Conophytum crateriforme – a new dumpling from Namaqualand.

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Photographs by the authors.

Summary: A new taxon in the dwarf succulent genus *Conophytum* from Namaqualand, South Africa is described – *Conophytum crateriforme.* The plant is named for its distinctive bowl shape.

INTRODUCTION

The genus *Conophytum* is found in South Africa and Namibia, with a geographical range extending up the Atlantic coast from just north of Cape Town to the small town of Luderitz on the edge of the Namib Desert. The genus is most closely associated with the Succulent Karoo biome of South Africa. Nearly 80% of all *Conophytum* taxa can be found here with 90 taxa being endemic to this single biome. This contrasts with the low numbers of taxa (and even lower numbers of endemics) found in the Fynbos, Desert and Nama Karoo biomes. *Conophytum* is the largest genus in the Aizoaceae with more than 160 taxa described to subspecies level (Hammer and Young, 2015). In addition, Hammer (2002) recognises several further varieties. Such a high level of speciation is characteristic of many succulent genera in the region, especially within the Succulent Karoo (Desmet *et al*. 1998, Ihlenfeldt, 1994), but is most pronounced in *Conophytum*. The genus is also typified by a high degree of habitat specialisation, resulting in a large number of taxa that are significantly range-restricted, sometimes so much so that they may be referred to as point-endemics. It is estimated that approximately one fifth of all *Conophytum* taxa could be considered to be point-endemics with areas of occupancy ranging from just a few hundred to a few thousand square metres (unpublished). Some *Conophytum* taxa are both highly localised and are limited in population size with several possessing fewer than 1000 individuals.

The centre of endemism for *Conophytum* is in the immediate vicinity of the Northern Cape towns of Springbok and Steinkopf, lying just south of the Richtersveld. Steinkopf was once the home of Reverend Gottlieb Meyer (1867-1958), notable amateur botanist and discoverer of a large number of succulent species, including many *Conophytum*. It is no surprise that Meyer was so successful in his finds as the immediate area is particularly florally diverse: it is common, for example, to find 20 or more individual *Conophytum* taxa in the area of a single quarter degree grid cell (approx. 600km^2). It is a combination of this diversity together with the local abundance of succulents that continues to draw botanists to the area. Whilst one may believe that the area has therefore been extremely well explored, the tendency for some *Conophytum* taxa to occur in highly localised geographical areas often means that such discrete populations may be easily overlooked.

Here we describe a new, highly localised, *Conophytum* taxon from an area already well known for its succulent diversity and richness.

DISCOVERY

This new *Conophytum* is currently only known from a single site in Namaqualand, lying to the northwest of Springbok and southwest of Steinkopf (Figure 1). The area in which the plants are found is well known for several *Conophytum* species, including several local endemics. Indeed the type locality lies close to the effective epicentre for the distribution of a number of *Conophytum* species, including *C. wettsteinii*. The plants themselves inhabit the upper slopes of a quartz ridge on lichen-covered south-facing cliffs (Figure 2). Whilst the new species was found on quartz (more typically home to related taxa such as *C. flavum*), this is a relatively unusual substrate on which to find *C. wettsteinii* (which is more normally found on granite). *C. wettsteinii* also has a tendency to favour shade such as the cracks and fissures in south or southwest-facing vertical rock faces. This is unlike *C. flavum* which prefers full sun; although the preference for sun or shade habitats is not an absolute rule in either species. All plants of the new species were observed growing in shade. The plants appear to be severely restricted in their distribution, with an area of occupancy estimated to be < 0.5 km^2. Explorations of the immediate area have, so far, been unsuccessful in extending its known range or in locating further populations. The plants do not occur on the eastern extension of the quartz ridge although the far western extent of the ridge remains poorly explored. The size of the population is very small and estimated to be fewer than 1000 individuals. The combination of such a restricted range and small population size would suggest that this taxon should be listed on the South African National Red List as *Critically Rare.*

In habitat, the plant forms very large clusters, regularly consisting of 50 or more bodies. The age of such huge clusters is unknown but by comparison with the growth rates of similar taxa in cultivation many of the plants that the authors have seen in habitat must be decades old. Another indicator of age is the presence of a number of old, annual, sheaths, which in some plants (especially those that are sheltered) may persist for many years (see Figure 4). Younger plants are present at the site, often occupying tiny cracks in the rock face, but these are generally less common than established clusters. When AJY visited the site in 2012 it was particularly noticeable that some large clusters had died (Figure 3). The remaining plants appeared to be in good health. Other succulents typical of the area inhabit the lower slopes and the upper, exposed parts of the ridge itself. These include the distinctive "*herrei"* form of *Adromischus marianiae*, the robust and waxy-skinned *'linearilucidum*' form of C*. bilobum*, *Tylecodon paniculatus* and *Mitrophyllum clivorum*.

This particular *Conophytum* has been observed in habitat by several botanists in recent years, including all the authors. All those who have seen it have commented on its distinctiveness. In particular three morphological features of the new *Conophytum* stand out. First, the blue-green, spotted plant bodies are universally concave (usually markedly so; Figure 4). By contrast the bodies of *C. wettsteinii* are more typically flattened, with some being convex or only slightly concave. The extent of the latter is never as extreme as that seen in *C. crateriforme* either in habitat or during its subsequent cultivation at Kirstenbosch. Indeed, Steven Hammer, Adam Harrower and Russell Wagner

who visited the site in 2003 jokingly referred to the plants at the time as '*uberconcavum*', such was the impact of the body shape. This concave nature is especially pronounced in very young individuals where the plants can sometimes resemble dough dimpled by a heavily pressed thumb (see Figures 4,6 and 8).

Second, the persistent sheath (i.e., the remains of the previous year's leaves) is highly distinctive and its appearance, especially in terms of pigmentation, is unique in the genus *Conophytum* (Figures 5 and 6). In particular, the dark-brown, seemingly burnt, almost leather-like, sheath (see Figure 6) contrasts with the formal description of *C. wettsteinii* that states, "sheath **whitish**, sometimes spotted, brittle, persistent" (Hammer, 2002). This suggests substantial differences in the morphology and/or biochemical composition of the epidermis between the two taxa. Whilst the structure of the sheath resembles that of *C. francoiseae* (Figure 7) the dark-brown pigmentation (other than in the tannic spots) that is so evident in *C. crateriforme* is lacking. The sheath in *C. crateriforme* forms a prominent raised edge, a feature also seen in the Augrabies endemic *C. francoiseae* (c.f. Figures 5 and 7).

Finally, the diurnal flowers of *C. crateriforme* that emerge from a discreet fissure (~2-4 mm in length) share some features of both *C. wettsteinii* and *C. francoiseae.* The petals of *C. crateriforme* are recurved, pink, paling to white towards the centre and organised in one to two series (Figure 8). Amongst these three species, the corolla tube is longest in *C. francoiseae* and the calyx tube is typically more prominent (Figure 7). However the latter is usually hardly visible in either *C. crateriforme* or *C. wettsteinii*. The pale yellow anthers found in *C. crateriforme* lie in line with the tube mouth or are only slightly exserted, whereas they are generally well exserted in both of the other taxa. By contrast, *C. wettsteinii* typically possesses magenta coloured petals whereas those of *C. francoiseae* and indeed some taxa within the more widespread *C. jucundum* complex show a greater tendency toward pink hues. It is interesting to compare the flowering times for these three species. Whilst *C. crateriforme* and *C. wettsteinii* flower at the same time as the vast majority of other taxa in the genus, i.e., in the South African autumn, *C. francoiseae* flowers much earlier in summer.

DESCRIPTION

C. crateriforme is readily distinguished from other *Conophytum* taxa through a combination of its epidermal colouring (when sheathed) and body shape. It differs from *C. wettsteinii* by having a concave upper surface to the body and a brown-coloured sheath with raised upper rim; It differs from *C. francoiseae* in the brown colouring of its sheath and flowering in autumn rather than summer.

The reasons for recognizing *C. crateriforme* as a species distinct from its closest relatives *C. wettsteinii* and *C. francoiseae* can be summarized as follows:

(1) The chocolate-brown colouration of the sheath in *C. crateriforme* differs from the white / off-white sheaths seen in both *C. wettsteinii* and *C. francoiseae* (and indeed the vast majority of other *Conophytum* taxa) suggesting significant differences in epidermal pigment composition. This sheath colouration is unique in Section Wettsteinii but may be seen in some other *Conophytum* taxa, e.g., *C. mirabile*.
(2) *C. crateriforme* possess a body shape that is typically highly concave and strongly contrasting with the shapes of the leaves of *C. wettsteinii* and *C. francoiseae.*

In other attributes the taxon is less well defined from other taxa:

(3) The habitats occupied by *C. crateriforme, C. wettsteinii* and *C. francoiseae* are similar, with all three taxa generally showing a preference for shade.
(4) The flowers of *C. crateriforme* clearly places the taxon in Section Wettsteinii (as described by Hammer, 2002) possessing a close affinity in structure to those of *C. wettsteinii* and, especially *C. francoiseae.*

The combination of the distinguishing features described above clearly indicates that *C. crateriforme* is related to both *C. wettsteinii* and *C. francoiseae,* effectively sharing some traits of both. It is worth remembering that Hammer originally considered *C. francoiseae* to be a subspecies of *C. wettsteinii* but later raised it to full species status (in part because of shared traits with *C. jucundum*) so these are already considered to be close. In conclusion, we believe that it is not possible to assign the taxon to an existing species and the information supports the description of this *Conophytum* at species level: *Conophytum crateriforme*.

C. crateriforme A.J.Young C.Rodgerson A.D.Harrower S.A.Hammer subg. **Derenbergia**, Section **Wettsteinia. Type:** Adam Harrower, Steven Hammer and Russell Wagner ADH1503 (National Botanical Gardens, Compton Herbarium, Kirstenbosch, Cape Town, 13-5-2003 **Holotype**)
Highly caespitose, often in clusters of 50 or more bodies; **Leaves** wholly fused**,** leaf-pair strongly concave, blue-green, densely spotted top 12-25 mm diameter, 10 mm tall; drying to a leather-like, brittle, dark-brown on the sides and raised edge but off-white and spotted on the upper surface; **Flowers** diurnal appearing in early autumn, breaking through the resting sheath, 25-30 petals slightly recurved, pink, in 1-2 series, stamens pale yellow; **Fruit** shallow, soft, rust-coloured; **Ecology** in shade in cracks and crevices of vertical quartz cliffs; **Distribution** Southwest of Steinkopf, Namaqualand, Northern Cape, S Africa, 2917BC.

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We thank Derek Tribble and Irma Burger for their valuable contributions and insights into the South African succulent flora. Derek first reported the plants to us, suggesting a connection with *C. bachelorum* (then lost) and Irma fearlessly assisted with local roads, ruminants and cuisine. We also thank Terry Smale for his comments on the manuscript.

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FIGURE LEGENDS

Figure 1. General map showing the location of *C. crateriforme* in South Africa.

Figure 2. The habitat of *C. crateriforme* on lichen-covered south-facing quartz boulders.

Figure 3. A medium-sized plant of *C. crateriforme* in habitat.

Figure 4. The concave body shape of *C. crateriforme* is one of its main distinguishing features.

Figure 5. *C. crateriforme* photographed in autumn at the Type Locality in Namaqualand. After light rains the plant is starting to shed its sheath.

Figure 6. A close-up of the sheath of *C. crateriforme* showing it's highly pigmented and, almost leather-like, appearance. Within the genus *Conophytum* the persistent sides of the sheath of *C. crateriforme* are immediately distinctive.

Figure 7. Flowers emerging through the sheath of *C. francoiseae* LAV25430A (Augrabies).

Figure 8. Close up of the flower of *C. crateriforme* showing the pink recurved petals and, few, pale yellow anthers in line with the mouth of the corolla tube.

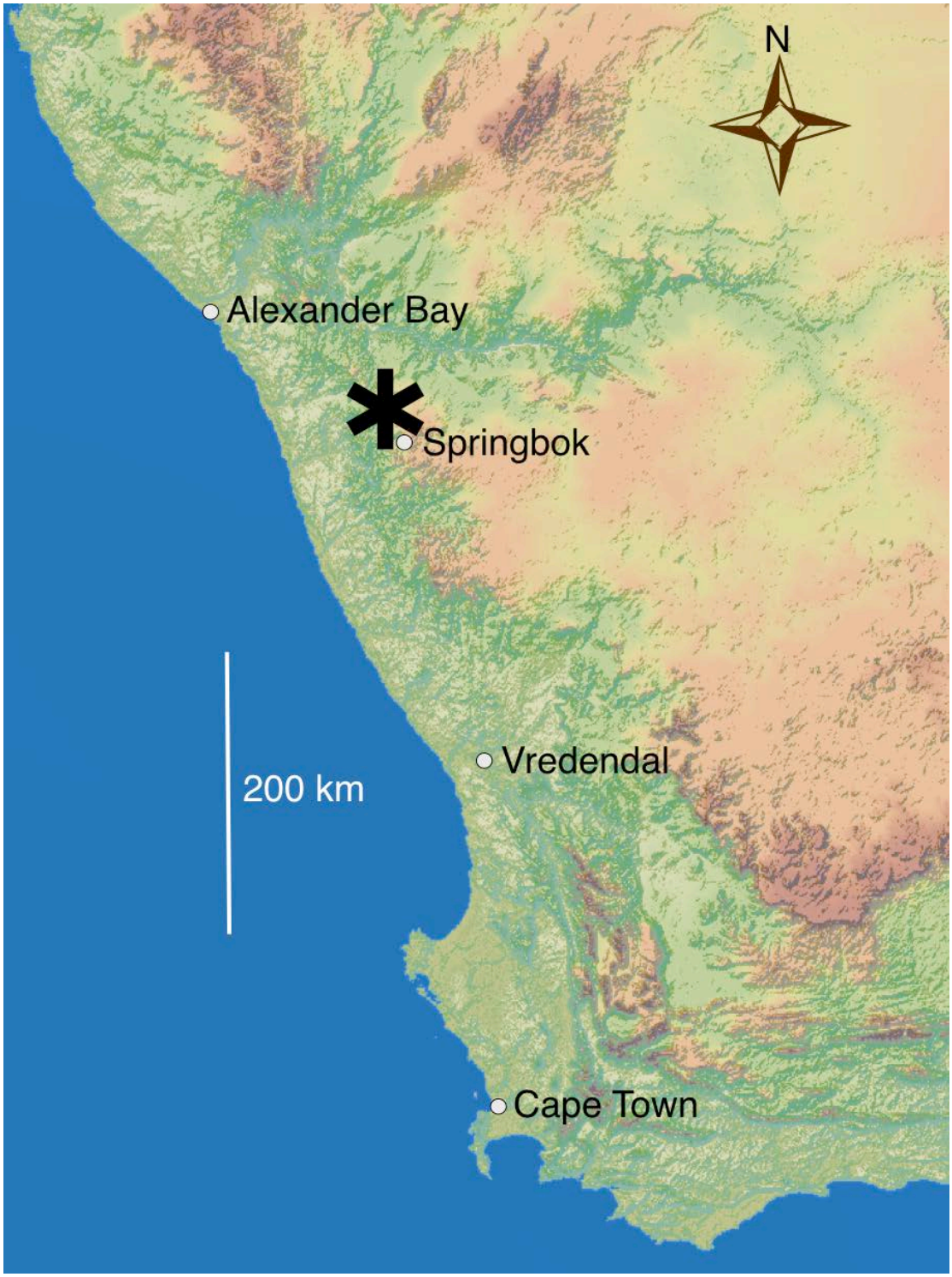

Figure 1

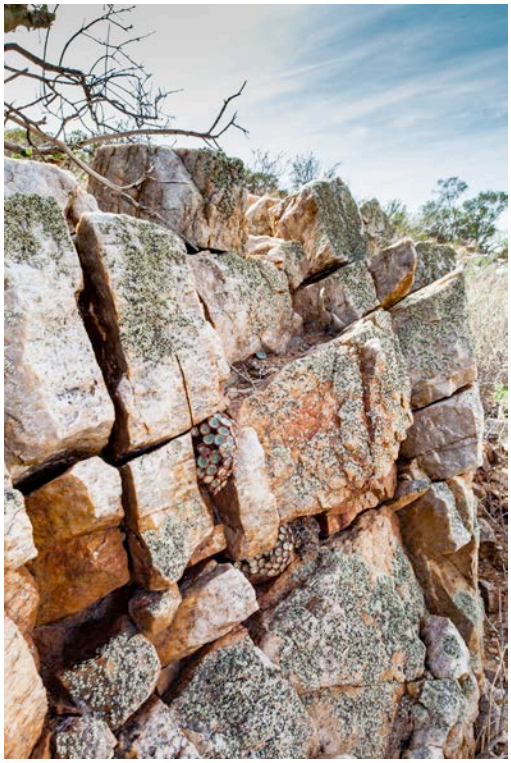

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8