

A new species of *Berkheya* (Asteraceae, Arctotideae) from the Northern Cape, South Africa

Authors:

Nicola G. Bergh¹
Nick A. Helme²

Affiliations:

¹Compton Herbarium, South African National Biodiversity Institute, South Africa

²Nick Helme Botanical Surveys, Scarborough, South Africa

Correspondence to:

Nicola Bergh

Email:

n.bergh@sanbi.org.za

Postal address:

Private Bag X7, Claremont 7735, South Africa

Dates

Received: 20 Feb. 2014

Accepted: 04 July 2014

Published: 18 Sept. 2014

How to cite this article:

Bergh, N.G. & Helme, N.A., 2014, 'A new species of *Berkheya* (Asteraceae, Arctotideae) from the Northern Cape, South Africa', *Bothalia* 44(1), Art. #123, 5 pages. <http://dx.doi.org/10.4102/abc.v44i1.123>

Copyright:

© 2014. The Authors.
Licensee: AOSIS
OpenJournals. This work is licensed under the Creative Commons Attribution License.

Read online:

Scan this QR code with your smart phone or mobile device to read online.

Background: *Berkheya* is a large, mainly southern African genus of approximately 75 species, several of which are poorly known and under-collected. Since revision in 1959, only a few new species have been described. Publication of new taxa facilitates conservation objectives and contributes to a better understanding of the southern African flora.

Objectives: The objectives of this study were to describe a new species of *Berkheya*, consider its taxonomic position within the genus and assess its conservation status.

Methods: Macromorphology and micromorphology of the new species were compared with known species.

Results: *Berkheya dumicola* N.G.Bergh & Helme was described from two subpopulations from the northern Bokkeveld escarpment, Northern Cape Province, South Africa. The species is a tall shrub with radiate flowerheads, toothed receptacle alveole margins, a uniseriate pappus of small, rounded scales and very short twin-hairs on the cypsela.

Conclusion: *Berkheya dumicola* is a new species with a unique combination of features. Based on morphological characteristics, its closest relative within the genus is likely to be the recently described *Berkheya chrysanthemoides* J.C.Manning & Goldblatt. The limited geographic extent and small population size of *B. dumicola* warrant an International Union for Conservation of Nature (IUCN) status of 'Endangered'.

Introduction

Berkheya Ehrh. (Asteraceae) is the largest genus in Arctotideae subtribe Gorteriinae, the 'spiny daisies' of southern Africa. The genus has been shown to be paraphyletic using both molecular (Funk & Chan 2008; Funk, Chan & Keeley 2004) and morphological data (Karis 2006) and changes in generic circumscriptions in the subtribe are anticipated (Karis *et al.* 2009). Based on current evidence, *Berkheya* consists of approximately 75 species distributed predominantly in South Africa. The genus was last revised by Roessler (1959) and has thus not been treated as a whole for over 50 years, despite several useful regional treatments, including Goldblatt and Manning (2000), Hilliard (1977), Manning and Goldblatt (2012a) and Snijman (2013), and the description of a handful of new species (Hilliard 1977; Hilliard & Burt 1975; Manning *et al.* 2010; Manning & Goldblatt 2012b). The prevalent covering of sharp spines makes *Berkheya* species difficult and painful to collect and the genus is poorly known and under-collected, despite forming a prominent component of many plant communities.

Berkheya species occur in several bioregions but are concentrated in the Greater Cape Floristic Region, where they are most strongly associated with the winter-rainfall desert (succulent Karoo) vegetation (Verboom *et al.* in press). Most species are perennial herbs, less commonly shrubs, distinguished from allied genera by the possession of, (1) involucre bracts that are always spiny and basally connate but never hardened into a woody structure, (2) a honeycombed receptacle with the cypselas embedded in alveoli that are all of equal size and (3) a pappus (Roessler 1959).

Roessler (1959) divided *Berkheya* into eight series based on characters of the receptacle alveolar margins, cypsela hair type, pappus arrangement and structure, degree of connation of the involucre bracts, leaf morphology (including degree of division, margin serration and indumentum), leaf arrangement (opposite versus alternate), presence or absence of ray florets and growth form. Additional characters used to define species include hairiness of the stems and leaves, leaf shape and size, form of the leaf margins, size and structure of the leaf spines, arrangement and size of the capitula, ray floret colour and the size and morphology of the involucre bracts.

Berkheya material from a localised area in the northern Bokkeveld escarpment in the Calvinia region of the Northern Cape Province (Figure 1) was examined and this could be distinguished from other species in the genus by its tall, shrubby habit, relatively large and broad leaves, small

radiate heads clustered in paniculate groups, very short uniseriate pappus scales and short hairs on the cypselas. This material represents a new species which is described in detail here.

Research method and design

Berkheya specimens from the South African National Biodiversity Institute's (SANBI) Compton Herbarium in Cape Town (NBG), SANBI's South African Museum Herbarium in Cape Town (SAM) and the Bolus Herbarium at the University of Cape Town (BOL) were compared with those of the new taxon. Holotype material was collected and dried using standard techniques in October 2013. Type material has been deposited in NBG, BOL and SANBI's National Herbarium in Pretoria (PRE), Kew Herbarium at the Kew Royal Botanic Gardens, United Kingdom (K) and the Swedish Museum of Natural History Herbarium in Stockholm (S).

Habitat and habit were documented in the field. Morphological structures were examined on dried and rehydrated specimens using a dissecting microscope. Images were captured from the microscopes using an Olympus SC30 digital camera attachment and the software Analysis getIT v. 5.1 (Olympus Soft Imaging Systems, Münster, Germany). Measurements were made on digital images using MeasureIT v. 5.1 from the same company.

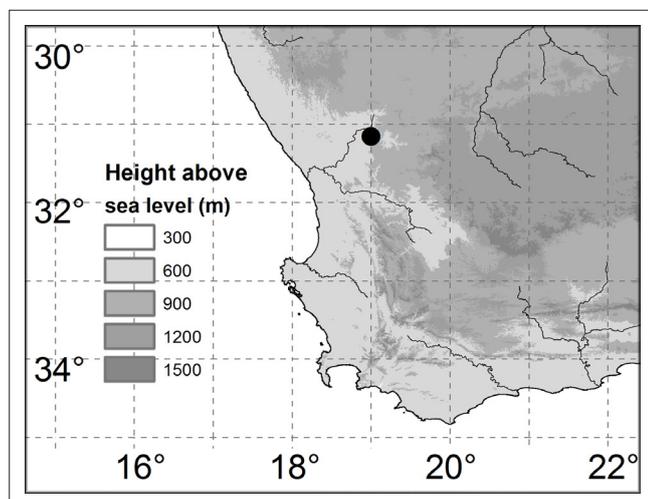
Plants were collected under collecting permit FLORA 02/02/2013 issued to Compton Herbarium staff by the Department of Nature Conservation, Northern Cape Province.

Taxonomic treatment

Berkheya dumicola N.G. Bergh & N.A. Helme, sp. nov.

Type

SOUTH AFRICA. **Northern Cape:** 3119 (Calvinia): Noord Bokkeveld, top of Die Hel pass, north-west of farm



Source: Map drawn by M. Smith
The black dot represents the location of the two known populations of *Berkheya dumicola*.

FIGURE 1: Distribution of *Berkheya dumicola*.

Kookfontein (–AA), 12 Oct. 2013, *Helme 7794* (NBG, holo.; BOL, PRE, K, S, iso.).

Description

Well-branched shrub up to 2 m tall, with gnarled woody stem to 120 mm diameter at base, branches leafy towards apices (Figure 2a), thinly (glandular-) tomentose. *Leaves:* alternate, sessile, oblanceolate in outline, 30 mm – 80 mm × 20 mm – 50 mm, lamina narrowed to slender base ± 2 mm wide, pinnatifid, two-jugate with five primary lacinia, lacinia increasing in size distally, primary lateral lacinia each with smaller secondary lobe in distal axil, narrowed at base and often with additional slender patent lobes resembling spines, lacinia somewhat concave, triangular to narrowly triangular, shorter than to as long as the width of undivided portion, excurrent in apical yellowish spine but lacking spines along margins, margins revolute (Figure 2b), discolorous, adaxial surface thinly woolly when young, glabrescent, abaxial surface densely white-felted. *Capitula:* shortly pedunculate, 3–10 in loose corymbs at ends of short, slender flowering branches, several branches arranged together in paniculate synflorescences, radiate, 20 mm – 35 mm diameter across expanded ray florets, florets rich yellow. *Involucral bracts:* 4-seriate (Figure 2c), basally connate in involucre ± 4 mm deep, squarrose, concave, narrowly lanceolate, margins thickened, cartilaginous, yellowish, with apical spine 2 mm – 3 mm long and with 2 or 3 pairs of similar marginal spines, glabrous, outer bracts 5 mm – 8 mm × 2 mm – 3 mm, median 10 mm – 12 mm × 2 mm – 3 mm, inner narrowly lanceolate, 6 mm – 8 mm × 1.5 mm – 2.0 mm. *Receptacle:* deeply alveolate (Figure 2d), ovaries embedded in fleshy alveolar tissue, alveole margins extended into irregularly serrated cartilaginous teeth 1.0 mm – 2.5 mm long (Figure 3d). *Ray florets:* 8–10, sterile and lacking pappus, attached to small alveoles fused to inner surface of innermost involucral bracts (Figure 2d), tube ± 8 mm long, glandular-pubescent, limb narrowly oblanceolate, 12 mm – 15 mm × 3 mm – 5 mm, lamina apex unevenly 4-toothed with central division much shallower than two lateral divisions (Figure 3a). *Disc florets:* 16–18, hermaphrodite, corolla funnel-shaped, 8 mm – 9 mm long, tube ± 5 mm long, densely glandular-pubescent with long pale hairs, deeply lobed, lobes erect, narrowly lanceolate, ± 4 mm long, apically sparsely hairy with short clavate orange hairs on abaxial surfaces, lobe margins somewhat thickened (Figure 3b). *Anthers:* sagittate with lanceolate apical appendage, ± 5 mm long (Figure 3c). *Style:* papillose, with indistinct ring of antrorse hairs well below the branching point, style branches tapering towards apex, obtuse (Figure 3c). *Cypselas:* obovoid, 2.0 mm – 3.0 mm × 0.8 mm, angled, distally densely covered with, short, antrorse twin-hairs (Figure 3e). *Pappus:* of short scales, uniseriate, ± 20, entire, ± 0.3 mm × 0.2 mm, oblong-ovate, apex obtuse-truncate, glabrous (Figures 3e and 3f). *Pollen:* lophate. *Flowering time:* September to October.

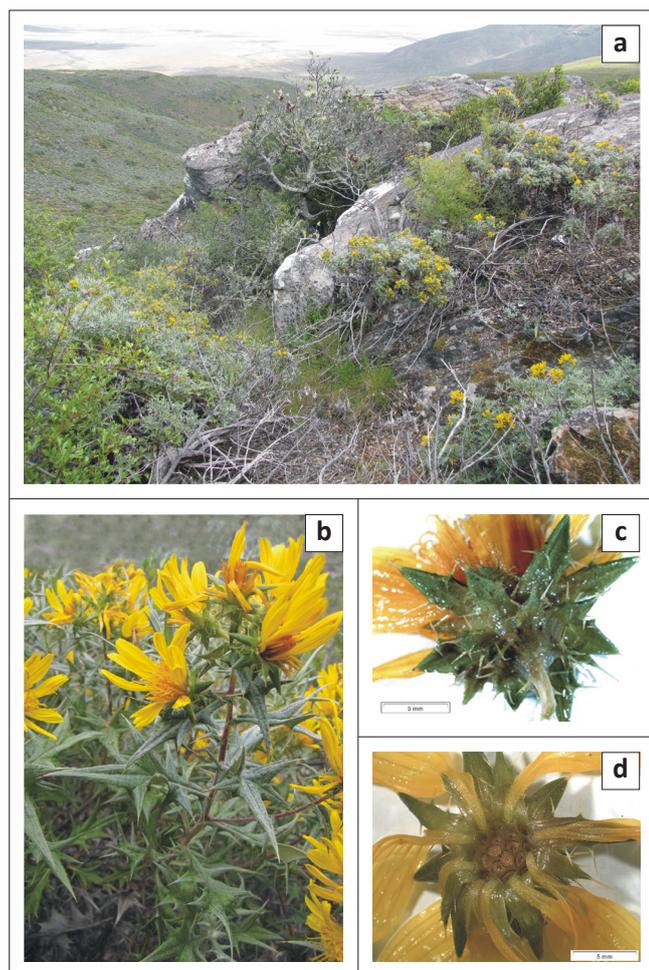
Distribution and habitat

This large, shrubby species has been collected from only one locality in the northern Bokkeveld, north-west of

Nieuwoudtville, on the very edge of the escarpment (Figure 1). Two subpopulations, each of approximately 30 plants, have been found growing about 800 m apart on steep, southwest-facing slopes amongst large sandstone boulders (Figure 2a). The plants occasionally sprawl over the rocky outcrops. The aspect appears to be important because *B. dumicola* was not seen in otherwise similar habitats along the escarpment edge which generally have a drier, more northerly aspect.

Ecology

The species grows in tall, fire-protected thicket vegetation. It is estimated that the habitat has not burnt for at least 80 years. The plants are rooted in deep loamy soils and, because of the steep slope and dense surrounding vegetation, are often partly shaded for part of the day. The thicket vegetation in which they occur includes species such as *Kiggelaria africana* L., *Gymnosporia buxifolia* (L.) Szyszyl., *Lobostemon glaucophyllus* (Jacq.) H.Buek., *Stachys* sp., *Podalyria myrtifolia* (Retz.) Willd. and *Diospyros austroafricana* De Winter. Average annual rainfall in the area is



Source: Photographs (a) and (b) taken by N. Helme, (c) and (d) taken by N. Bergh, of rehydrated material from the type collection

FIGURE 2: Macromorphological features and habitat of *Berkheya dumicola*, including, (a) habitat and habit, (b) inflorescence comprising clusters of three to ten heads; large leaves with spines present at the lacinia apices but not along the margins, (c) base of capitulum showing short peduncle and spiny, 4-seriate involucre and (d) deeply alveolate receptacle with irregularly fimbriate alveolar margins (disc florets corollas removed).

likely to be in the order of 400 mm – 500 mm per year, with pronounced and rapid declines to the east and west of the escarpment edge (Manning & Goldblatt 1997).

Etymology

The specific epithet 'dumicola' means 'thicket dweller' (Stearn 1967) and refers to the rocky, fire-protected vegetation in which this species occurs.

Diagnosis and relationships

Berkheya dumicola is an unusually large, shrubby species in a genus dominated by perennial herbs. The shrubby habit, radiate heads and relatively broad leaves (Figure 2b) are most consistent with *Berkheya* series *Fruticosae* Roessler, but members of this series are characterised by entire or shortly toothed (rarely fringed) receptacle alveolar margins, densely hairy cypselae with the silky hairs often long (up to 4 mm), and a biseriate pappus of lanceolate or subulate scales. The conspicuously fimbriate, serrate-toothed alveolar margins, shortly pubescent cypselae with twin-hairs and uniseriate pappus of short, obtuse scales (Figures 3d–3f) set *B. dumicola* apart from members of series *Fruticosae*. Only one other *Berkheya* species



Source: Photographs taken by N. Bergh

FIGURE 3: Micromorphological features of *Berkheya dumicola*, taken from rehydrated material of the type collection, depicting, (a) ray floret and associated receptacular tissue, (b) disc floret, (c) dissected disc floret showing style and anthers, (d) section through receptacle to show embedded cypselae and alveolar margins, (e) dry cypselae and (f) pappus.

shares this unusual combination of characters: the recently described *Berkheya chrysanthemoides* from the nearby central Bokkeveld. *Berkheya dumicola* differs from *B. chrysanthemoides* in having leaves that are broader (20 mm – 50 mm in *B. dumicola*; 15 mm – 30 mm in *B. chrysanthemoides*), lack marginal spines (both species have spines on the lacinia apices but *B. chrysanthemoides* also possesses smaller antrorse spines along the margins) and are conspicuously tomentose on their abaxial surfaces (contrasting with the abaxially glabrous leaves of *B. chrysanthemoides*). The capitula of *B. dumicola* are smaller (20 mm – 35 mm in *B. dumicola*; 40 mm – 50 mm in *B. chrysanthemoides*) and clustered together in larger groups (three to ten in *B. dumicola*; one to three in *B. chrysanthemoides*).

Manning *et al.* (2010) speculated that *B. chrysanthemoides* may have its closest taxonomic relatives in Roessler's (1959) series *Rigidae*, the species of which are characterised by similar alveole, pappus and cypselas characters, as well as sharing anther and pollen features. Species in series *Rigidae*, however, are generally herbaceous or suffruticose and lack ray florets. *Berkheya chrysanthemoides*, and now *B. dumicola*, therefore represent unusually large and radiate putative members of this series. It is remarkable that these likely sister-species, both only recently discovered, occur relatively nearby on the Bokkeveld escarpment. Both species are known from only a single locality each and further collections are required to determine their full geographical ranges and morphological variation.

Conservation status

The total global population of *B. dumicola* is currently thought to be less than 100 mature plants and the species thus fits the criteria for EN D1 (International Union for Conservation of Nature [IUCN] 2001). No threats to the species are currently known.

Other material examined

SOUTH AFRICA. Northern Cape: 3119 (Calvinia): Noord Bokkeveld, top of Die Hel pass, north-west of farm Kookfontein (–AA), 16 Sept. 2006, Helme 4225 (NBG).

Discussion

Berkheya dumicola is morphologically most similar to *B. chrysanthemoides* and together they form an unusual and geographically proximate subgroup within *Berkheya* (*B. chrysanthemoides* is also from the Bokkeveld plateau, growing in the Oorlogskloof Nature Reserve approximately 50 km to the south of where *B. dumicola* occurs). Of consideration is the fact that both species are known from only very few specimens, so the documented range of within-species variation is small. However, many species do occur naturally in very geographically restricted ranges and with only a small number of individuals. Assessment of natural variation in these cases must, of necessity, be based

on a small number of specimens. Careful comparison of morphological differences between *B. chrysanthemoides* and *B. dumicola* revealed a suite of characters, derived from both reproductive and vegetative structures, differing sufficiently and consistently to warrant separating the two taxa.

Conclusion

Berkheya dumicola is a new, possibly endangered species recently discovered in the northern part of the Bokkeveld plateau in the Northern Cape Province of South Africa.

Acknowledgements

Thanks to G.A. Verboom and S. Smuts for fieldtrip assistance and R.J. McKenzie for a translation of Roessler's (1959) Latin key to *Berkheya*. We are grateful to M. Smith for production of the map and plates. We also thank S. Magoswana for assistance with microscopy and J. Manning for helpful comments on the manuscript. Northern Cape Nature Conservation provided permits.

Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

N.A.H. (Nick Helme Botanical Surveys) discovered the plant and recognised it as a new species, as well as contributing to the manuscript and writing the sections on ecology and conservation status. N.G.B. (SANBI Kirstenbosch) performed the dissections and microscope work and wrote the initial taxonomy section and draft manuscript.

References

- Funk, V. & Chan, R., 2008, 'Phylogeny of the spiny African daisies (Compositae, tribe Arctotideae, subtribe Gorteriinae) based on *trnL-F*, *ndhF*, and ITS sequence data', *Molecular Phylogenetics and Evolution* 48, 47–60. <http://dx.doi.org/10.1016/j.ympev.2008.03.035>
- Funk, V.A., Chan, R. & Keeley, S., 2004, 'Insights into the evolution of the tribe Arctoteae (Compositae: subfamily Cichorioideae s.s.) using *trnL-F*, *ndhF*, and ITS', *Taxon* 53(3), 637–655. <http://dx.doi.org/10.2307/4135440>
- Goldblatt, P. & Manning, J., 2000, 'Cape Plants: A conspectus of the Cape flora of South Africa', *Strelitzia* 9, South African National Biodiversity Institute, Pretoria.
- Hilliard, O.M., 1977, *Compositae in Natal*, University of Natal Press, Pietermaritzburg.
- Hilliard, O.M. & Burtt, B.L., 1975, 'Notes on some plants of southern Africa chiefly from Natal: IV: 161: *Berkheya pannosa* Hilliard', *Notes from the Royal Botanic Garden Edinburgh* 34(1), 77–78.
- International Union for Conservation of Nature, 2001, *International Union for the Conservation of Nature red list categories and criteria version 3.1*, IUCN Species Survival Commission, Gland, Switzerland.
- Karis, P.O., 2006, 'Morphological data indicates two major clades of the subtribe Gorteriinae (Asteraceae-Arctotideae)', *Cladistics* 22, 199–221. <http://dx.doi.org/10.1111/j.1096-0031.2006.00109.x>
- Karis, P.O., Funk, V.A., McKenzie, R.J., Barker, N.P. & Chan, R., 2009, 'Arctotideae', in V.A. Funk, A. Susanna, T.F. Stuessy & R.J. Bayer (eds.), *Systematics, evolution and biogeography of Compositae*, pp. 386–410, International Association for Plant Taxonomy, Vienna.
- Manning, J.C. & Goldblatt, P., 1997, *Nieuwoudtville: Bokkeveld plateau and Hantam South African wild flower guide*, Botanical Society of South Africa, Cape Town.
- Manning, J.C. & Goldblatt, P., 2012a, 'Plants of the Greater Cape Floristic Region 1: The core Cape flora', *Strelitzia* 29, South African National Biodiversity Institute, Pretoria.

- Manning, J.C. & Goldblatt, P., 2012b, '*Berkheya jardineana* (Arctotideae – Gorteriinae), a new dwarf perennial from Swartruggens, Western Cape', *Bothalia* 42(1), 57–59.
- Manning, J.C., Karis, P.O., Goldblatt, P. & Helme, N.A., 2010, '*Berkheya chrysanthemoides* and *Heterorhachis hystrix*, two new species of Arctotideae-Gorteriinae from the southwestern Cape', *Bothalia* 40(2), 185–190.
- Roessler, H., 1959, 'Revision der Arctotideae-Gorteriinae (Compositae)', *Mitteilungen der Botanischen Staatssammlung München* III, 71–500.
- Snijman, D.A., 2013, 'Plants of the Greater Cape Floristic Region 2: The extra Cape flora', *Strelitzia* 30, South African National Biodiversity Institute, Pretoria.
- Stearn, W.T., 1967, *Botanical Latin: History, grammar, syntax, terminology and vocabulary*, Thomas Nelson & Sons, London.
- Verboom, G.A., Linder, H.P., Forest, F., Hoffmann, V., Bergh, N.G. & Cowling, R.M., in press, 'Cenozoic assembly of the Greater Cape flora', in N. Allsopp, J. Colville & G.A. Verboom (eds.), *Fynbos: Ecology, evolution and conservation of a megadiverse region*, Oxford University Press, Oxford.