



Crassula × *mortii* (Crassulaceae subfam. Crassuloideae), a new natural hybrid between *C. perforata* and *C. rubricaulis* from South Africa's southern Cape

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Introduction

In terms of species-level diversity, the genus *Crassula* Linnaeus (1753: 282) is by far the most diverse in the Crassulaceae within the *Flora of Southern Africa* region [Namibia, Botswana, Eswatini (formerly Swaziland), Lesotho, South Africa] (Tölken 1977a, b, 1985). In this region diversity is highest in the Fynbos and Succulent Karoo Biomes, both of which straddle the southern Cape, an area represented in the Western and Eastern Cape provinces.

Along Montagu Pass near the coastal town of George, the natural geographical distribution ranges of several *Crassula* species overlap, including those of *C. perforata* Thunberg (1778: 329, 338) (Fig. 1A–B) and *C. rubricaulis* Ecklon & Zeyher (1837: 296) (Fig. 1C–D). Where these two species occur together, a natural hybrid, described and illustrated here as *C. ×mortii* Gideon F.Sm. & N.R.Crouch (Figs 1E, 2A–D), may be found.

Materials and methods

The description is based on detailed morphological studies of material of *C. ×mortii*, as well as individuals of the putative parents, *C. perforata* and *C. rubricaulis*, in the field at Montagu Pass, Western Cape. Measurements were taken by hand using a ruler, except for floral measurements below 4 mm, which were taken using hand-held magnifying equipment. The new nothospecies was compared to the putative parents, with character information for these two species sourced from living material and the most recent taxonomic treatments for southern Africa, by Tölken (1977a, b, 1985). Authors of the taxa cited follow IPNI (2020+), but in the notation required by *Phytotaxa*, and herbarium codes follow Thiers (2020+). Nomenclatural issues accord with the Shenzhen Code (Turland *et al.* 2018).

Taxonomic treatment

Crassula × *mortii* Gideon F.Sm. & N.R.Crouch, *nothosp. nov.* (Fig. 2A–D).

Type:—SOUTH AFRICA. Western Cape province, 3322 (Oudtshoorn): Montagu Pass, cremnophytic on sandstone cliff, alt. 350 m, (–CD), 6 December 2019, flowered in cultivation in Pretoria during October 2020, *N. Crouch 1298* (holotype PRU!).

Parentage:—*Crassula perforata* Thunberg (1778: 329, 338) × *Crassula rubricaulis* Ecklon & Zeyher (1837: 296).

Diagnosis:—Vegetatively *C. ×mortii* differs from *C. perforata* by having more elliptic, dull khaki green leaves, rather than somewhat deltoid, glaucous leaves. The leaf margins are ciliate in *C. ×mortii*, as in *C. rubricaulis*, rather than horny as in *C. perforata*. *Crassula ×mortii* differs from *C. rubricaulis* by not having cultrate to oblanceolate leaves, and the leaves of *C. ×mortii* are basally fused, as in *C. perforata*, rather than free as in *C. rubricaulis*. The flowers of *C. ×mortii* are bright white, as in *C. rubricaulis*, not cream to pale yellow as in *C. perforata*, and of an intermediate size. The sepals of *C. ×mortii* are bluntly acute as in *C. perforata*, not sharply acute as in *C. rubricaulis*, and have margins smooth rather than minutely toothed, as often found in *C. rubricaulis*. *Crassula ×mortii* flowers earlier than either of its parents and has 6- rather than 5-partite floral parts.

Description:—Perennial, branched, small to medium-sized, pendent, somewhat spreading, succulent shrublets to 30 cm tall and wide. *Roots* fibrous, often produced at nodes where stem touches the soil. *Stems* 3–4 mm in diameter, reddish when young, becoming woody, dark brown with age; *bark* reddish brown to dark brown, flaking. *Leaves* elliptic to ovate, often crowded towards the branch tips, old leaves persistent for a long time; *blade* (8–)10–15(–20) × 5–8(–12) mm, dull khaki green, often strongly red-infused, obscurely to distinctly red-spotted, flattened to concave adaxially, convex abaxially; *margins* red, ciliate; *base* cuneate, fused to opposite leaf in a pair; *apex* bluntly acute-tipped. *Inflorescence* small to medium-sized, few- to many-flowered, elongated to rounded thyrse with ± sessile flowers, brittle when dry; *peduncle* indistinct as a result of vegetative leaves grading into bracts higher up. *Calyx* consisting of 6 sepals; *sepals* (0.5–)1.0(–1.5) mm long, light green, longitudinally reddish brown-infused especially towards apex, drying reddish brown, elongated-triangular to narrowly oblong, basally very slightly fused, margins smooth, apex bluntly acute, mucronate. *Corolla* consisting of 6 petals, short-tubular, basally fused for ± 0.1 mm, uniformly bright white; *lobes* 3.0–3.5 mm long, ovate-oblong, spreading at first, soon recurved, sometimes adorned with a minute abaxial appendage near apex. *Stamens* 6; *filaments* 1.5–2.0 mm long, white; *anthers* 0.50–0.75 mm long, mustard yellow, ± elliptic, well-exserted. *Carpels* 6, 1.0–1.5 mm long, white, free, rather abruptly tapering into styles; *styles* ± 0.75 mm long, yellowish white; *stigmas* capitate, more intensely yellow than styles. *Squamae* 0.2–0.3 × 0.25–0.35 mm, whitish green, ± horizontally oblong, free, succulent. *Follicles* 3–4 mm long, drying blackish brown, dehiscent. *Seed* ± 0.5 mm long, light brown to reddish brown, with a rough surface, ellipsoid. *Chromosome number* unknown.

Distribution and habitat:—*Crassula × mortii* is currently known from a single location along Montagu Pass, which is located to the north of George in the Outeniqua Mountains of the Western Cape Province of South Africa, but it likely also occurs elsewhere where the natural geographical distribution ranges of its putative parents, *C. perforata* and *C. rubricaulis*, overlap. The nothospecies grows as a cremnophyte on a steep, semi-shaded, moist, west-facing sandstone rock face (Fig. 2A), alongside its putative parents and various other small succulents and geophytes. At the type locality the novelty finds purchase in shallow soil overlying a rock ledge, where it presents a pendulous habit (Fig. 2A).

Phenology:—Flowers (Fig. 2B–C) early- to mid-summer in the southern hemisphere.

Etymology:—*Crassula × mortii* is named for Mark Eugene Mort (born 25 May 1969, Seward, Pennsylvania, USA–) (Fig. 2E). Growing up in western Pennsylvania, very close to the Appalachian Mountains, Mark was able to explore nature from a young age. In 1992 he completed a BS degree in Biology at Indiana University of Pennsylvania, after which he was awarded a fellowship to study at the Mount Desert Island Biological Laboratory near Bar Harbor, Maine. Plant taxonomy became Mark's primary interest as a Masters student at the College of William and Mary in Williamsburg, Virginia, where he conducted a floristic study of the vascular plants and forest vegetation in Prince George County, Virginia. In 1994 Mark graduated with a Master's degree and then initiated his doctoral studies at Washington State University, Pullman, Washington. His dissertation included a broad molecular phylogenetic study of the family Crassulaceae based on chloroplast sequence data. He eventually published some of the earliest phylogenetic analyses of the Crassulaceae (Mort *et al.* 2001, 2005a, b, 2009) and has a continuing interest in the family (Smith *et al.* 2017). In the course of his research he conducted multiple collecting expeditions, including to the Canary Islands and South Africa, which enabled him to study diversity in the Old World Crassulaceae first-hand. Following the award in 1999 of a doctoral degree, he undertook postdoctoral work at Ohio State University. In 2001, he accepted a tenure-track position at the University Kansas in Lawrence, Kansas, in the Department of Ecology and Evolutionary Biology (assistant professor) and the Biodiversity Institute and Natural History Museum (Assistant Curator). Presently, Mark is a tenured full professor at the University of Kansas where he also serves as co-director for the Undergraduate Biology Program.

Discussion:—Morphological assessment of the taxon represented by *N. Crouch 1298* (PRU) revealed it to not correspond with any known *Crassula* species from southern Africa, but rather to represent a hybrid, here named *C. × mortii*, based on putative parents found growing sympatrically at Montagu Pass. The form of both vegetative and reproductive characters was intermediate in many respects with *C. perforata* and *C. rubricaulis* (Fig 1E; Table 1). *Crassula rubricaulis* was included in *C. sect. Curtogyne* (Haworth 1821: 8) Tölken (1977a: 300), corresponding to sect. XII of Tölken (1985: 158–159), while *C. perforata* was included in *C. sect. Perfilatae* Haw. ex De Candolle (1828: 18) (see Tölken 1977b: 410, Tölken 1985: 189–190 [sect. XV]). That the nothospecies is of intersectional origin is consistent with observations by Tölken (1977a: 301) that species in *C. sect. Curtogyne* can hybridise beyond sectional limits, particularly with some in *C. sect. Squamulosae* Haworth (1821: 11). This report, however, represents the first record known to us of a hybrid involving *C. rubricaulis* as a parent, and of hybridisation between *C. sect. Curtogyne* and *C. sect. Perfilatae*, as defined by Tölken (1977a, b, 1985). However, neither *C. sect. Curtogyne* nor *C. sect. Perfilatae* is monophyletic according to Bruyns *et al.* (2019).

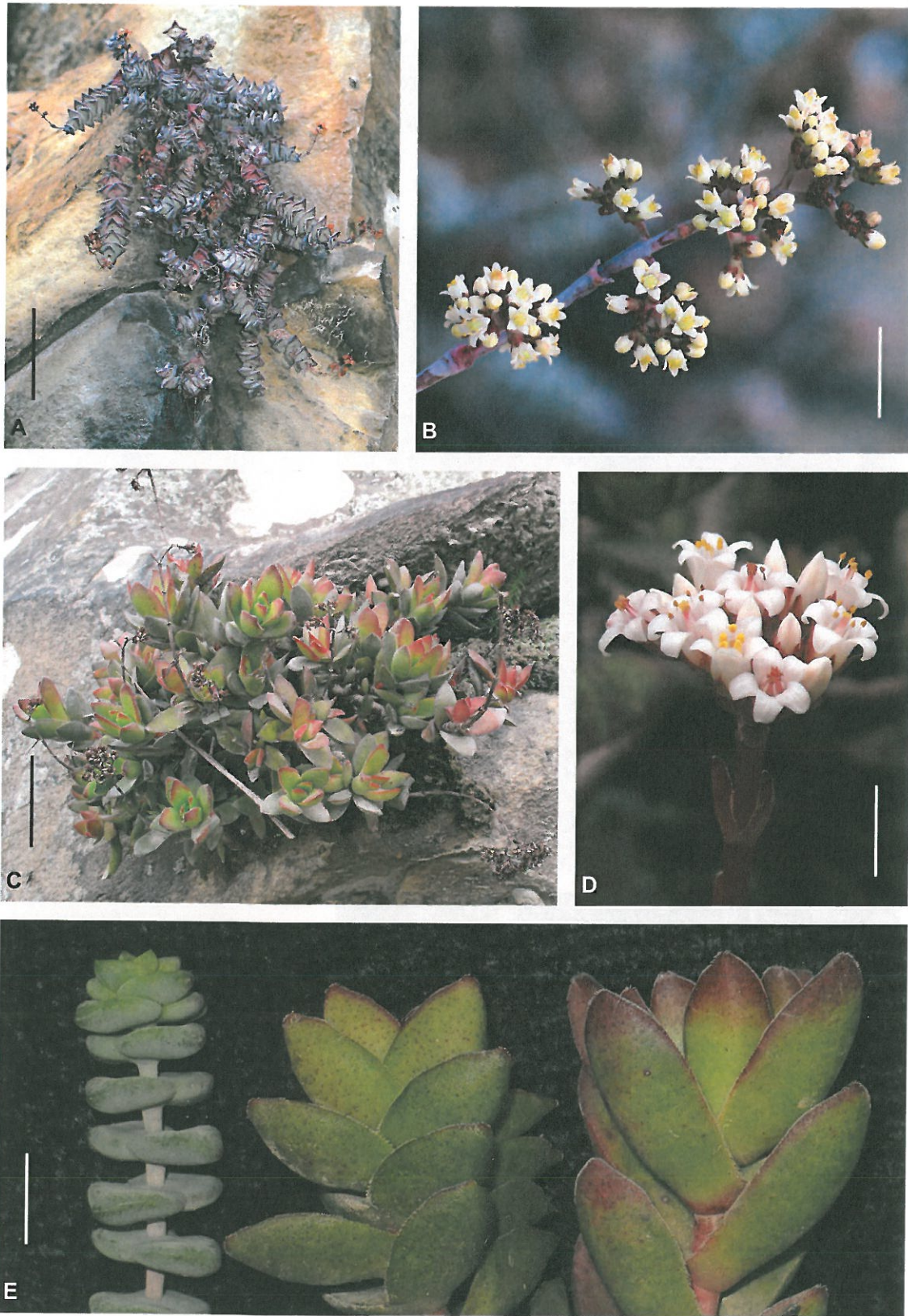


FIGURE 1. A. *Crassula perforata* habit, with leaf pairs basally fused. B. *Crassula perforata* inflorescence. C. *Crassula rubricaulis* habit with leaves basally cuneate. D. *Crassula rubricaulis* inflorescence. E. Leafy shoots of *C. perforata* (left), *C. x mortii* (centre), and *C. rubricaulis* (right), all from Montagu Pass. Scale bars: A: 7 cm; B: 9 mm; C: 45 mm; D 4.5 mm; E: 8 mm. Photographs: Neil R. Crouch.



FIGURE 2. *Crassula* \times *mortii* from Montagu Pass, Western Cape Province, South Africa. A. Habit. B. Inflorescence lateral view. C. Inflorescence dorsal view. D. Leafy shoot. E. Mark Mort (1969–) while conducting fieldwork in South Africa. Scale bars: A: 30 mm; B: 3 mm; C: 3 mm; D 7 mm. Photographs by the authors (A–D) and Jenny Archibald (E).

TABLE 1. Comparison of selected vegetative and reproductive characters of *Crassula perforata*, *C. ×mortii*, and *C. rubricaulis*.

#	Character	<i>C. perforata</i>	<i>C. ×mortii</i>	<i>C. rubricaulis</i>
A.	Vegetative			
1.	Leaf shape	Ovate to triangular-deltoid	Elliptic to ovate	Cultrate to oblanceolate
2.	Leaf colour*	Glaucous	Dull khaki green	Mid-green
3.	Leaf margin	Often red or yellow; horny	Red; ciliate	Often red; ciliate
4.	Leaf base	Abruptly cuneate; fused to opposite leaf	Gradually cuneate; fused to opposite leaf	Gradually cuneate; not fused to opposite leaf
B.	Reproductive			
5.	Number of floral parts	5	6	5
6.	Sepal apex	Bluntly acute	Bluntly acute	Sharply acute
7.	Sepal margins	Smooth	Smooth	Often minutely toothed
8.	Corolla lobe length (mm)	2.0–2.5	3.0–3.5	4.0–5.5
9.	Corolla lobe shape	Elliptic-oblong	Oblong-ovate	Oblong-ovate
10.	Petal colour	Cream to pale yellow	Uniformly bright white	Bright white to red-tinged
11.	Abaxial petal appendage near apex	Absent	Present or absent; minute	Present
12.	Anther colour	Yellow	Mustard yellow	Brown
13.	Flowering period	(July–)November–April	October–?	January–May

*Leaves of species of *Crassula* are often strongly red-infused, depending on their exposure to solar irradiation.

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