Phytotaxa 714 (1): 069–078
https://www.mapress.com/pt/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

https://doi.org/10.11646/phytotaxa.714.1.4

A new cliff-dwelling species of *Crassula* (Crassulaceae: Crassuloideae) from the Mpumalanga Escarpment, Northern Drakensberg, South Africa

NEIL R. CROUCH[1,6*], MICHELE WALTERS[2,7], MERVYN LÖTTER[3,4,8] & GIDEON F. SMITH[5,9]

[1]*Biodiversity Research, Assessment and Monitoring, South African National Biodiversity Institute, P.O. Box 52099, Berea Road, 4007 South Africa*
[2]*Department of Nature Conservation, Tshwane University of Technology, Private Bag X680, Pretoria, 0001 South Africa*
[3]*Mpumalanga Tourism & Parks Agency, P. Bag X1088, Lydenburg, 1120 South Africa*
[4]*School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg, South Africa*
[5]*Ria Olivier Herbarium, Department of Botany, Nelson Mandela University, P.O. Box 77000, Gqeberha, 6031 South Africa*
[6] *N.Crouch@sanbi.org.za; https://orcid.org/0000-0002-4938-5840*
[7] *WaltersM@tut.ac.za; https://orcid.org/0000-0001-8302-3408*
[8] *Mervyn.Lotter@gmail.com; https://orcid.org/0000-0002-4767-9079*
[9] *smithgideon1@gmail.com; https://orcid.org/0000-0002-5417-9208*
**Author for correspondence*

Abstract

A new species of *Crassula*, *C. turpiniae* (Crassulaceae subfam. Crassuloideae), is described from high altitude rock faces (1640–2200 m) along a restricted stretch of the Mpumalanga Escarpment in eastern South Africa. The new species shows affinities with both *C. multicava* and *C. ovata* and, along with these two species, fits in *C.* sect. *Anacampseroideae*. The new species can be easily separated from the other two based on the expression of several diagnostic vegetative and reproductive characters. The placement of *C. turpiniae* within the most recently proposed sectional classification for the *Crassula* taxa of southern Africa is discussed.

Key words: classification, *Crassula turpiniae*, *Crassula* sect. *Anacampseroideae*, southern Africa, taxonomy

Introduction

With about 150 species with 230 taxa, *Crassula* Linnaeus (1753: 282) (Crassulaceae subfam. Crassuloideae) is the most speciose and morphologically diverse of the South African genera included in the Crassulaceae. It is widespread throughout the southern African subcontinent in both winter- and summer-rainfall regions, with centres of diversity in the Klein Karoo, Namaqualand-Richtersveld, and Eastern Cape. Of the 20 *Crassula* sections recognised by Tölken (1985) in his treatment for the *Flora of Southern Africa* (*FSA*) region [Namibia, Botswana, Eswatini, Lesotho, and South Africa], it is the comparatively small *C.* sect. *Anacampseroideae* Haworth (1821: 9) (see Tölken 1977a: 181–217, 1985: 128–137) with 11 species (18 taxa) that has provided outstanding value to horticulture, both in South Africa and globally (Rowley 2003). Several well-known bedding or potted plant members of this group include *C. ovata* (Miller 1768: species no. 8 on first page headed "COT | COT") Druce (1917: 617) [jade plant], *C. lactea* Aiton (1789: 396) [tailor's patch], and *C. multicava* Lemaire (1862: 40) (fairy crassula). Most cultivars selected from these species (see for example Boom 1963: 84–85, Guillot Ortiz *et al*. 2008: 37–41, and Mottram 2013: 4–5 on *C. ovata*), along with, for example, the horticulturally popular *C. perforata* Thunberg (1778: 329) (string-of-buttons) in *C.* sect. *Perfilatae* (Haw. ex Candolle 1828: 18) emend. Tölken (1977b: 410), have originated from stock obtained from South Africa's floristically diverse Eastern Cape province. The majority of species included in *C.* sect. *Anacampseroideae* and a large range of other crassulas, many of which are endemic to the Eastern Cape (Smith & Marx 1990), are found in the region (Tölken 1977a: 181–182).

A new species of *Crassula*, *C. turpiniae* N.R.Crouch, Mich.Walters, M.Lötter & Gideon F.Sm. (Figs 1 and 2) is described here. Its most appropriate sectional placement is considered to be in *C.* sect. *Anacampseroideae*, based on the most recent revision of *Crassula* in South Africa (Tölken 1977a, b) as well as on the subsequent *FSA* treatment of the

Accepted by Ronell R. Klopper: 21 Jul. 2025; published: 6 Aug. 2025

family as a whole (Tölken 1985: 128–137). *Crassula turpiniae* is a cremnophyte of exposed rocky outcrops and cliffs in the distinctly montane reaches of the northern Drakensberg range in the Mpumalanga province of South Africa. The new species is illustrated and compared to species with which it shares some characters.

Materials and methods

The description of *C. turpiniae* is based on morphological studies of material from Herb. BNRH, now incorporated in Herb. J, as well as on living material found at the type locality. The vegetative and reproductive characters of all known collections of *C. turpiniae* were studied and measurements taken by hand using a ruler, except for floral measurements below 4 mm, which were taken using a Motic SMZ 168 stereo microscope. Terminology used in the description mostly follows Lawrence (1970: 737–775), Stearn (1985: 311–357), and Beentje & Williamson (2010).

The new species was compared to the two most superficially similar species in the genus, *C. multicava* [included in *C*. [sect. *Anacampseroideae*] subsect. *Petiolares* (Haw. ex Candolle 1828: 18) Tölken (1977a: 194)] and *C. ovata* [included in *C*. [sect. *Anacampseroideae*] subsect. *Latifoliae* (Candolle 1828: 17) Tölken (1977a: 211)]. Note however that, eight years later, Tölken (1985: 128–137), in his treatment of the Crassulaceae for the *FSA* project, did not follow the division of *C*. sect. *Anacampseroideae* into the subsections that he earlier published in his revision of *Crassula* (Tölken 1977a: 181–217), as reflected above. Accordingly, we follow Tölken (1985).

Crassula turpiniae was additionally compared with *C. pellucida* Linnaeus (1753: 283) subsp. *brachypetala* (Drege ex Harvey 1862: 354) Tölken (1975: 114) [earlier included in *C*. [sect. *Anacampseroideae*] subsect. *Fasciculares* Tölken (1977a: 183)] to confirm its sectional placement. The character information for the three taxa in question and the sectional limits of *C*. sect. *Anacampseroideae* in *Crassula* were sourced from living material as well as from the most recent taxonomic treatments of the genus by Tölken (1977a, b, 1985).

Nomenclatural issues accord with the *Shenzhen Code* (Turland *et al*. 2018). Author attributions of the scientific plant names cited in this paper follow IPNI (2025+), albeit in the notation required by *Phytotaxa*, i.e., by citing the protologues of the names as full bibliographic references. Herbarium codes follow Thiers (2025 [continuously updated]).

Results

General:—Morphological assessment of the taxon represented by *J.E. Burrows 9562* (Herb. BNRH [now incorporated into Herb. J]), the holotype of the name *C. turpiniae* published here, indicated that it belongs in *C*. sect. *Anacampseroideae*, but that it does not correspond with any known *Crassula* species from southern Africa. Of the species in *C*. sect. *Anacampseroideae*, *C. turpiniae* most closely resembles *C. multicava* and *C. ovata*, neither of which is known from the Mpumalanga Escarpment.

Crassula turpiniae differs from *C. multicava*, *C. pellucida* subsp. *brachypetala* (see 'Materials and methods', above), and *C. ovata* according to the character states as recorded in Table 1 and as discussed in the '*Character comparison and discussion*:—' and '*Diagnosis*:—' that follow.

Character comparison and discussion:—*Crassula turpiniae* is placed in *C*. sect. *Anacampseroideae*. All species within this section have carnose to slightly woody stems; (usually) flat, glabrous leaves with hydathodes arranged in more or less dense rows along the margins (for example Figs 1D and 2A); and star-shaped flowers with petals spreading from the base (Tölken 1977a: 181–182). Unlike other sections recognised in the genus, all taxa in *C*. sect. *Anacampseroideae* have styles that arise from the posterior apex of the ovary (Tölken 1977a: 182) (Fig. 2F).

The only grassland member of *C*. sect. *Anacampseroideae* that is known from the vicinity of *C. turpiniae* is *C. pellucida* subsp. *brachypetala*. However, *C. turpiniae* lacks the hairs found in lines on either side of the stem and on the pedicel of *C. pellucida* subsp. *brachypetala* and further has an inflorescence that is not half-hidden by its subtending leaves; nor are the calyx lobes linear-triangular but rather oblong and acute to truncate (Figs 2B and E). The leaves have distinctly different shapes (ovate to lanceolate-spathulate in *C. pellucida* subsp. *brachypetala*), relative to those of *C. turpiniae*, which are suborbicular (Figs 1 and 2); and the stems of *C. pellucida* subsp. *brachypetala* are neither as carnose, nor as constricted at the nodes, as are very distinctly the case in *C. turpiniae*. Plants of *C. pellucida* subsp. *brachypetala* in grassveld in KwaZulu-Natal may produce a swollen underground rhizome (with fleshy scale leaves) but never form caudices as do those of *C. turpiniae*.

TABLE 1. Comparison of selected vegetative and reproductive characters of *Crassula multicava*, *C. pellucida* subsp. *brachypetala*, *C. ovata*, and *C. turpiniae*.

#	Character	*C. multicava*	*C. pellucida* subsp. *brachypetala*	*C. ovata*	*C. turpiniae*
A.	**Vegetative**				
1.	Stem vestiture	Glabrous	Lines of hairs	Glabrous	Glabrous
2.	Caudex	Absent	Absent	Absent	Present
3.	Hydathodes	Single row along upper and lower margins and extensively scattered on both surfaces	Single, marginal row on upper surface	Single row along upper and lower margins, also scattered on both surfaces	Single, uneven row along upper margin and occasional on both surfaces
4.	Leaf apex	Rounded or emarginate	Acute	Pointed or mucronate	Rounded to obtuse to truncate
5.	Leaf base	Rounded-attenuate	Cuneate	Cuneate	Rounded
6.	Leaf margin	Entire, green often yellowish green	Entire to serrate, colourless	Entire, colourless or red	Entire, often red
B.	**Reproductive**				
7.	Peduncle length (mm) and colour	30–80; green to brownish pink	Absent, or not obvious, greenish purple	10–30; green to pink	17–30; deep pink
8.	Calyx lobe length (mm)	1–2	2.5–5.0	1–2	1.6–2.0
9.	Calyx lobe shape	Triangular	Linear-triangular	Broadly triangular	Oblong
10.	Corolla lobe shape; colour	Lanceolate; cream, tinged red	Elliptic to oblanceolate-oblong; white, often tinged pink	Elliptic-lanceolate; white, often tinged pink	Ovate-elliptic; white
11.	Corolla lobe orientation	Spreading to sometimes recurved	Spreading	Spreading	Spreading to slightly recurved
12.	Pistil colour	Tinged pink	White	Tinged pink	Cherry red
13.	Corolla lobe:calyx ratio	≥2:1	≤1:1	≥5:1	>2:1

Crassula sect. *Anacampseroideae* accommodates the arborescent taxa, *C. ovata* and *C. arborescens* (Miller 1768: species no. 7 on first page headed "COT | COT") Willdenow (1798: 1554), which measure up to 1.5 m in height with carnose stems of up to 12 cm in diameter (Tölken 1977a: 211–217, 1985: 135–137, Smith *et al*. 2017: 88–89). Their inflorescences take the form of a terminal thyrse and the calyx lobes are a ⅕ or less of the length of the corolla lobes (Tölken 1977a: 211). In contrast, *C. turpiniae* measures to only 0.3 m in height with stems of up to 10 mm in diameter at the base and has inflorescences comprising compound dichasia (Fig. 2A), with flowers presenting calyx lobes that are nearly ½ the length of the corolla lobes (Fig. 2B–E).

The rootstocks of *C. turpiniae* wedge into the crevices of the rocks on which they grow, rooting at the distinctly constricted nodes such that carnose stems often become adpressed to the substrate. Older rootstocks become distinctly caudiciform (Fig. 1E), a feature not shared with taxa in *C*. sect. *Anacampseroideae* where representatives such as *C. multicava*, whilst often growing lithophytically, do not at all develop such succulent and tight-fitting roots. *Crassula turpiniae* can be further distinguished from the more herbaceous taxa in *C*. sect. *Anacampseroideae* by the deciduous nature of its old leaves, and the characteristic cherry red colouration of its carpels post-anthesis in the course of fruit development (Fig. 1B).

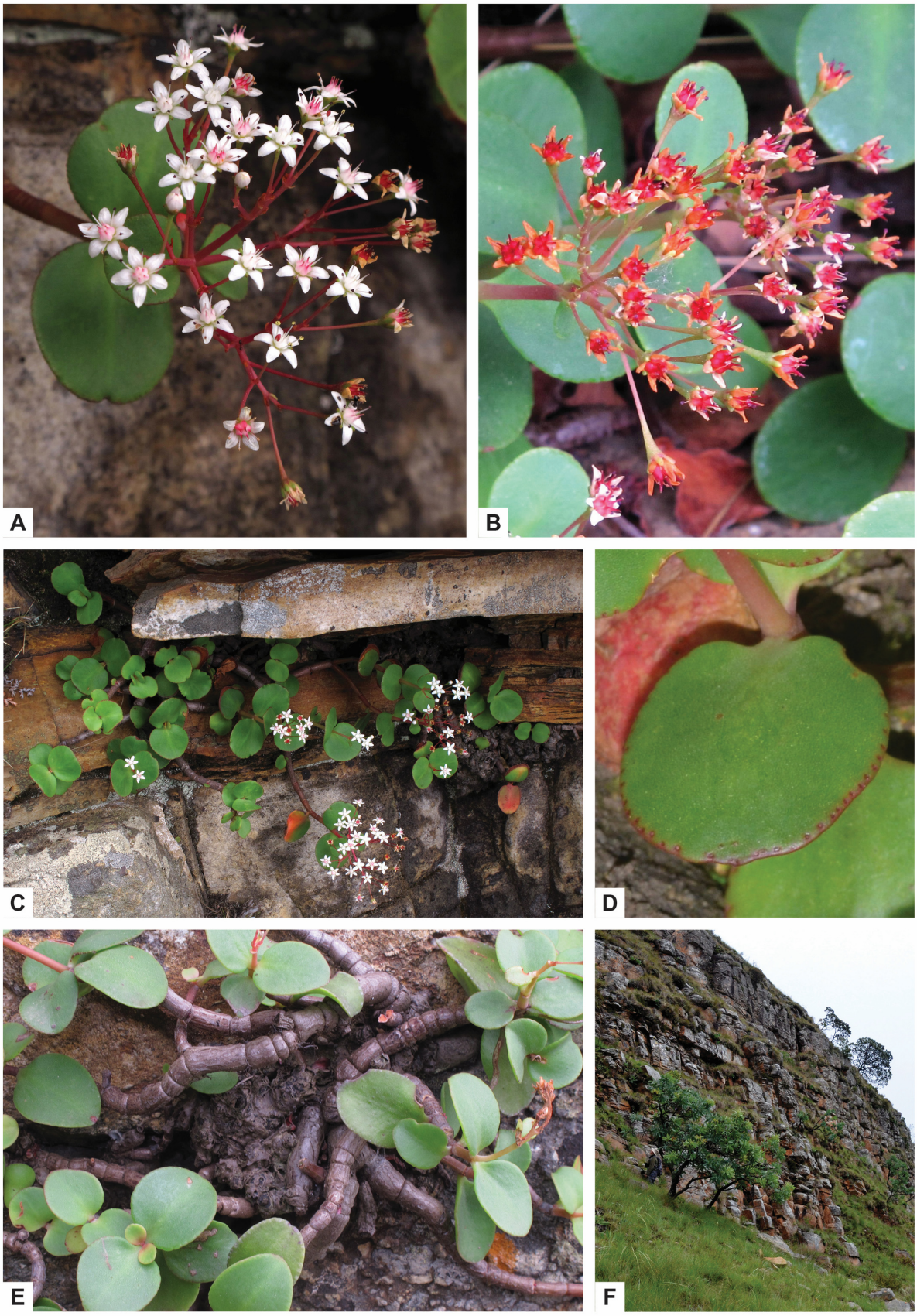

FIGURE 1. *Crassula turpiniae*. **A.** Mature inflorescence with most of the flowers at anthesis. **B.** Developing fruit. **C.** Habit. **D.** Suborbicular leaf showing the marginal hydathodes. **E.** Stems are prominently constricted at the nodes. Note the caudiciform rootstock. **F.** The cliff habitat in Long Tom Pass Montane Grassland. Photograph credits: Neil R. Crouch (A–C, E) and Mervyn Lötter (D, F).

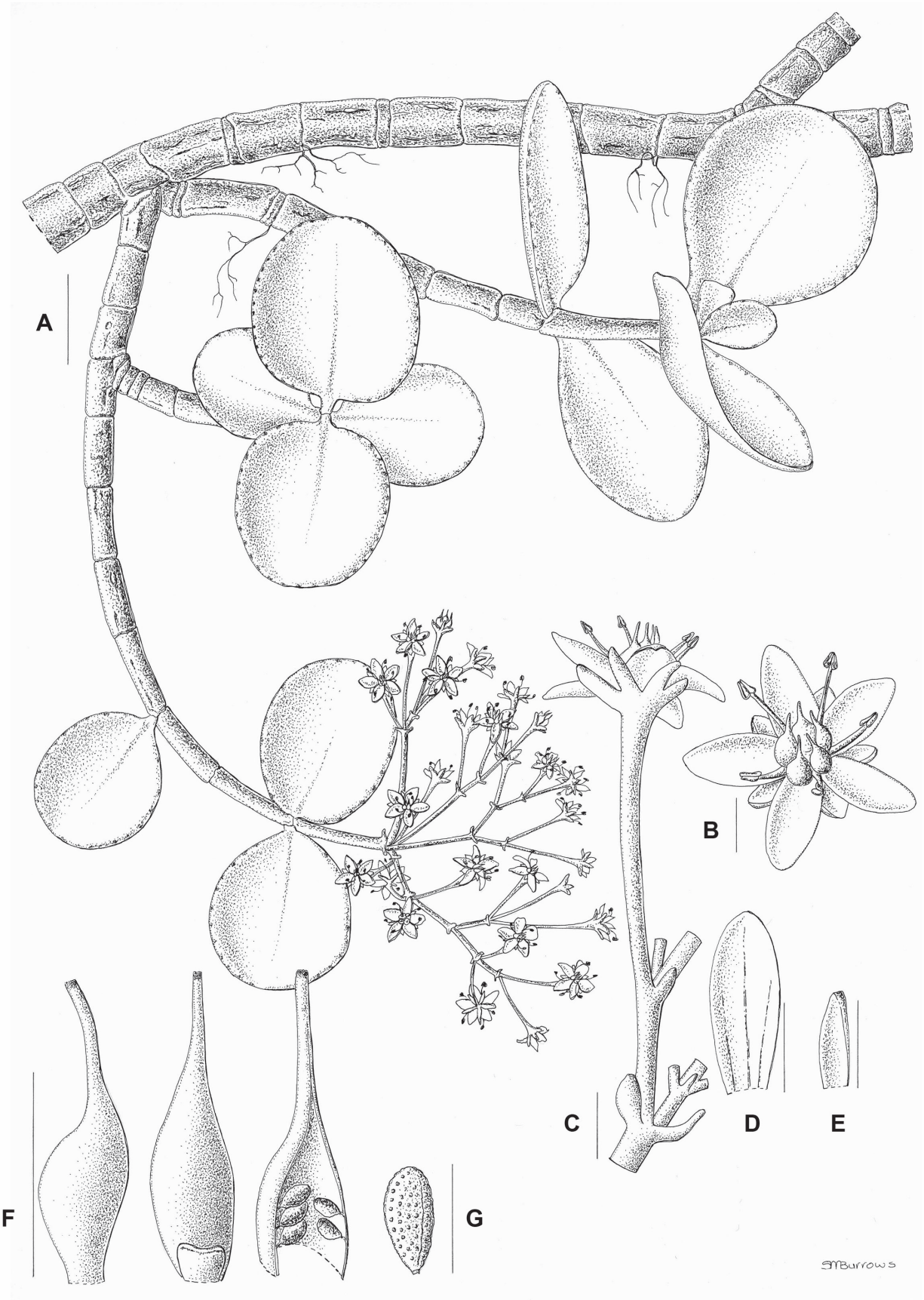

FIGURE 2. *Crassula turpiniae*. **A.** Habit. **B.** Individual flower. **C.** Part-inflorescence. **D.** Petal. **E.** Calyx lobe. **F.** Pistil, squamule, ovary. **G.** Ovule. Scale bars: A, 10 mm; B–F, 2 mm; G, 1 mm. Artist: Sandra Burrows.

Nomenclature and taxonomy of *Crassula turpiniae*

Crassula turpiniae N.R.Crouch, Mich.Walters, M.Lötter & Gideon F.Sm., ***sp. nov.*** (Figs 1 and 2).

Type:—SOUTH AFRICA. Mpumalanga province: Lydenburg District (2530BA), on rock ledges in montane grassland, elev. 1700 m, 8 November 2006, *J.E. Burrows 9562* (holotype, Herb. BNRH [now incorporated into Herb. J]!).

Diagnosis:—*Crassula turpiniae* most closely resembles *C. multicava* and *C. ovata.* It differs from *C. multicava* in its smaller and more rotund leaves with hydathodes present in a single row along the leaf blade margins rather than widely scattered over both surfaces; in its stems that are much more prominently constricted at the nodes; and in the longer pedicels of its flowers, which at anthesis have white rather than red-infused petals. *Crassula turpiniae* differs from *C. ovata* in its leaf shape, which sports a mostly rounded rather than pointed or mucronate apex; in its smaller and more prostrate habit, and in having calyx lobes that extend over a greater proportion (to ½) of the corolla than in *C. ovata* (to ⅕).

Description:—Perennial, ± branched, succulent plants. *Roots* thickly succulent, occasionally caudiciform. *Stems* carnose, lower down up to 10 mm in diam.; *bark* greyish brown, flaking. *Branches* 0.25(–0.70) m long, often patent, succulent to slightly woody, glabrous, spreading to procumbent to pendulous, prominently constricted at nodes where they sometimes root. *Leaves* dorsiventrally flattened, glabrous, glands occasionally scattered ad- and abaxially, green-blue, turning red before abscission, desiccating leaves deciduous, petiolate; *blade* (15–)20–22(–28) × (17–)18–19(–27) mm, broadly ovate to suborbicular, basally rounded; *margin* entire to repand, green-blue or reddish, glands in an uneven row; *apex* rounded to obtuse to truncate; *petiole* 2–3 mm long. *Inflorescence* sympodial, an irregularly branched, terminal, compound dichasium, subumbellate, 17–30 × 1.2–1.5 mm; *peduncle* distinct, deep pink, bracts narrowly oblong; *pedicels* 9–11 × 0.4–1.2 mm, glabrous, tapering towards base, reddish proximally, green distally. *Flowers* pentamerous, rarely hexamerous. *Calyx lobes* 1.6–2.0 × 0.4 mm, oblong, acute to truncate, glabrous, fleshy, green with red apex, ± ½ as long as petals. *Corolla* star-shaped, scarcely fused at base, white; *petals* 3.5–4.0 × 1.5 mm, spreading at right angles to pedicel to slightly recurved, ovate-elliptic, broadly acute, with the terminal hood pink below, without prominent dorsal appendage. *Carpels* oblong-reniform; *ovary* 1.5 × 0.8 mm, white, turning cherry red; *ovules* 4–5(–7), elongate, with rows of pointed papillae; *style* 1 mm long, slender, arising from posterior ovary wall, stigma indistinct. *Stamens* with filaments 2.5 mm long; *anthers* 0.3–0.4 mm long, purple-brown; *pollen* yellow-cream. *Squamulae* as long as broad, constricted towards base, 0.3 × 0.3 mm, yellow, apically indented, slightly recurved. *Seeds* 0.45 × 0.25 mm, ellipsoid, brown, with vertical rows of papillae. *Chromosome number*: unknown.

Distribution and habitat:—*Crassula turpiniae* is endemic to the Mpumalanga province of South Africa where it has only been recorded from the Lydenburg–Pilgrim's Rest region. Except for this general locality (see Fig. 3), no provenance data from specimens or field observations are given. This deviation from widely followed taxonomic practice is justified by the fact that illegal collecting of succulent plants from the wild in South Africa is a severe and escalating problem, and it was decided not to provide any information regarding the exact whereabouts of this new species that could cause known populations to be targeted for destructive collecting (Smith *et al*. 2023).

Plants of *Crassula turpiniae* are near-obligate cremnophytic. The species is currently only known from four localities although we anticipate the occurrence of several other, as yet undiscovered populations, because of the inaccessibility of the terrain.

The species occupies a narrow ecological niche on fire-protected cliffs. In habitat, plants are scattered or clustered across suitable sites and may be locally abundant as at the type locality where the population comprises over 100 individuals, most of which form spreading colonies. The species extends over a range of 50 km in a narrow north–south band where it straddles steep southern, southeastern, and eastern slopes in Long Tom Pass Montane Grassland (Lötter & Burrows 2012). It grows at an elevation of 1640 to 2200 m above sea level, usually in places in partial sun, which receive sunlight in the morning only, and always in fire protected microhabitats on or near rocks. Plants sometimes occur in the partial shade of rock overhangs or shrubs. This known range is frequently covered in mist and receives between 980 and 1290 mm of rainfall every year, based on a 2020 high-resolution rainfall model developed by the Mpumalanga Tourism & Parks Agency. At these high altitudes, the temperature is quite cool with a modelled average annual temperature of only 14 to 16°C (Schulze 1997). The geology is comprised of banded shale and quartzites of the Timeball Hill and Hekpoort formations of the Pretoria Group, where plants tend to grow in small pockets of humus rich soils scattered in the narrow crevices between shale and quartzite rock layers (Fig. 1C). These steep and rocky areas are generally protected from fires and such shielded plants may grow to become compact and cushion-like (Fig. 1E). Associated plant species include *Merwilla plumbea* (Lindley 1830: 1355) Speta (1998: 109), *Helichrysum reflexum* Brown (1894: 356), *Schizochilus lilacinus* Schelpe ex Linder (1980: 426), *Selaginella mittenii* Baker (1883: 81), and *Streptocarpus galpinii* Hooker (1891: 388).

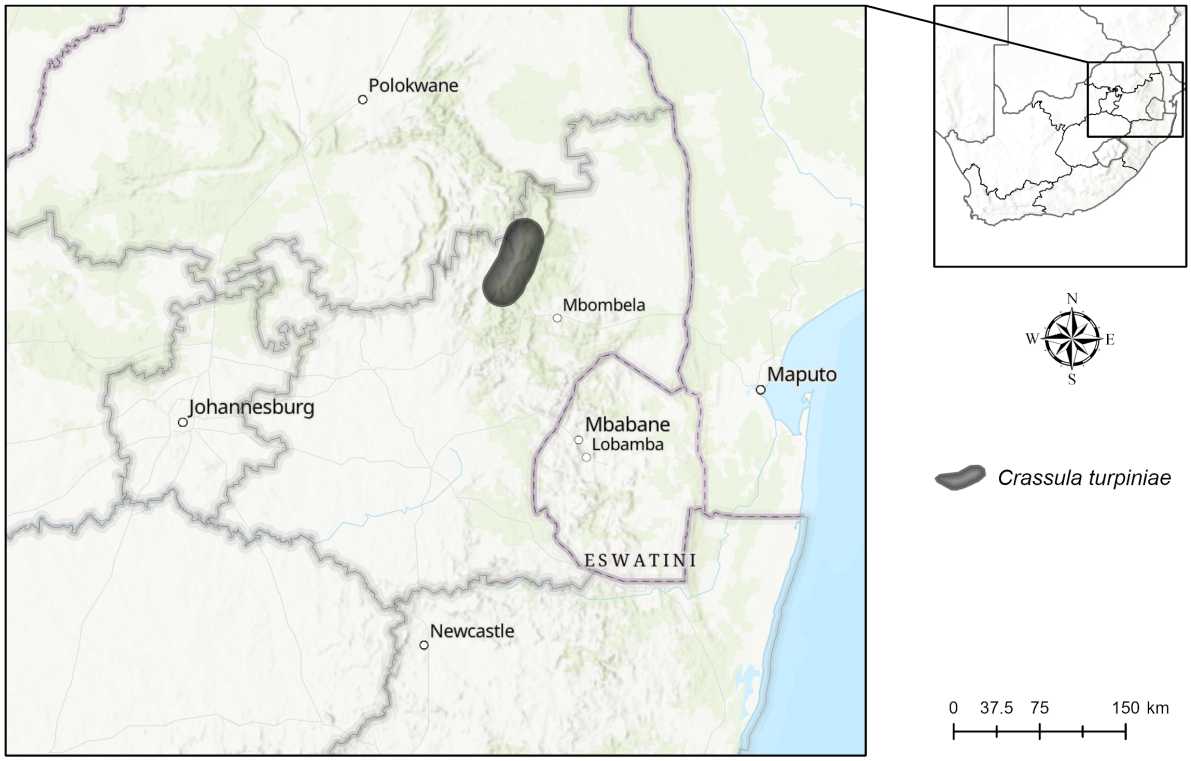

FIGURE 3. Generalised and buffered known geographical distribution range of *Crassula turpiniae*.

Phenology:—Plants flower from September to November, peaking in October.

Etymology:—*Crassula turpiniae* is named in honour of Ms Barbara Turpin (7 June 1959–) for her valuable contribution to plant conservation in the Mpumalanga province, South Africa. On first arrival in South Africa from England some 20 years ago, she spent several years as a volunteer digitising and georeferencing thousands of herbarium specimens for the Lydenburg (Herb. LYD), Buffelskloof (Herb. BNRH [now incorporated into Herb. J]), and Hortus Siccus McMurtrianus (HSMC) herbaria. Ms Turpin was based at the Buffelskloof Herbarium until January 2021 and remained actively involved in plant collection, documentation, and conservation in Mpumalanga in South Africa, and in Mozambique. In 2017 Ms Turpin accompanied the authors to the type locality to assess the population of the species subsequently named for her.

Conservation status:—*Crassula turpiniae* is one of more than 50 plant species that are endemic on the shale- or quartz-derived substrates of the Lydenburg Centre of Plant Endemism (Lötter *et al*. 2002). The Lydenburg Centre occupies the region between the Wolkberg Centre to the East and the Sekhukhuneland Centre to the northwest and its geology predominantly consists of shale, quartzite, and small quantities of andesite, with diabase intrusions. Two subcentres have been identified within the Lydenburg Centre, namely the Long Tom Pass- (21 endemics) and Steenkampsberg- (16 endemics) subcentres, with most of the endemics found in the families Iridaceae, Orchidaceae, Asteraceae, Gesneriaceae, and Ericaceae. Although only 60% of the Long Tom Montane Grassland is still natural and untransformed (Lötter *et al*. 2014), all of the known populations of *C. turpiniae* occur within gazetted protected areas. Threats to this area are primarily from invasive alien plants or from both organised and illegal artisanal gold mining activities (Lötter & Burrows 2012), although plants could potentially be poached for the illegal trade in such subjects. The Lydenburg Centre is included within the recently defined orographic entity, the Limpopo–Mpumalanga–Eswatini Escarpment (LMEE), itself a component of southern Arica's Great Escarpment (Clark *et al*. 2022). The presence of *C. turpiniae* as endemic to the LMEE further reinforces the circumscription of this newly recognised orographic entity, which is likely the largest in the summer rainfall region of southern Africa.

Crassula turpiniae has a very small extent of occurrence of <20 km^2 and fewer than five known locations. The threat to subpopulations of alien plants through encroachment by trees of the genus *Pinus* is substantial and expanding

continuously, with many cliffs in nearby gorges completely colonized by pines; these are spreading with little or no control. We accordingly propose a national Red List category of Near Threatened.

Additional collections (paratypes):—SOUTH AFRICA. Mpumalanga province: Lydenburg District (2530BA), wooded grassland, 14 September 2010, *H. Delhay 229* (BNRH [now incorporated into Herb. J]!); elev. 1730 m, 7 November 2017, *N.R. Crouch, M. Lötter & B. Turpin 1293* (BNRH [now incorporated into Herb. J]!); 29 January 2014, *D.M. McMurtry 15209* (BNRH [now incorporated into Herb. J]!).

Acknowledgements

The Curators of, at the time, an independent Herb. BNRH and Herb. PRE are thanked for making facilities available during this study, and Barbara Turpin for assistance in both the herbarium and field. We thank Sandra Burrows for the line illustration of *C. turpiniae* (Fig. 2), and Dr Tanza Crouch for assembling the plate (Fig. 1).

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