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Petalidium sebrabergense (Acanthaceae), a new species from Namibia

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Abstract

Petalidium sebrabergense, first collected in May 2024 and easily mistaken for *P. cirrhiferum*, is described here as a new species. It is a range-restricted species, only known from Namibia's Zebra Mountains, within the Kaokoveld Centre of Endemism. It typically grows on plains, hillsides, and along ephemeral riverbeds and drainage lines, primarily in soils derived from anorthosite and gabbro of the Kunene Igneous Complex. Key distinguishing features for *P. sebrabergense* include the pale green appearance of the plants, vegetative parts with indumentum of dense, simple, multi-cellular stalked glandular trichomes, frequently interspersed with widely spaced eglandular simple and bifurcate trichomes, often with some leaves additionally bearing sparsely branched dendritic trichomes. The flowers are borne in racemose dichasia and are notable for having the corolla lobes lilac or mauve, with both sides concolorous. A comparison of key morphological features distinguishing *P. sebrabergense* from *P. cirrhiferum*, its closest look-alike, is provided. Brief comparisons are also made with *P. huillense*, *P. subcrispum*, and *P. welwitschii*, species with which it can be confused, particularly in herbarium specimens. Based on IUCN Red List criteria, a provisional conservation status of Critically Endangered (CR) is recommended for the new species.

Key words: anorthosite, endemism, Epupa, flora, Kaokoveld Centre of Endemism, Kunene Igneous Complex, Kunene Region, Kunene River, Ruellieae, Swartbooisdrif, taxonomy, ultramafic rocks, Zebra Mountains

Introduction

Currently, 43 described species of *Petalidium* Nees von Esenbeck (1832: 75) are recognised in Africa. The primary centre of diversity for this genus is in northwestern Namibia and neighbouring southwestern Angola. Namibia is home to 33 species, while 13 species are recorded in Angola, six in South Africa, and a total of 35 species are noted in the *Flora of southern Africa region*, which includes South Africa, Namibia, Botswana, Eswatini, and Lesotho (Germishuizen & Meyer 2003, Figueiredo & Smith 2008, Swanepoel 2020, Swanepoel & Manzitto-Tripp 2022, Swanepoel *et al.* 2022, Dexter *et al.* 2023, Swanepoel & Van Wyk 2023a, b, 2024, 2025, Swanepoel *et al.* 2023, 2024).

Currently, no updated key exists for identifying all accepted species of *Petalidium*. This paper contributes to a long-term project, led by one of us (WS), focused on extensive fieldwork in underexplored regions of Namibia and Angola to discover and document undescribed species. The ultimate aim is to produce a comprehensive monograph of the genus, a task that will take considerable time. To justify the effort and cost of exploration, we describe new taxa as they are discovered.

In the present contribution a new species of *Petalidium* is described. This new entity is restricted to the Zebra Mountains in the Kaokoveld Centre of Endemism—a biogeographical region rich in range-restricted plant species in northwestern Namibia and adjacent southwestern Angola (Van Wyk & Smith 2001). The Zebra Mountains are notable for being one of the largest known outcrops of anorthosite, with associated mafic-ultramafic rock types, on Earth (Maier *et al.* 2013) (Fig. 1). Soils derived from mafic-ultramafic rocks are typically rich in heavy metals, which are often linked to high levels of plant endemism (Siebert *et al.* 2001, Van Wyk & Smith 2001, Adhikari *et al.* 2022).

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FIGURE 1. The Zebra Mountains, home to the newly discovered *Petalidium* species, are situated in northwestern Namibia. Covering ca. 1230 km², they are part of the Kunene Complex—one of the world's largest anorthosite massifs. The mountains derive their name from the distinctive striped and spotted patterns on their slopes, which are clearly visible from a distance and depicted in the photograph. This "zebra" pattern results from alternating bands of dark, vegetation-scarce boulders (dark leucotroctolite) and densely vegetated areas. The latter appear brownish cream during the dry season (as in photograph) and turn greenish brown after sufficient rainfall. Photograph by W. Swanepoel.

During a botanical expedition to the northern part of the Zebra Mountains in June 2014, one of us (WS) encountered a *Petalidium* characterised by its dwarf shrub habit, multi-stemmed from just below or above ground level, pale green or grey-green leaves and lilac or mauve flowers in racemose dichasia. The plants were initially thought to be a pale-flowered form of *P. cirrhiferum* Moore (1902: 307) that occurs in the same wider area. However, further study revealed that the plants have vegetative parts with an indumentum of dense, mainly simple, multi-cellular stalked-glandular trichomes in contrast to the matted dendritic trichomes of *P. cirrhiferum*. During a subsequent expedition to the Zebra Mountains in May 2024, the plants were again in flower, enabling material to be collected upon which this description is based. The new species can be confused with several other members of *Petalidium* in northwestern Namibia with which it shares morphological similarities, especially in features of the habit, indumentum, leaves, and flowers. Its closest relative is probably *P. cirrhiferum*. A study of the *Petalidium* holdings in the Herbs PRE, PRU, and WIND revealed no earlier collections of the new species.

The Kaokoveld Centre is a pronounced centre of diversity and endemism for *Petalidium* (Craven 2009, Tripp *et al*. 2017, Dexter *et al.* 2023, Loiseau *et al*. 2023) and related Acanthaceae (e.g., Tripp & Dexter 2012, Darbyshire *et al*. 2020). However, the Centre remains botanically underexplored, making the discovery of yet another new species unsurprising. In recent years, the Zebra Mountains have been recognised as a distinct subcentre of plant endemism within the Kaokoveld Centre. Over the past nine years, at least three new endemic woody species have been described from this area: *Maerua sebrabergensis* Swanepoel (2015: 123), *Ocimum sebrabergensis* Swanepoel & Van Jaarsveld (2019: 204), and *Carissa sebrabergensis* van Jaarsv. & Swanepoel in Van Jaarsveld *et al*. (2021: 150).

Methods

Morphological descriptions and ecological information presented here are based primarily on field observations and material collected following extensive field work in Namibia. Diagnostic features for the new species and *P. cirrhiferum* were determined through examination of fresh material, the type material in Herb. WIND, as well as high-resolution images of type material available on JSTOR Global Plants (https://plants.jstor.org/). This was supplemented by the study of the protologues and available herbarium collections in the National Botanical Research Institute in Namibia (WIND), the South African National Biodiversity Institute, Pretoria (PRE), and the University of Pretoria (PRU) (herbarium codes follow Thiers 2025). A 6.5–45.0× magnification stereo microscope was used for studying morphological features. Descriptive terminology follows Beentje (2016), Manktelow (2000), and Hewson (2019). 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. A preliminary conservation assessment was conducted using the standard procedures based on IUCN (2012) recommendations, and the online GeoCAT tool (Bachman *et al.* 2011).

Taxonomic treatment

Petalidium sebrabergense Swanepoel & A.E.van Wyk, *sp. nov.* (Figs 2–5)

Diagnosis:—A woody dwarf shrub up to 0.75 m tall, morphologically most similar to *Petalidium cirrhiferum,* differing by lacking dendritic trichomes on stems (*vs*. dendritic trichomes present); indumentum on leaves with trichomes sparsely to densely scattered (*vs*. appearing matted or floccose); leaf lamina lanceolate (*sensu* Lindley's definition [Beentje 2016]), oblanceolate or elliptic (*vs*. lanceolate [*sensu* Lindley], ovate or narrowly ovate); bracteoles with indumentum abaxially lacking dendritic trichomes (*vs*. long-stalked dendritic trichomes present); corolla lobes adaxially lilac or mauve (pale violet) (*vs*. heliotrope, magenta or purple-red [bright violet or red]).

Type:—NAMIBIA. Kunene Region: Zebra Mountains, ca. 14 km southwest of Enyandi, rocky mountain side, 1713AD, 1202 m a.s.l., 12 May 2024, *Swanepoel 647* (holotype WIND!; isotypes PRE!, PRU!).

Hemispherical woody dwarf shrub up to 0.75 m tall; all vegetative parts with dense, simple, multi-cellular stalked glandular trichomes (short and fine to longer and robust), often interspersed with widely spaced eglandular simple and bifurcate trichomes, glabrescent. *Stems* multi-stemmed from just below or above ground level, erect to procumbent, older distal stems cylindrical, bark smooth, light brown; young stems quadrangular, green, cystoliths visible, narrowly elliptic or circular. *Leaves* opposite and decussate on new shoots, fascicled on older stems; petiole 1–11 mm long; lanceolate [*sensu* Lindley's definition (Beentje 2016)], oblanceolate or elliptic, flat or sub-conduplicate, sometimes undulate towards margin, often recurved towards apex, 12–50 × 4–18 mm, green, pale green or grey-green (due to white indumentum), sometimes maroon-grey-green, in herbarium material pale green or olive-green, often some leaves with sparsely branched dendritic trichomes in addition (shorter than longest stalked glandular trichomes) rarely with an apical gland or glabrous to almost so, apex acute or obtuse, attenuate, often apiculate, base attenuate, margins entire, crenulate, denticulate or crenulate-serrate, sometimes undulate, midrib and the 4 to 6 principal lateral veins on each side of it prominently raised adaxially, cystoliths not visible. *Flowers* in axillary racemose dichasia 35–140 mm long; bracts foliaceous, oblanceolate, sessile, up to 20 mm long, indumentum similar to leaves; pedicels (below bracteoles; "peduncle" of some authors) 2–3 mm long; bracteoles lanceolate or narrowly ovate, slightly asymmetrical, coriaceous, 14.4–16.2 × 3.4–4.9 mm, apex attenuate, pale green, stramineous when dry, venation reticulate, dark green, indumentum abaxially of simple multi-cellular stalked glandular trichomes (weak and short to longer and robust) up to 2 mm long (not or barely visible to the naked eye), sometimes with few simple or bifurcate eglandular ones in addition, adaxially sparsely strigose, trichomes simple, bulbous-based, on veining towards base stalked glandular ones in addition, margins lanate towards apex, cystoliths visible both sides, small, linear, dense. *Calyx* ca. 6.6 mm long including basal tube of ca. 1.6 mm deep, lobes 4, regular, narrowly triangular, acute, unequal, 3.5–5.0 × 1.4–2.0 mm, anticous lobe bifid for ca.1.1 mm; strigose both sides. *Corolla* with narrow unexpanded portion of tube cylindrical, laterally slightly flattened, ca. 22.7 mm long with lobes straightened, narrow portion ca. 10.0 mm long, ca. 2.9 mm diam., outside glabrous, inside puberulous distally on anterior side otherwise glabrous, expanded portion at a slight angle to anterior side of narrow portion, ca. 5.2 mm long, outside puberulous, inside of anterior part with scattered long

FIGURE 2. *Petalidium sebrabergense*. Habitat and habit. **A.** Dwarf shrubs in foreground with bright green foliage following recent rains; in open shrub and tree savanna of inter-mountain valley on whitish soil derived from anorthosite. **B.** Spreading dwarf shrubs in an ephemeral stream bed on whitish anorthosite-derived soil. Photographs by W. Swanepoel.

FIGURE 3. *Petalidium sebrabergense*. Habit and leaf variation. **A.** Dwarf shrub ca. 400 mm high with relatively narrow leaves, growing among dark rocks of leucotroctolite. **B.** Dwarf shrub ca. 250 mm high with relatively broad leaves, growing in whitish anorthosite-derived soil. Photographs by W. Swanepoel.

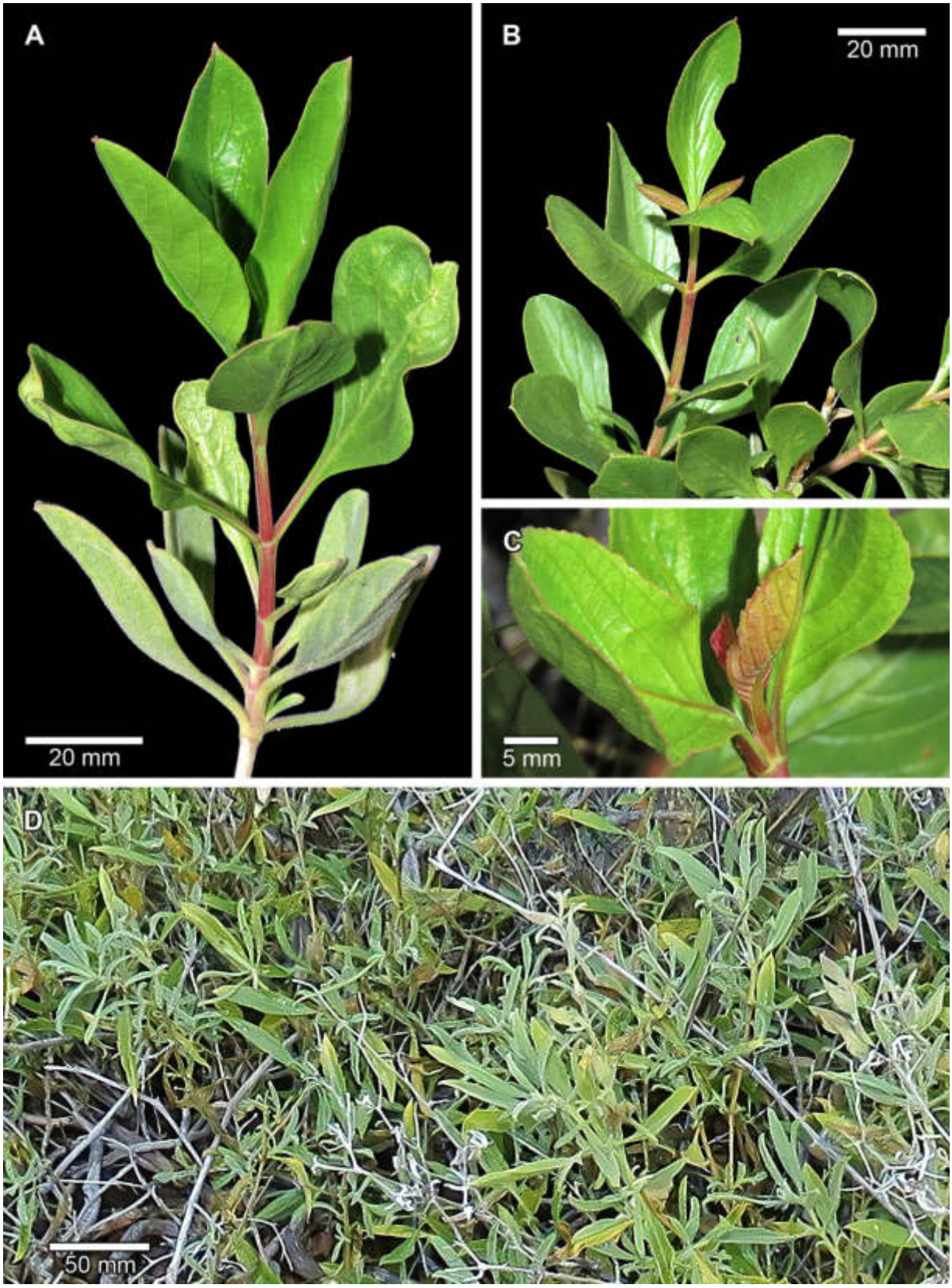

FIGURE 4. *Petalidium sebrabergense*. Morphology of leaves: relatively broad (A–C) and narrow-leaved forms (D). **A.** Shoot bearing entire-margined leaves; the older, proximal leaves have a relatively dense, but not matted, greyish indumentum likely developed under drier conditions, while the younger, distal leaves are nearly glabrous and bright green, having formed after significant rainfall. **B.** Shoot with leaves produced following favourable rainfall, some exhibiting denticulate or crenulate-serrate margins. **C.** Actively growing tip of a shoot under optimal soil moisture conditions, displaying leaves with crenulate-serrate margins. **D.** Leaves of narrow-leaved form. Photographs by W. Swanepoel.

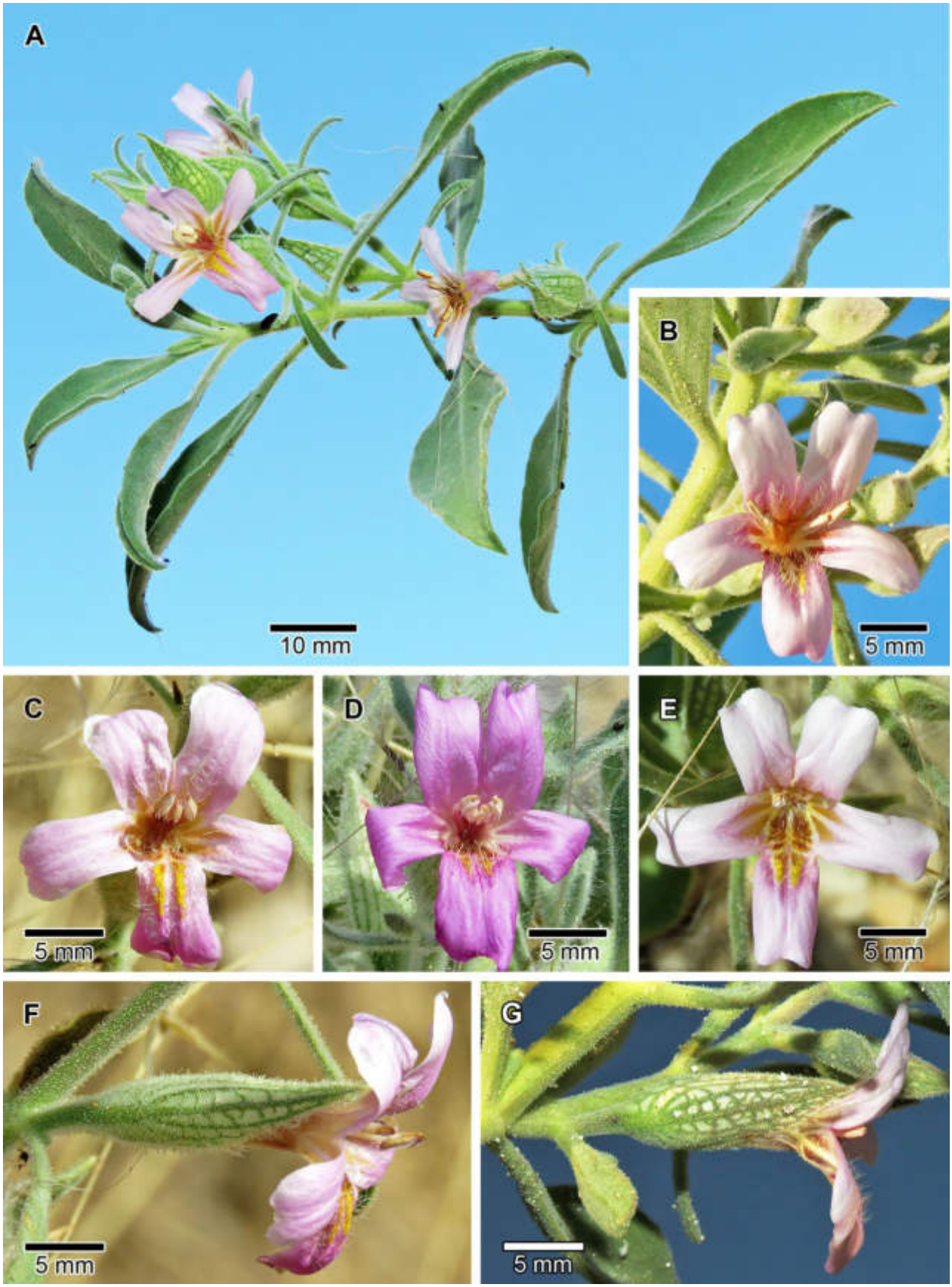

FIGURE 5. *Petalidium sebrabergense*. Morphology of flowers. **A.** Shoot with relatively narrow leaves and flowers. **B, C, D, E.** Flowers in front view, each from a different plant to show variation. Corolla lobes are lilac or mauve (pale violet), both surfaces concolorous. **F, G.** Flower in side view; bracteoles abaxially with numerous simple multi-cellular stalked glandular trichomes up to 2 mm long (not or barely visible to the naked eye), but lacking dendritic trichomes. Photographs by W. Swanepoel.

stiff white simple trichomes towards mouth, inside otherwise glabrous, herringbone pattern prominently transversely 5-ribbed inside; lobes obovate, often recurved towards margins, then appearing rectangular, spreading or ascending-spreading, anterior lobe ca. 7.9 × 5.2 mm, lateral lobes ca. 6.6 × 3.9 mm, upper lobes ca. 7.4 × 3.1 mm, connate for 20% of their length, lobe apices entire or crenulate, rounded or retuse, all lobes similarly coloured, both sides concolorous, lilac or mauve (pale violet), nectar guides narrowly triangular, conspicuous, yellow on anterior lobe, crimson or peach on other lobes; lobes glabrous adaxially except for few long stiff white simple trichomes towards bases. *Stamens* didynamous, inserted dorsally in throat, fused portion ca. 0.9 mm long, free parts slightly tapering towards apex, puberulent towards bases, long filaments ca. 4.3 mm long, short filaments ca. 2.1 mm long, outer filament with basal ridge from point of insertion on corolla ("trace") decurrent to ca. 3 mm from base of tube; filament curtain reduced (*sensu* terminology of Manktelow 2000); anthers 2-thecous, thecae ovate-oblong, equal, ca. 2.5 mm long excluding short basal spur, mauve-white, purple-white or cream, puberulent towards base. *Gynoecium* ca. 14.8 mm long; ovary ovoid, laterally compressed, ca. 1.6 × 1.1 mm, inserted in fleshy disc, glabrous; style filiform, ca. 13.2 mm long, puberulous with scattered short-stalked glandular trichomes towards base in addition, stigma lobes linear, sub-equal, ca. 0.9 mm long. *Capsule* flattened ovoid, ca. 9 × 5 mm, smooth, tawny, glossy, glabrous; seeds cordate, ca. 3.7–4.0 × 3.2–3.5 mm, densely covered with white hygroscopic trichomes.

Phenology:—Flowers and fruit have been recorded in May and June (late summer to early winter).

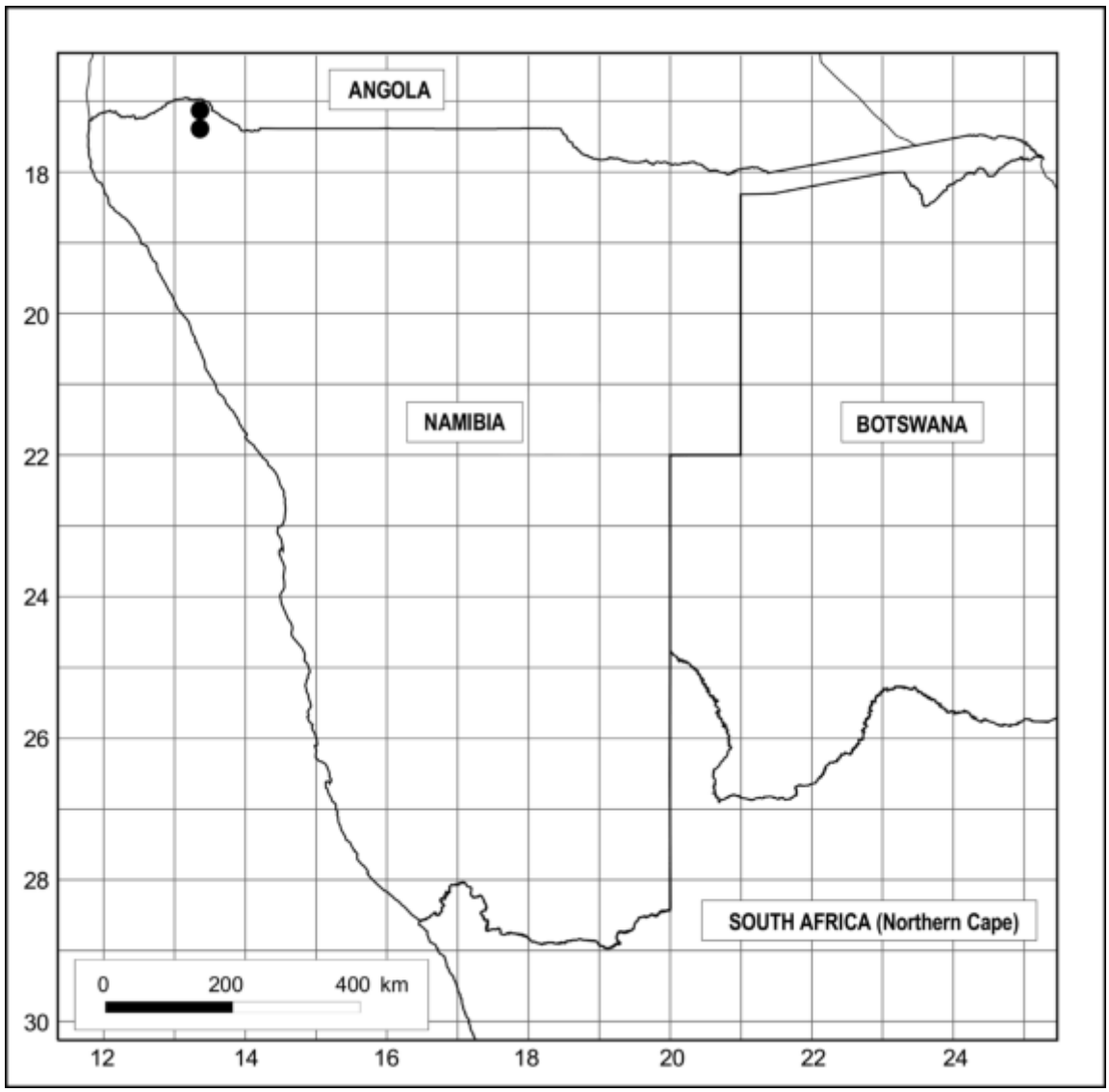

FIGURE 6. Known distribution of *Petalidium sebrabergense* (black dots). Based on herbarium specimens in Herb. WIND, and duplicates (still to be presented) in Herbs PRE and PRU.

Distribution and habitat:—Currently, *Petalidium sebrabergense* is only known to occur in the Kaokoveld, northwestern Namibia, specifically in the Zebra Mountains between Enyandi and Swartbooisdrif (Fig. 6). It typically

inhabits plains, hillsides, and ephemeral riverbeds and drainage lines (Figs 2 & 3), primarily thriving in clay soils derived from the Kunene Igneous Complex, which includes dark leucotroctolite, olivine-bearing anorthosite, dunite, gabbro, and norite (Miller & Schalk 1980, Maier *et al.* 2012). The species is found at elevations ranging from 810 to 1300 m a.s.l., ca. 180 km inland from the Atlantic Ocean. The region receives an average annual rainfall of 250–350 mm, mainly during the summer months (Atlas of Namibia Team 2022). However, it is possible that the species has a wider distribution within the Zebra Mountains, as many areas remain difficult to access. Given the presence of satellite outcrops of the Kunene Igneous Complex in nearby parts of southern Angola (Maier *et al.* 2012), further exploration may reveal its presence there as well.

Conservation status:—*Petalidium sebrabergense* has been recorded in the northern Zebra Mountains at several sites where it is occasional to locally common. Although a brief search at various other sites with seemingly suitable habitat did not reveal any plants, it is probably more widespread than currently known (see under 'Distribution and habitat' above). The extent of occurrence (EOO) has been calculated as 40.5 km² and the area of occupancy (AOO) as 23.5 km², based on a cell width of 2 km as recommended by the IUCN Standards and Petitions Committee (2024). Due to its limited geographical range (EOO < 100 km²), with only one known locality (the Zebra Mountains in Namibia) and habitat under pressure from prolonged drought conditions, *Petalidium sebrabergense* is here provisionally assessed as Critically Endangered CR B1a,b(iii) (IUCN 2012).

Etymology:—The specific epithet refers to the Zebra Mountains (Fig. 1), known as *Sebraberge* in Afrikaans, located in northwestern Namibia, where *Petalidium sebrabergense* is exclusively found.

Notes:—*Petalidium sebrabergense* is morphologically most similar to *P. cirrhiferum*, perhaps its closest relative. Hence these two species were compared in the diagnosis above. Some of the morphological features to distinguish between *P. sebrabergense* and *P. cirrhiferum* are provided in Table 1; also see Fig. 7.

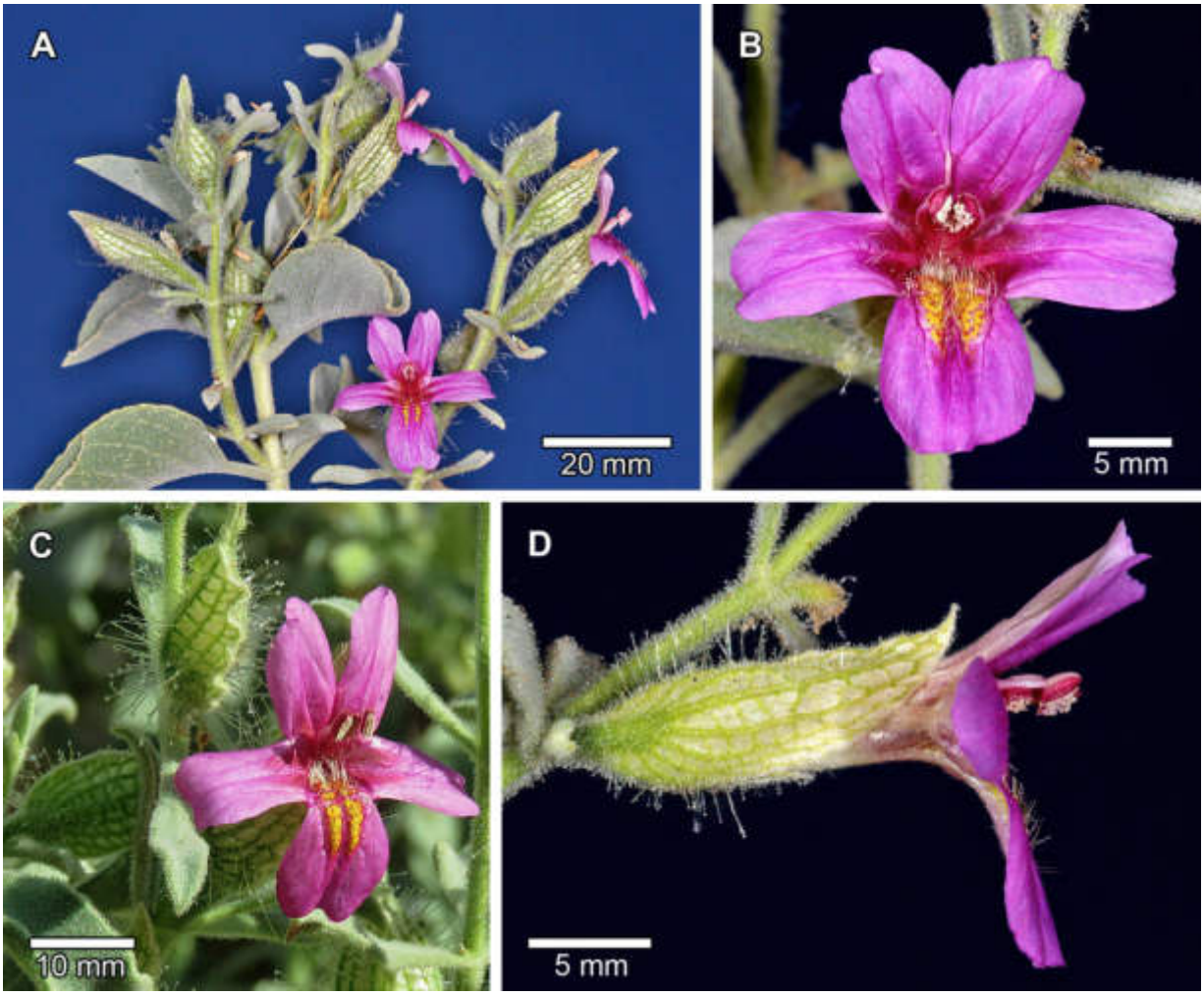

FIGURE 7. *Petalidium cirrhiferum*. Morphology of leaves and flowers. **A.** Branchlet showing ovate or narrowly ovate leaves with greyish indumentum composed of matted dendritic and bifurcate trichomes (microscopic enlargement required). **B.** Flower in front view. **C.** Flower in front view and persistent bracteoles of spent flowers. Note outer surface of bracteoles with robust, long-stalked dendritic trichomes up to 5 mm long. **D.** Flower in side view, showing bracteole with long-stalked dendritic trichomes. Photographs by W. Swanepoel.

TABLE 1. Morphological comparison between *Petalidium sebrabergense* and *P. cirrhiferum*.

Character	*P. sebrabergense*	*P. cirrhiferum*
Indumentum on stems	Dendritic trichomes absent; eglandular simple trichomes often present	Dendritic trichomes present; eglandular simple trichomes absent
Indumentum on leaves	Stalked glandular trichomes, often in addition simple, bifurcate or on some leaves sparsely branched dendritic trichomes (shorter than longest stalked glandular ones) or glabrous to almost so; sparsely to densely scattered, but not matted	Dendritic and bifurcate trichomes, sometimes with widely-spaced stalked glandular ones in addition (length ca. equal to dendritic ones); matted or floccose
Leaves (shape)	Lanceolate (*sensu* Lindley), oblanceolate or elliptic; flat or sub-conduplicate, sometimes undulate towards margin, often recurved towards apex	Ovate or narrowly ovate, rarely lanceolate (*sensu* Lindley); sub-conduplicate to conduplicate, sometimes undulate towards margin
Lamina (apex; base)	Acute or obtuse, often apiculate; attenuate	Acute, attenuate or rounded; cuneate, truncate, or attenuate
Leaves (lamina size) (mm)	12–50 × 4–18	10–70 × 4–54
Inflorescences	Axillary racemose dichasia, 35–140 mm long	Axillary and terminal racemose dichasia, 50–250 mm long
Bracts (indumentum)	Similar to leaves	Similar to leaves but always with simple multi-cellular stalked glandular trichomes in addition (length equal to or longer than dendritic ones)
Bracteoles (indumentum (abaxially)	Dendritic trichomes lacking	Robust dendritic trichomes present, long-stalked, up to 5 mm long
Bracteoles (indumentum (adaxially)	Sparsely strigose towards apex	Strigose towards apex, with multicellular simple stalked glandular trichomes on veining in addition
Calyx (indumentum abaxially)	Short-stalked glandular trichomes absent	Short-stalked glandular trichomes present
Calyx (length) (mm)	Ca. 6.6	Ca. 10.8
Corolla upper lobes (shape, fusion and size) (mm)	Obovate, apices rounded or retuse, ca. 7.9 × 5.2, connate for 20% of their length	Obovate, apices rounded, retuse or ca. praemorse, ca. 9.7 × 5.6, connate for 27% of their length
Corolla lateral lobes (shape and size) (mm)	Obovate, apices entire or crenulate, rounded or retuse, ca. 6.6 × 3.9	Obovate, apices rounded, retuse or ca. praemorse, ca. 9.4 × 5.5
Corolla anterior lobe (shape and size) (mm)	Obovate, apex entire or crenulate, rounded or retuse, ca. 7.9 × 5.2	Obovate or elliptic, apex rounded, retuse or ca. praemorse, ca. 10.1 × 8.9
Corolla lobes (colour, adaxially)	Lilac or mauve (pale violet)	Heliotrope, magenta or purple-red (bright violet or red)
Corolla lobes (colour, abaxially)	Similar to adaxial side	Whitish, notably paler than adaxial side
Corolla nectar guides (upper and lateral lobes)	Crimson or peach; conspicuous	Claret or crimson; inconspicuous
Filaments (free parts, length) (mm)	Long stamen ca. 4.3 Short stamen ca. 2.1	Long stamen ca. 5.4 Short stamen ca. 3.8
Filaments (free parts indumentum)	Stalked glandular trichomes absent	Stalked glandular trichomes present
Outer filament basal ridge	Decurrent to ca. 3.0 mm from base of tube	Decurrent to ca. 7.2 mm from base of tube
Anther thecae (indumentum)	Puberulent towards base	Dorsally with short, stalked glandular trichomes
Ovary (size) (mm)	Ca. 1.6 × 1.1	Ca. 2.0 × 1.9
Distribution	Namibia: Kunene Region in the Zebra Mountains east of Epupa	Angola: Namibe Province in Iona National Park; Namibia: Kunene Region from Epupa westwards in mountainous area along Kunene River

Petalidium sebrabergense exhibits variation in both leaf size and indumentum density. Plants with relatively narrow leaves were found in rocky habitats (Figs 2A, 5A). However, the flowers appear identical in both narrow-leaved and broad-leaved forms. Further investigation should explore whether these two forms remain morphologically distinct and are consistently associated with different substrates. If this is the case, subspecific status could be considered for each form. The indumentum is generally denser (but never matted) on leaves that develop under drought stress conditions (Fig. 4A).

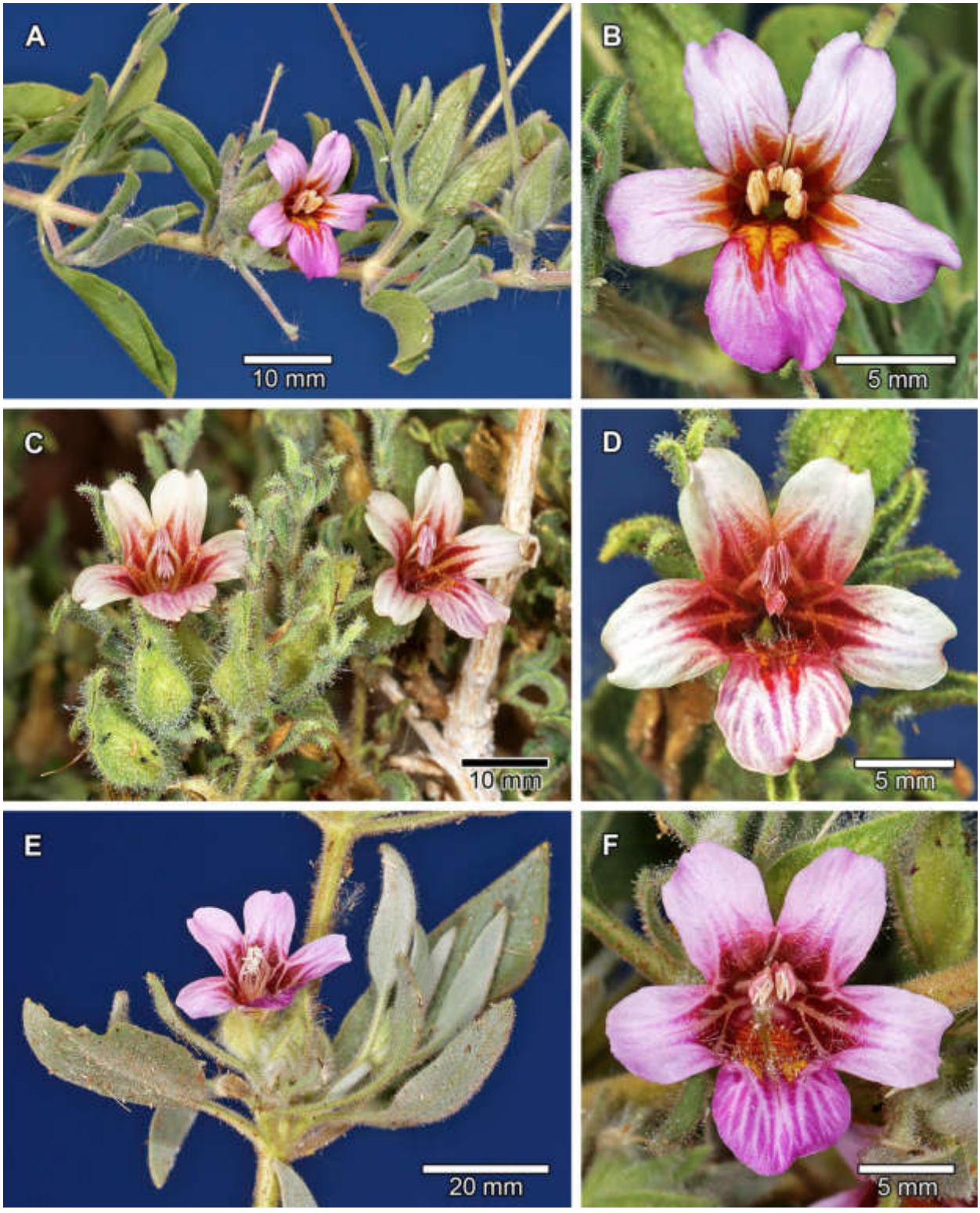

FIGURE 8. Leaf and flower morphology of three species of *Petalidium* with which *P. sebrabergense* can be confused, particularly in herbarium specimens. **A, B.** *P. huillense*, branchlet with leaves and flowers (A); flower in front view (B). **C, D.** *P. subcrispum*, branchlet with leaves, flowers and persistent bracteoles of spent flowers (C); flower in front view (D). **E, F.** *P. welwitschii*, branchlet with leaves and flower (E); flower in front view (F). Photographs by W. Swanepoel.

The new species, particularly in herbarium specimens, may be mistaken for several other species of *Petalidium* from the lower Kunene River and its surrounds. These similar species share characteristics such as simple stalked glandular trichomes on vegetative parts, more or less straight corolla tubes, and corolla lobes in shades of violet with conspicuous nectar guides on all lobes. Notably, they include *P. huillense* Clarke (1899: 91), *P. subcrispum* Meyer (1967: 509), and *P. welwitschii* Moore (1880: 227) (Fig. 8). However, *P. sebrabergense* can be distinguished by its leaf shape—lanceolate [*sensu* Lindley's definition (Beentje 2016)], oblanceolate, or elliptic—with margins that are often crenulate, denticulate or crenulate-serrate (Fig. 4B, C). In contrast, *P. huillense* has oblong-elliptic leaves with entire margins, while *P. subcrispum* has ovate leaves with entire or undulate margins.

The leaf indumentum of *P. sebrabergense* consists of simple stalked glandular trichomes often interspersed with short eglandular simple, bifurcate or dendritic trichomes. In contrast, the leaf indumentum of *P. welwitschii* is densely matted, consisting of dendritic trichomes interspersed with simple stalked glandular ones, unlike the sparser trichome coverage seen in the other species.

Additionally, *P. welwitschii* is characterised by very long simple glandular trichomes on its bracteoles that are visible to the naked eye, whereas in the other species, they can only be seen under magnification. Furthermore, the corolla lobe traces, especially on the anterior lobe of *P. welwitschii* and *P. subcrispum*, appear paler in colour than the associated lobe, whereas in the other species the traces blend with the lobe. The inflorescence axis of *P. sebrabergense* is relatively long (up to 140 mm) and not spinescent, whereas in *P. huillense* it is much shorter (up to 60 mm long) and spine-tipped.

All the mentioned species are from the group composed of plants with irregular, four-parted calyces (Obermeijer 1936, Tripp *et al*. 2017).

Additional specimen examined (paratype):—NAMIBIA, Kunene Region: Zebra Mountains, river valley 7 km northeast of Ombuku, 1713AB, 843 m, 10 January 2025, *Swanepoel 653* (WIND!).

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