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Petalidium mannheimerae (Acanthaceae), a new species from Namibia and South Africa, with notes on the taxonomic identity of *P. parvifolium*

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Abstract

Petalidium mannheimerae, here described as a new species, is only known from the Gariep Centre of Plant Endemism in southern Namibia and northwestern South Africa. Apparently first collected in 1961, it grows on arid hillsides and in drainage lines. Diagnostic morphological characters for *P. mannheimerae* include the rigid, cylindrical distal stems, grey-brown or yellow-brown bark, puberulent vegetative parts with sparsely scattered but robust glandular and eglandular trichomes, and the solitary white flowers with the unexpanded part of the corolla tube shorter than the expanded part. A comparison of some of the more prominent features to differentiate *Petalidium mannheimerae* from its morphologically most similar relatives is provided. Based on IUCN Red List categories and criteria, a conservation assessment of Vulnerable VU D1 is recommended for the new species. Herbarium specimens of *P. mannheimerae* have long been misidentified as *P. parvifolium*, a rarely collected species from east-central Namibia and west-central Botswana. Lectotypes are designated for three taxa, namely *P. parvifolium*, *P. parvifolium* var. *angustifolium* (a synonym of *P. linifolium*), and *P. wilmaniae* (a synonym of *P. parvifolium*).

Keywords: desert, endemism, flora, Gariep Centre, lectotypification, Ruellieae, taxonomy

Introduction

At present, 30 described species of *Petalidium* Nees von Esenbeck (1832: 75) are recognized in the *Flora of southern Africa* region (South Africa, Namibia, Botswana, Eswatini, and Lesotho), of which 28 have been recorded for Namibia and five for South Africa (Germishuizen & Meyer 2003, Germishuizen *et al*. 2006, Swanepoel 2020, 2022). In the present contribution a new species of *Petalidium* is described. According to available distribution records, this new entity is endemic to the Gariep Centre of Endemism—a biogeographical region rich in range-restricted plants in southern Namibia and adjacent northwestern South Africa (Van Wyk & Smith 2001).

In September 2014, during a botanical expedition to the Aussenkehr area, Namibia, one of us (LN) encountered an unfamiliar *Petalidium*, characterized by a dense, rounded dwarf shrub habit, rigid stems, puberulent vegetative parts with robust scattered glandular and eglandular trichomes, and solitary white flowers with the unexpanded part of the corolla tube shorter than the expanded part. The plants were in flower, enabling the taxon to be identified as an undescribed species. Similar plants were subsequently found in the Northern Cape Province of South Africa at Swartkop, to the south of Vioolsdrif. A search of the *Petalidium* holdings in Herb. PRE revealed several other collections of the new species, all but one filed under *P. parvifolium* C.B.Clarke ex Schinz (1926: 146).

The new species can be confused with several other members of *Petalidium* in southern Namibia and northwestern South Africa with which it shares morphological similarities, especially in features of the habit, indumentum, leaves, and flowers. Its closest relatives are probably *P. lucens* Obermeijer (1936: 155) and *P. parvifolium*. Other species with

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which the new species might be confused are *P. cymbiforme* Schinz (1926: 145) and *P. linifolium* Anderson (1863: 25). The new species differs from all of these in a combination of characters. In the present contribution we formally describe the new species as *P. mannheimerae* and compare it with its morphologically most similar relatives. We also provide notes on the identity of *P. parvifolium*, the name most often incorrectly applied to the new species in herbaria.

Methods

Morphological descriptions and ecological information presented here are based on field observations and material collected following extensive field work in Namibia and South Africa. Diagnostic features for the new species, *P. lucens*, *P. cymbiforme*, *P. linifolium, P. oblongifolium* Clarke (1912: 22), and *P. parvifolium* were determined through examination of fresh material including high-resolution images of the type material available on the internet through JSTOR Global Plants (https://plants.jstor.org/) and at Herb. Z+ZT (https://www.herbarien.uzh.ch/en/herbarien-zzt). This was supplemented by study of the protologues including Vollesen (2013) and herbarium collections. The herbaria of the National Botanical Research Institute in Namibia (WIND), South African National Biodiversity Institute, Pretoria (PRE), and University of Pretoria (PRU) were consulted for possible collections of the new species (herbarium abbreviations follow Thiers 2019). A 6.5–45.0× magnification stereo microscope was used for studying morphological features. Descriptive terminology follows Beentje (2016) and Manktelow (2000). Locality information for specimens cited also provides the quarter degree grid squares following the degree reference system of Edwards & Leistner (1971). The distribution map was compiled from specimen data using ArcView 3.1 software. Conservation assessment follows IUCN (2012) recommendations.

Identity of *Petalidium parvifolium*, and lectotypifications of names

Petalidium parvifolium, a manuscript name proposed by Charles Baron Clarke [1832–1906], was validly published by Hans Schinz (1926), who at the time recognized two varieties. *Petalidium parvifolium* var. *parvifolium* was based on a gathering, *Fleck 548* (Fig. 1), collected at Olifant Kloof [Olifantskloof], which is in west-central Botswana (Fig. 2) close to the border with Namibia. The other variety, *P. parvifolium* var. *angustifolium* (as "*angustifolia*") Schinz (1926: 146), was based on two gatherings, *Fleck s.n.* from Daberas in Great Namaqualand (now southern Namibia), and *Schenk 758* from bushveld at Inkumpi River (Zebedeles River, Potgietersrust District), today in the Mokopane District of Limpopo, South Africa. *Petalidium parvifolium* was furthermore considered to be somewhat intermediate between *P. oblongifolium* and *P. linifolium*.

In her revision of *Petalidium* in South Africa and Namibia (then still South West Africa), Obermeijer (1936) under "Species not examined" listed *P. parvifolium* var. *parvifolium* and var. *angustifolium* as the only names for which she was unable to trace any original material (suspected to be in Herb. Z), hence she did not include these two taxa in her treatment. She did, however, speculate that the material of *P. parvifolium* var. *angustifolium* from Limpopo may well be a narrow-leaved form of *P. oblongifolium*. According to Meyer (1961: 71) all the specimens of *P. parvifolium* examined by Schinz in Herb. Z were incorrectly filed under *Phaulopsis* Willdenow (1800: 342), thus explaining why they could not be found by Obermeijer.

According to Meyer (1968), *P. parvifolium* is a member of *Petalidium* sect. *Petalidium*. For his treatment of Acanthaceae in *Prodromus einer Flora von Südwestafrica*, Meyer (1968) located and studied the original material of *P. parvifolium* var. *parvifolium* (Fig. 1) and *P. parvifolium* var. *angustifolium* in Herb. Z+ZT. This enabled him, apparently for the first time since the revision of Obermeijer (1936), to confidently associate these names with specific taxa. In his key to the species, the following leads are given as applicable to *P. parvifolium*: leaves obovate, ± 15 × 5 mm; flowers borne singly in leaf ("bract") axils, these flower-bearing leaves being similar or hardly different from foliage leaves; bracteoles ovate-lanceolate, ± 13 × 6 mm at flowering time, distinctly membranous, outside with at most isolated glandular hairs, the vein network often dark green to blackish; flowers with pedicel ± 1–2 mm long, lateral and upper corolla lobes ± pale violet, blue or pink.

There are two specimens of *Fleck 548* in Herb. Z+ZT (Z-000000924 and Z-000000925), obviously duplicates of the same gathering. In the protologue of the name *P. parvifolium*, Schinz (1926) did not identify one specific specimen as the type, hence the two specimens are considered syntypes following the definitions of the *International Code of Nomenclature for algae, fungi, and plants* (Turland *et al.* 2018) and guidelines on holotype recognition by McNeill

(2014). The sheet *Fleck 548* (Z+ZT, barcode Z-000000924) is **designated here** as the **lectotype** for the name *P. parvifolium*. We have chosen this sheet because it carries a label that gives the locality as stated in the protologue, and apparently was written by Fleck himself. It also carries an annotation with the name *Petalidium parvifolium* in Schinz's hand (Fig. 1).

A study of the two gatherings (syntypes) of *P. parvifolium* var. *angustifolium* in Herb. Z+ZT showed that they represent two different taxa. *Schrenk 758* (Z-000033081) is *P. oblongifolium*, as was suspected by Obermeijer (1936), and subsequently confirmed by Paul G. Meyer (1934–) in the form of a determinavit label dated 1957 and affixed to the sheet. What has been referred to as *Fleck s.n.* from Daberas in Namibia (Fig. 2) by Obermeijer (1936) is in fact *Fleck 520*, a gathering consisting of two specimens in Herb. Z+ZT (Z-000033079 and Z-000033080). This gathering represents *Petalidium linifolium*, an identification also supplied for both specimens on determinavit labels by Meyer in 1957, and published as such in Meyer (1961, 1968). The sheet *Fleck 520* (Z+ZT, barcode Z-000033079) is **designated here** as **lectotype** for the name *P. parvifolium* var. *angustifolium*. We consider it appropriate to select as lectotype the specimen representing *P. linifolium*, a species characterized by its narrow leaves and hence also the feature that motivated the recognition of *P. parvifolium* var. *angustifolium*. Moreover, the sheet Z-000033079 was determined as *P. parvifolium* var. *angustifolium* in Schinz's hand.

Petalidium parvifolium was recognized in *Flora Zambesiaca* by Vollesen (2013), who also provided a description of the species. Vollesen, however, considered *P. parvifolium* var. *angustifolium* to be a synonym of *P. parvifolium,* a decision with which we do not agree. We also do not agree with his citation of "*Schrenk 758* in Z" as holotype for the name *P. parvifolium* var. *angustifolium*; our interpretation is that this specimen is a syntype. Hence when in *Flora Zambesiaca* the distribution of *P. parvifolium* is given as Botswana, Namibia, and South Africa, it should be kept in mind that the claimed South African part of the distribution is most probably based on *Schrenk 758*.

Meyer (1961, 1968) concluded that *P. wilmaniae* Obermeijer (1936: 156), a species newly described by Obermeijer (1936) and named for Maria Wilman (1867–1957), is conspecific with *P. parvifolium*. We agree with Meyer's decision to treat *P. wilmaniae* as a synonym of *P. parvifolium*. In the protologue of *P. wilmaniae*, Obermeijer (1936) cited three gatherings, namely *Wilman* (herb. 1647; this being the accession number in Herb. KMG), *Dinter 5150* and *Dinter 5154*. She did, however, clearly designate the Wilman gathering as "*type*", though without indicating a specific specimen. Obermeijer (1936) cited duplicates of this gathering in Herbs KMG, BOL, and SAM. All three specimens were seen by Obermeijer as they carry *determinavit* labels signed by her in December 1934. There is also a duplicate of this gathering in Herb. K (K000394978), the latter annotated by Meyer in December 1959, but not by Obermeijer. Seeing that Obermeijer did not designate a single specimen as type, the duplicates of the Wilman gathering are all considered syntypes (McNeill 2014, Turland *et al.* 2018). The sheet *Wilman* (Herb. KMG 1647) in Herb. BOL (BOL138557; #BOL 15287) is **designated here** as the **lectotype** for the name *P. wilmaniae.* We have chosen this particular specimen as lectotype because it is of good quality, carries all relevant information and is also the only one of the duplicates annotated as "type!" in Obermeijer's hand. The Wilman gathering is from between Oas and Sandfontein near Gobabis in Namibia, a locality that falls within the known range of *P. parvifolium* (Fig. 2). The two gatherings, *Dinter 5150* and *5154*, which were also cited by Obermeijer (1936) in the protologue of *P. wilmaniae*, are not *P. parvifolium*, but have, pending further field observations, provisionally been identified by us as *P. lucens* (based on a study of the specimens in Herb. PRE). These Dinter collections are from Aob, east of the Great Karas Mountains, Namibia, a locality that extends the known range of *P. lucens* slightly further north so as to overlap with the range of *P. linifolium* (Fig. 2).

Following the revision of *Petalidium* by Obermeijer (1936), collections of a white-flowered *Petalidium* taxon from the Richtersveld, Northern Cape, here described as *P. mannheimerae*, were incorrectly identified in Herb. PRE as *P. parvifolium.* The oldest collection seen, *Van Breda 1497* (PRE), dates from 1961. These identifications resulted in *Petalidium parvifolium* being listed as one of the five described species of *Petalidium* for South Africa (Germishuizen & Meyer 2003, Germishuizen *et al.* 2006). However, nearly all herbarium specimens from South Africa investigated by us and filed under this name in Herbs PRE, PRU, and WIND turned out to be *P. mannheimerae*. In fact, we have not seen any herbarium material of the real *P. parvifolium* from South Africa (for known distribution range see Fig. 2). Snijman (2013), however, must have questioned these identifications as *P. parvifolium*, because she referred to the white-flowered *Petalidium* from the Richtersveld as *P.* sp. A.

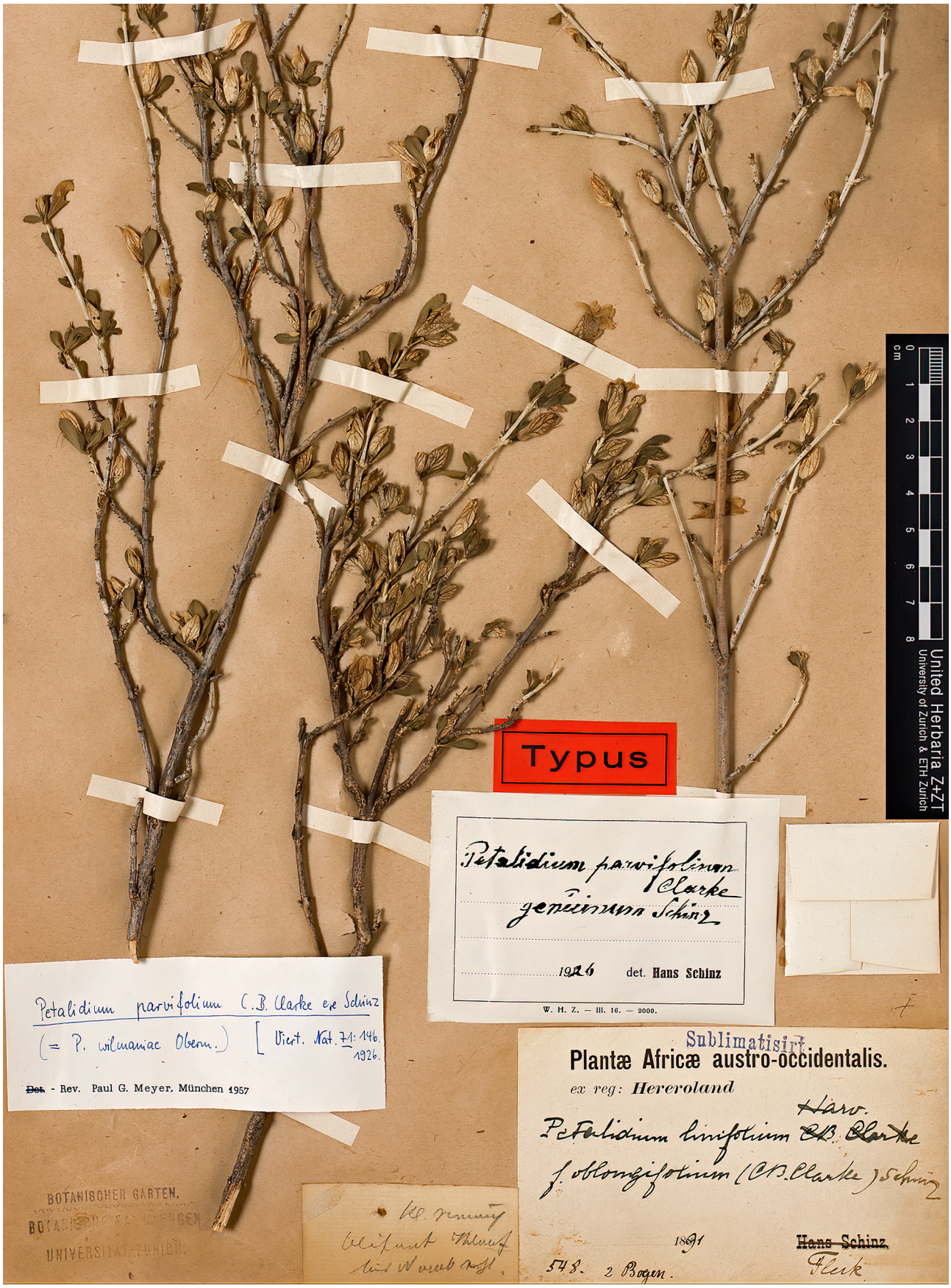

FIGURE 1. *Petalidium parvifolium*. Part of the lectotype, *Fleck 548*, in Herb. Z+ZT. Photograph: Z-000000924 by Zurich United Herbaria Z+ZT / CC BY 4.0.

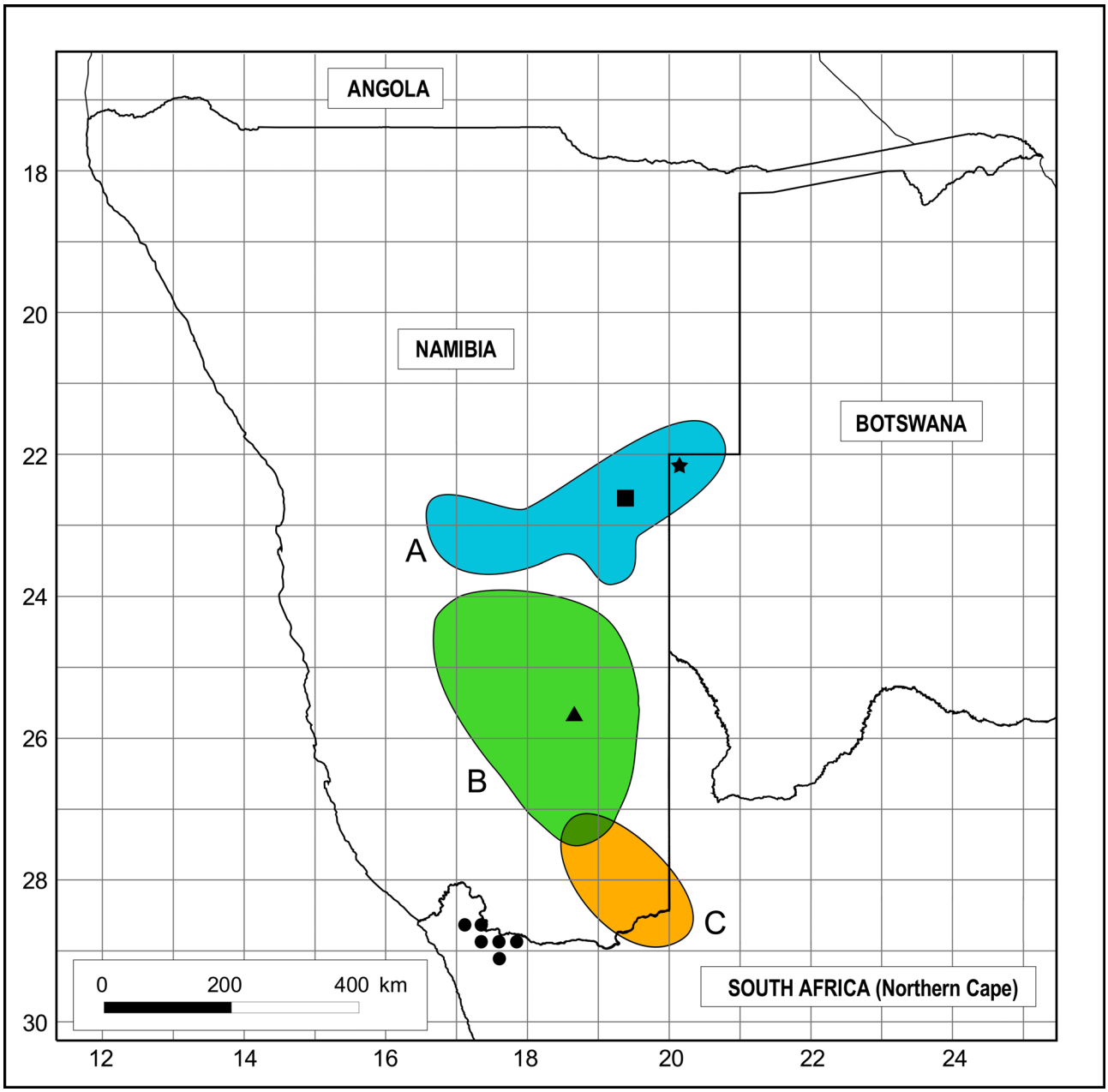

FIGURE 2. Known distribution of *Petalidium mannheimerae* (black dots; ●) based on specimens in Herbs PRE, PRU, and WIND. Also depicted are the distribution ranges of *P. parvifolium* (A. blue), *P. linifolium* (B. green), and *P. lucens* (C. orange). A black star (★) marks the locality (2220AA) of the lectotype of *P. parvifolium* (*Fleck 548* in Herb. Z+ZT, barcode Z-000000924). A black triangle (▲) indicates the locality (2518DA) of the lectotype of *P. parvifolium* var. *angustifolium* (*Fleck 520* in Herb. Z+ZR, barcode Z-000033079), considered a synonym of *P. linifolium*. A black square (■) depicts the locality (2219CB) of the lectotype of *P. wilmaniae* (*Wilman* Herb. KMG 1647 in Herb. BOL, barcode BOL138557, #BOL 15287), here considered a synonym of *P. parvifolium*.

Taxonomic treatment

Petalidium mannheimerae Swanepoel, Nanyeni & A.E.van Wyk, *sp. nov.* (Figs 3 & 4)

Diagnosis:—A woody dwarf shrub up to 1.5 m tall, morphologically most similar to *Petalidium lucens* and *P. parvifolium* differing from both in having the lamina semi-succulent, subconduplicate to conduplicate, recurved towards apex, and with lateral veins indistinct or absent (*vs*. lamina not succulent, flat, lateral veins distinct); from *P. lucens* in having indumentum on vegetative parts puberulent and on leaf margins having widely spaced, robust, stalked glands (*vs*. dense short simple or sessile stellate trichomes [with 2 or 3 branches], usually with isolated dendritic trichomes in

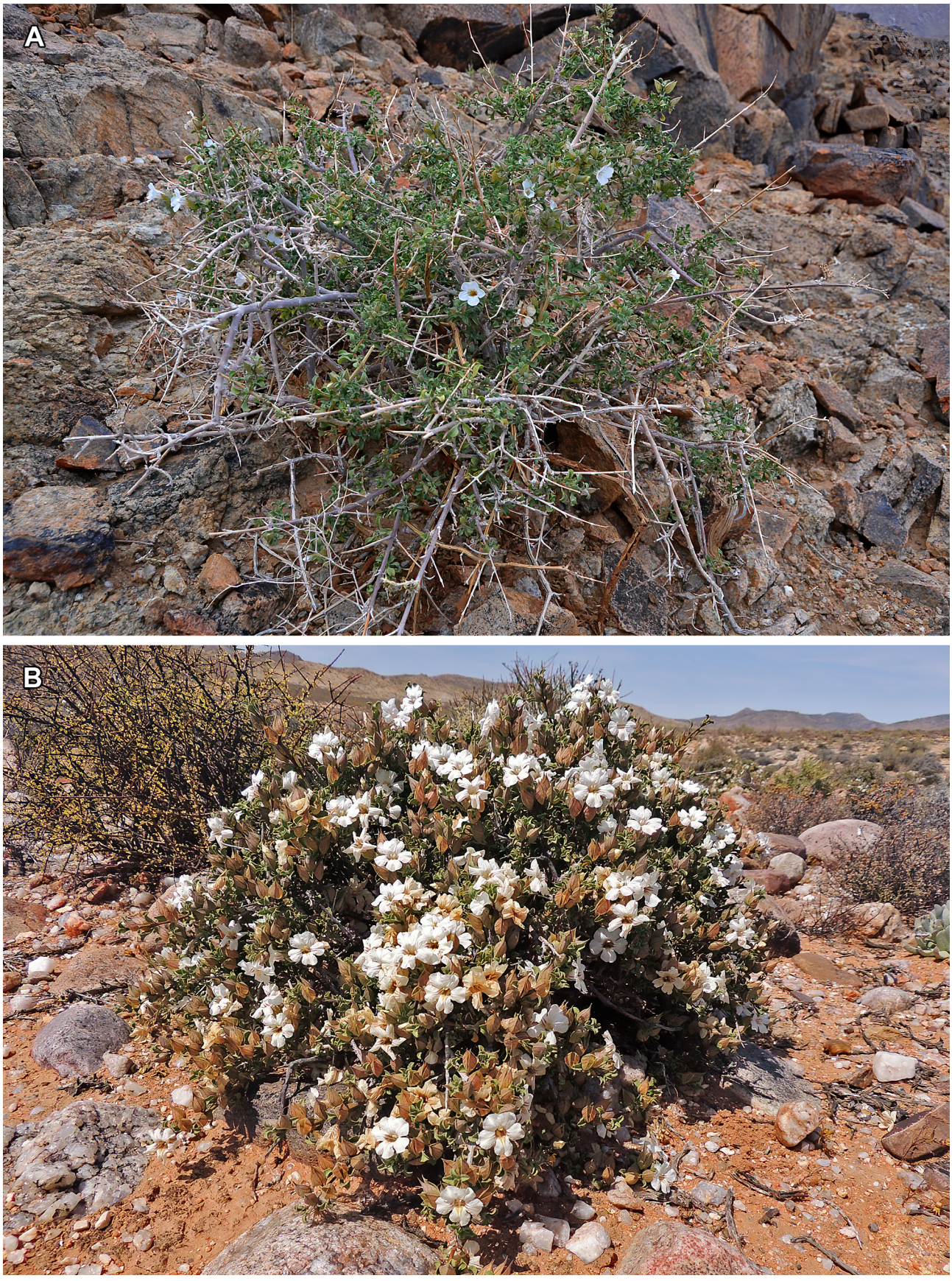

FIGURE 3. *Petalidium mannheimerae*, habitat and habit. **A.** Plant in flower during a particularly dry season (Aussenkjer [Aussenkehr] 147 Farm, ||Kharas Region, Namibia). **B.** Plant in full flower (Kosies, Richtersveld, Northern Cape, South Africa). Photographs by L. Nanyeni (A) & M. Koekemoer (B).

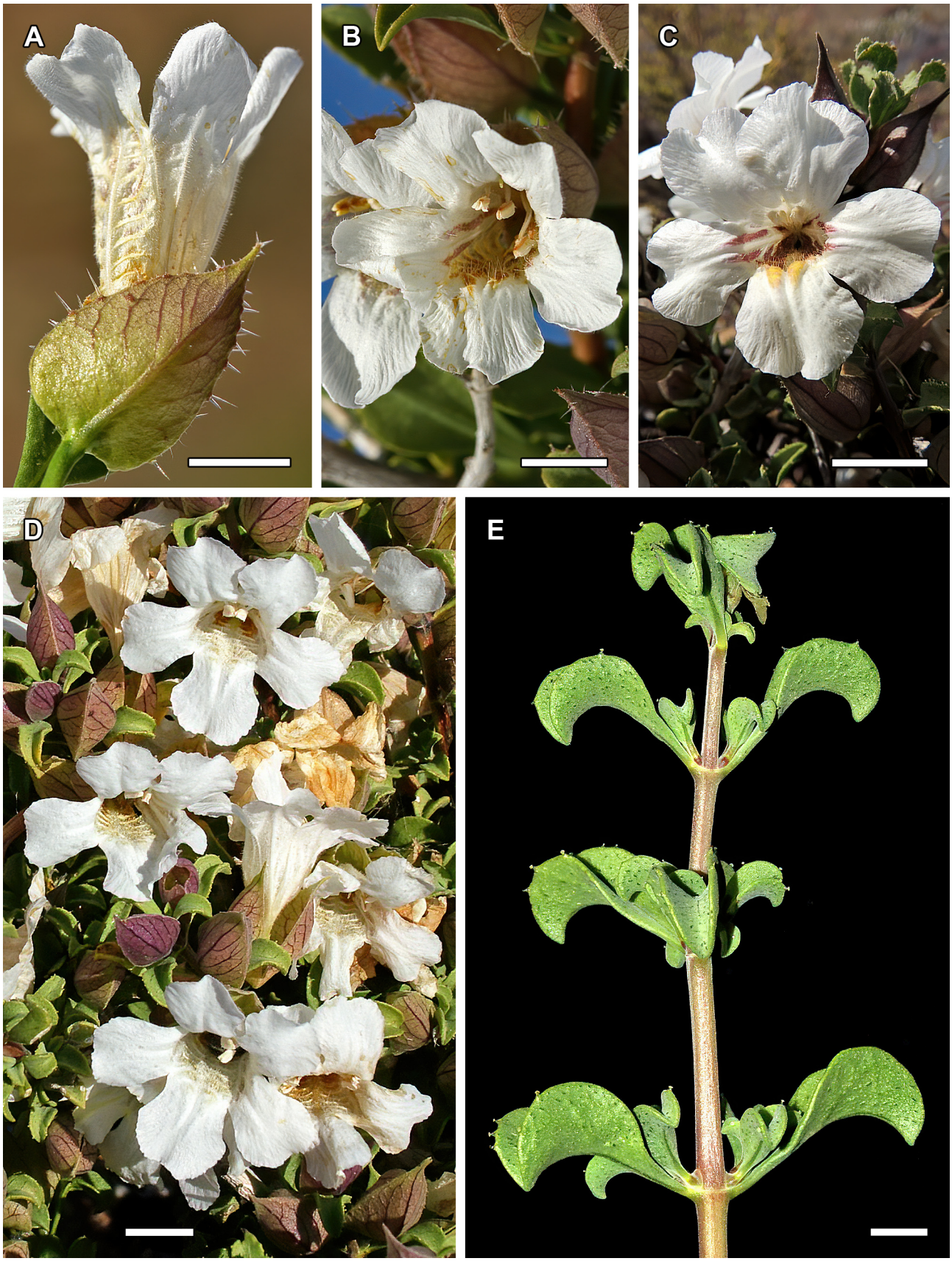

FIGURE 4. *Petalidium mannheimerae*, morphology of flowers from different localities in the Richtersveld, Northern Cape, South Africa (A–D), and leaf morphology (E). **A.** Flower in lateral view (Sun Valley). **B.** Flower in front view (Sun Valley). **C.** Flower in front view (Kosies). **D.** Flowers (Umdaus). **E.** Branchlet showing leaves being semi-succulent, the blade subconduplicate to conduplicate, recurved towards apex, the margins with isolated, robust, stalked glandular trichomes. Scale bar = 5 mm. Photographs by M. Koekemoer (A–C), N. Jürgens (D), & W. Swanepoel (E).

addition, glabrescent), corolla lobes white (*vs*. mauve or light blue); from *P. parvifolium* in having indumentum on vegetative parts puberulent (*vs*. scattered sessile glandular trichomes), leaf margins with widely spaced, robust, stalked glandular trichomes (vs. trichomes absent), corolla white (*vs*. mauve, white or white with lilac tinge).

Type:—NAMIBIA. ||Kharas Region: Karasburg District, Aussenkjer [Aussenkehr] 147 Farm: The mountain on the bank of the Orange River less than a km from the turn off to the right as you come in from the Sjambok entrance, 2817CB, 14 September 2014, *Nanyeni 936* (holotype WIND!; isotypes PRE!, PRU!).

Petalidium sp. A in Snijman (2013: 164).

Dense, woody, dwarf shrub to 1.5 m tall. *Stems* multi-stemmed from just below or above ground level from a thick rootstock or main stem, up to 140 mm in diam., bark smooth, cream, grey-white or grey-black; older distal stems rigid, cylindrical, bark smooth or longitudinally fissured, cream, grey-brown or yellow-brown; young stems quadrangular, green, puberulent, usually with widely spaced, long, robust, multi-cellular trichomes, glabrescent, cystoliths visible, linear or linear-oblanceolate. *Leaves* opposite and decussate, subsessile or with petioles up to 1.5 mm long; lamina narrowly obovate, oblanceolate, elliptic or suborbicular, subconduplicate to conduplicate, recurved towards apex, 10–24 × 4–16 mm, green, semi-succulent, puberulent, apex acute, rounded or emarginate, base attenuate, decurrent onto petiole almost to stem, margin entire with widely spaced, robust, stalked glandular trichomes; midrib conspicuous, prominent abaxially, lateral veins indistinct or absent, cystoliths conspicuous on both sides, especially in herbarium material. *Flowers* solitary, axillary, supporting leaf ("bract") similar to foliage leaves; pedicels (below bracteoles) 3–4 mm long; bracteoles ovate, usually asymmetrically, membranaceous, apex attenuate, usually with 1–5, long, sharp, robust, multicellular trichomes, base cordate or truncate, pale green, yellow-green or mauve-green, when dry also buff or brown, venation usually conspicuous, pale green, dark green or mauve-green, prominent especially adaxially, 13–15 × 7–9 mm, puberulent both sides, margins lanate and sometimes with widely spaced short stalked glandular and or long, robust multicellular trichomes, cystoliths visible on midrib towards base. *Calyx* 5–6 mm long including basal tube of 1–2 mm, puberulous abaxially towards base and with scattered very short stalked glandular trichomes abaxially, strigose adaxially, margins puberulous-ciliate; lobes 5, regular, linear-triangular, acute, 3.3–4.0 × 1.0–1.2 mm. *Corolla* with narrow unexpanded portion of tube cylindrical, slightly widening towards throat, slightly flattened, 22–25 mm long with lobes straightened, narrow portion ca. 5–7 mm long, 2.0–2.5 mm diam., expanded portion 8–10 mm long, corolla white, inside of expanded portion pale maroon, chestnut or yellow, distal half sometimes white, lobe traces (veins) including herringbone pattern on anticous portion white, front lobe with two pale yellow or cream narrowly triangular nectar guides or guides absent, other lobes sometimes with pale maroon markings towards base, outside puberulous, towards mouth with few long stiff white hairs, throat puberulous, otherwise glabrous; lobes patent, obovate, apices rounded, often retuse, margins entire or irregularly denticulate to crenate, upper lobes overlapping, free, ca. 6 × 9 mm, lateral lobes ca. 8 × 8 mm, front lobe ca. 9 × 7 mm; palate prominently transversely ca. 7-ribbed. *Filaments* didynamous, inserted dorsally in throat, filaments fused for ca. 1.8 mm at base, fused part prominent, adnate to tube, free parts tapering towards apex, flattened, sparingly puberulous with few short stalked glandular trichomes, long filament 6.1–7.3 mm long, short filament 4.3–4.8 mm long, outer filament trace decurrent to base of tube, puberulous; filament curtain phaulopsoid (Manktelow 2000); anthers 2-thecous, thecae oblong, equal or subequal, 2.1–2.3 mm long with scattered short stalked glandular trichomes, apex rounded, with minute spurs at base, 0.2 mm long. *Gynoecium* ca. 14 mm long; ovary ovoid, laterally compressed, 2.0 × 1.3 mm, inserted on fleshy disc, glabrous; style filiform, ca. 10 mm long, puberulous, stigma lobes linear, slightly flattened, unequal, longer lobe ca. 0.8 mm long, shorter lobe ca. 0.4 mm long. *Capsule* elliptic, 6.5–7.0 × 3.4–5.0 mm long, tawny, glossy, glabrous.

Phenology:—Flowers have been recorded in August and September; fruits throughout the year.

Distribution and habitat:—At present, *Petalidium mannheimerae* is known in Namibia from the vicinity of Aussenkehr in the Orange River Valley and in South Africa from ca. 30 km south of Vioolsdrif to near Eksteenfontein in the Richtersveld (Fig. 2). It occurs 92–110 km from the Atlantic Ocean on hillsides and drainage lines, at elevations of 134–187 m in Namibia and in South Africa at 551–700 m a.s.l. Average annual rainfall in the area is less than 50 mm (Mendelsohn *et al.* 2002).

Conservation status:—*Petalidium mannheimerae* has been recorded at seven localities in an area of ca. 60 × 15 km where it is locally occasional to common. Although a brief search at various other localities with seemingly suitable habitat did not reveal any plants, it is probably more widespread than currently known. Although protected in the Aussenkehr Nature Park in Namibia, small stock farming on the banks of the Orange River might lead to over-utilization by domestic goats belonging to local inhabitants. In South Africa, grazing by small stock and even a heavily grazed population is noted on herbarium sheets by two collectors (*Jürgens 22952*, *Steyn 2127*). At Swartkop, mining activities might pose a threat as *P. mannheimerae* occurs very close to and even in the mining area. A recent visit to the area of distribution revealed many dead woody plants, recently died, probably due to prolonged droughts in the area.

It is possible that some of these might be referred to the new species. *Petalidium mannheimerae* is here provisionally ranked as Vulnerable VU D1 (IUCN 2012).

Etymology:—The specific epithet honours Mrs Coleen Anne Mannheimer [1957–], renowned Namibian botanist and former curator of the National Herbarium of Namibia (WIND). She has collected widely in Namibia and has authored or co-authored several publications on the Namibian flora. Coleen introduced one of us (LN) to botany and botanical fieldwork and has since been a mentor to him in the herbarium and in the field. Her knowledge of the Namibian flora is exceptional and her ability to develop and encourage future Namibian botanists has been profound.

Notes:—Some of the morphological features to distinguish among *Petalidium mannheimerae*, *P. lucens*, and *P. parvifolium* are provided in Table 1; also see Figs 4–6.

Petalidium mannheimerae can also be confused with *P. cymbiforme* and *P. linifolium* due to similarities in habit and flower morphology. However, these species have a different indumentum and linear leaves, with the corolla of *P. linifolium* pale mauve (*vs*. white) and the venation of the bracteoles of *P. cymbiforme* inconspicuous (*vs*. usually conspicuous).

All the mentioned species are members of *Petalidium* sect. *Petalidium* (sensu Meyer 1968), a group composed of plants with regular, five-parted calyces (Obermeijer 1936; Tripp *et al*. 2017).

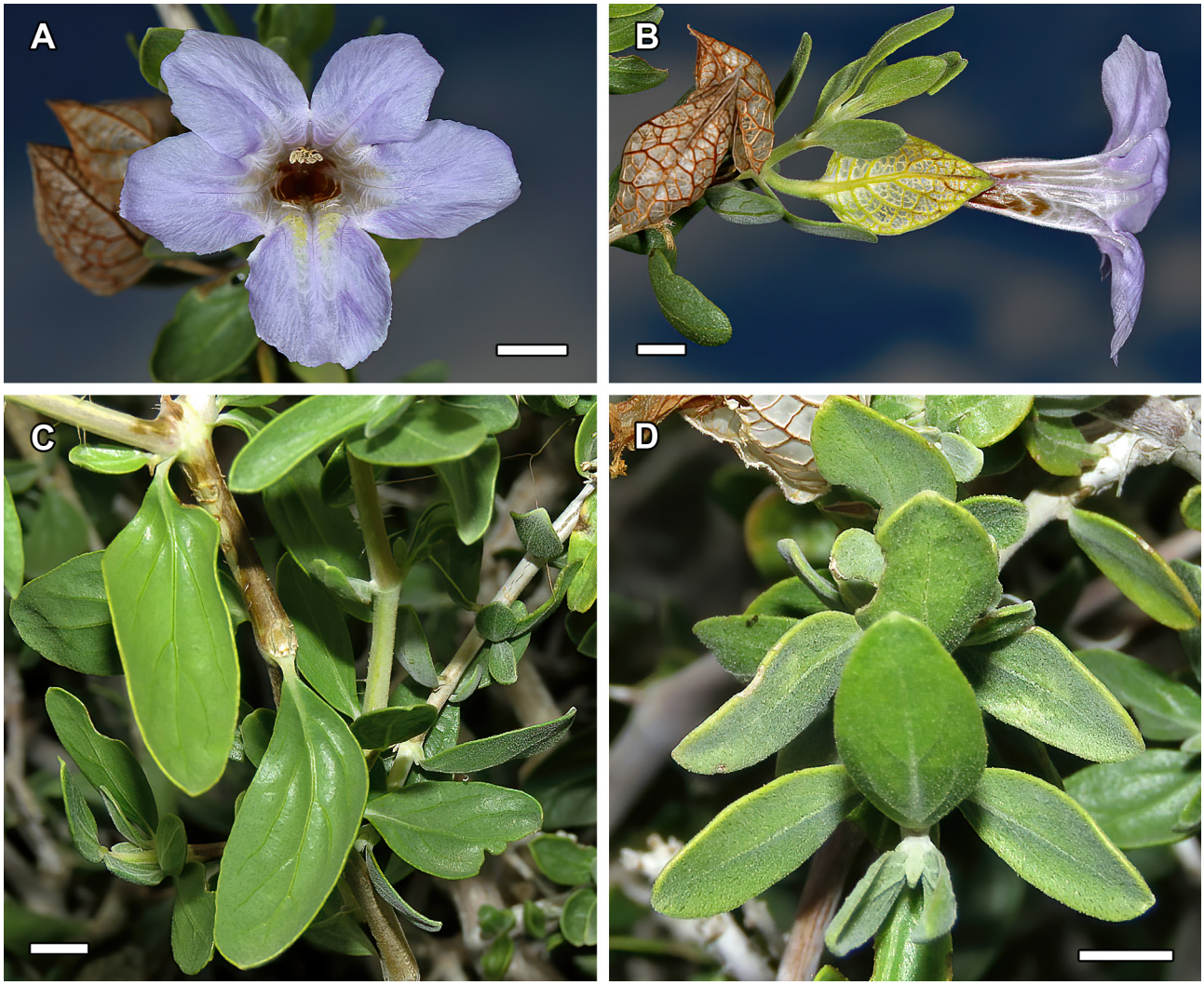

FIGURE 5. *Petalidium lucens*, flower and leaf morphology. **A.** Flower in front view. **B.** Flower in lateral view. **C.** Older leaves, relatively smooth adaxially. **D.** Relatively young leaves with greyish indumentum. Scale bar = 5 mm. Photographs by W. Swanepoel.

TABLE 1. Prominent morphological differences between *Petalidium mannheimerae*, *P. lucens*, and *P. parvifolium*.

Character	*P. mannheimerae*	*P. lucens*	*P. parvifolium*
Indumentum on vegetative parts	Puberulent, on stems usually with widely spaced long, robust, stalked, multi-cellular trichomes and on leaf margins with isolated, robust, stalked glandular trichomes in addition; glabrescent	Dense short simple or sessile stellate trichomes (with 2 or 3 branches), usually with isolated dendritic trichomes in addition; glabrescent	Scattered sessile glandular trichomes; glabrescent
Leaves (shape)	Narrowly obovate, oblanceolate, elliptic or suborbicular, subconduplicate to conduplicate, recurved towards apex; semi-succulent; margins entire	Oblanceolate to linear-lanceolate, broadly oblanceolate, broadly lanceolate, narrowly elliptic or ovate, flat; not succulent; margins entire	Narrowly obovate, oblanceolate, flat; not succulent; margins sometimes sparsely crenate-serrate towards apex
Leaves (size) (mm)	10–24 × 4–16	Up to 32 × 17	4–30 × 2–11
Leaves (apex)	Acute, rounded or emarginate	Acute or obtuse	Rounded to obtuse, apiculate
Bracteoles (shape)	Ovate, often asymmetrically so	Ovate to broadly ovate	Lanceolate-ovate
Bracteoles (colour)	Pale green, yellow-green, mauve-green, buff or brown	White	White
Bracteoles (venation)	Pale green, dark green or mauve-green, conspicuous or not	Dark green or dark brown, highly conspicuous	Green, brown, dark brown or violet, conspicuous
Bracteoles (apex)	Attenuate, usually with 1–5 long, sharp, robust trichomes	Acute with a long mucro	Acute, sometimes apiculate
Bracteoles (indumentum) (abaxially)	Puberulent, margins lanate and sometimes with isolated short stalked glandular and or long, robust multicellular trichomes	Puberulent with short-stalked glandular trichomes in addition, some often robust, margins lanate	Scattered sessile glands, towards base sometimes with very short glandular trichomes in addition
Bracteoles (size)(mm)	13–15 × 7–9	18–20 × 15	10–12 × 4–5
Pedicels below bracteoles (orientation and length)	Porrect, 3–4 mm long	Ascending, 8–12 mm long	Ascending, 1–3 mm long
Corolla (indumentum)(outside)	Puberulous	Scattered short-stalked glandular and isolated eglandular multi-cellular trichomes	Puberulous
Corolla (colour of lobes)	White; nectar guides pale yellow, cream or absent	Mauve; nectar guides cream	Mauve, white or white with lilac tinge; nectar guides yellow
Anthers (length)(mm)	2.1–2.3	ca. 3.3	ca. 2.2
Anthers (indumentum)	Scattered short-stalked glandular trichomes	Scattered short-stalked glandular trichomes	Scattered short-stalked glandular and few simple trichomes
Style (indumentum)	Puberulous	Puberulous	Puberulous with short-stalked glandular trichomes in addition
Distribution	Namibia (lower Orange River Valley in ǁKharas Region) and South Africa (Northern Cape Province)	Namibia (ǁKharas Region) and South Africa (Northern Cape Province)	Botswana (Kgalagadi District), Namibia (Omaheke and Khomas Regions)

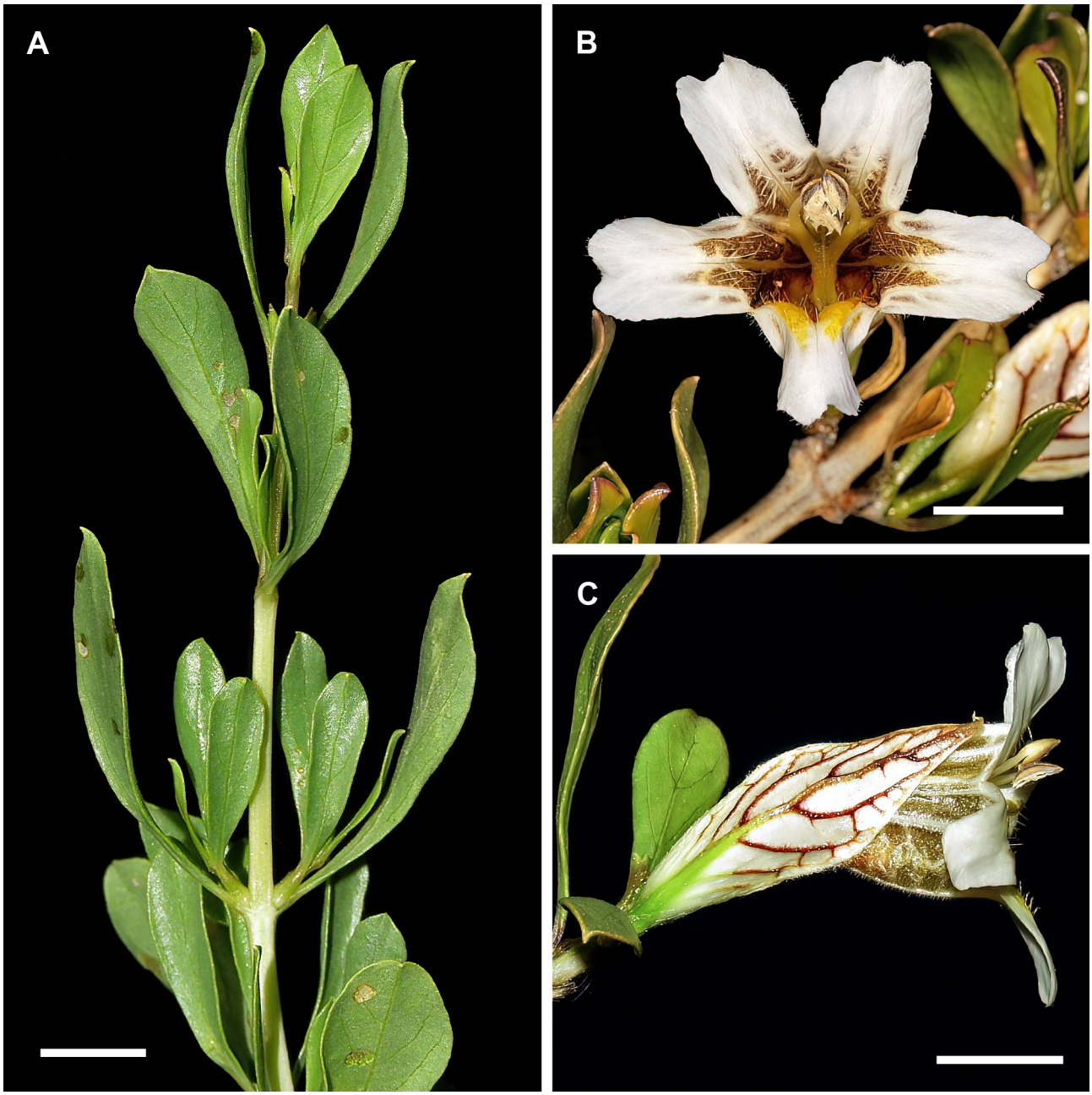

FIGURE 6. *Petalidium parvifolium*, flower and leaf morphology. **A.** Branchlet showing leaves that are not succulent; blade ± flat and margins without long, robust, multi-cellular trichomes and isolated, robust, stalked glandular trichomes. **B.** Flower in front view. **C.** Flower in lateral view. Scale bar = 5 mm. Photographs by W. Swanepoel.

Additional specimens examined (paratypes):—NAMIBIA. ||Kharas Region: Karasburg District, Aussenkjer [Aussenkehr] 147 Farm: The mountain on the bank of the Orange River less than a km from the turn off to the right as you come in from the Sjambok entrance, 2817CB, 12 August 2018, *Nanyeni 1371*, *1372* (WIND!); Mountain slope, 250 m downstream of Sambok River Mouth, Farm Aussenkehr 147, 2817CB, 134 m, 23 February 2022, *Swanepoel 571* (WIND!). SOUTH AFRICA. Northern Cape Province: Richtersveld. Kahams area east of Stinkfonteinberge, east of kloof running down from Cornellsberg, 2817CA, 600 m, 5 September 1977, *Oliver, Tölken & Venter 665* (PRE!); 12 miles from Stinkfontein on way to Vioolsdrif in Richtersveld, 2917CB, ca. 700 m, 15 November 1971, *Werger 1511* (PRE!); Richtersveld. Vanzylsrivier, 2817CB, 580 m, 25 September 1987, *Jurgens 22952* (PRE!); Namaqualand District. Richtersveld, southeast of Sunvalley camp site, 2817CB, 551 m, 8 August 2011, *Steyn 1847* (PRE!); Richtersveld. Near Stinkfontein, 2817CD, 14 September 1961, *Van Breda 1497* (PRE!); Richtersveld. Road between Stinkfontein & Modderdrift, 20 miles from Stinkfontein, 2817CD,15 September 1961, *Hardy 675* (PRE!); Vioolsdrif, Klein Helskloof, 20 km northeast of Eksteenfontein, 2817CD, 9 September 2002, *Venter & Venter 9800*

(PRE!); Namakwaland. 53 km vanaf Steinkopf pad na Vioolsdrif, 2817DC, 27 August 1983, *Van Wyk 6513* (PRE!, PRU!); Vioolsdrif District. Nababeepsberg (Swartberge) in deep gorge below Helshoogte on eastern side of main road, 2817DC, 27 August 1988, *Williamson 3912* (PRE!); Namakwaland. Swartbergmyn tussen Steinkopf en Vioolsdrif, 2817DD, 27 August 1983, *Van Wyk 6532* (PRE!, PRU!); Swartkop Mine, 2817DD, 643 m, 7 August 2018, *Nanyeni 1370* (PRE!, WIND!); Namaqualand District. Wyepoort River Valley, 2917BA, 598 m, 9 October 2015, *Steyn 2127* (PRE!).

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