

Cotyledon nielsii (Crassulaceae), a new cremnophyte from KwaZulu-Natal, South Africa

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Photographs: Neil R. Crouch

Summary: A new *Cotyledon* species, *C. nielsii* N.R.Crouch, D.Styles & Mich.Walters, is described from cliffs of the western part of eThekwin Metro near the city of Durban, KwaZulu-Natal province, South Africa. The species is closely allied to the recently described *C. petiolaris* van Jaarsv. from the Wild Coast region of the Eastern Cape province, but is readily separable on vegetative and reproductive characteristics.

Zusammenfassung: Beschrieben wird eine neue *Cotyledon*-Art, *C. nielsii* N.R.Crouch, D.Styles & Mich.Walters, von Klippen im westlichen Teil der Metropolgemeinde eThekwin nahe der Stadt Durban, Provinz KwaZulu-Natal, Südafrika. Die Art ist nah verwandt mit der kürzlich beschriebenen *C. petiolaris* van Jaarsv. aus der Region Wild Coast in der Provinz Eastern Cape, ist aber anhand vegetativer und reproduktiver Merkmale leicht zu unterscheiden.

Introduction

Cotyledon L. is a small, largely southern African genus of about twenty taxa with a centre of diversity in the Eastern and Western Cape provinces of South Africa. Representatives of this leaf succulent taxon are distributed from the southern tip of Africa to the Arabian Peninsula and are adapted to a wide variety of habitats. They occur from cliffs alongside estuaries through to rocky outcrops in Afromontane situations, and are variously adapted to sites that range from extremely arid to moist tropical (Tölken, 1985; Van Jaarsveld & Koutnik, 2004).

In recent years, the genus *Cotyledon* has attracted renewed interest from workers in the Crassulaceae, with several restricted-range South

African species being described. Other than *Cotyledon xanthantha* Van Jaarsv. & Eggl from the dry river valleys of Still Bay and *C. tanquana* Van Jaarsv. from the lower slopes of the Cedarberg, all are cremnophilous taxa. They include *C. egglii* Van Jaarsv. (Barberton Centre of Endemism), *Cotyledon gloeophylla* Van Jaarsv. (Kouga Dam region), *C. barbeyi* Schweinf. ex Baker var. *soutpansbergensis* Van Jaarsv. & A.E.van Wyk (Soutpansberg) and, along the eastern seaboard, *C. flanaganii* Schönland & Baker f. subsp. *mzimvubuensis* Van Jaarsv., *C. pendens* Van Jaarsv., *C. petiolaris* Van Jaarsv. (Figures 1 and 2) and *C. woodii* Schönland & Baker f. subsp. *cremnophila* Van Jaarsv. The last five mentioned taxa are all from river gorges along the botanically underexplored Wild Coast region of the Eastern Cape province. The subject of this account, a new cremnophytic *Cotyledon* with distinctly puberulous corolla tubes (Figure 3), as well as pronouncedly petiolate and hairy leaves (Figure 4), occurs near Durban in east-central KwaZulu-Natal (Figure 5).

The novelty was first discovered by Niels Jacobsen on 6 August 1967 at Cato Ridge to the west of Durban, where it was found growing on a slope at the base of a cliff. Just prior to this its closest relative *Cotyledon petiolaris* was collected for the first time some 300km to the south, by Rudolf Georg Strey (28 April 1907–30 June 1988) near Cat's Pass in the Eastern Cape province, although this species was similarly not described until a half century later (Van Jaarsveld, 2015), though based on material from the Mbashe River valley. One Cato Ridge collection of Jacobsen (*N. Jacobsen 37*, NU) was assessed by Toelken in May 1978 in the course of his re-evaluation of the *Cotyledon orbiculata* L. complex (Tölken, 1979),



Figure 1. *Cotyledon petiolaris* in habitat alongside the Nqabara River estuary, Eastern Cape province, June 2017. The leaf petioles are distinct but relatively short, and the margins red.



Figure 3. The corollas of *Cotyledon nielsii* from Delville Wood are short, with reflexed lobes as long as the tube. They are characteristically puberulous on the outside, as are the calyces, petioles and peduncles.



Figure 2. *Cotyledon petiolaris* inflorescence, of cultivated material from Collywobbles on the Mbashe River, Eastern Cape province, sourced close to type locality, May 2019. The flowers of this species are externally glabrous and are here visited by the Common hairtail butterfly, *Anthene definata*.



Figure 4. Prominently petiolate and puberulous leaves of a flowering shoot of *Cotyledon nielsii*, Delville Wood. The puberulous corolla lobes are recurved to reflexed.

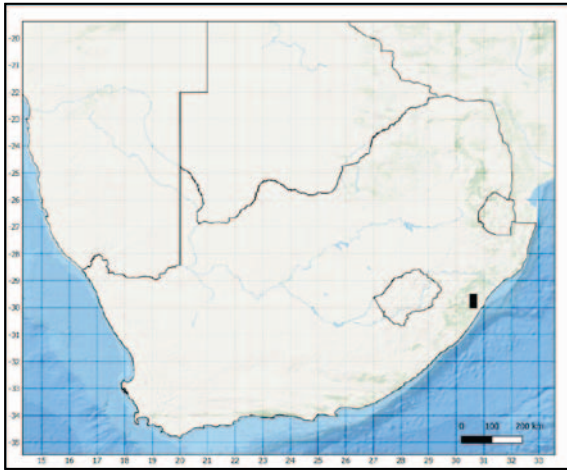


Figure 5. Known geographical distribution range of *Cotyledon nielsii* in South Africa.

but not assigned with certainty to any variety of *C. orbiculata*. An annotation on the NU specimen in Toelken's hand reads 'Cot. orbiculata L. Corolla tube very unusual – not var. oblonga'. The PRE duplicate of the Jacobsen material, with about 15 fully open flowers was annotated by Toelken that same year (month not indicated) with 'not mature flowers? *Cotyledon orbiculata* L. probably var. oblonga (Haw.) DC.' The Cato Ridge material clearly confounded Toelken, likely on account of its small subcylindrical flowers which do not match the significantly larger flowers of *Cotyledon orbiculata* var. *oblonga* (Haw.) DC. with their corolla tubes characteristically bulging about the middle. The only variety of *C. orbiculata* documented from KwaZulu-Natal is var. *oblonga* (Tölken, 1979; 1985), whilst *C. velutina* Hook.f. and *C. barbeyi* Schweinf. ex Baker var. *barbeyi* are the other two genus members confirmed from the province (Van Jaarsveld & Koutnik, 2004). *Cotyledon velutina* is essentially an Eastern Cape species known as far north as the Mzimkhulu River valley in southern KwaZulu-Natal, whereas *C. barbeyi* is a far ranging south-tropical African species that has its southernmost limit in Zululand, northern KwaZulu-Natal.

Diagnosis: *Cotyledon nielsii* differs from *C. petiolaris* in having a puberulous rather than glabrous outer corolla, with a longer petiole (15–17mm compared with 8–10mm long), and squamae that are hemispherical instead of oblong. From *Cotyledon velutina* it may be distinguished by its smaller flowers, petiolate rather than sessile leaves, and filaments that are tufted with hairs at their point

of insertion in the corolla, rather than glabrous.

Taxonomy: *Cotyledon nielsii* N.R.Crouch, D.Styles & Mich.Walters **sp. nov.** (Figures 3, 4, 7 and 8). **Type:** SOUTH AFRICA. KwaZulu-Natal province, 2930 (Pietermaritzburg): Craiglea, Cato Ridge, growing on slope at base of cliff, 1500ft (457m) above sea level, 6 August 1967, (–DA), N. Jacobsen 3344 (37) (PRE, holo-; NU, as '37' only, iso-).

Description: Perennial, erect to spreading, branched shrub to 250–500(–900)mm high. **Roots** fibrous. **Branches** ascending to decumbent, 5–7mm in diameter, at first green becoming greyish brown and grey in older branches. **Leaves** green, firm and leathery, lamina 45–65 × 32–38mm, ovate to elliptic; adaxial surface planar to arched, somewhat concave in young leaves, both surfaces puberulous bearing translucent, sometime purple-infused hairs 0.15mm in length, margin reddish, often indistinctly so, cartilaginous, undulating, continuous to the top of the petiole; apex obtuse, very shortly pointed; petiole 15–17mm long. **Inflorescence** an erect thyrses up to 150–200mm high, comprising 3–4 dichasia, each with few flowers held semi-pendulous and occasionally erecto-patent. **Peduncle** 50–130 mm high, with hairs similar to those on the leaves and with 1–2 pairs of bracts (1.6 × 0.5mm) early deciduous. **Pedicels** 15–18mm long, to 22mm in fruit. **Calyx lobes** 5, triangular, green becoming maroon-infused, 2 × 2mm, hairy. **Corolla** subcylindrical, widest at the base, slightly bulging between calyx lobes, hairy outside, glabrous within except for tuft of hairs where filaments are fused to tube; tube reddish orange, but distinctly green under low light conditions, 11–12mm long and 7–8mm in diameter, lobes reddish-orange, free for 11mm at apex (11 × 4.5mm), linear-lanceolate, recurved or reflexed. **Stamens** 13.5mm long, fused to base of corolla, in 2 whorls, free for 8mm; **Anthers** yellow, elliptic, 1.5mm long. **Carpels** tapering, 12.5mm long, styles not spreading distally. **Squamae** hemispherical, forming a near-patent basin-like structure, yellowish-green, 1.5 × 1.5mm. **Follicles** not seen. **Seeds** not seen. **Chromosome number:** unknown.

Eponymy: This species is named for Niels Henning Günther Jacobsen (b. 10 September 1941–), who first discovered this species at Cato Ridge, and whose voucher has been designated the holotype. He has contributed c. 7400 herbarium specimens during his career as a scientist (herpetologist) (Gunn & Codd, 1981), with important Crassulaceae material amongst these, including the first known gathering of *Kalanchoe waterbergensis* Van Jaarsv. He has also authored several new entities in *Crassula*, including *C. calcarea* N.H.G.Jacobsen, *Crassula quadrifaria* N.H.G.Jacobsen and *C. wernerii* N.H.G.Jacobsen.

Flowering time: July–September.



Figure 6. The cliff habitat of *Cotyledon nielsii* at Delville Wood near Durban, stratified with Natal Group Sandstones overlying granite.



Figure 7. Habit of *Cotyledon nielsii*, with pendent branches that grow outward from the cliff face, Delville Wood.



Figure 8. Flowering shoot of *Cotyledon nielsii*, Delville Wood.



Figure 9. The flowers of *Cotyledon velutina* from the Mzimkhulu River valley in KwaZulu-Natal are puberulous and subcylindrical like *C. nielsii*, but have longer corolla lobes, and are borne by plants with sessile leaves presenting auriculate bases.

Distribution and ecology: *Cotyledon nielsii* is known only from two sites within the western eThekweni Metropolitan area, which is centred on the city of Durban, KwaZulu-Natal, South Africa (Figure 5). These localities, at Cato Ridge and at Delville Wood, are 18km distant from one another, and at both sites plants are found growing as fire-protected cremnophytes on steep cliffs, in succulent-rich vegetation. The unit of vegetation type is delimited as Eastern Valley Bushveld (SVs 6) (Rutherford et al., 2006). At Delville Wood near Shongweni plants grow on cliffs (Figure 6) in full sun or the partial shade of shrubs, on a western aspect at an altitude of 440m. As is usual with most species adapted to cliff environments the plants are rooted in shallow soil pockets, in this case upon granite (Figure 7), with the soil derived in part from an overlying band of Natal Group Sandstones. *Cotyledon nielsii* shares its habitat with many other succulent species, including *Crassula orbicularis* L., *Crassula perforata* Thunb., *Crassula expansa* Dryand subsp. *expansa*, *Crassula cultrata* L., *Crassula pellucida* L. subsp. *brachypetala* (Drège ex Harv.) Toelken, *Crassula perfoliata* L. var. *heterotricha* (Schinz) Toelken, *Bulbine natalensis* Baker, *Tetradenia riparia* (Hochst.) Codd, *Delosperma velutinum* L.Bolus, *Delosperma trad-*

escantoides (A.Berger) L.Bolus, *Senecio oxydon-tus* DC., *Euphorbia evansii* Pax, *Cyanotis robusta* Oberm., *Peperomia blanda* (Jacq.) Kunth and *Plectranthus hadiensis* (Forssk.) Schweinf. ex Spreng.

Conservation status: Despite extensive attention paid by botanists to the cliffs of the western eThekweni Metropolitan area and Inanda region since approx. 2000 this species has only been observed at two localities. At the Delville Wood site there are less than 150 individuals. Given that the precipitous cliff habitat of *C. nielsii* buffers somewhat against human impacts, and nothing is yet known of subpopulation number fluctuations, the species does not qualify for a category of threat according to the five IUCN (2001) criteria. However, given its very restricted range (EOO <500km²), specialised habitat and small known global population (<10,000 mature individuals), the species is considered Rare within the South African plant conservation context.

Discussion: Among the southern African *Cotyledon* species *C. nielsii* may at once be identified by a combination of sexual and vegetative features: the short inflorescences, short, hairy, subcylindrical corollas with reflexed lobes, and leaves with undulate, cartilaginous margins that extend to the top of the long petioles (Figure 8). Its distinction

#	Character	<i>C. petiolaris</i>	<i>C. nielsii</i>	<i>C. velutina</i>
1	Leaf lamina (mm)	75–125 × 35–55	45–65 × 32–38	50–90(–110) × 20–40
2	Leaf shape	Oblanceolate, rarely elliptic	Ovate to elliptic	Oblanceolate, rarely obovate
3	Leaf vestiture	Puberulous with translucent hairs	Puberulous with translucent to purple-infused hairs	Glabrous to tomentose
4	Leaf base	Petiolate, 8–10mm long	Petiolate, 15–17mm long	Sessile, base cuneate, sometimes auriculate
5	Cartilaginous leaf margin	Continuous to petiole apex	Continuous to petiole apex	Continuous to stem
6	Corolla vestiture (outside)	Glabrous	Hairy puberulous	Glabrous, rarely hairy
7	Corolla tube (mm)	Subcylindrical, 14–16 × 9–10	Subcylindrical, 11–12 × 7–8	Ampullaceous to subcylindrical, 14–17
8	Corolla lobe length (mm) and presentation	12–13, recurved	11, recurved to reflexed	20, recurved to reflexed
9	Corolla colour	Orange-red	Reddish orange, greenish at base when shaded	Copper-coloured or orange and often with yellow margins
10	Filament vestiture at insertion point	Hairy-tufted	Hairy-tufted	Glabrous
11	Squamae	Oblong, rounded at the apex, spreading, yellowish green, 2.5–3 × 2mm	Hemispherical, forming a near-patent basin-like structure, yellowish green, 1.5 × 1.5mm	Transversely oblong, apex slightly emarginated, yellow, 0.5 × 1mm
12	Peduncle height (mm)	150–200	150–200	300–600
13	Plant height (mm)	250–350	250–900	to 2500
14	Flowering period	May–July	July–Sept	Nov–Dec

Table 1. Main diagnostic characters separating *Cotyledon nielsii* from close relatives in the FSA region (cf. Tölken, 1985; Van Jaarsveld and Koutnik, 2004; Van Jaarsveld, 2015)

from *Cotyledon petiolaris* and *C. velutina* (Figure 9) is further clarified by consideration of several characters (Table 1), and also phenology. Possible reasons for *C. nielsii* escaping the attention of botanists until relatively recently despite its location within a heavily populated Metropolitan Area include its requirement for specialist cliff habitats, and its cryptic co-habiting with a surprising ‘doppelgänger’, a local and unusual form of *Crassula cultrata* to which it bears remarkable vegetative semblance. This *Crassula* species reaches its northernmost limit in the Durban area, and is rather different morphologically and phenologically to plants of the same taxon in the southwest of its large range. Sterile plants of both taxa present similar hairy, elliptic leaves, which makes them hard to distinguish, especially when drought-stressed. Although the leaf of this particular form of *Crassula cultrata* lacks a reddish margin, it is often similarly undulate, and the laminae have near-identical colour, vestiture and orientation (not distinctly bent to one side of the stem).

Specimens examined: *Cotyledon nielsii* KwaZulu-Natal province, Pietermaritzburg (2930), Delville Wood, in shallow soils along ledges, roadside cliff within 100m of railway tunnel and waterfall, western aspect, 440m above sea level, 25 July 2018, (–DC), *N.R.Crouch & E.G.J.Akhurst 1296* (BNRH!); *Cotyledon petiolaris* Eastern Cape province, Willowvale (3228), 3 miles from Cat’s Pass on cliffs at riverbed, 13 July 1966, (–AD), *Strey 6666* (NH!, PRE!).

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