 420 m. Within this area the species occupies a range of habitats, including shallow seasonal pans, rock pools and seeps over sheetrock. In the southern Drakensberg region, it chiefly occurs on Clarens Sandstone and only rarely extends onto the overlying basalt formation.

Diagnostic features and relationships: *Isoëtes aemulans* differs from *I. labri-draconis* in it being a more robust species bearing more (up to 50 vs. 13 in *I. labri-draconis*) and longer (up to 130 mm long vs. 90 mm in *I. labri-draconis*) lycophylls with peripheral fibre strands in the lycophylls, and in the dimorphic megaspores. Dimorphic megaspores develop within the same sporangia.

Isoëtes aemulans was previously included in a broadly defined *I. transvaalensis* Jermy & Schelpe. *Isoëtes transvaalensis* is characterised by monomorphic megaspores with the proximal faces having a few low and inconspicuous verrucae, the distal face is near levigate with a few small and low verrucae, the lycophylls lack fibre bundles, and the epidermal cells towards the lycophyll apices are isodiametric to polygonal in outline, with near straight to gently curved and often much thickened anticlinal walls.

Additional specimens examined

MPUMALANGA.—**2430** (Pilgrim's Rest): Mariepskop (–DB), 18 Jan. 1969, *O. Hilliard & B.L. Burtt 5989* (NU, PRE); Mariepskop, *H.P. van der Schyff 6353* (BOL, PRU). **2528** (Pretoria): Quarry near Balmoral off-ramp in N4 (–DD), 7 Jan. 1984, *J.E. Burrows 5908* (PRE); **2530** (Lydenburg): On Kruisfontein road (–AC), *J.E. Burrows 3297* (BOL).

FREE STATE.—**2827** (Senekal): Excelsior, Korannaberg (–CC), 9 Mar. 1989, *J. du Preez 1942* (PRE); Korannaberg, Farm Wesselskloof (–CD), 20 Mar. 2011, *J.P. Roux 5278*, *5279*, *5281* (NBG). **2828** (Beth-

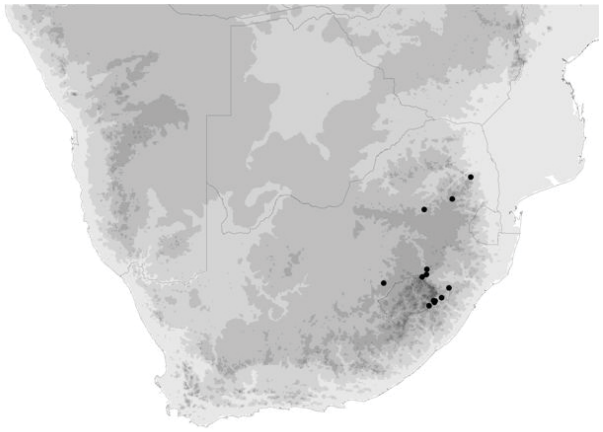


FIGURE 3.—Distribution of *Isoëtes aemulans*.

lehem): Qwa-Qwa, in seasonal pools (–DB), 16 Jan. 2007, *J.P. Roux 4219* (NBG); Witsieshoek, 16 Feb. 1981, *J.P. Roux 955* (NBG). **2829** (Harrismith): Harrismith, Bakerskop, (–AC), 23 Nov. 1982, *J.P. Roux 1277* (NBG); 4 Mar. 2002, *J.P. Roux 3348* (NBG); 21 Mar. 2011, *J.P. Roux 5286*, 5288, 5289 (NBG); Harrismith, Farm Windmill (–CA), 12 Jan. 1982, *J.P. Roux 1070* (NBG); Farm Klavervlei, 22 Mar. 2011, *J.P. Roux 5292, 5293, 5295, 5296* (NBG). **2927** (Maseru): Thaba Patswa (–AC), 12 Jan. 1989, *J. du Preez* 883 (BLFU).

KWAZULU-NATAL.—**2829** (Harrismith): Estcourt, Griffin's Hill (–DD), J.P. Roux 3334 (NBG); **2929** (Underberg): Mulangane Ridge, above Carter's Nek (–BC), *O.M. Hilliard & B.L. Burtt 17582* (NU); Cobham Forest Reserve, Sipongweni Caves (–CB), 14 Apr. 1974, *O.M. Hilliard 5531* (BOL, NU); Bushman's Nek, Thamathu Cave (–CC), 5 Feb. 1976, *O.M. Hilliard & B.L. Burtt 8961* (PRE); Sani Pass, 6 Feb. 2010, *J.P. Roux 4748* (NBG).

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ACANTHACEAE & LAMIACEAE

NOMENCLATURAL CORRECTIONS IN *JUSTICIA* AND *LEONOTIS*

The taxonomic changes effected in the recent edition of *Plants of the Greater Cape Floristic Region 1: The Core Cape Flora* (Manning & Goldblatt 2012) include three nomenclatural errors in *Justicia* L. (Acanthaceae) and *Leonotis* (Pers.) R.Br. (Lamiaceae). These were kindly pointed out by Lize von Staden of the South African National Biodiversity Institute, and are corrected here.

ACANTHACEAE

Justicia linifolia *(Lindau) V.A.W.Graham* in Kew Bulletin 43: 618 (1988). *Aulojusticia linifolia* Lindau: 325 (1897). *Siphonoglossa linifolia* (Lindau) C.B.Clarke: 75 (1901). *Justicia linifolia* (Lindau) J.C.Manning & Goldblatt: 790 (2012), nom. superfl. [non *J. linifolia* B.Heyne *nom. nud.* in Wallich (1830)].

The combination in *Justicia* for *Aulojusticia linifolia* Lindau (1897) was provided by Graham (1988), rendering our combination superfluous.

Justicia tubulosa *(E.Mey ex Nees) T.Anders.* in Journal of the Linnean Society (Botany) 7: 41 (1863). *Adhatoda tubulosa* E.Mey. ex Nees: 392 (1847). [*J. tubulosa* E.Mey. *nom. nud.* in Drège: 196 (1843)].

Gendarussa leptantha Nees: 372 (1841). *Justicia leptantha* (Nees) Lindau: 349 (1895), hom. illegit., non *Justicia leptantha* (Nees) T.Anders. (1863). *Siphonoglossa leptantha* (Nees) Immelman: 209 (1989).

Justicia tubulosa subsp. **late-ovata** *(C.B.Clarke) J.C.Manning & Goldblatt*, comb. nov. *Justicia pulegioides* var. *late-ovata* C.B.Clarke in W.T. Thiselton-Dyer in Flora capensis 5,1: 62 (1901). *Siphonoglossa leptantha* subsp. *late-ovata* (C.B.Clarke) Immelman: 209 (1989). *Justicia leptantha* subsp. *late-ovata* (C.B.Clarke) J.C.Manning & Goldblatt: 790 (2012).

The combination *Justicia leptantha* (Nees) Lindau (1895) [= *Gendarussa leptantha* Nees (1841)] is an illegitimate homonym for the Madagascan *J. leptantha* (Nees) T.Anders. (1863) [= *Rhaphidospora leptantha* Nees (1847)]. The correct name in *Justicia* for the mainland species is *J. tubulosa* (E. Mey. ex Nees) T.Anders., for which we provide the necessary new combination for subsp. *late-ovata*.

Although traditionally attributed solely to Nees, the full author citation for the basionym should be *Adhatoda tubulosa* E.Mey. ex Nees on the presumption that Nees's (1847) citation of Meyer's *Justicia tubulosa* (published

without description in Drège 1843) is an indication that he was taking it up in *Adhatoda*.

LAMIACEAE

Leonotis pentadentata *J.C.Manning & Goldblatt*, nom. nov. pro *Lasiocorys capensis* Benth., Labiatarum genera et species 6: 600 (1834) [non *Leonotis capensis* Raf. (1836) = *Leonotis ocymifolia* (Burm.f.) Iwarsson]. *Leucas capensis* (Benth.) Engl.: 268 (1888). *Leonotis capensis* (Benth.) J.C. Manning & Goldblatt: 809 (2012), hom. illegit.

The combination *Leonotis capensis* (Benth.) J.C.Manning & Goldblatt (2012) proposed for *Leucas capensis* (Benth.) Engl. (1888) is an illegitimate later homonym of *Leonotis capensis* Raf. (1836). As there appears to be no available later name for *Leucas capensis* (Benth.) Engl., we propose the replacement name *Leonotis pentadentata* in allusion to the distinctive 5-toothed calyx (Codd 1985), following the precedent in *L. sexdentata* Skan.

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FABACEAE

A NEW SPECIES OF *LESSERTIA* (GALEGEAE) FROM KWAZULU-NATAL, SOUTH AFRICA

INTRODUCTION

Balkwill & Balkwill (1999) recognised nine species of *Lessertia* DC. in their revision of the genus for KwaZulu-Natal, including three previously undescribed species first listed but not described by Ross (1972), all with linear or falcate, compressed fruits, and therefore belonging to sect. *Stenolobae* Harv. (1862). Subsequent fieldwork has revealed a fourth new species, with the subfalcate-shaped and inflated fruits typical of sect. *Platylobae* Harv. (Harvey 1862).

Lessertia amajubica *Nkonki*, sp. nov.

TYPE.—KwaZulu-Natal, 2730 (Vryheid): Amajuba District Municipality Area, Dannhauser Municipality Area, (–BB), 9 Oct. 2006, *Ngwenya 2991* (NH, holo.; NBG, NH, PRE [2 sheets], iso.).

Decumbent, multi-stemmed perennial herb with a woody rootstock, up to 0.1 m high. *Branches* green, cano-pubescent or densely pubescent. *Stipules* lanceolate, 1–3 mm long. *Leaves* imparipinnate, 35–45 mm long; leaflets closely 6–7-jugate, oblong, 3–7 × 2–3 mm, base obcuneate, apex emarginate, densely strigose abaxially, glabrous adaxially; petioles 3–5 mm long. *Inflorescences* densely subcapitate, 8–10-flowered; peduncles longer than leaves, 45–64 mm long; pedicels 1–3 mm long; bracts oblong, 2–4 mm long, acute, pubescent with white hairs; bracteoles present at base of calyx, 1–2 mm long, pubescent with white hairs. *Flowers* 7–8 mm long, pink to purple. *Calyx* subequally 5-lobed, 3–4 mm long, strigose with white hairs; tube 1–2 mm long; lobes triangular-oblong, 2–3 mm long. *Standard* broadly ovate to suborbicular, 4–6 mm long, emarginate, glabrous; claw linear, 1–2 mm long. *Wings* 4–5 mm long, lamina oblong, as long as keel, obtuse, glabrous, without sculpturing; claw linear 1–2 mm long. *Keel* 4–5 mm long, lamina boat-shaped, obtuse, glabrous, pocket absent; claw linear 1–3 mm long. *Stamens* diadelphous; anthers monomorphic, basifixed. *Pistil* stipitate, hairy; ovary 5–6 mm long, narrowly elliptic; style ± 2–5 mm long, curved upwards, bearded terminally and along upper surface. *Fruits* subfalcate, inflated, 18–23 × 6–8 mm, sparsely hairy, ± 5–11-seeded, indehiscent. *Flowering time:* March to December. Figure 1.

Etymology: named for the type locality in the the district Amajuba.

Distribution and habitat: apparently highly localised and known only from the vicinity of Fairbreeze Village in Amajuba District near Dannhauser in KwaZulu-

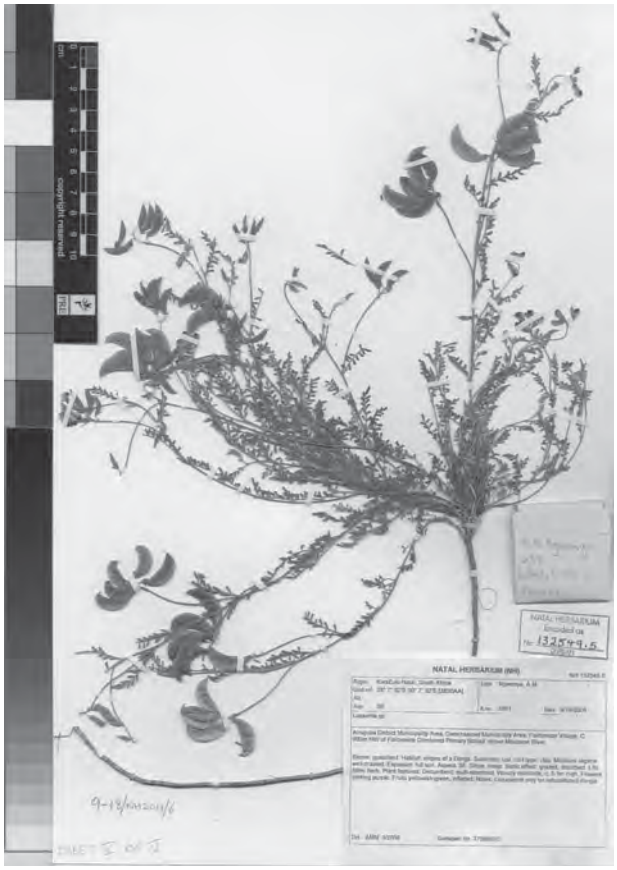


FIGURE 1.—Holotype of *Lessertia amajubica* Nkonki, *Ngwenya 2991* (NH).

Natal (Figure 4). It grows in grassland on sandstone, in well-drained soils exposed to full sun, at altitudes of 1 213–1 345 m.

Diagnostic characters: *Lessertia amajubica* is similar to *L. harveyana*, *L. stricta* and especially *L. excisa*, but differs from these species in the subcapitate inflorescence, the short leaves and leaflets, the strigose vestiture of the stems, leaves and calyx, shape and relative length of the calyx lobes, and especially in the hairy ovary and markedly inflated, sparsely hairy fruits (Figures 2, 3; Table 1). The calyx lobes in *L. amajubica* are triangular-oblong, 2–3 mm long and ± twice as long as the tube; in *Lessertia excisa* the calyx lobes are broadly triangular, 1–2 mm long, and the tube 1 mm long; in *L. harveyana* narrowly triangular, 3–4 mm long with tube 2 mm long; and in *Lessertia stricta* broadly triangular, 1 mm long with tube 2–3 mm long. *Lessertia harveyana* is characterised by broad, obovate leaflets and obliquely depressed-ovate, glabrous fruits; *L. stricta* by long, oblong-lanceolate leaflets, lax inflorescences, long pedicels and long, obliquely obovoid-oblong, attenuate fruits; and *L. excisa* by its subfalcate, compressed fruits with black hairs on the calyx. Immature fruits of *Lessertia excisa* (Figure 3, B5) are almost identical to those of *Lessertia amajubica* (Figure 3, B2 & 3) in side view. It is critical to compare only mature fruits when identifying *Lessertia* species.

Only *Lessertia stricta* has a distribution potentially overlapping with *L. amajubica*; with *L. harveyana* occurring further southwards and eastwards, and *L. excisa* known only from the western parts of the Northern and Western Cape Provinces (Figure 4).

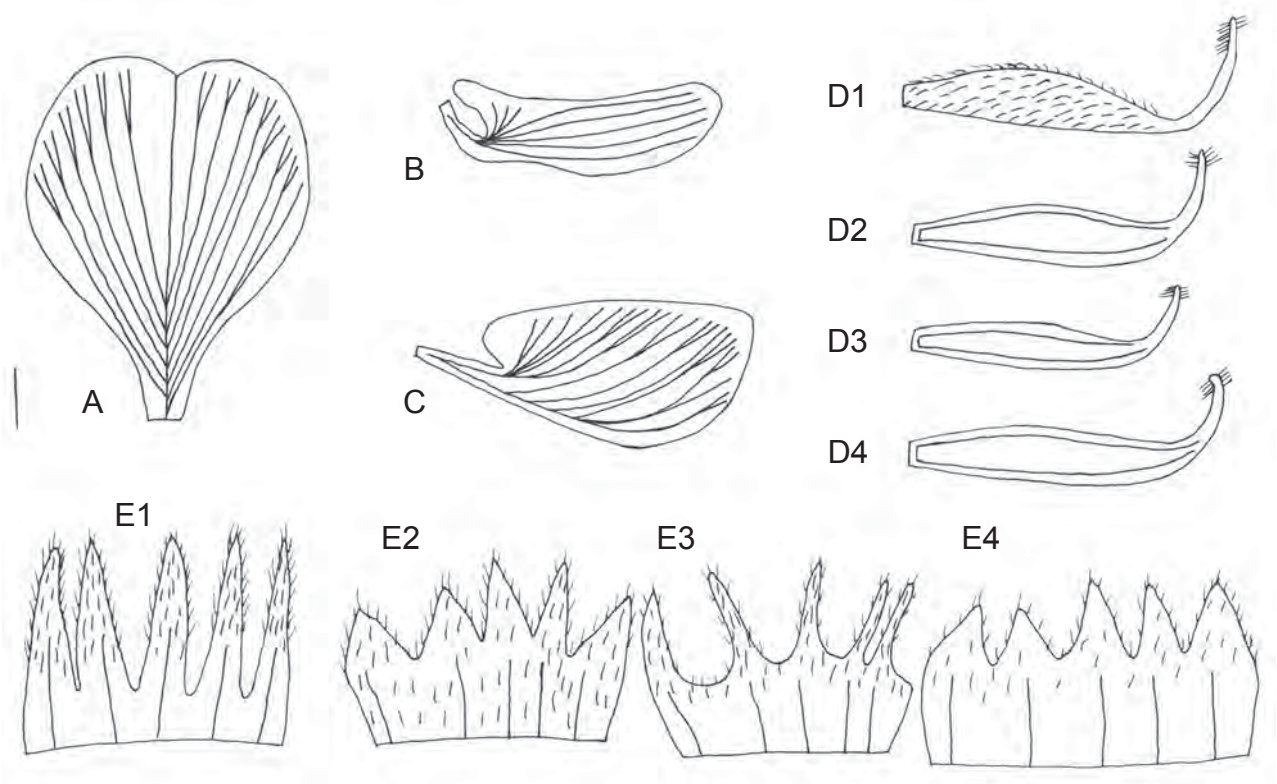


FIGURE 2.—Flower structure (calyces, petals and pistils) in *Lessertia amajubica, L. excisa, L. harveyana* and *L. stricta*. A–D1, E1, *L. amajubica, Ngwenya 548* (NH); A, standard petal; B, wing petal; C, keel petal; D1, pistil; E1, calyx. D2, E2, *L. excisa, Acocks & Hafstrom 2317* (PRE); D2, pistil; E2, calyx. D3, E3, *Lessertia harveyana, Pegler 1281* (PRE); D3, pistil; E3, calyx. D4, E4, *Lessertia stricta, Germishuizen 4367* (PRE); D4, pistil; E4, calyx. Scale bar: 1 mm.

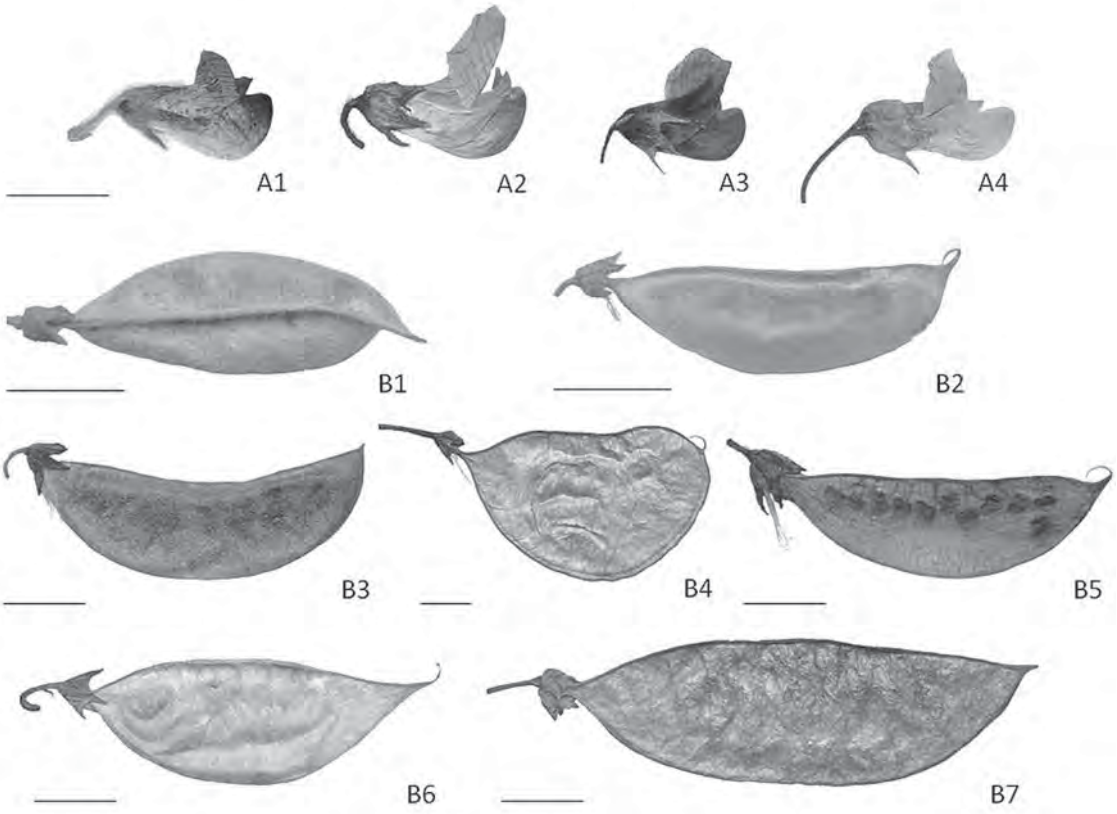


FIGURE 3.—Diagnostic characters of *Lessertia amajubica* and morphologically similar species. A, flowers. B, fruits. A1, *Lessertia amajubica* (*Ngwenya 2991*); A2, *Lessertia excisa* (*Ecklon & Zeyher 32792*, NBG); A3, *Lessertia harveyana* (*Grobbelaar 657*, PRE); A4, *Lessertia stricta* (*Junod 17375*, PRE). B1, B2, *Lessertia amajubica*, fruit in top and side views (both *Ngwenya 2991*, NH); B3, *Lessertia amajubica*, pressed fruit in side view (*Ngwenya 2991*); B4, *Lessertia excisa*, mature fruit in side view (*Zeyher 15507*, NBG); B5, *Lessertia excisa*, young fruit in side view (*Stirton 6074*, PRE); B6, *Lessertia harveyana*, mature fruit in side view (*Pienaar 561*, PRE); B7, *Lessertia stricta*, mature fruit in side view (*Dieterlen 95*, NH). Scale bars: 5 mm.

Additional specimens seen

KWAZULU-NATAL.—**2730** (Vryheid): Amajuba Dist., Dannhauser Municipality Area, Mbabane River, Fairbreeze Farm, (–CC), *Ngwenya 548* (NH). **2830** (Dundee): Fairbreeze Village, above Mbabane River, (–AD), 25 March 2010, *Ngwenya 3454* (NH); Dorenkop Village, ± 120 m from the Steildrift to Dannhauser Road, (–CA), *Ngwenya 3464* (NH).

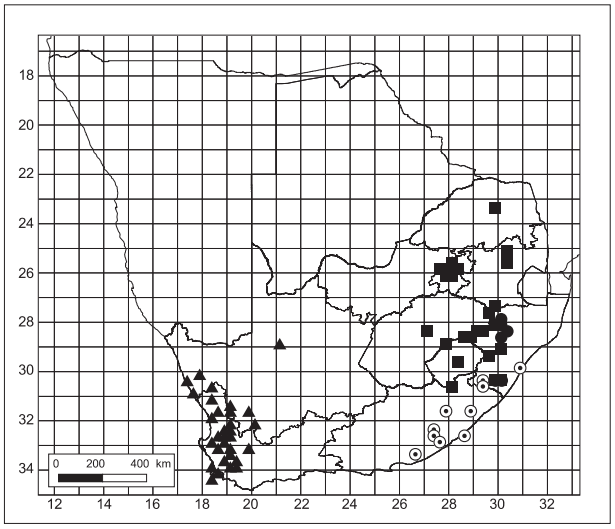


FIGURE 4.—Distribution of *Lessertia amajubica* (●), *L. excisa* (▲), *L. harveyana* (⊙) and *L. stricta* (■).

ACKNOWLEDGEMENTS

We thank Dr Hugh Glen for translating the diagnosis into Latin. Hester Steyn is thanked for preparing the distribution map. [Editor's note: as from 2012, *Bothalia* only publishes diagnoses in English, in line with the decision taken at the Eighteenth International Botanical Congress, Melbourne, Australia, July 2011 and reflected in the 2012 *International Code of Nomenclature for algae, fungi and plants* (Melbourne Code) that either English or Latin may be used for the diagnosis.]

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TABLE 1.—Major morphological differences between *Lessertia amajubica*, *L. excisa*, *L. harveyana* and *L. stricta*

Characters	*Lessertia amajubica*	*Lessertia excisa*	*Lessertia harveyana*	*Lessertia stricta*
Inflorescence	Subcapitate	Elongate	Elongate	Elongate
Fruit turgidity Fruit vestiture Fruit shape	Markedly inflated Hairy Narrowly subfalcate	Slightly inflated Glabrous Broadly subfalcate	Slightly inflated Glabrous Obliquely depressed-ovate	Slightly inflated Glabrous Obliquely obovoid-oblong
Calyx lobe shape Calyx hairs	Triangular-oblong White	Broadly triangular Black	Narrowly triangular White	Broadly triangular White
Indumentum	Densely strigose	Copious hairs	Glabrescent	Glabrescent
Leaf length Leaflet length Pedicel length	35–45 mm 3–7 mm 1–3 mm	40–80 mm 4–12 mm 1–2 mm	15–25 mm 7–11 mm 3–4 mm	40–75 mm 7–15 mm 5–7 mm

GENTIANACEAE

THE TAXONOMIC AND CONSERVATION STATUS OF *SEBAEA FOURCADEI*

INTRODUCTION

Sebaea Sol. ex R.Br. (Gentianaceae tribe Exaceae) likely consists of about 65 species, mainly in South Africa, with a few in Tropical Africa, Asia, Australia and New Zealand (Kissling *et al.* 2009a, b). The southern African species were revised by Marais (1961) and Marais & Verdoorn (1963), but no recent worldwide taxonomic treatment exists for *Sebaea*, and species estimates range from a conservative ± 60 species up to ± 150–159 species (Kissling *et al.* 2009a). *Sebaea fourcadei* was described by Marais (1961) from only two specimens collected near Humansdorp and Knysna in the Eastern Cape in South Africa. Since then only one additional specimen has been identified, collected from Hofman's Bosch near Humansdorp by L. Britten in 1919. It remained unidentified in the Selmar Schonland herbarium (GRA) until 2012. Fourcade was thought to have been the first person to discover the species, but his collection dates from 1932 and Britten was therefore the first to find it.

Sebaea fourcadei is closely allied to *Sebaea ramosissima* (Marais & Verdoorn 1963), which has a much wider and slightly more easterly distribution. The two species are both slender herbs with flowers superficially similar, but differ in that the former has capitate stigmas and smaller anthers, whereas stigmas of *S. ramosissima* are clavate. The ranges of the two species are parapatric since *S. fourcadei* has been found only east of Port Elizabeth, between Knysna and Humansdorp, whereas *S. ramosissima* occurs between Port Elizabeth and East London in the Eastern Cape and as far north as Middelburg. However, considering the morphological similarities, the possibility remained that the two might be conspecific if it was found that anther length and stigma shape were variable characters within the two species. *Sebaea fourcadei* was accordingly classified as DDT (Data Deficient with taxonomic problems) in the Red List of South African Plants (Raimondo *et al*. 2009). The flag, 'T' indicates that there is insufficient information to adequately assess its conservation status, mainly because of taxonomic uncertainty (Victor 2006).

We aimed to clarify the distinction between the two species, and to try to rediscover it in its original habitat, allowing for a better assessment of its conservation and taxonomic status.

MATERIAL AND METHODS

All herbarium specimens of *Sebaea ramosissima* Gilg. in PRE and one of *S. fourcadei* Marais housed in GRA were studied. Special attention was given to the diagnostic characters, i.e. the length of the anthers and the shape of the stigma. Type specimens were viewed on the ALUKA website (http://plants.jstor.org). Acronyms for herbaria are listed in Holmgren *et al*. (1990) and Smith & Willis (1999).

RESULTS

Morphology

Both *Sebaea fourcadei* and *S. ramosissima* are slender annual herbs, simple or branched, growing up to 25 cm high. Examination of the herbarium specimens confirmed the similarities and differences between specimens as follows. Leaf size and shape are similar, as well as inflorescence. The yellow corolla is slightly smaller in *S. fourcadei*, with the tube measuring 3–4 mm long and lobes 2.7–3.5 mm long, whereas in *S. ramosissima* the flowers are larger with the tube 3.5–6.0 mm long and lobes 5.5–8.0 mm long. The most distinctive characters separating the two species are the capitate stigma in *S. fourcadei*, whereas in *S. ramosissima* the stigma is clavate; in addition, the anthers of *S. fourcadei* are much smaller, up to 1.25 mm long, whereas those of *S. ramosissima* are 2–3 mm long. These differences are consistent across specimens examined, and we therefore confirm that the two species are distinct.



FIGURE 1.—Belvedere, the settlement in Humansdorp where *Sebaea fourcadei* used to occur. Photographer: J.E. Victor.

Ecology

Field trips were undertaken in September 2011 and December 2012 to search the Knysna and Humansdorp sites to rediscover the species. Unfortunately, the known localities at Belvedere, near Knysna (Figure 1) and the farm Geelhoutboom, near Humansdorp, are now transformed by residential development and agricultural practices. It is therefore unlikely that *S. fourcadei* still exists there. We also searched possible habitats nearby, e.g. Goukamma Nature Reserve but were unable to relocate the species.

Specimens examined

Sebaea fourcadei

EASTERN CAPE.—**3424** (Humansdorp): Geelhoutboom, Lower Tsitsikimma, 500' [132 m], (–BB), Nov. 1932, *H.G. Fourcade 4880*, (Bolus, iso.—ALUKA image!); Hofman's Bosch, Jan. 1919, *Britten 1110* (GRA!); **3423** (Knysna): Belvedere, (–AA), Oct. 1931, *V.A. Duthie* 1175, (K, —scanned image!).

Sebaea ramosissima

EASTERN CAPE.—**3326** (Bathurst): (–DB) *Burchell 3784* (K—ALUKA image!, PRE!, syn.); **3227** (King William's Town): (–CD) *Tyson 3129*, (SAM.—ALUKA image!, syn.); Cape, *Ecklon 661* (M.—ALUKA image!). **3124** (Graaff Reinet): Old Wapadsberg Pass road, (–DD), 26 Nov. 1977, *Hilliard 10688* (PRE). **3124** (Middelburg): Compassberg farm, (–AD), 1 Mar. 1962, *Acocks 22090* (PRE). **3226** (Mpofu Game Reserve): Intloni area Section 9. Upper Blinkwater River area, (–DA), 2 Feb. 2006, Von Staden. **3226** (Mpofu Game Reserve): Public road to post Retief Conservancy, (–DA), 28 Feb. 2006, *Bredenkamp 3329* (PRE). **3227** (King William's Town): Hatcheries, Pirie forest, (–CC), 9 Nov. 1901, *Galpin 5933* (PRE). **3326** (Partly: Southwell): Lower Albany, (—BA), Nov. 1893, *Schonland 780* (PRE). **3327** (Peddie District): Bell, (–AA), Dec. 1906, *Galpin 7708* (PRE).

CONCLUSION

The two localities in which *Sebaea fourcadei* was formerly found are both transformed, and the species is unlikely to still occur there. It may still exist in suitable pristine habitats between Knysna and Humansdorp, but intensive surveys need to be conducted to rediscover this species. At present, we consider that the species may be extinct, having been unable to relocate it at the known localities due to transformation brought about by agriculture around Humansdorp and housing developments at Belvedere (Figure 1).

It is recommended that the IUCN conservation status of *Sebaea fourcadei* be changed to CR: PE (Critically Endangered, possibly extinct).

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ASTERACEAE

SENECIO PSEUDOLONGIFOLIUS, A NEW NAME FOR THE MISAPPLIED *S. LINIFOLIUS*

Senecio linifolius L. (1759) was based on a South African collection in the herbarium of J. Burman (Wijnands 1983). Linnaeus (1763) later published the replacement name *S. longifolius* L. for the species to avoid homonymy with his new combination *S. linifolius* (L.) L. (1763) for a Mediterranean species based on *Solidago linifolia* L. (1753). These two nomenclatural steps transgress two articles in the International Code of Nomenclature (McNeill *et al.* 2012): the replacement *S. longifolius* L. (1763) is superfluous and illegitimate (Art. 52), and the combination *Senecio linifolius* (L.) L. (1763) is a heterotypic later homonym of *S. linifolius* L. (1759) and therefore nomenclaturally illegitimate (Art. 53). The name *S. linifolius* L. (1759) is therefore correctly applied to the South African species. For the Mediterranean species, the earliest available name appears to be *Senecio malacitanus* Huter (1905).

The illegitimate *Senecio longifolius* L. (1763) has, however, been widely taken up and used in the taxonomic literature (e.g. Bergius 1767; Willdenow 1803; Candolle 1838; Schultz 1844; Harvey 1865; Juel 1918; Bond & Goldblatt 1984) and has also made the transition to the popular literature (Batten & Bokelman 1966). It is only recently that the name *S. linifolius* has been applied to the South African taxon (Manning & Goldblatt 2012). As currently understood, *S. linifolius* is a small shrub from the Eastern Cape, with the leaves clustered apically on basally leafless stems and abruptly differentiated from the inflorescence bracts. The terminal synflorescences are distinctly pedunculate, loose cymes with the capitula subtended by four or five supplementary bracts (bracteoles) and containing five ligulate florets each.

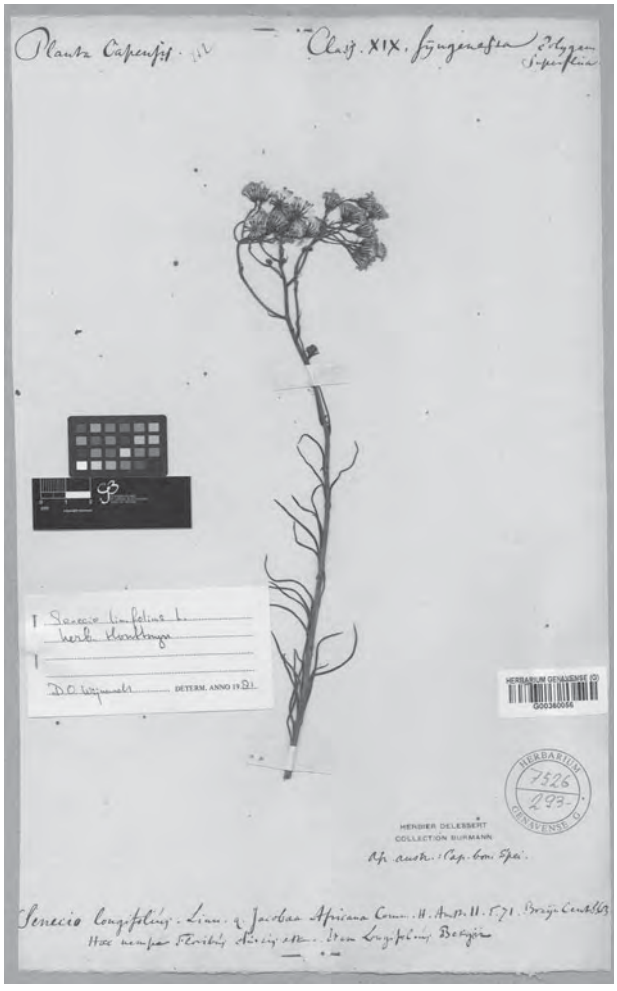


FIGURE 1.—Lectotype of *Senecio linifolius* L. (*G00360056*).

Senecio linifolius L. (1759) was lectotypified by Wijnands (1983) against a specimen in the Burman Herbarium at the Conservatoire et Jardin botaniques de la Ville de Genève (G) (Figure 1). This specimen comprises a single flowering branch. The leaves are scattered along the entire length of the stem and grade gradually into the inflorescence bracts. The capitula are subtended by numerous supplementary bracts (bracteoles) and each contains more than five ligulate florets. In none of these respects does it match the current usage of *S. linifolius* L., which appears to have been established by Harvey (1865), and whose description for the *Flora capensis* matches the current concept exactly. Harvey (1865) also included the name *Cineraria filifolia* Thunb. (1800) as a synonym of *S. longifolius* L. The collection under this

name in Thunberg's herbarium (UPS-THUNB19915) is consistent with this interpretation of the name (Figure 2).

It is evident, therefore, that the name *S. linifolius* L. has been incorrectly applied since Harvey's (1865) time. From the Burman lectotype, it appears to us to closely resemble *S. burchellii* DC., *S. inaequidens* DC. or an allied species, but this group is in need of a comprehensive taxonomic revision and its precise identity remains to be established.

As an aside, the name *S. odontophyllus* Wallich ex C.Jeffrey (1992), published by Jeffrey (1992) as a replacement name for the Indian species until then known under the illegitimate later homonym *S. linifolius* (Wallich ex DC.) C.B.Clarke (1876) [non *S. linifolius* L. (1759)], was mistakenly applied to *S. linifolius* L. by Goldblatt & Manning (2000) but later corrected (Goldblatt & Manning 2010).

What, then, is the correct name for the Eastern Cape taxon currently treated as *S. linifolius*? The transfer to *Senecio* of the only available name, *Cineraria filifolia* Thunb. (1800), is unfortunately blocked by the existence of *S. filifolius* P.J Bergius (1767). C.H. Schultz (1844) included the manuscript name *S. pseudolongifolius* as a synonym of *S. longifolius* in his *Compositae Kraussianae*, and this name remains invalidly published (MacNeill *et al.* 2012: Art. 34.1). The relevant material to which this name applies is a collection made by C.F. Krauss during April and June 1839 near Uitenhage in Eastern Cape under the number 552. We have located two duplicates of this collection, one at TUB, comprising four fragments, and the other at MO comprising a single fragment. Krauss's collection is consistent with the current interpretation of *S. linifolius* in both morphology and locality, making it clear that Schultz interpreted the species as currently understood. We therefore validate the name *S. pseudolongifolius* as a replacement name for *Cineraria filifolia* Thunb. (1800).

Senecio linifolius [as '*linifolia*'] *L.*, Systema naturae, ed. 10, 2: 1215 (1759). *S. longifolius* L.: 1222 (1763), nom. illegit. superfl. Type: 'Habitat ad Cap. b. spei.', herb. Burmann [G00360056, lecto., designated by Wijnands: 83 (1983)].

Senecio malacitanus *Huter* in Oesterreichische botanische Zeitschrift; gemeinütziges Organ für Botanik 55: 402 (1905). Type: Herb. Huter.

Solidago linifolia L.: 881 (1753). *Senecio linifolius* (L.) L.: 1220 (1763), hom. illegit. [non *Senecio linifolius* L. (1759)]. Type: '*Iacobaea Linifolio Hispanica et Ital.'*, illustration in Boccone: t. 49 (1697) [lecto., designated by Wijnands: 83 (1983)].

Senecio odontophyllus *Wallich* [*Aster odontophyllus* Wallich, nom. nud. in Cat. no. 3285 comp. no. 395] *ex C.Jeffrey* in Kew Bulletin 47(1): 95 (1992), as a replacement name for *S. linifolius* (Wallich ex DC.) C.B.Clarke: 202 (1876), non *S. linifolius* L. (1759). *Doronicum linifolius* Wallich [*Aster linifolius* Wallich, nom. nud in herb.] ex DC.: 322 (1838). Type: India, 'Khasia', Herb. Wallich.



FIGURE 2.—Lectotype of *Cineraria filifolia* [*Senecio pseudolongifolius*] (*Thunberg s.n. UPS-THUNB19915*).

Senecio pseudolongifolius *Sch.Bip. ex J.Calvo*, nom. nov. pro *Cineraria filifolia* Thunb., Prodr. Pl. Cap.: 154 (1800) [non *Senecio filifolius* P.J.Bergius (1767)]. Type: South Africa, *Cap. bonae Spei*, without precise locality or date, *C.P. Thunberg s.n.* (UPS-THUNB19915, lecto., designated here).

Senecio pseudolongifolius Sch.Bip. in Flora 27(2): 699 (1844), nom. inval. pro syn. *S. longifolius* L.

Senecio longifolius sensu Harv. (1865), non L. (1759).

Senecio odontophyllus sensu Goldblatt & Manning (2000), non [Wallich ex] C.Jeffrey (1992).

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HYACINTHACEAE

FIVE NEW COMBINATIONS IN ORNITHOGALOIDEAE IN SOUTHERN AFRICA AND A RECOMMENDATION FOR OPTIONAL COMBINATIONS IN THE SUBFAMILY

Ethesia tanquana Mart.-Azorín & M.B.Crespo (Martínez-Azorín & Crespo 2012), *Stellarioides chartacea* Mart.-Azorín *et al.* (Martínez-Azorín *et al.* 2013a) and *Trimelopter craibii* Mart.-Azorín *et al.* (Martínez-Azorín *et al.* 2013b) (Hyacinthaceae: Ornithogaloideae) are recently described novelties from southern Africa. They were named following the generic classification of the subfamily proposed by Martínez-Azorín *et al.* (2011), one of two recent classifications for the subfamily derived from substantively the same molecular phylogeny. The alternative classification adopted by Manning *et al.* (2009) is the preferred option among southern African botanists, where it has been adopted by the major herbaria in the country (e.g. BOL, NBG, PRE). We provide combinations for the three new taxa in this classification to permit their integration into collections and literature.

Ornithogalum recurvum Oberm. (1971) was treated as a synonym of *O. stapffii* Schinz until resurrected by Martínez-Azorín & Crespo (in press). We provide the necessary combination in *Albuca*.

We also provide the new combination *Albuca comosa* (Welw. ex Baker) J.C.Manning & Goldblatt, based on *Urginea comosa* Welw. ex Baker (Baker 1874), as the correct name for the species known until now as either *Ornithogalum pulchrum* Schinz or *Albuca pulchra* (Schinz) J.C.Manning & Goldblatt. The transfer of this basionym to *Ornithogalum* was precluded by the existence of the earlier *Ornithogalum comosum* L. (1753), but we overlooked its availability in *Albuca* until alerted to this fact by Martínez-Azorín & Crespo (2013).

Finally, we recommend that all future descriptions of species and any new combinations in Ornithogaloideae include an optional combination in the alternative classification (i.e. Manning *et al.* 2009 or Martínez-Azorín *et al.* 2011) to obviate the necessity for separate publication of these combinations, and to facilitate their direct integration into existing collections and databases.

Albuca chartacea *(Mart.-Azorín* et al.*) J.C.Manning & Goldblatt*, comb. nov. [subg. *Urophyllon* (Salisb.) J.C.Manning & Goldblatt]. *Stellarioides chartacea* Mart.-Azorín *et al.* in Phytotaxa 85: 2 (2013).

Albuca craibii *(Mart.-Azorín* et al.*) J.C.Manning & Goldblatt*, comb. nov. [subg. *Monarchos* (U.Müll.-Doblies & D.Müll.-Doblies) J.C.Manning & Goldblatt]. *Trimelopter craibii* Mart.-Azorín *et al.* in Phytotaxa 87: 52 (2013).

Albuca comosa *(Welw. ex Baker) J.C.Manning & Goldblatt*, comb. nov. [subg. *Namibiogalum* (U.Müll.-Doblies & D.Müll.-Doblies) J.C.Manning & Goldblatt]. *Urginea comosa* Welw. ex Baker in Transactions of the Linnaean Society London, Botany 1: 247 (1878).

Urginea angolensis Baker: 364 (1874). *Battandiera angolensis* (Baker) Mart.-Azorín & M.B.Crespo: 2 (2013). [Transfer of this, the oldest epithet for the species, to *Albuca* is blocked by the name *A. angolenesis* Welw. (1859)].

Ornithogalum pulchrum Schinz: 221 (1890). *Albuca pulchra* (Schinz) J.C.Manning & Goldblatt in Manning *et al.*: 92 (2009).

Albuca recurva *(Oberm.) J.C.Manning & Goldblatt*, comb. nov. [subg. *Namibiogalum* (U.Müll.-Doblies & D.Müll.-Doblies) J.C.Manning & Goldblatt]. *Ornithogalum recurvum* Oberm. in Bothalia 10: 357 (1971). *Battandiera recurva* (Oberm.) Mart.-Azorín & M.B.Crespo: 3 (2013).

Ornithogalum tanquanum *(Mart.-Azorín & M.B.Crespo) J.C.Manning & Goldblatt*, comb. nov. [sect. *Xanthochlora* (U.Müll.-Doblies & D.Müll.-Doblies) J.C.Manning & Goldblatt]. *Ethesia tanquana* Mart.-Azorín & M.B.Crespo in Anales del Jardín Botánico de Madrid 69: 203 (2012).

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GERANIACEAE

PELARGONIUM PACHYPODIUM (SECT. *OTIDIA*), A NEW SPECIES FROM NORTHERN CAPE, SOUTH AFRICA

Pelargonium L'Hér. ex Aiton is a genus of ± 250 species distributed throughout Africa and Madagascar into the Middle East, Australia, and St Helena (Vorster 2000). It has its centre of diversity in southwestern South Africa, where it constitutes the third largest genus in the Cape Floristic Region, with 148 species recorded (Goldblatt & Manning 2000).

Currently 16 sections are recognised in the genus (Bakker *et al.* 2004), of which several have been subject to full or partial taxonomic review. Sect. *Otidia* (Sweet) DC. is a group of ± 25 species, some distinctive and isolated but others closely related and hardly distinguishable from one another (Becker & Albers 2009). Most species show xeromorphic growth with succulent stems and with the posterior (upper) petals eared above their bases (Becker & Albers 2005). Sect. *Otidia* is restricted to the dry areas of the winter rainfall region of Western Cape and the coastal region of Northern Cape (Dreyer *et al*. 1992). The section was partially reviewed by Becker & Albers (2005, 2009). *Pelargonium pachypodium* is a new species from the Hantam in Northern Cape.

Pelargonium pachypodium *J.P.Roux*, sp. nov.

TYPE.—Northern Cape, 3119 (Calvinia), foot of Keiskie Mountain, farm Keiskie, 31°39.235'S, 19°53.811'E, (–DB), 1,257 m, 16 Dec. 2011, *C. Ficq & J. Ball s.n.* (NBG, holo.).

Suffrutex with subterranean or partially exposed subsucculent, globose caudex to 40 mm diam., from which 1–4 perennial aerial branches arise. *Aerial branches* golden-green, firmly herbaceous, terete, to 250 mm long, 2–4 mm in diam., mostly simple or with one or more short branches distally, retrorsely strigulose initially but later glabrous, hairs unicellular, subulate, to 95 µm long, closely tuberculate. *Leaves* summer deciduous, mid-green, widely spaced; *stipules* firmly herbaceous, caducous, narrowly triangular, to 2.2 mm long, to 1.5 mm wide, strigulose; *petiole* terete, 8–12 mm long, strigulose, hairs to 160 µm long; *lamina* pinnatisect, oblong to elliptic in outline, 10–70 × 10–15 mm, carnose, pinnae alternate, rhomboid to obtrullate, to 7 × 6 mm, plicate, unequally lobed, lobes narrowly to broadly cuneate, adaxially and abaxially strigulose; *rachis* persistent as stramineous, fibre-like appendage. *Inflorescences* termi-

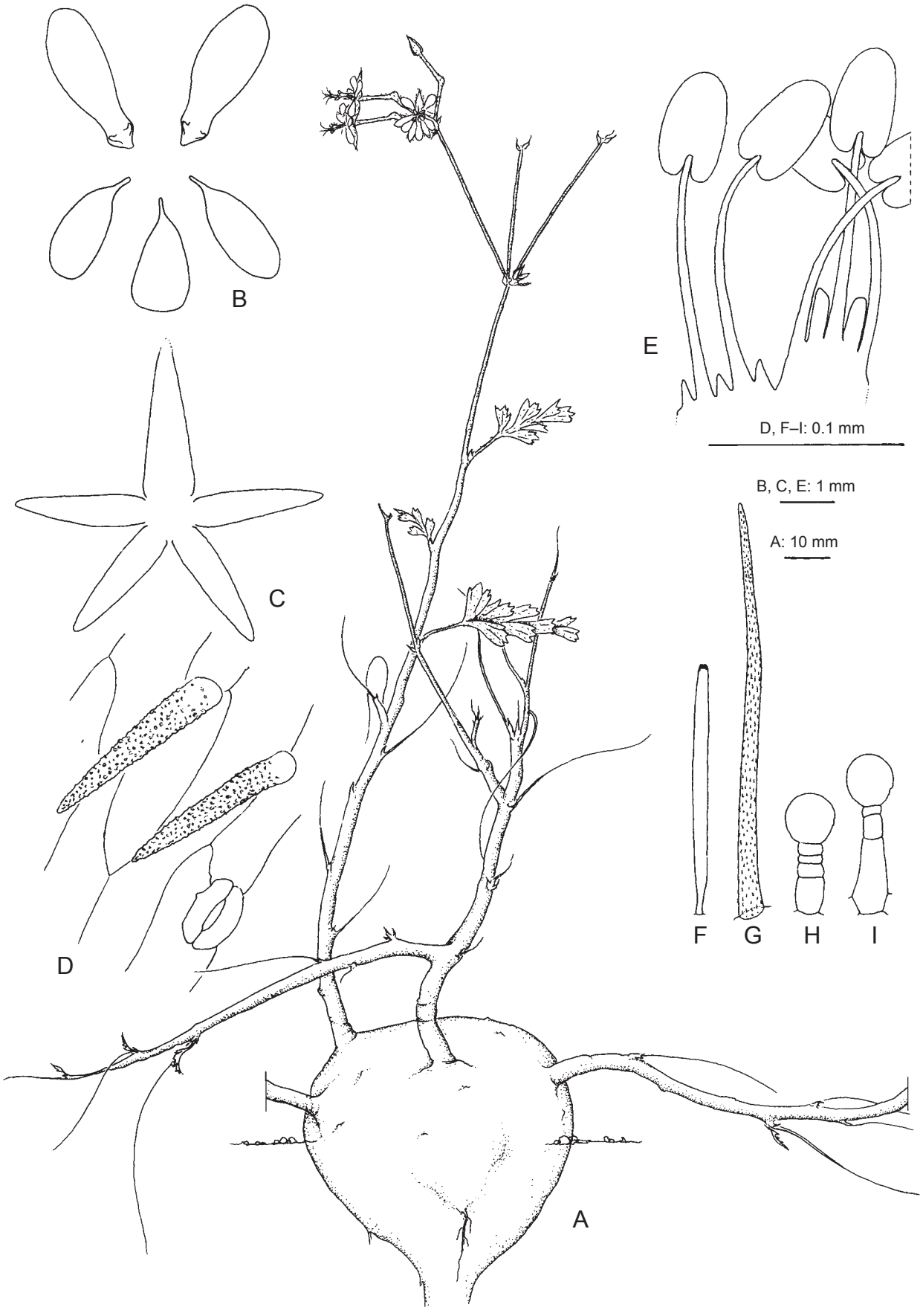


FIGURE 1.—Habit and floral parts of *Pelargonium pachypodium*. A, habit; B, petals; C, sepals; D, verruculate retrorse hairs on abaxial surface of sepals; E, androecium; F, cylindrical hair from carpel; G, verruculate hair from style; H & I, glandular hairs from style. Scale bars: A, 10 mm; B, C, E, F, 1 mm; D, G–J, 0.1 mm. Illustrated by J.P. Roux.

nal on vegetative stems, rachis to 90 mm long, of 3–4 internodes up to 37 mm long, each node bearing 3–5 pseudo-umbels in succession, with pinnatifid leaves to 6 mm long at nodes, stipules broadly cuneate, to 1.5 × 1 mm, maroon, peduncles terete, to 40 mm long, to 1 mm in diameter, strigulose, pseudo-umbels 3–4 flowered. *Flowers* sub-regular, to 8 mm diam.; *pedicels* terete, 2.5–7.0 mm long, to 0.2 mm diam., closely set with hyaline, unicellular subulate hairs and pluricellular glandular hairs; *hypanthium* 4–8 mm long, closely set with hairs similar to those on pedicels; *sepals* narrowly elliptic, olive green with narrow hyaline margins, uppermost to 6.6 × 1.5 mm, lateral and lower sepals to 5.5 × 1.4 mm, glabrous adaxially, abaxially closely set with hairs and glandular hairs similar to those on stems and leaves, glandular hairs 4- or more-celled with basal cell enlarged and often conical and with 2–4 narrow neck cells, the apical cell globose, glandular, to 40 µm in diameter; *petals* 5, white to pale cream, immaculate, upper two narrowly elliptic, shortly clawed, to 6 × 2.2 mm, lateral petals narrowly elliptic, to 5 × 2 mm, clawed in basal 1 mm, basal petal narrowly obovate to obovate, to 4.5 × 2.2 mm, clawed in basal 1 mm long, claw in lateral and basal petals simple. *Androecium*: staminal column ± 1 mm long, hyaline, *fertile stamens* 5, exerted, posterior to 6.2 mm long, median 3.0–5.6 mm long, filaments white to pale mauve in basal half and deep mauve distally; *staminodes* of unequal length, superior two narrowly triangular, to 3 mm long, acute or truncate, proximally hyaline with mauve apices, the inferior three hyaline, acute, to 1.4 mm long; *anthers* ellipsoid, to 2.3 × 1.1 mm, orange. *Gynoecium*: *ovary* obclavate, to 2.8 × 0.8 mm, densely set with white, appressed hairs, the hairs unicellular, cylindrical, to 220 µm long, smooth, truncate; *style* reddish and glabrous in distal half, filiform, to 3 mm long, proximally densely set with mix of hyaline, unicellular, acicular, verruculate hairs to 380 µm long and few-celled capitate glandular hairs to 70 µm long, glabrous distally; *stigma* 5-branched, branches to 1.5 mm long, mauve. *Fruits* unknown. *Flowering time*: December and January. Figure 1.

Etymology: from the Greek *pachys*, thick, and *podion*, foot, alluding to the tuber-like subterranean or partially exposed stem of the plant.

Distribution and ecology: *Pelargonium pachypodium* is currently known from a single population at the foot of Keiskie Mountain southeast of Calvinia (Figure 2) at 1 250 m. Vegetation at the type locality is Roggeveld Shale Renosterveld (Mucina & Rutherford 2006), a moderately tall shrubland dominated by the asteraceous renosterbos, *Elytropappus rhinocerotis*, and with a rich geophytic community. The mean annual rainfall for the region is 146 mm and largely occurs during the period May to August. *P. pachypodium* is a cryptic species, with the aerial stems supported by and concealed among the surrounding vegetation. Flowering takes place during the hot and arid mid-summer months of December and January when few other plants in the region are in bloom. During this time the plants are devoid of functional leaves.

Pelargonium pachypodium appears to be the larval host plant of the recently described butterfly *Lepidochrysops frederikeae* (Lycaenidae) (Henning & Ball 2012), with oviposition taking place on the flowers. Adult butterflies were observed feeding on the flowers and may be an important pollinator, while the later-developing leaves presumably constitute the main food source of the larval instars (Henning & Ball 2012).

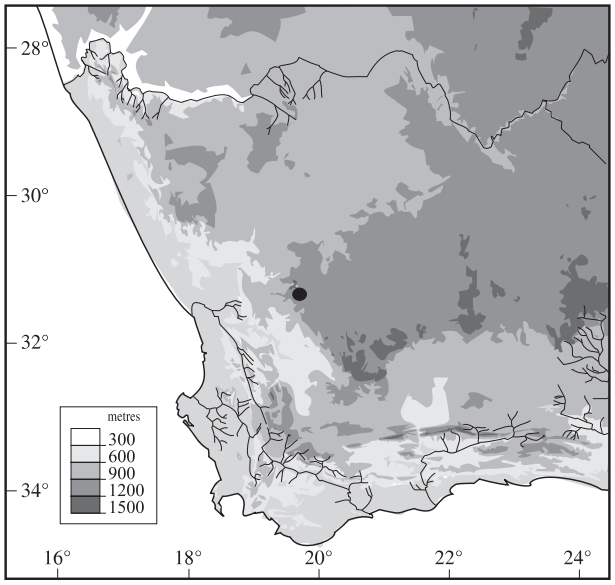


FIGURE 2.—Distribution of *Pelargonium pachypodium*.

Diagnostic features and relationships: the relationship of *Pelagonium pachypodium* with other species in the section is unclear. The most diagnostic feature of *P. pachypodium* is the tuber-like stem or rootstock from which one or more vegetative stems arise. The persistent, fibre-like leaf rachises are also highly distinctive.

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GERANIACEAE

VALIDATING PELARGONIUM SECT. RENIFORMIA

Dreyer, in a paper on the subdivision of *Pelargonium* sect. *Cortusina* (DC.) Harv., (Dreyer *et al.* 1992: 94) clearly intended the establishment of sect. *Reniformia* (R.Knuth) Dreyer by the inclusion of the words *comb. nov*. in the manuscript. In the following pages the authors referred to the section as such. The newly established section was based on *P.* sect. *Cortusina* subsect. *Reniformia* R.Knuth (1912: 443). The combination proposed there is, however, invalid as, in excluding full and direct citation of the basionym, it does not comply with Articles 32.5 and 33.4 of the Code (McNeill *et al.* 2006).

In 2000, Dreyer (Dreyer & Marais 2000) again established the section based on the same basionym as indicated above. Here a Latin diagnosis supplemented the new combination but again no full and direct reference to the name-bringing basionym was provided, as is prescribed in Articles 32.5 and 33.4 of the Code (McNeill *et al.* 2006) rendering this combination also invalid.

The section name is validated here.

Pelargonium sect. **Reniformia** *(R.Knuth) Dreyer ex J.P.Roux*, comb. et stat. nov.

Pelargonium sect. *Cortusina* subsect. *Reniformia* R.Knuth in Engler, Das Pflanzenreich 53: 443 (25 Mar. 1912). Type: *Pelargonium reniforme* Curtis, designated by Dreyer (1992: 94).

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Bothalia 42,2: 241–269 (2012)

Guide for authors to *Bothalia*

This guide is updated when necessary and includes an index. **Important points and latest additions appear in bold type.**

Bothalia is named in honour of General Louis Botha, first Premier and Minister of Agriculture of the Union of South Africa. This house journal of the South African National Biodiversity Institute (SANBI), Pretoria, is devoted to the furtherance of botanical science. The main fields covered are taxonomy, ecology, anatomy and cytology. Two parts of the journal and an index to contents, authors and subjects are published annually.

1 EDITORIAL POLICY

1.1 *Bothalia* welcomes original papers dealing with flora and vegetation of southern Africa and related subjects. Full-length papers and short notes, as well as book reviews and obituaries of botanists, are accepted. The editor should be notified that an article is part of a series of manuscripts; please submit a list of the parts of a series; all parts should preferably be published in one journal.

1.2 Submission of a manuscript to *Bothalia* implies that it has not been published previously and is not being considered for publication elsewhere.

1.3 Authors whose first language is not English are requested to have their MS edited by an English speaker before submission.

1.4 Articles are assessed by referees, both local and overseas. Authors are welcome to suggest possible referees to judge their work. Authors are responsible for the factual correctness of their contributions. *Bothalia* maintains an editorial board (see title page) to ensure that international standards are upheld.

1.5 **Page charges:** as stated in our notification included in volume 23,1 (May 1993), MSS submitted for publication in *Bothalia* are subject to payment of page charges of R125,00 per printed page, VAT included. The following are exempt from these charges: 1, SANBI members; 2, persons/institutions who have been granted exemption by the Executive Committee of the SANBI; 3, authors of contributions requested by the Editor; 4, contributors to the column '*FSA* contributions'. The Editor's decision on the number of pages is final. An invoice will be sent to the author, who must arrange for payment as soon as possible to SANBI, Publications Section, Private Bag X101, Pretoria 0001.

1.6 Deadline dates for submission of MS: for possible inclusion of the MS for the May issue—May of the previous year, and for the October issue—October of the previous year.

2 REQUIREMENTS FOR A MANUSCRIPT

2.1 Only electronic submission of manuscripts will be accepted. Manuscripts do not need to be provided in hard copy, and manuscripts that are submitted in hard copy only will not be processed further until the electronic version is received by the Production Editor. Manuscripts should be e-mailed to the Production Editor (y.steenkamp@sanbi.org.za), along with images of figures of sufficient quality to use for refereeing purposes (but small enough to e-mail to referees, generally less than 2 MB per image). Higher quality images, if too large to e-mail, should be provided on a CD, hand-delivered, couriered, or mailed to the Production Editor (see 23. Address of Production Editor, below) for publication purposes. Line drawings may be provided on a CD (scanned in at 1200 dpi, in bitmap TIF format) or originals provided to the Publications Section of SANBI to assist with the scanning (see 12.3 below for more details).

2.2 Papers should conform to the general style and layout of recent issues of *Bothalia* (from volume 26 onwards).

2.3 Material should be presented in the following sequence: title, name(s) of author(s), address(es) of author(s) and mention of granting agencies, keywords and abstract.

2.4 The sequence continues with Introduction and aims, Contents (see 8), Material and methods, Results, Interpretation (Discussion), Specimens examined (in revisions and monographs), Acknowledgements, References, Index of names (recommended for revisions dealing with more than about 15 species), Tables, Captions of figures and figures. In the case of short notes, obituaries and book reviews, keywords and an abstract are omitted.

2.5 All pages must be numbered i.e. typed consecutively on the top right-hand corner of the page, beginning with the first page to those with references, tables, captions of figures and figures.

2.6 Special characters: use your own word or code that is unique and self-explanatory, enclosed between angle brackets, e.g. <mu>m for µm. Please supply us with a list of the codes.

2.7 Use a non-breaking space (in MS Word—Ctrl, shift, space) to keep two elements together on the same line, e.g. 3 500.

2.8 Do not justify lines.

2.9 Do not break words, except hyphenated words.

2.10 A **hyphen** is designated as one dash, with no space between the letter and the dash, e.g. ovate-lanceolate. See also **17.7.**

2.11 An **N-dash** is typed in MS Word code (alt + 0150) or as **three** hyphens with no space between the letter and the hyphen, e.g. 2- - -5 mm (typeset, it looks like this, 2–5 mm). See also **17.7.**

2.12 An **M-dash** is typed in MS Word code (alt + 0151) or as **two** hyphens with no space between the letter and the hyphen, e.g. computers- -what a blessing! (typeset, it looks like this: computers—what). See also **17.7.**

2.13 **Do not use a double space anywhere** between words, after commas, full stops, colons, semicolons or exclamation marks.

2.14 Use lower case x as times sign, with one space on either side of the x, e.g. 2 x 3 mm.

2.15 Use single (not double) opening and closing quotes, e.g. the so-called 'stiffy' refers to a rigid diskette. In MSWord the codes are alt + 0145 and alt + 0146.

2.16 Keys—put only three leader dots before number of taxon (with one space before and after each dot), regardless of how far or near the word is from the right margin, e.g. . . . 1. *R. ovata* (see 13.18).

3 REQUIREMENTS FOR ELECTRONIC FILES

3.1 USE NORMAL STYLE ONLY.

3.2 Provide electronic files on CD or send by e-mail to y.steenkamp@sanbi.org.za.

3.3 Data should be in MSWord and in NORMAL style throughout.

3.4 All lines, headings, keys, etc., should start flush at the margin, therefore **no indentations, footnotes, tabs or styles** of any kind.

3.5 In MS Word, italics and bold should be used where necessary.

3.6 Paragraphs and headings are delineated by a carriage return <ENTER> but no indentation.

3.7 Graphics i.e. drawings, graphs or photographs: submit in a separate file, do not include it in the text.

3.8 Image files with a bigger file size than 4MB cannot be e-mailed as the SANBI has a 4MB limitation on the network's firewall at Head Office. Files smaller than 4MB should be e-mailed to: y.steenkamp@sanbi.org.za. Image files bigger than 4 MB should be provided on a CD or can be copied to the SANBI FTP site by using the following link: ftp://ftp.sanbi.org/incoming/. Permission needs to be obtained to copy material to the FTP site. Please contact the Production Editor for details.

3.9 Provide an image file originated in Corel Draw (version 14 or lower), as a CDR file, with fonts converted to curves. Submit image files originated in other drawing programmes as encapsulated postscript files (EPS). The conversion to TIF or other file extensions will be accommodated by SANBI Graphics (see 12.2–12.4).

3.10 If extensive changes to image files are proposed by the editor, the author will be contacted and the specific image file will have to be re-submitted after the indicated corrections have been implemented.

3.11 **Do NOT include tracked changes when submitting a MS on a CD or electronically.**

4 AUTHOR(S)

When there are several authors, the covering letter should indicate clearly which of them is responsible for correspondence and, if possible, telephonically available while the article is being processed. The contact address, telephone number and email address should be mentioned if they differ from those given on the letterhead.

5 TITLE

The title should be as concise and as informative as possible. In articles dealing with taxonomy or closely related subjects, the family of the taxon under discussion (see also 13.2) should be mentioned in brackets but author citations should be omitted from plant names (see also 13.6).

6 KEYWORDS

Up to 10 keywords (or index terms) should be provided in English in alphabetical sequence. The following points should be borne in mind when selecting keywords:

6.1 Keywords should be unambiguous, internationally acceptable words and not recently coined little-known words.

6.2 They should be in a noun form and verbs should be avoided.

6.3 They should not consist of an adjective alone; adjectives should be combined with nouns.

6.4 They should not contain prepositions.

6.5 The singular form should be used for processes and properties, e.g. evaporation.

6.6 The plural form should be used for physical objects, e.g. augers.

6.7 Location (province and/or country); taxa (species, genus, family) and vegetation type (community, veld type, biome) should be used as keywords.

6.8 Keywords should be selected hierarchically where possible, e.g. both family and species should be included.

6.9 They should include terms used in the title.

6.10 They should answer the following questions:

6.10.1 What is the *active concept* in the document (activity, operation or process).

6.10.2 What is the *passive concept* or object of the active process (item on which the activity, operation or process takes place).

6.10.3 What is the means of accomplishment or how is the active concept achieved (technique, method, apparatus, operation or process).

6.10.4 What is the environment in which the active concept takes place (medium, location).

6.10.5 What are the independent (controlled) and dependent variables?

6.11 Questions 6.10.1 to 6.10.3 should preferably also be answered in the title.

7 ABSTRACT

7.1 An abstract of no more than 200 words should be provided. Abstracts are of great importance and should convey the essence of the article.

7.2 It should refer to the geographical area concerned and, in taxonomic articles, mention the number of taxa treated. It should not contain information not appearing in the article.

7.3 In articles dealing with taxonomy or closely related subjects all taxa from the rank of genus downwards should be accompanied by their author citations (see also 13.6).

7.4 Names of new taxa and new combinations should not be italicized but put in bold. If the article deals with too many taxa, only the important ones should be mentioned.

8 TABLE OF CONTENTS

A table of contents should be given for all articles longer than about 60 typed pages, unless they follow the strict format of a taxonomic revision.

9 ACKNOWLEDGEMENTS

Acknowledgements should be kept to the minimum compatible with the requirements of courtesy. Please give all the initials of the person(s) you are thanking.

10 LITERATURE REFERENCES

In text

10.1 Literature references in the text should be cited as follows: 'Jones & Smith (1986) stated...', or '...(Jones & Smith 1986)' or (Ellis 1988: 67) when giving a reference simply as authority for a statement. For treatment of literature references in taxonomic papers see 14.

10.2 When more than two authors are involved in the paper, use the name of the first author followed by *et al*.

10.3 When referring to more than one literature reference, they should be arranged chronologically and separated by a semicolon, e.g. (Nixon 1940; Davis 1976; Anon. 1981, 1984).

10.4 Titles of books and names of journals should preferably not be mentioned in the text. If there is good reason for doing so, they should be treated as described in 10.12 and 10.13.

10.5 Personal communications are given only in the text, not in the list of references. Please add the person's full initials to identify the person more positively, e.g. C. Boucher pers. comm.

In References at end of article

10.6 References of the same author are arranged in chronological sequence.

10.7 Where two or more references by the same author are listed in succession, the author's name is repeated with every reference, except in an obituary, where the name of the deceased in the list of publications (not in the references) is replaced by an N-dash.

10.8 All publications referred to in the text, including those mentioned in full in the treatment of correct names in taxonomic papers, but no others, and no personal communications, are listed at the end of the manuscript under the heading References.

10.9 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. This sequence is retained when used in the text, irrespective of the chronology.

10.10 If an author has published both on his own and as a 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.

10.11 Author names are typed in CAPITAL LETTERS.

10.12 Titles of journals and of books are written out in full and are italicized as follows: *Transactions of the Linnean Society of London* 5: 171–217, or *Biology and ecology of weeds*: 24.

10.13 Titles of books should be given as in *Taxonomic literature*, edn 2 by Stafleu & Cowan and names of journals as in the latest edition of *World list of scientific periodicals*.

10.14 Examples of references:

Collective book or Flora

BROWN, N.E. 1909. Asclepiadaceae. In W.T. Thiselton-Dyer, *Flora capensis* 6,2: 518–1036. Reeve, London.

CUNNINGHAM, A.B. 1994. Combining skills: participatory approaches in biodiversity conservation. In B.J. Huntley, Botanical diversity in southern Africa. *Strelitzia* 1: 149–167. National Botanical Institute, Pretoria.

Book

DU TOIT, A.L. 1966. *Geology of South Africa*, edn 3: 10–50. S.M. Haughton (ed.). Oliver & Boyd, London.

HUTCHINSON, J. 1946. *A botanist in southern Africa*: 69. Gawthorn, London.

Journal

DAVIS, G. 1988. Description of a proteoid-restioid stand in Mesic Mountain Fynbos of the southwestern Cape and some aspects of its ecology. *Bothalia* 18: 279–287.

SMOOK, L. & GIBBS RUSSELL, G.E. 1985. Poaceae. *Memoirs of the Botanical Survey of South Africa* No. 51: 45–70.

STEBBINS, G.L. Jr. 1952. Aridity as a stimulus to plant evolution. *American Naturalist* 86: 35–44.

In press, in preparation

TAYLOR, H.C. in press. *A reconnaissance of the vegetation of Rooiberg State Forest*. Technical Bulletin, Department of Forestry.

VOGEL, J.C. 1982. *The age of the the Kuiseb river silt terrace at Homeb. Palaeoecology of Africa* 15. In press.

WEISSER, P.J., GARLAND, J.F. & DREWS, B.K. in prep. Dune advancement 1937–1977 and preliminary vegetation succession chronology at Mlalazi Nature Reserve, Natal, South Africa. *Bothalia*.

Thesis

KRUGER, F.J. 1974. *The physiography and plant communities of the Jakkalsrivier Catchment*. M.Sc. (Forestry) thesis, University of Stellenbosch.

MUNDAY, J. 1980. *The genus* Monechma *Hochst*. (*Acanthaceae tribe Justiciae*) *in southern Africa*. M.Sc. thesis, University of the Witwatersrand, Johannesburg.

Miscellaneous paper, report, unpublished article, technical note, congress proceedings

ANON. no date. *Eetbare plante van die Wolkberg*. Botanical Research Unit, Grahamstown. Unpublished.

BAWDEN, M.G. & CARROL, D.M. 1968. *The land resources of Lesotho*. Land Resources Study No. 3, Land Resources Division, Directorate of Overseas Surveys, Tolworth.

BOUCHER, C. 1981. Contributions of the Botanical Research Institute. In A.E.F. Heydorn, *Proceedings of workshop research in Cape estuaries*: 105–107. National Research Institute for Oceanology, CSIR, Stellenbosch.

NATIONAL BUILDING RESEARCH INSTITUTE 1959. *Report of the committee on the protection of building timbers in South Africa against termites, woodboring beetles and fungi*, edn 2. CSIR Research Report No. 169.

11 **TABLES (also electronic submissions)**

11.1 Each table should be presented on a separate sheet and be assigned an Arabic numeral, i.e. the first table mentioned in the text is marked ‘Table 1’.

11.2 In the captions of tables the word ‘TABLE’ is written in capital letters. See recent numbers of *Bothalia* for the format required.

11.3 Avoid vertical lines, if at all possible. Tables can often be reduced in width by interchanging primary horizontal and vertical heads.

12 **FIGURES (original or electronic submissions)**

12.1 Line drawings (original artwork) should be in jet-black Indian ink, on fine art paper, 200 gsm. Lines should be clear enough to accommodate reduction. Do not use draughtman’s film as it causes problems with the scanning process.

12.2 Drawings in pencil will not be accepted.

12.3 Provide original drawings electronically as bitmap TIF files, 600 dpi or preferably, 1200 dpi. Provide photographs electronically as either TIF or JPG files, 600 dpi or higher. At the request of the Author, the Publications Section of SANBI will assist with the scanning of original material. Figures should be planned to fit, after reduction, into a width of either 80, 118 or 165 mm, with a maximum vertical length of 230 mm. Allow space for the caption in the case of figures that will occupy a whole page.

12.4 Graphs and histograms should be submitted as stipulated in 3.9, or as TIF or JPG files at a resolution of 600 dpi or higher if generated in other programmes. Graphs and histograms generated in EXCEL or MSWord, should be provided as is. File conversion into the correct format will be accommodated by SANBI Graphics. Please do not supply embedded graphics in the documents or files that are optimized for screen use. Do not submit graphs and histograms in colour. If shading is used it should be easily discernible.

12.5 Photographs should be of excellent quality on glossy paper with clear detail and moderate contrast so that the figures can be scanned without retouching them electronically. If submitted electronically, provide as a TIF or JPG file at 600 dpi or higher and not as a DOC, PDF, EXCEL or POWERPOINT file.

12.6 Photograph mosaics should be submitted as **separate** photographs or TIF/JPG files at 600 dpi or higher, as well as a photocopy/layout of the mosaic. Final layout of the mosaic will be done by our graphics department.

12.7 Do not number the original images but include a scale bar. Indicate the lettering on the photocopy and not on the original image or electronic copy.

12.8 If several illustrations are treated as components of a single composite figure they should be designated by capital letters.

12.9 Note that the word ‘Figure’ should be written out in full, both in the text and the captions and should begin with a capital ‘F’ (but see 14.7 for taxonomic papers).

12.10 In the text the figure reference is then written as in the following example: ‘The stamens (Figure 4A, B) are...’

12.11 In captions, ‘FIGURE’ is written in capital letters.

12.12 Scale bars or scale lines should be used on figures.

12.13 In figures accompanying taxonomic papers, voucher specimens should be given in the relevant caption.

12.14 Figures are numbered consecutively with Arabic numerals in the order they are referred to in the text. These numbers, as well as the author’s name and an indication of the top of the figure, must be written in soft pencil on the back of all figures.

12.15 Captions of figures should not be pasted under the photograph or drawing and should also not be included in any electronic version of the figures.

12.16 Captions of figures should be collected together and typed at the end of the MS and headed *Captions for figures*.

12.17 Authors should indicate in pencil in the text where they would like the figures to appear.

12.18 Authors wishing to have the originals of figures returned must inform the editor in the original covering letter and must mark each original 'To be returned to author'.

12.19 Authors wishing to use illustrations already published elsewhere must obtain written permission before submitting the manuscript and inform the editor of this fact.

12.20 It is strongly recommended that taxonomic articles include dot maps as figures to show the distribution of taxa. Maps will be reduced to column width (80 mm): the symbols and numbers used must be large enough to stand reduction. The maps should show: numbered grid lines of latitude and longitude; the provinces of South Africa; and a scale line. Maps of neighbouring countries should be treated in the same way, with bordering states clearly labelled. For orientation purposes, a small inset map should appear in a corner of the figure.

12.21 ArcView GIS maps are acceptable. The layout representing all the appropriate themes (including grid lines) should be submitted as an encapsulated postscript file (EPS).

12.22 Colour figures are permitted only if: a) it will clarify the article and b) the cost of reproduction and printing is borne by the author.

12.23 Magnification of figures in the caption should be given for the size as submitted.

13 **TEXT**

13.1 As a rule, authors should use the plant names (but not of all authors of plant names—see 13.6) as listed in PRECIS (National Herbarium **PRE**toria **C**omputerised **I**nformation **S**ystem).

13.2 Names of genera and infrageneric taxa are usually italicized, with the author citation (where relevant; see 13.6) not italicized. Exceptions include names of new taxa in the abstract, correct names given in the synopsis or in paragraphs on species excluded from a given supraspecific group in taxonomic articles; in checklists and in indices, where the position is reversed, correct names are not italicized and synonyms are italicized.

13.3 Names above generic level are not italicized.

13.4 In articles dealing with taxonomy, the complete scientific name of a plant (with author citation) should be given at the first mention in the text. The generic name should be abbreviated to the initial thereafter, except where intervening references to other genera with the same initial could cause confusion (see 16.6).

13.5 In normal text, Latin words are italicized, but in the synopsis of a species, Latin words such as *nom*. *nud*. and *et al*. are not italicized (see 16.4, 17.2).

13.6 In accordance with Garnock-Jones & Webb (1996) in *Taxon* 45: 285, 286, authors of plant names are not to be added to plant names except in taxonomic papers. Names of authors of plant names should agree with the list published by the Royal Botanic Gardens, Kew, entitled, *Authors of plant names*, edited by R.K. Brummitt & C.E. Powell (1992).

13.7 Modern authors not included in the list should use their full name and initials when publishing new plant names. Other author names not in the list should be in agreement with the recommendations of the Code.

13.8 Names of authors of publications are written out in full, without initials, except in the synonymy in taxonomic articles where they are treated like names of authors of plant names.

13.9 Names of plant collectors are italicized whenever they are linked to the number of a specimen. The collection number is also italicized, e.g. *Acocks 14407*.

13.10 Surnames beginning with 'De', 'Du' or 'Van' begin with a capital letter unless preceded by an initial.

13.11 For measurements use only units of the International System of Units (SI). In taxonomic papers only mm and m, should be used; in ecological papers cm or m should be used.

13.12 The use of '±' is preferred to c. or ca (see 17.8).

13.13 Numbers 'one' to 'nine' are spelt out in normal text, and from 10 onwards they are written in Arabic numerals.

13.14 In descriptions of plants, numerals are used throughout. Write 2.0–4.5 (not 2–4.5) and 2.0–4.5 6–9. When counting members write 2 or 3 (not 2–3), but 2–4.

13.15 Abbreviations should be used sparingly but consistently. No full stops are placed after abbreviations ending with the last letter of the full word (e.g. edition = edn; editor = ed.); after units of measure; after compass directions; after herbarium designations; after countries, e.g. USA and after well-known institutions, e.g. CSIR.

13.16 Apart from multi-access keys, indented keys should be used with couplets numbered 1a–1b, 2a–2b, etc. (without full stops thereafter).

13.17 Keys consisting of a single couplet have no numbering.

13.18 Manuscripts of keys should be presented as in the following example:

1a Leaves closely arranged on elongated stem; a submerged aquatic with only capitula exserted . . . 1b. *E. setaceum* var. *pumilum*

1b Leaves in basal rosettes; stems suppressed; small marsh plants, ruderals or rarely aquatics:

2a Annuals, small, fast-growing pioneers, dying when habitat dries up; capitula without coarse white setae; receptacles cylindrical:

3a Anthers white . . . 2. *E. cinereum*

3b Anthers black . . . 3. *E. nigrum*

2b Perennials, more robust plants; capitula sparsely to densely covered with short setae:

13.19 Herbarium voucher specimens should be referred to wherever possible, not only in taxonomic articles.

13.20 The word Figure should be written out in full and should begin with a capital F, also in captions where the whole word is in capital letters (see 12.8–12.11).

14 SPECIES TREATMENT IN TAXONOMIC PAPERS

14.1 The procedure to be followed is illustrated in the example (17.2), which should be referred to, because not all steps are described in full detail.

14.2 The correct name (bold, not italicized) is to be followed by its author citation (italicized) and the full literature reference, with the name of the publication written out in full (not italicized).

14.3 Thereafter all literature references, including those of the synonyms, should only reflect author, page and year of publication, e.g. C.E.Hubb. in Kew Bulletin 15: 307 (1960); Boris et al.: 14 (1966); Boris: 89 (1967); Sims: t. 38 (1977); Sims: 67 (1980).

14.4 The description and the discussion should consist of paragraphs commencing, where possible, with italicized leader words such as *flowering time, etymology, diagnostic characters, distribution and habitat*, with a colon following the leader word and the first word of the sentence beginning with a lower case letter.

14.5 When more than one species of a given genus is dealt with in a paper, the correct name of each species should be prefixed by a sequential number followed by a full stop. Infraspecific taxa are marked with small letters, e.g. 1b., 12c., etc.

14.6 Names of authors are written as in 13.6, irrespective of whether the person in question is cited as the author of a plant name or of a publication.

14.7 The word 'figure' is written as 'fig.', and 't.' is used for both 'plate' and 'tablet' (but see 12.9 for normal text).

14.8 Literature references providing good illustrations of the species in question may be cited in a paragraph commencing with the word Illustrations followed by a colon. This paragraph is given after the last paragraph of the synonymy, see 17.2.

14.9 When new combinations are made, the full literature reference must be given for the basionym, e.g.:

Antimima saturata (*L.Bolus*) *H.E.K. Hartmann*, comb. nov.

Ruschia saturata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 122 (1929). *Mesembryanthemum atrocinctum* N.E.Br.: 32 (1930). Type: *Pillans BOL18952* (BOL, holo.–photo!).

14.10 **Treatment of subspecies. Example:**

37. **Acacia robusta** *Burch*., Travels in the interior of southern Africa: 442 (1824); Harv.: 281 (1862); Oliv.: 349 (1871) pro parte excl. specim. *Welwitsch*; Palmer & Pitman: 807 (1973). Type: Cape Province, Kuruman Dist. Takoon [Litakun], *Burchell 2265* (K, holo.!).

[The species description encompassing the subspecific characteristics and notes on distribution should follow here.]

Two subspecies are distinguished:

Leaf rachis glabrous or almost so; pods straight or slightly curved . . . . . .37a. subsp. *robusta*

Leaf rachis sparsely to densely pubescent; pods usually ± falcate . . . . . 37b. subsp. *clavigera*

37a. subsp. **robusta.**

Brenan in Flora zambesiaca 3,1: 103 (1970); Ross: 37 (1971).

A. robusta Burch.: 442 (1824). [this is the basionym]

[The diagnostic description of the subspecies or reference to above key and notes on distribution should follow here.]

37b. subsp. **clavigera** (*E.Mey.*) *Brenan* in Flora zambesiaca 3,1: 104 (1970); Ross: 193 (1973). Type: Natal, near Port Natal [Durban], *Drège s.n.* (K, iso.!; P, fragm.!).

A. clavigera E.Mey., Commentariorum 1: 168 (1836); Benth.: 510 (1875); Brenan: 365 (1958).

[The diagnostic description of the subspecies or reference to above key and notes on distribution should follow here.]

15 CITATION OF SPECIMENS

15.1 Type specimen in synopsis: the following should be given (if available): country (if not in RSA), province, grid reference (at least for new taxa), locality as given by original collector, modern equivalent of collecting locality in square brackets (if relevant, e.g. Port Natal [now Durban]), quarter-degree square, date of collection (optional), collector's name and collecting number (both italicized).

15.2 The abbreviation s.n. (*sine numero*) is given after the name of a collector who usually assigned numbers to his collections but did not do so in the specimen in question (see 15.11), or the herbarium number can then be cited with no space between the herbarium and its number e.g. *Marloth SAM691* (see 17.2). The herbaria in which the relevant type(s) are housed are indicated by means of the abbreviations given in the latest edition of *Index Herbariorum*.

15.3 The holotype (holo.) and its location are mentioned first, followed by a semicolon, the other herbaria are arranged alphabetically, separated by commas.

15.4 Authors should indicate by means of an exclamation mark (!) which of the types have been personally examined.

15.5 If only a photograph, microfiche, electronic or Aluka image was seen, write as follows: *Anon. 422* (X, holo.–BOL, photo.!), or Anon. 422 (X, holo.–Aluka image, website accessed 14-08-2009), or (SDNH, holo. e!).

15.6 Lectotypes or neotypes should be chosen for correct names without a holotype. It is not necessary to lectotypify synonyms.

15.7 When a lectotype or a neotype are newly chosen, this should be indicated by using the phrase 'here designated' (see 17.2). If reference is made to a previously

selected lectotype or neotype, the name of the designating author and the literature reference should be given. In cases where no type was cited, and none has subsequently been nominated, this may be stated as 'not designated'.

15.8 In brief papers mentioning only a few species and a few cited specimens the specimens should be arranged according to the grid reference system: Provinces/countries (typed in capitals) should be cited in the following order: Namibia, Botswana, Limpopo (previously Northern Transvaal, Northern Province), North-West (previously north-eastern Cape and southwestern Transvaal), Gauteng (previously PWV), Mpumalanga (previously Eastern Transvaal), Free State (previously Orange Free State), Swaziland, KwaZulu-Natal (previously Natal), Lesotho, and Northern Cape, Western Cape and Eastern Cape (Figure 1).

15.9 Grid references should be cited in numerical sequence.

15.10 Locality records for specimens should preferably be given to within a quarter-degree square. Records from the same one-degree square are given in alphabetical order, i.e (–AC) precedes (–AD), etc. Records from the same quarter-degree square are arranged alphabetically according to the collectors' names; the quarter-degree references must be repeated for each specimen cited.

15.11 The relevant international code of the herbaria in which a collection was seen should be given in brackets after the collection number; the codes are separated by commas. The following example will explain the procedure:

KWAZULU-NATAL.—2731 (Louwsburg): 16 km E of Nongoma, (–DD), 10-10-1960, *Pelser 354* (BM, K, PRE); near Dwarsrand, *Van der Merwe 4789* (BOL, M). 2829 (Harrismith): near Groothoek, (–AB), *Smith 234*; Koffiefontein, (–AB), *Taylor 720* (PRE); Cathedral Peak Forest Station, (–CC), 8 July 1905, *Marriot s.n.* (KMG); Wilgerfontein, *Roux 426*. Grid ref. unknown: Sterkstroom, *Strydom 12* (NBG).

15.12 For records from outside southern Africa authors should use degree squares without names, e.g.:

KENYA.—0136: Nairobi plains beyond race course, *Napier 485*.

15.13 Monographs and revisions: in the case of all major works of this nature it is assumed that the author has investigated the relevant material in all major herbaria and that he has provided the specimens seen with determinavit labels. It is assumed further that the author has submitted distribution maps for all relevant taxa and that the distribution has been described briefly in words in the text. Under the heading 'Vouchers' no more than five specimens should be cited, indicating merely the collector and the collector's number (both italicized). Specimens are alphabetically arranged according to collector's name. If more than one specimen by the same collector is cited, they are arranged numerically and separated by a comma. A collector's name and the voucher number(s) is separated from the next collector by a semicolon. The purpose of the cited specimens is not to indicate distribution but to convey the author's concept of the taxon in question.

15.14 The herbaria in which the specimens are housed are indicated by means of the abbreviation given in the latest edition of *Index Herbariorum*. They are given between brackets, arranged alphabetically and separated by commas behind every specimen as in the following example:

Vouchers: *Arnold 64* (PRE); *Fisher 840* (NH, NU, PRE); *Flanagan 831* (GRA, PRE), *840* (NH, PRE); *Marloth 4926* (PRE, STE); *Schelpe 6161, 6163, 6405* (BOL); *Schlechter 4451* (BM, BOL, GRA, K, PRE).

15.15 If long lists of specimens are given, list them together before Acknowledgements under the heading *Specimens examined*. They are arranged alphabetically by the collector's name and then numerically for each taxon. The species is indicated in brackets by the number that was assigned to it in the text and any infraspecific taxa by a small letter; this number follows the specimen number. If more than one genus is dealt with in a given article, the first species of the first genus mentioned is indicated as 1.1. This is followed by the international herbarium designation. Note that the name of the collector and the collection number are italicized:

Acocks 14724 (1.13a) BOL, K, P; *12497* (2.1b) BM, K, PRE. *Archer 1507* (1.4) BM, G.

Barker 9738 (1) NBG; *1916* (2) NBG; *295, 4766, 9478, 9796, 10330* (4) NBG; *1919* (5) BOL, NBG; *1917,1923, 1935, 2570, 2606, 2646, 3332, 4198, 4858, 10534, 10801* (5) NBG. *Burchell 2847* (2.8c) MB, K. *Burman 2401* (3.3) MO, S. *B.L. Burtt 789* (2.6) B, KMG, STE.

Esterhuysen 11497 (1) BOL; *1433* (5) BOL; *71402* (5) NBG.

16 SYNONYMS

16.1 In a monograph or a revision covering all of southern Africa, all synonyms based on types of southern African origin, or used in southern African literature, should be included.

16.2 Illegitimate names are designated by *nom. illeg*. after the reference, followed by non with the author and date, if there is an earlier homonym.

16.3 Nomina nuda (*nom. nud*.) and invalidly published names are excluded unless there is a special reason to cite them, for example if they have been used in prominent publications.

16.4 In normal text, Latin words are italicized, but in the synopsis of a species Latin words such as *nom. nud., et al*. are not italicized (see 13.5, 17.2).

16.5 Synonyms should be arranged chronologically into groups of nomenclatural synonyms, i.e. synonyms based on the same type, and the groups should be arranged chronologically by basionyms, except for the basionym of the correct name which is dealt with in the paragraph directly after that of the correct name.

16.6 When a generic name is repeated in a given synonymy it should be abbreviated to the initial, except where intervening references to other genera with the same initial could cause confusion (see 13.4).

17 DESCRIPTION AND EXAMPLE OF SPECIES TREATMENT

17.1 Descriptions of all taxa of higher plants should, where possible, follow the sequence: Habit; sexuality; underground parts (if relevant). *Indumentum* (if it can be

easily described for the whole plant). *Stems/branches. Bark. Stipules. Leaves*: arrangement, petiole absent/present, pubescence; blade: shape, measurements, apex, base, texture, colour; margin; midrib: above/below; petiole. *Inflorescence*: type, shape, measurements, position; bracts/bracteoles, involucral bracts: inner, outer. *Flowers*: shape, measurements, sex, colour. *Receptacle. Calyx. Corolla. Disc. Androecium. Gynoecium. Fruit. Seeds* (apply the same sequence of relevant features as in flowers). *Flowering time. Chromosome number (reference). Conservation status*. Figure number (word written out in full).

17.2 Example (not factual for this species):

1. **Englerophytum magalismontanum** (*Sond*.) *T.D.Penn*., The genera of Sapotaceae: 252 (1991). Type: Gauteng, Magaliesberg, *Zeyher 1849* (S, holo.–BOL, photo.!).

Bequaertiodendron magalismontanum (Sond.) Heine & Hemsl.: 307 (1960); Codd: 72 (1964); Elsdon: 75 (1980).

Chrysophyllum magalismontanum Sond.: 721 (1850); Harv.: 812 (1867); Engl.: 434 (1904); Bottmar: 34 (1919). *Zeyherella magalismontana* (Sond.) Aubrév. & Pellegr.: 105 (1958); Justin: 97 (1973).

Chrysophyllum argyrophyllum Hiern: 721 (1850); Engl.: 43 (1904). *Boivinella argyrophylla* (Hiern) Aubrév. & Pellegr.: 37 (1958); Justin et al.: 98 (1973). Types: Angola, *Welwitsch 4828* (BM, lecto.!, here designated; PRE!); Angola, *Welwitsch s.n*. (BM!).

Chrysophyllum wilmsii Engl.: 4, t. 16 (1904); Masonet: 77 (1923); Woodson: 244 (1937). *Boivinella wilmsii* (Engl.) Aubrév. & Pellegr.: 39 (1958); Justin: 99 (1973). Type: without locality and collector [B, holo.†; K!, P, lecto. e!, designated by Aubrév. & Pellegr.: 38 (1958), PRE!, S!, W!, Z!].

Bequaertiodendron fruticosa De Wild.: 37 (1923), non Bonpl.: 590 (1823); D.Bakker: 167 (1929); H.Fr.: 302 (1938); Davy: 640 (1954); Breytenbach: 117 (1959); Clausen: 720 (1968); Palmer: 34 (1969). Type: Mpumalanga, Tzaneen Dist., *Granville in Herb. Pillans K48625* (K, holo.!; G!, P!, PRE!, S!–**Aluka image, website accessed 14-08-2009).**

B. fragrans auct. non Oldemann: Glover: 149, t. 19 (1915); Henkel: 226 (1934); Stapelton: 6 (1954).

Illustrations: Harv.: 812 (1867); Henkel: t. 84 (1934?); Codd: 73 (1964); Palmer: 35 (1969).

Woody perennial; main branches up to 0.4 m long, erect or decumbent, grey woolly-felted, leafy. *Bark* smoothish, pale, beige-brown, flaking; lenticellate, splitting longitudinally. *Stipules* paired, spines up to 50 × 45 × ± 2 mm, unmistakeably large and flattened, roughly triangular in outline, the flared basiscopic lobe margins folded over in larger stipules, spines held at ± 90° to stem. *Stem* erect, simple or 1- or 2-branched, either from base or from upper stem nodes. *Leaves* linear to oblanceolate, 3–10(–23) × 1.0–1.5(–4.0) mm, obtuse, base broad, half-clasping. *Heads/Inflorescence* heterogamous, campanulate, 7–8 × 5 mm, solitary, sessile at tip of axillary shoots; involucral bracts in 5 or 6 series, inner exceeding flowers, tips subopaque, white, very acute. *Receptacle* nearly smooth. *Flowers* ± 23–30, 7–11 male, 16–21 bisexual, yellow, tipped pink. *Stamens* unilateral and declinate; filaments 7–9 mm long, exserted for 7–8 mm; anthers 3–4 mm long, dull pink. *Ovary* ovoid, ± 3.5 mm long; style dividing near apex of anthers, style branches 3–4 mm long, recurved. *Pappus* bristles very many, equalling corolla, scabridulous. *Capsules/achenes* subglobose, 3-lobed, 6–7 mm long. *Seeds* tetrahedral, colliculate, ± 2 mm long. *Flowering time*: September. *Chromosome number*: 2n = 22. Figure 23B.

17.3 As a rule, shape should be given before measurements.

17.4 In general, if an organ has more than one of the parts being described, use the plural, otherwise use the singular, for example, petals of a flower but blade of a leaf.

17.5 Language must be as concise as possible, using participles instead of verbs.

17.6 Dimension ranges should be cited as in 17.2.

17.7 Care must be exercised in the use of dashes and hyphens. A *hyphen* is a short stroke joining two syllables of a word, e.g. ovate-lanceolate or sea-green, with no space between the letter and the stroke. An *N-dash* (*en*) is a longer stroke commonly used instead of the word 'to' between numerals, '2–5 mm long' (do not use it between words but rather use the word 'to', e.g. 'ovate to lanceolate'; it is produced by typing three hyphens with spaces in between, or in MS Word the code is alt + 0150. An *M-dash* (*em*) is a stroke longer than an N-dash and is used variously, e.g. in front of a subspecific epithet instead of the full species name; it is produced by typing two hyphens with spaces in between, or in MSWord the code is alt + 0151. See also 2.10–2.12.

17.8 The use of '±' is preferred to c. or ca when describing shape, measurements and dimensions (see 13.12).

17.9 The decimal point replaces the comma in all units of measurement, e.g. leaves 1.0–1.5 mm long.

18 NEW TAXA

18.1 The name of a new taxon must be accompanied by at least a Latin diagnosis. Authors should not provide full-length Latin descriptions unless they have the required expertise in Latin at their disposal.

18.2 It is recommended that descriptions of new taxa be accompanied by a good illustration, **preferably a line drawing, or a photograph (second choice)** and a distribution map.

18.3 Example:

109. **Helichrysum jubilatum** *Hilliard*, sp. nov., *H. alsinoidei* DC. affinis, sed foliis ellipticis (nec spatulatis), inflorescentiis compositis a foliis non circumcinctis, floribus femineis numero quasi dimidium hermaphroditorum aequantibus (nec capitulis homogamis vel floribus femineis 1–3 tantum) distinguitur.

Herba annua e basi ramosa; caules erecti vel decumbentes, 100–250 mm longi, tenuiter albo-lanati, remote foliati. *Folia* plerumque 8–30 × 5–15 mm, sub capitulis minora, elliptica vel oblanceolata, obtusa vel acuta, mucronata, basi semi-amplexicauli, utrinque canolanato- arachnoidea. *Capitula* heterogama, campanulata, 3.5– 4.0 × 2.5 mm, pro parte maxima in paniculas cymosas terminales aggregata; capitula subterminalia interdum solitaria vel 2 vel 3 ad apices ramulorum nudorum ad 30 mm longorum. *Bracteae involucrales* 5-seriatae, gradatae, exteriores pellucidae, pallide stramineae, dorso lanatae, seriebus duabus interioribus subaequalibus et flores quasi aequantibus, apicibus obtusis opacis

niveis vix radiantibus. *Receptaculum* fere laeve. *Flores* ± 35–41. *Achenia* 0.75 mm longa, pilis myxogenis praedita. *Pappi* setae multae, corollam aequantes, apicibus scabridis, basibus non cohaerentibus.

TYPE.—Northern Cape, 2817 (Vioolsdrif): Richtersveld, (–CC), ± 5 miles E of Lekkersing on road to Stinkfontein, kloof in hill south of road, annual, disc whitish, 7-11-1962, *Nordenstam 1823* (S, holo.; E, NH, PRE).

19 PROVINCES OF SOUTH AFRICA (Oct. 1996)

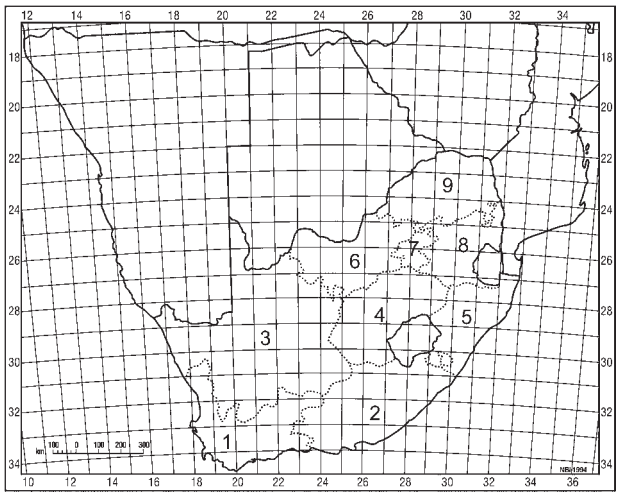


FIGURE 1.—1, Western Cape; 2, Eastern Cape; 3, Northern Cape; 4, Free State (previously Orange Free State); 5, KwaZulu-Natal (previously Natal); 6, North-West (previously northeastern Cape and southwestern Transvaal); 7, Gauteng (previously PWV); 8, Mpumalanga (previously Eastern Transvaal); 9, Limpopo (previously Northern Transvaal, Northern Province).

20 PROOFS

Only page proofs are normally sent to authors. They should be corrected in red ink and be returned to the editor **as soon as possible**. Do not add any new information.

21 REPRINTS

Reprints will no longer be issued. A PDF file of the article will be sent via the E-mail to authors and co-authors. It is for private use only, the SANBI copyright protects it from being used in another publication.

22 DOCUMENTS CONSULTED

Guides to authors of the following publications were made use of in the compilation of the present guide: *Annals of the Missouri Botanic Garden, Botanical Journal of the Linnean Society, Flora of Australia, Smithsonian Contributions to Botany, South African Journal of Botany* (including instructions to authors of taxonomic papers), *South African Journal of Science*.

23 ADDRESS OF PRODUCTION EDITOR

Manuscripts should be submitted to: Yolande Steenkamp, Production Editor: *Bothalia*, South African National Biodiversity Institute, Private Bag X101, Silverton 0184; or, preferably, e-mailed to: y.steenkamp@sanbi.org.za.

24 *FSA* CONTRIBUTIONS

24.1 Figures and text must conform to *Bothalia* format.

24.2 These articles will be considered as a full contribution to the *Flora of southern Africa* and will be listed as published in the '*Plan of Flora of southern Africa*', which appears in all issues of the *FSA* series.

25 PLACE NAMES

Ensure that local place names are correct. If in doubt, consult the Internet at

http://sagns.dac.gov.za/searchplacenamedatabase.asp

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