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PTERIDOPHYTA–SINOPTERIDACEAE

A NEW SUBSPECIES OF *CHEILANTHES DELTOIDEA* FROM GAUTENG AND LIMPOPO, SOUTH AFRICA

Cheilanthes deltoidea Kunze is a small and easily overlooked fern endemic to southern Africa. Hitherto it has been recorded in the western and northwestern parts of the Northern Cape, the Cederberg area of the Western Cape, and in southern Namibia. To the east, there is a disjunct record from the Waterberg in Limpopo Province (Jacobsen & Jacobsen 1986; Burrows 1990), and Klopper *et al.* (2006) reported the discovery of a particularly small form of *C. deltoidea* in the Centurion area of Gauteng. Klopper *et al.* (2006) suggested that this form (perhaps including the plants from the Waterberg) may warrant description as a new infraspecific taxon, but further studies were needed to confirm the suggested status. Recently, a population of this same entity was discovered north of the Cradle of Humankind area, very close to the Gauteng/North-West border. The population in the Waterberg was located and a comparative study of the various forms and their habitat was completed.

Northern Cape populations of *Cheilanthes deltoidea* fall within the winter rainfall region and produce new fronds during this time of year; during the dry summer months the plants are desiccated and shrivelled. In this region, *C. deltoidea* grows predominantly in fissures on granite or gneiss rock formations. The northeastern populations in Centurion, the Cradle of Humankind area and the Waterberg are in the summer rainfall region and the seasonality of its growing cycle differs accordingly. Centurion and Cradle of Humankind plants were only found on outcrops of chert rock associated with dolomite representing the Malmani Subgroup, Chuniespoort Group of the Transvaal Supergroup (Obbes 2000; Eriksson *et al.* 2006). These populations were present on chert in Carletonville Dolomite Grassland (Mucina & Rutherford 2006), but apparently do not occur on the chert outcrops of the Rand Highveld Grassland in Centurion (Petro Lemmer pers. comm.).

In the Waterberg, plants of *C. deltoidea* grow in Central Sandy Bushveld (Mucina & Rutherford 2006), on phonolithic lava that forms part of the lower strata of the Waterberg Group (Barker *et al.* 2006; Prof. P. Eriksson & Dr N. Lenhardt pers. comm.). Plants were consistently smaller in Centurion, the Cradle of Humankind area and the Waterberg than in the Northern Cape. Based on the clear disjunction in the distribution range, the specific geological requirements, and the morphological and phenological differences observed, the small form from Gauteng and Limpopo is here described as a new subspecies.

***Cheilanthes deltoidea* Kunze subsp. *silicicola* Klopper & A.E.van Wyk**, subsp. nov., a subspecies typica frondis minoribus (lamina \pm 8–21 mm longa, pinnis basalibus \pm 5–15 mm longis), squamis rhizomatis pallide brunnescentibus, stipa lamina sesquilogior, in silicula vel lava phonolithica aestate crescente differt.

TYPE.—Gauteng, 2528 (Pretoria): Centurion, Irene, Doornkloof, Smuts House Museum, on koppie close to monument, (–CC), 30-03-2006, R.R. Klopper & A.W. Klopper 217 (PRE, holo.).

Rhizome shortly creeping, 2–3 mm diam., densely covered with roots and old stipe bases; scales lanceolate, attenuate, \pm 2–3 mm long, pale light brownish, concolorous, entire. *Fronds* closely tufted, erect, herbaceous to thinly coriaceous; stipe sulcate, slender, 10–22(–45) mm long, dark reddish brown, becoming darker with age, glabrous. *Lamina* broadly deltate in outline, 8–21 (–30) \times 9–26(–35) mm, 2- or 3-pinnatifid, pinnae in 3–5 \pm opposite pairs, basal pinnae basiscopically developed, 5–15(–18) mm long; ultimate segments oblong acute to broadly spatulate in fertile fronds, obtuse in sterile or partially sterile fronds, margins entire, glabrous; rhachis

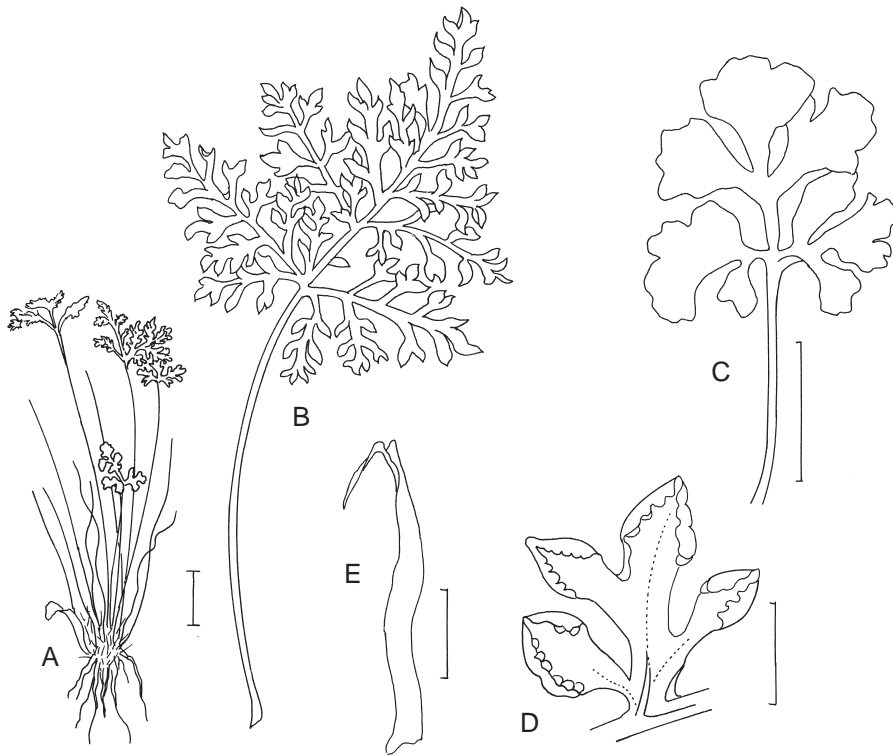


FIGURE 21.—*Cheilanthes deltoidea* subsp. *silicicola*, R.R. Klopper & A.W. Klopper 217. A, habit; B, mature leaf growing in deep shade; C, immature leaf; D, marginal sori; E, rhizome scale. Scale bars: A–C, 5 mm; D, E, 2 mm. Artist: G. Condy.

dark reddish brown, glabrous, narrowly winged for its entire length. Venation free, obscure adaxially. Sori linear; false indusium continuous, 0.3–0.4 mm broad. Figure 21.

Diagnostic characters: *Cheilanthes deltoidea* subsp. *silicicola* can be distinguished by its small, broadly deltoid fronds, continuous false indusium, and winged rachis. It is consistently smaller (frond lamina \pm 8–21 mm long, basal pinnae \pm 5–15 mm long) than the typical subspecies and has an average stipe:lamina ratio of \pm 1.5 (compared to \pm 1 in subsp. *deltoidea*). When growing in the shade of rocks, as at the type locality, plants can become larger (stipe up to 45 mm long, and lamina up to 30 \times 35 mm), but they never reach the average size of *C. deltoidea* subsp. *deltoidea*, and the stipe:lamina ratio remains consistent. Rhizome scales of *C. deltoidea* subsp. *silicicola* are a pale brownish colour as opposed to more castaneous in *C. deltoidea* subsp. *deltoidea* (Table 2). Furthermore, *C. deltoidea* subsp. *deltoidea* only grows in sheltered rock crevices on south-facing aspects, where it is completely sheltered from direct sunlight. It is found mostly on granite or gneiss rock for-

mations (Jacobsen 1983; Burrows 1990). *Cheilanthes deltoidea* subsp. *silicicola* grows on north- or northwest-facing aspects, and is confined to chert and phonolithic lava outcrops (Klopper *et al.* 2006).

Distribution: only known from the Centurion area of Gauteng and north of the Cradle of Humankind (Gauteng/North-West border), with an outlier record from the Waterberg in the Limpopo Province (Figure 22). It could be more widespread where suitable geology is present.

Habitat and ecology: grows in sheltered soil pockets and rock crevices mainly on northern and northwestern aspects of chert outcrops associated with dolomite of the Malmani Subgroup, Chuniespoort Group of the Transvaal Supergroup, and on phonolithic lava of the Waterberg Group. In Centurion and the Cradle of Humankind area, this fern has only been found on chert and not on the associated dolomite.

In Centurion it is found in a relatively small area in Carletonville Dolomite Grassland near the transition with Rand Highveld Grassland (Mucina & Rutherford 2006), but is not present in the latter (Petro Lemmer pers. comm.). The population north of the Cradle of Humankind also occurs in Carletonville Dolomite Grassland, whereas the Waterberg population is associated with Central Sandy Bushveld (Mucina & Rutherford 2006). During the dry season it shrivels up completely and revives when sufficient moisture is available.

Etymology: from Latin, *silicis* (silica), and *-cola* (inhabiting), alluding to the narrow geological preference of this subspecies that only grows on chert and phonolithic lava, both having a very high silica content.

TABLE 2.—Differences between *Cheilanthes deltoidea* subsp. *silicicola* and *C. deltoidea* subsp. *deltoidea*

	subsp. <i>silicicola</i>	subsp. <i>deltoidea</i>
Rhizome scales	2–3 mm long, pale light brownish	\pm 3 mm long, castaneous
Stipe length	10–22 mm	16–34 mm
Lamina length	8–21(–30) mm	18–50(–100) mm
Basal pinnae length	5–15(–18) mm	11–34(–55) mm
Stipe:lamina ratio	\pm 1.5	\pm 1
Geology (substrate)	chert or phonolithic lava	granite or gneiss

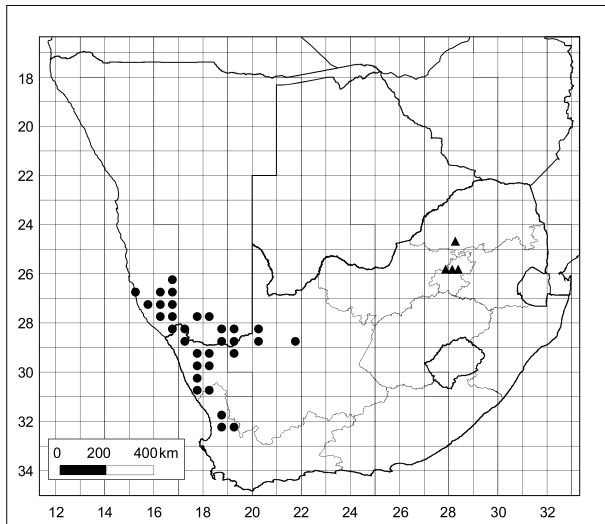


FIGURE 22.—Known distribution of *Cheilanthes deltoidea*, adapted from Burrows (1990), with his permission, by adding localities based on specimens kept at PRE and NBG that have been collected since publication of map; *Cheilanthes deltoidea* subsp. *deltoidea*, ●; *C. deltoidea* subsp. *silicicola*, ▲.

Conservation status: owing to its very small size and the fact that this fern shrivels up during dry periods, it is easily overlooked. Much of the suitable habitat for this plant has already been destroyed through massive urban expansion in Centurion. For this reason *Cheilanthes deltoidea* subsp. *silicicola* was assessed as Vulnerable [VU B1ab(ii,iii,iv,v) + 2ab(ii,iii,iv,v); C2a(i); D1+2] by the Threatened Species Programme (Victor & Pfab 2009, as *C. deltoidea* subsp. nov.). It is exposed to several threats, the most prominent being habitat loss from urbanization, but also alien vegetation, unnatural fire regimes, and trampling.

Other specimens examined

GAUTENG.—2527 (Rustenburg): Kalkheuwel-wes, Lewenskloof, (–DD), 24-01-2008, L. Mills s.n. (PRE). 2528 (Pretoria): Centurion, Doornkloof, Portion 107 on Farm Doornkloof 391-JR, (–CC), 18-02-2006, P. Lemmer 623 (PRE), Portion 198 (part of remainder of Portion 335), 25-03-2006, R.R. Klopper, J. Nel & A. Nel 216 (PRE); Irene, Farm Doornkloof 391-JR, rocky ridges between Smutskoppie and M57, (–CC), 29-03-2005, A.E. van Wyk 13630 (PRU), 07-10-2005, A.E. van Wyk 13653 (PRU); Doornkloof 391-JR, (–CC), 31-01-2008, L. Mills s.n. (PRE); Erasmia, (–CC), 24-01-2008, L. Mills s.n. (PRE); Centurion, Irene, Century Hill, (–CC), 03-02-2009, J.J. Meyer 5168 (PRE); Centurion, Farm Rietvallei 377-JR, adjacent to Rietvlei Nature Reserve, close to where Olifantsfontein road crosses Sesmylspruit, (–CD), 26-02-2006, R.R. Klopper & A.W. Klopper 215 (PRE).

LIMPOPO.—2428 (Modimolle/Nylstroom): Waterberg Dist., Farm Leeuwpoot 573 KR, (–CB), 21-03-1980, N. Jacobsen 5209 (PRE), 08-04-1984, W.B. Jacobsen 5500 (PRE); Waterberg Dist., Farm Leeuwpoot 573 KR, (–CB), ± 20 km northwest of Modimolle (Nylstroom) on Lephallale (Vaalwater) road, on ridge next to dam wall, 05-12-2009, R.R. Klopper & A.W. Klopper 255, 256 & 257 (PRE).

Cheilanthes deltoidea* Kunze** in Linnaea 10: 535, 536 (1836) subsp. ***deltoidea. *Pellaea deltoidea* (Kunze) Baker: 146 (1867). *Allosorus deltoideus* (Kunze) Kuntze: 806 (1891). *Doryopteris deltoidea* (Kunze) Diels: 269 (1899). Type: Northern Cape, Namaqualand, Zilverfontein, J.F. Drège s.n. (LZ†, holo.; K, lecto.; B, BM, K!, isolecto.), designated by Anthony (1984: 109).

Doryopteris deltoidea (Kunze) Diels var. *laxa* Sim: 217 (1915). Type: Northern Cape, Namaqualand, between O’Kiep and Nababeep, 1883, H. Bolus 9463 (PRE, holo.!, BOL!, K, iso.).

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