



Taxonomy of the small southern African endemic genus *Echiostachys* Levyns (Boraginaceae: Boraginoideae)



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ABSTRACT

The small genus *Echiostachys* Levyns (Boraginaceae: Lithospermeae) is revised. It was segregated from *Lobostemon* Lehm. on the basis of the herbaceous habit, radical foliage, spiciform inflorescence, slightly accrescent calyx, and lack of staminal scales. Three species are recognised. An identification key, descriptions, full nomenclature, illustrations, and distribution maps are provided.

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1. Introduction

Echiostachys Levyns (Boraginaceae) is a small genus of three species of herbaceous perennials found in the Core Cape Floristic Region (CFR) of South Africa (Manning and Goldblatt, 2012). It is closely allied to the shrubby genus *Lobostemon* Lehm. (28 spp.) (Hilger and Böhle, 2000; Cohen, 2014; Selvi et al., 2017), also largely restricted to the CFR, and both are currently included in the tribe Lithospermeae subtribe Echiinae of subfamily Boraginoideae (Hilger et al., 2020). Boraginaceae s.str., when treated as one of 11 narrowly circumscribed families comprising the order Boraginales, includes \pm 1 800 spp. in \pm 100 genera and 11 tribes segregated among the three subfamilies Boraginoideae, Cynoglossoideae and Echiochiloideae (Chacón et al., 2016; Luebert et al., 2016; Hilger et al., 2020). The family is alternatively more broadly circumscribed as the only member of Boraginales (Angiosperm Phylogeny Group APG IV, 2016; Christenhusz et al., 2017), comprising six subfamilies that are otherwise treated as separate families in other classifications.

Echiinae are well defined by their slightly irregular corolla lacking fornications (i.e., scales in the throat) and gynobasic ovary developing into four nutlets (Candolle and Candolle, 1846). The first species of

both *Echiostachys* and *Lobostemon* were described in the genus *Echium* L. (Linnaeus 1753; Burman, 1768). *Lobostemon* was established as a genus by Lehmann (1830) for the single species *L. echioides* Lehm. and was distinguished from *Echium* by the presence of staminal scales at the base of the filaments. The remaining southern African species included in *Echium* were subsequently transferred to *Lobostemon* by Buek (1837), who described several additional species in the genus. Within *Lobostemon* he recognised a small group of seven species that were distinguished from the remaining shrubby species by their herbaceous habit, spiciform inflorescence and reduced staminal scales. This group of species is congruent with the current circumscription of *Echiostachys*, although subsequent authors have differed in their generic placement of the group.

Candolle (1846) retained the shrubby species in *Lobostemon* but returned the herbaceous taxa to the genus *Echium* on the basis that they lacked the staminal scales that were taken as diagnostic for *Lobostemon*. Within *Echium*, this small group was segregated as the section *Trichobasis* DC. & A.DC. This treatment was not universally adopted, and Gürke (1893) and subsequently Wright (1904) were among the botanists who rejected it by following Buek (1837) in including the herbaceous taxa in *Lobostemon* as *L. sect. Trichobasis* (DC. & A.DC.) Gürke, separated from the remaining, shrubby species by their herbaceous habit, unbranched stems, terminal spiciform inflorescence, and reduced staminal scales.

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In contrast, Johnston (1924) transferred *Lobostemon* in its entirety to *Echium* but was later (Johnston, 1953) convinced to reinstate the genus, including within it the herbaceous species of sect. *Trichobasis* but without an infrageneric classification.

The herbaceous species comprising *L.* sect. *Trichobasis* were formally segregated at generic level as the genus *Echiostachys* by Levyns (1934), defined by the herbaceous habit, mainly radical foliage, spiciform inflorescence, slightly accrescent calyx, and lack of staminal scales. At the time, Levyns (1934) also reduced the number of species from eight to three. Her treatment has been followed since then.

A partial phylogenetic analysis of nuclear and plastid sequences of some species of *Echium* and allied genera retrieved *Lobostemon* + *Echiostachys* as sister to a monophyletic *Echium* (Selvi et al., 2017). All three genera share similar heteropolar, tricolporate pollen with a reticulate-gemmate tectum (Retief and Van Wyk, 1997). The monophyly of either *Lobostemon* or *Echiostachys* has not yet been established as just two species of *Lobostemon* plus *E. incanus* were sampled. The analysis by Selvi et al. (2017) suggests that *Echiostachys* is nested within *Lobostemon* but additional sampling is required to resolve the matter. A detailed phylogeny of *Echiostachys* and *Lobostemon* is currently in preparation (Velani et al., in prep.).

The genus *Lobostemon* was recently monographed by Buys (2011) but no modern treatment of *Echiostachys* exists. We provide this here in preparation for a more complete phylogenetic analysis of the two genera.

2. Materials and methods

2.1. Nomenclature and data

All relevant types were examined, either as specimens or online (see individual citations in the text), as well as all collections from BOL, NBG, PRE and SAM (acronyms following Thiers 2022), the primary collections for the study of species centered in the Greater Cape Floristic Region. Lectotypes were designated for those names for which a holotype had not been designated. This affected primarily names published by Buek (1837) and based on collections by Ecklon & Zeyher, which typically lack collecting numbers. Our lectotypification thus fixes the application of the names to individual specimens.

Authorities of names are abbreviated according to the International Plant Names Index (<https://www.ipni.org>).

Measurements of floral parts were made from rehydrated herbarium material. All species were also studied in the field. Specimens are cited according to the Quarter Degree Reference System (Leistner and Morris, 1976). Sight records from Greyton for both *E. ecklonianus* and *E. incanus*, representing slight range extensions from the herbarium data, were taken from the online resource iNaturalist after their identifications had been reviewed and confirmed by us (<https://www.inaturalist.org> Accessed July 2022) as follows: *E. ecklonianus*: www.inaturalist.org/observations/95176242 & 91,533,267; *E. incanus*: www.inaturalist.org/observations/11111653&52704559.

2.2. Species circumscriptions

Species were defined as morphologically diagnosable groups of populations that were distinguished from other populations by a combination of two or more character states, with a more or less contiguous geographical distribution, and a recognizable ecology. The morphological discontinuities between the species are taken to indicate breaks in gene flow. There is circumstantial evidence supporting this assumption for *E. ecklonianus* and *E. incanus* as the two taxa are sympatric around Greyton in Western Cape without any intermediates between them.

3. Taxonomy

3.1. Genus

Echiostachys Levyns in J. Linn. Soc., Bot. 49: 445 (1934). Lectotype: *Echiostachys incanus* (Thunb.) Levyns, effectively designated by Phillips, Gen. S. African Fl. Pl.: 632 (1951).

Echium sect. *Trichobasis* DC. & A.DC. in Candolle, Prodr. 10: 13 (1846). *Lobostemon* sect. *Trichobasis* (DC. & A.DC.) Gürke in Nat. Pflanzenfam. [Engler and Prantl] IV, 3A: 128 (1893). Type: *E. caudatum* Thunb. (= *Echiostachys spicatus* (Burm.f.) Levyns), effectively designated by Johnston in J. Arnold Arbor. 34: 293 (1953).

Caespitose perennial herbs, producing one or more tufts of deciduous radical leaves annually, the flowering stem arising laterally at base of new growth; rootstock a woody taproot, slender or cylindrical-tapering, covered with maroon-purplish flaking bark. Radical leaves, linear-oblongate or elliptic, obtuse, acute or attenuate, narrowed and petiole-like below, adpressed strigose-villous with a mixture of short and longer hairs, hairs simple or pustular; cauline leaves on flowering stem smaller, sub-erect, linear-oblongate or elliptic, obtuse to attenuate, decreasing in size acropetally, indumentum as for radical leaves. Flowering stem villous or rarely subglabrous below. Inflorescence a pseudo-spike of numerous 1 to 4(6)-flowered cymules, ovoid to cylindrical, elongating in fruit; pedicels short, villous; bracts linear-oblongate or elliptic, lowermost leaf-like, villous. Calyx slightly accrescent, sepals 5, ± free, equal, linear-oblongate, adpressed-pilose or -sericeous on both surfaces. Corolla funnel-shaped, white, cream-coloured, pink, purplish or blue; tube sparsely pubescent on outer surface, mainly opposite filament insertion, bearded within between filament bases; lobes 5, obtuse, central veins sparsely hairy on inner surface or glabrous. Stamens subequal or usually one stamen shorter than others, epipetalous, attached near middle of tube, exerted; filaments bearded or tufted at base; anthers dorsifixed, subglobose. Style gynobase, villous in basal third; stigma small. Ovary four-lobed. Fruit of four nutlets, nutlets ellipsoid with median ventral ridge, surface rugose-tuberculate or nearly smooth, echinulate with small glassy trichomes.

Three species; South Africa, endemic to the south-western parts of the core Cape Floristic Region, in fynbos shrubland on sandy and loamy soils.

3.2. Key to the species

1a Corolla ± 12 mm long, white; radical leaves 15–50 mm wide; plants from deep coastal sands from St Helena Bay to Yzerfontein. . .

3. *E. spicatus*

1b Corolla 5–9 mm long, cream-coloured to purple; radical leaves 6–20 mm wide; plants from clay or loam soils from Clanwilliam to Swellendam:

2a Corolla whitish; radical leaves mostly attenuate apically, base sericeous; hairs at base of filaments in a brush-like tuft; nutlets rugose-tuberculate . . . 2. *E. incanus*

2b Corolla purplish, pinkish or blue; radical leaves obtuse, base strigose-villous; hairs at base of filaments in a linear beard extending shortly up free part; nutlets ± smooth . . . 1. *E. ecklonianus*

3.3. Species descriptions

1. *Echiostachys ecklonianus* (H.Buek) Levyns in J. Linn. Soc., Bot. 49: 448 (1934). *Lobostemon ecklonianus* H.Buek in Linnaea 11: 144 (1837); C.H.Wright in Fl. Cap. 4(2): 41 (1904). *Echium ecklonianum* (H. Buek.) DC. & A.DC., Prodr. 10: 14 (1846). Type: South Africa, Western Cape, Simonstown (3418): 'Hottentotshollandskloof (Stellenbosch)' (–BB/BD), Ecklon & Zeyher 83 (SAM-51023!, lecto., designated here). Note: We designated the SAM material as lectotype as it is the only original material that we have been able to locate. Duplicates of other

Lobostemon species described by Buek (1837) are available online [<https://plants.jstor.org> accessed November 2022] but only this one of *L. ecklonianus*.

Lobostemon galpinii C.H.Wright in Fl. Cap. 4(2): 41 (1904). *Echium galpinii* (C.H.Wright) I.M.Johnst. in Contrib. Gray Herb. 73: 52 (1924). Type: South Africa, Western Cape, Caledon (3419): 'Houw Hoek Mountains' (–AA), flowers purple, 8 Nov 1897, Galpin 4349 (K-000418996, holo.-image!; PRE!, iso.).

Common name: Pink Boragebrush

Caespitose perennial herbs; rootstock slender or cylindrical. *Radical leaves* 7 to 12, sub-erect, oblanceolate, 50–150 × 5–18 mm, obtuse or acute, narrow and petiole-like below, abaxial and adaxial surfaces adpressed strigose-villous with a mix of long and short trichomes ± 1–2 mm long, trichomes simple or pustular, white; petiole-like base densely strigose to villous. *Flowering stem* arising laterally to leaf tuft, flexed outwards at base then erect, 200–400 mm long, villous with patent hairs 1–2 mm long, base strigose to villous; cauline leaves sub-erect, smaller than radical leaves, oblanceolate, obtuse or acute, abaxial and adaxial surfaces strigose-villous. *Inflorescence* a dense, cylindrical pseudo-spike of numerous 1 to 3(6)-flowered cymes, 40–80(175) × (15–)20–40(–50) mm; pedicels 1–2 mm long, strigose-pilose; bracts linear-oblanceolate, 5–10 mm long, lowermost bracts somewhat leaf-like. *Calyx* slightly accrescent to ± 9 mm long in fruit, sepals linear-oblanceolate, 3–6 mm long, obtuse, densely pilose or sericeous. *Corolla* funnel-shaped, 6–8 mm long, purplish, pinkish or blue, tube 4–6 mm long, outer surface very sparsely villous mainly opposite filament insertion, inner surface bearded between filament bases, lobes ± equal, ovate, 2 mm long, central veins sparsely hairy or glabrous. *Stamens* inserted 2–4 mm from base of corolla tube, subequal or usually one stamen shorter than others, 7–10 mm long, longest stamen exerted ± 4 mm from tube, shortest exerted ± 2 mm; filaments bearded at base for 2–4 mm with hairs running shortly onto tube below filament insertion; anthers ± 0.5 mm long. *Style* 10–13 mm long, exerted ± 4 mm from tube, sparsely villous in lower two thirds. *Nutlets* ellipsoid, inner surface with median ridge, nearly smooth [*vide Levyns (1934)*]. *Flowering time:* Aug–Nov(Dec). (Figs. 1A & 2).

Distribution and ecology: *Echiostachys ecklonianus* is restricted to the extreme southwestern parts of Western Cape, South Africa, from the lower slopes of Sir Lowry's Pass on the western foothills of the Hottentot's Holland Mountains and the western Riviersonderend Mountains at Greyton and along the Kleinrivier Mountains to near Bredasdorp [there is a single early record from Swellendam dating from the early nineteenth century (*Mund SAM 18,643*) but the species has not been recorded east of Bredasdorp since that collection] (Fig. 3); on gravelly or loamy slopes and flats at altitudes up to 285 m a.s.l., flowering best after fire.

Diagnosis and relationships: *Echiostachys ecklonianus* is distinguished by the relatively short, obtuse radical leaves 50–150 mm long (including petiole-like base) and ± one half or two thirds the length of the flowering stem and not conspicuously silky at the base, and by the small purplish, pinkish or blue flowers with the corolla 5–8 mm long. The filaments are bearded at the basal 2–4 mm, the hairs not forming a distinct brush-like tuft. The nutlets are reported to be ± smooth (Levyns, 1934).

Echiostachys incanus has similarly small flowers 5–9 mm long but the corolla is consistently whitish in color, the leaves are usually longer, 130–230(–260) mm long and often ± as long as the flowering stem, with characteristic acute or attenuate apices, and the base of the petiole-like portion is conspicuously silky. In addition, the hairs at the base of the filaments are congested in a distinct brush-like tuft, and the nutlets are markedly rugose-tuberculate. The two species are largely parapatric but both have been recorded from near Greyton (*E. ecklonianus*: www.inaturalist.org/observations/95176242 & 91,533,267; *E. incanus*: www.inaturalist.org/observations/11111653 & 52,704,559) and possibly also Elim and Swellendam, although there

are no recent collections of *E. incanus* from Elim, and none of either species from Swellendam since the early nineteenth century.

Additional specimens examined

South Africa. WESTERN CAPE. **3320 (Montagu):** Swellendam (–CD), without date, *Mund SAM 18,643* (SAM). **3418 (Simonstown):** Sir Lowry's Pass, lower slopes (–BB), 6 Sep 1931, *Levyns 3209* (BOL); Sir Lowry's Pass (–BB), Oct 1900, *Bolus s.n.* (BOL); 19 Nov 1944, *Barker 3381* (NBG); Elgin (–BD), Sep 1929, *Bolus 20,002* (BOL); Elgin Basin, Arieskraal Farm (–BD), 285 m, 13 Sep 1995, *Rode 449* (NBG). **3419 (Caledon):** Kleinmond, in slightly clayey soil (–AA), Jul 1938, *Esterhuysen 1455* (BOL); Houw Hoek (–AA), Sep 1902, *Bolus 9944* (BOL); 26 Sep 1954, *Barker 1038* (NBG), 10 Sep 1997, *Goldblatt & Manning 10,735* (NBG); Viljoen's Pass (–AA), Dec 1924, *Rogers 28,934* (SAM); near Bot river (–AA), 24 Jul 1931, *Salter 1213* (BOL); western Riviersonderend Mountains, Elands Kloof 59, Rusty Gate farm (–AB), 6 Dec 2012, *Helme 7688* (NBG); Palmiet River, Grabouw (–AC), 8 Oct 1896, *Guthrie s.n.* (NBG); Oct 1948, *Stokoe 63,194* (SAM); Hemel en Aarde Mt. (–AC), 30 Sep 1928, *Gillett M.107* (NBG); Kogelberg State Forest (–AC), 150 m, 6 Aug 1993, *Kruger 1162* (NBG); Fernkloof Nature Reserve (Northcliff) Hermanus (–AD), 21 Oct 1982, *Burman 880* (BOL); near Hermanus (–AD), Dec 1930, *Levyns 3014* (BOL); Hermanus (–AD), Oct 1903, *Bolus 9684* (BOL); Hermanus, Rotary Drive, burnt slope (–AD), 10 Oct 1974, *Goldblatt 3011* (NBG, PRE); ENE of Stanford, (–AD), 25 Sep 1949, *Acocks 15,502* (PRE); N side of Akkedisbergpas, Bosch River 609, west of Klein River (–BC), 186 m, 2 Nov 2008, *Helme 5718* (NBG); Elands Kloof (–BD), 10 Oct 1951, *Levyns 9773* (BOL); 5.5mi [9 km] NE of Die Dam, (–CA), 23 Sep 1962, *Acocks 22,765* (PRE); near Uitkraal (–CB), 2 Oct 1935, *Muir 4996* (NBG); Fairfield Hills (–DA), 29 Aug 1928, *Lewis 5301* (NBG); Bredasdorp (–DA), 4 Sep 1943, *Van Thikeck 326* (NBG); Viljoenshof on road to Ratel River (–DA), 4 Sep 1964, *Van Breda 1736* (NBG, PRE); between Bredasdorp and Elim (–DA), Sep 1933, *Levyns 4522* (BOL); 8 Oct 1950, *Heginbotham 166* (NBG); near Elim and Gansbaai (–DA), Oct 1947, *Stokoe 63,195* (SAM); Baardskeerdersbos (–DA), 4 Sep 1943, *Hockole 8584* (BOL); 4 Sep 1943, *van Niekerk 326* (NBG); between Elim and Hagedasberg [Akkedisberg] Pass (–DB), 6 Aug 1947, *Levyns 8433* (BOL); near Elim (–DB), Oct 1894, *Bolus 9999* (BOL).

Imprecise locality: Hottentots Holland, Oct 1817, *Mundt 51,024* (SAM).

2. *Echiostachys incanus* (Thunb.) Levyns in J. Linn. Soc., Bot. 49: 446 (1934). *Echium incanum* Thunb., Prod. Pl. Cap. 1: 33 (1794); **Thunberg, Fl. Cap.: 164 (1823).** Type: South Africa, Western Cape, 'Cape of Good Hope' [Swartlandiae arenosis], *Thunberg s.n.* (UPS-THUNB4102, lecto., designated by Nordenstam and Buys in Taxon 60: 1191 (2011); LD1258404-image!, MEL2433464-image!, SBT12951, isolecto.).

Lobostemon splendens H.Buek in Linnaea 11: 146 (1837); C.H. Wright in Fl. Cap. 4(2): 40 (1904). *Echium splendens* (H.Buek.) DC. & A.D.C., Prodr. 10: 15 (1846). Type: South Africa, Western Cape, Clanwilliam (3218): 'prope Brakfontein' (Clanwilliam) (–BB), Aug.–Sept., *Ecklon & Zeyher* (MEL238964-lecto.-image!, designated here; G190392-image!, HAL115139-image!, HBG503003 & 503004-images!, SAM18645!, isolecto.). **Note:** The MEL duplicate is selected as lectotype as it is a fine collection and bears the inscription '*Lobostemon splendens nov. sp.*' in Lehmann's handwriting. Duplicates from his herbarium are known to have been used by Buek (Buys and Nordenstam, 2009).

Lobostemon viridi-argenteus H.Buek in Linnaea 11: 144 (1837); C.H. Wright in Fl. Cap. 4(2): 41 (1904). *Echium viridi-argenteum* (H.Buek.) DC. & A.D.C., Prodr. 10: 13 (1846). Type: South Africa, Western Cape, Clanwilliam (3218): 'ad radices Piquet-berge [Piketberg]' (–DC), Oct., *Ecklon & Zeyher* (G190390, lecto.-image!, designated here). **Note:** We designated the G material as lectotype as it is the only original material that we have been able to locate. Duplicates of other *Lobostemon* species described by Buek (1837) are available online [<https://plants.jstor.org> accessed Nov 2022] but only this one of *L. viridi-argenteus*.

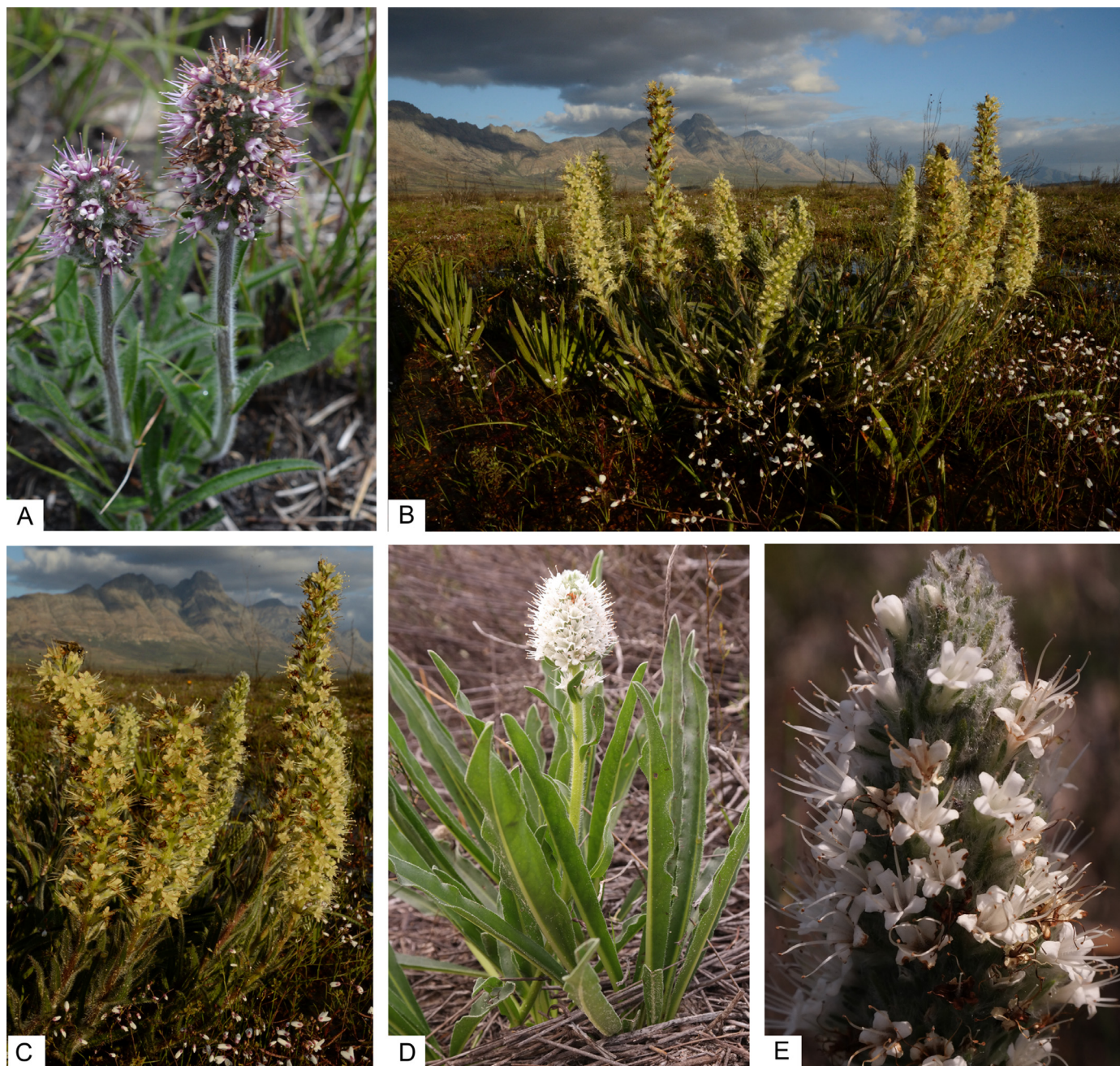


Fig. 1. *Echiostachys* species. A. *E. ecklonianus*. Western Cape, Bredasdorp, Sandberg Fynbos Reserve. B, C. *E. incanum*. Western Cape, Wellington, Elandsberg Nature Reserve. D, E. *E. spicatus*. Western Cape, Langebaan, Elandsfontein. Photographs: A, Rupert Kopman; B, C, John Manning; D, E, Nick Helme.

[*Echium spicatum* sensu L.f., Suppl. Pl.: 132 (1782), Thunb., Fl. Cap.: 165 (1823) et Candolle, Prodr. 10: 14 (1846), non Burm.f. (1768)]

[*Lobostemon spicatus* sensu C.H.Wright in Fl. Cap. 4(2): 41 (1904), non (Burm.f.) H.Buek (1837)].

Note: [Linnaeus \(1782\)](#) applied the name *Echium spicatum* to a collection consistent with *E. incanum* in the Linnean Herbarium (LINN191.6). [Levyns \(1934\)](#) interpreted this as independent publication of the later homonym *E. spicatum* L.f., (non Burm.f.) and therefore treated *E. spicatum* 'L.f.' as a synonym of *E. incanum*. This interpretation is not justified as there is no reason to doubt that [Linnaeus \(1782\)](#) was merely misapplying Burmann's name, as was explained by [Nordenstam and Buys \(2011\)](#). [Wright \(1904\)](#) followed [Linnaeus \(1782\)](#) in misapplying the name *E. spicatum* to *E. incanum*. The correct application of the name *E. spicatum* was established by [Levyns \(1934\)](#).

Common name: Common Boragebrush

Caespitose perennial herbs; rootstock cylindrical-tapering. *Radical leaves*, ± 7 to 12, sub-erect, linear-oblongate, 130–230 (–260) \times 6–20 mm, acute or attenuate, narrowed and petiole-like below, abaxial and adaxial surfaces adpressed strigose-villous with a mix of long and short hairs ± 1 –2 mm long, trichomes simple or pustular, white; petiole-like base densely sericeous with simple hairs. *Flowering stems* arising laterally to leaf tuft, flexed outwards at base then erect, 200–400 mm long, villous with patent hairs 1–2 mm long, densely sericeous at base; cauline leaves sub-erect, smaller than radical leaves, linear-oblongate, acute-attenuate, strigose-villous. *Inflorescence* a dense cylindrical pseudo-spike of numerous 1 to 3(4)-flowered cymules, 25–150 \times (15–)20–30 mm; pedicels 2–3 mm long, strigose-pilose; bracts linear-oblongate, 2–10 mm long,

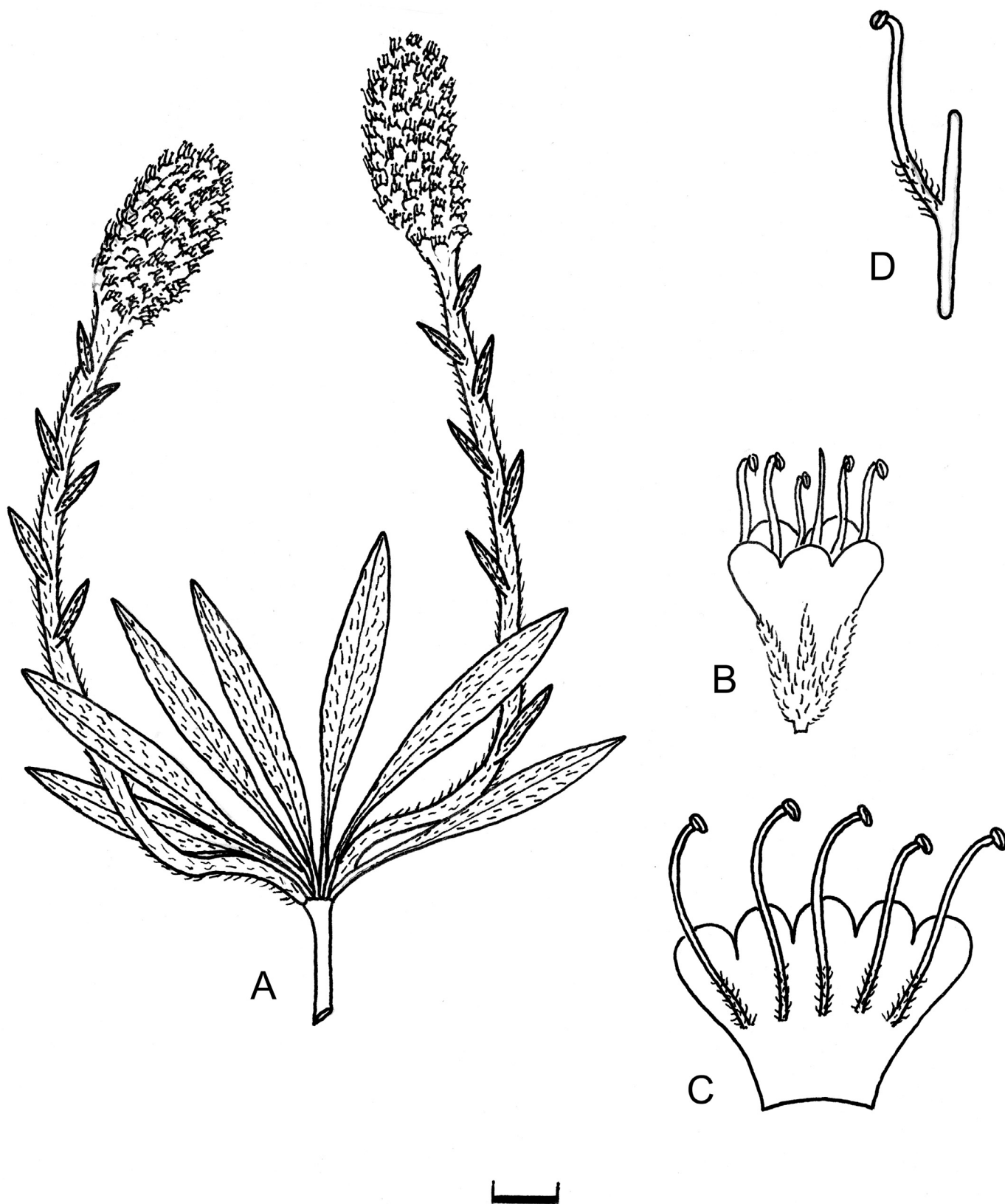


Fig. 2. *Echiostachys ecklonianus*. Western Cape, Elgin Basin, Arieskraal Farm, Rode 0449 (NBG). A, whole plant; B, detached flower; C, corolla opened out; D, single stamen showing bearded filament base. Scale bar: A = 20 mm; B–D = 2.5 mm. Artist: N. Velani.

lowermost bracts somewhat leaf-like. *Calyx* slightly accrescent to 9 mm long in fruit, sepals linear-oblongate, 3–5 mm long, obtuse, densely sericeous. *Corolla* funnel-shaped, 6–9 mm long, cream-

coloured or white; tube 4–7 mm long, outer surface very sparsely vil-
 lous mainly opposite filament insertion, inner surface bearded
 between filament bases, lobes ovate, ± 2 mm long, central veins

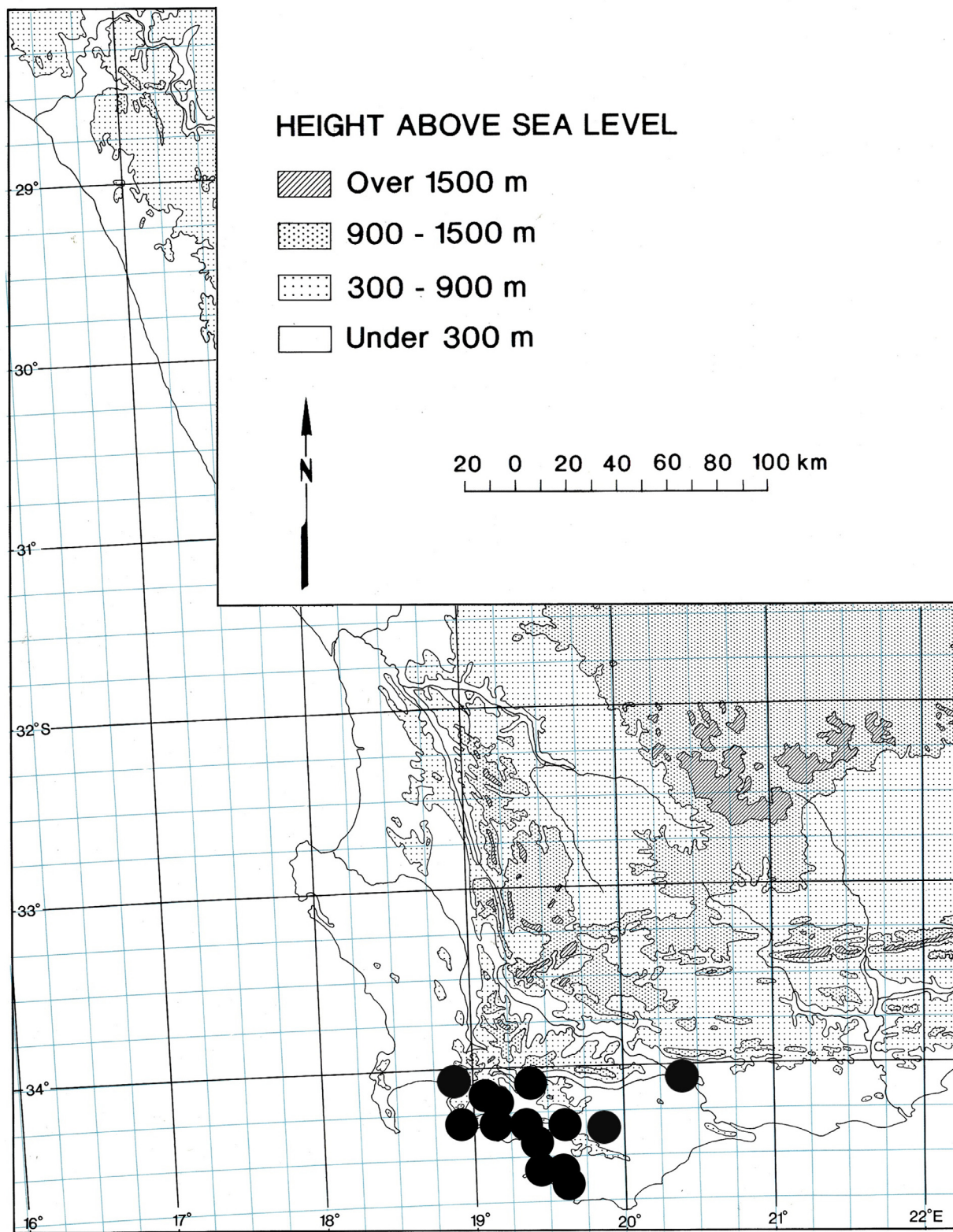


Fig. 3. Distribution of *Echiostachys ecklonianus*.

sparsely hairy. *Stamens* inserted 2–4 mm from base of corolla tube, subequal or one longer than the rest, ± 10 mm long, longest stamen exerted ± 4 mm beyond tube, shorter exerted ± 2 mm; filaments bearded at the base in a brush like tuft ± 2 mm long; anthers ± 0.5 mm long. *Style* 10–13 mm long, exerted ± 4 mm beyond the tube, sparsely villous in lower two thirds. *Nutlets* ellipsoid-apiculate,

inner surface with median ridge, 3–4 \times 1.5–2.5 mm, rugose-tuberculate but less so towards base, echinulate, tubercles tipped with 1 or 2 longer stiff glassy hairs, pale gray. *Flowering time*: Aug–Oct (Figs. 1B, C and 4).

Distribution and ecology: *Echiostachys incanus* is restricted to the south-western parts of Western Cape, South Africa, ranging



Fig. 4. *Echiostachys incanus*. Western Cape, Elim, *Anon s.n. SAM 18647* (SAM). A, whole plant; B, detached flower; C, corolla opened out; D, single stamen showing bearded filament base. Scale bar: A = 20 mm; B–D = 2.5 mm. Artist: N. Velani.

from the lower Olifants River Valley north of Citrusdal along the western foothills of the coastal mountains from Piketberg southwards to the flats at the base of the Hottentots-Holland Mountains at Gordon's Bay, extending slightly inland along the Upper Breede River Valley to near Worcester and eastwards to Greyton at the

western end of the Riviersonderend Mountains [there are historical records from further east in the form of a single collection each from Elim (*Anon s.n. SAM 18,647*) and Swellendam (*Mund SAM 18,646*) respectively but both date from the nineteenth century and the species has not been collected there since] (Fig. 5); on

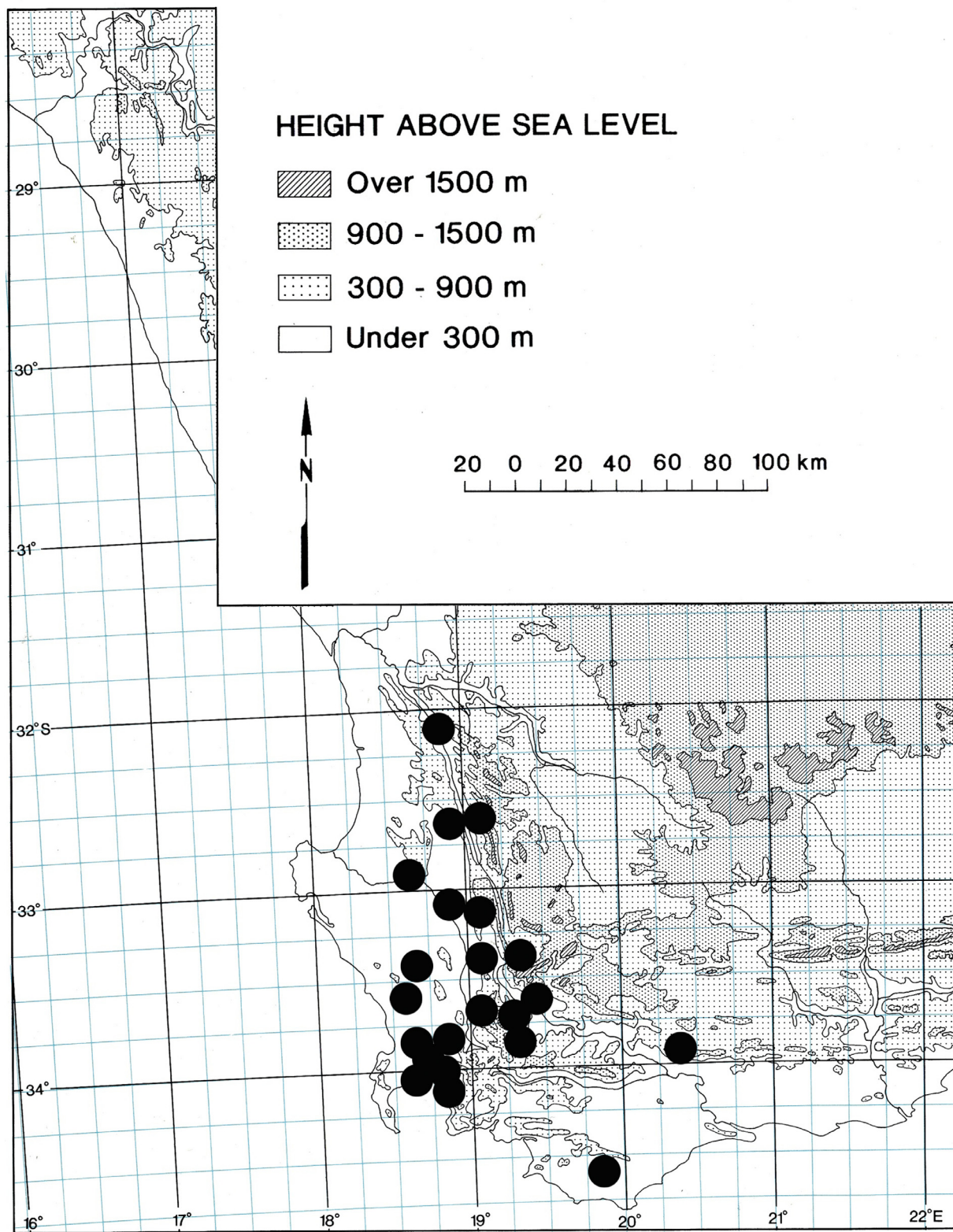


Fig. 5. Distribution of *Echiostachys incanus*.

seasonally wet, gravelly or loamy flats from near sea level to 800 m a.s.l.

Diagnosis and relationships: *Echiostachys incanus* is the most widespread and commonly collected species in the genus and is usually readily identified by its whitish flowers with corolla 6–9 mm long and the ± markedly acute or attenuate radical leaves, the bases of

which are conspicuously covered in dense silky hairs. These silky hairs at the base of the radical leaves are also characteristic of *E. spicatus* from the coastal forelands but that species has significantly larger flowers, ± 12 mm long. Florally, *E. incanus* is unique in the genus in having the filament hairs tightly bunched into a brush-like tuft at the base of the filaments, rather than a more extended beard as in *E.*

ecklonianus and *E. spicatus*. This difference in filament hairs, combined with differences in corolla color and radical leaf apex serve to separate *E. incanus* from *E. ecklonianus*, which has similarly small flowers, 6–8 mm long but pink or mauve to blue, and mostly obtuse radical leaves that lack the dense silky vestiture at the base.

The markedly reticulate-tuberculate seeds of *E. incanus* may also be distinctive, as seeds in the other two species are evidently obscurely striate or almost smooth but further observations are needed to confirm this.

Additional specimens examined

South Africa. WESTERN CAPE: **3218 (Clanwilliam)**: Clanwilliam (–BB), without date, *Zeyher s.n.* (SAM); Olifant's River Valley, 10 miles [16 km] north of Citrusdal (–DB), Sep 1945, *Levyns 57,915* (SAM); 5 miles [8 km] north of Citrusdal (–DC), 1 Sep 1945, *Compton 17,125* (NGB); Piketberg, Witwater Moravian Mission, slope above the Mission (–DC), 11 Oct 2009, *Koopman 4078* (NGB); Piketberg (–DC), Oct 1895, *Bolus 13,613* (BOL). **3318 (Cape Town)**: Porterville (–BB), September 1960, *Loubser 1071* (NGB); 19 Oct 1964, *Kellerman 18* (NGB); Riverlands Nature Reserve (–DA), 26 Aug 1992, *Kurzweil 1689* (NGB); Riverlands Nature Reserve, central area near track (–BC), 13 Sep 2009, *Helme 6284* (NGB); Botterberg (–DA), 19 Sep 1943, *Wasserfall 418* (NGB); Dassenberg, Kalbaskraal, (–DA), Apr 1965, *Gouws 208* (NGB); between Durbanville and Wellington (–DC), Oct 1929, *Levyns 2525* (BOL); Durbanville (–DC), 30 Sep 1966, *Compton 16,036* (NGB); Durbanville, D'Urbanvale Estate, Uitkamp wetlands (–DC), 12 Dec 2008, *Cowell, Stoll & Pekeur 3886* (NGB); 12 Sep 2013, *Helme 8057* (NGB); Kraaifontein (–DC), 1 Sep 1938, *Acocks & Hafström 1297* (PRE); Eersterivier, Penhill Estate, Greg Avenue, shale band (–DD), 26 Sep 1979, *Raitt 424* (NGB); Stellenbosch, Van der Stel (–DD), Sep 1926, *Smith 3226* (PRE); Stellenbosch Flats (–DD), Sep 1927, *Markotter 8565* (NGB); Uitkyk (–DD), Nov 1883, *MacOwan 4116* (SAM); 1928, *Gillett 1823* (NGB); Stellenbosch (–DD), *Ecklon 50,973* (SAM); *Duthie 676* (SAM); Elsenberg (–DD), 18 Sep 1926, *Grant 2153* (PRE). **3319 (Worcester)**: ± 6 km N of Gouda, Bonne Esperance 83, west of Roodezandberg (–AA), 30 Sep 2010, *Helme 6793* (NGB); near Hermon on farm Bartholomeusklip, flats near stream before homestead (–AC), 13 Sep 2001, *Trinder-Smith 278* (BOL); Hex River Valley, Oct 1895 (–BC), *Marloth 6193* (PRE); Wellington (–CA), 13 Sep 1941, *Compton 11,629* (NGB); between Worcester and Villiersdorp (–CB), 1 Oct 1951, *Compton 22,919* (NGB); Botha's Halt [Botha], (–CB), 5 Aug 1959, *Van Breda 617* (PRE); hills southeast of the Greater Brandvlei Dam (south of Worcester) (–CB), Sep 2014, *Le Roux 1182* (NGB); 15 km NW of Worcester, Bobbejaansrivier Valley east of Rondekop (–CB), 16 Nov 2016, *Helme 8867* (NGB); Paarl east, SE of Newton, north of old sewage ponds, Kykuit, erf 961 (–DB), 4 Nov 2008, *Helme 5768* (NGB); clay flats near Paarl, north of town (–DB), 24 Sep 1974 *Goldblatt 2743* (NGB, PRE); Paarl, railway, (–DB), without date, *Drège 50,974* (SAM); Hercules Pillar (–DD), 16 Sep 1942, *Compton 13,654* (NGB). **3320 (Montagu)**: Swellendam (–CD), without date, *Mund SAM 18,646* (SAM). **3418 (Simonstown)**: Cape Flats, Wynberg (–AB), 17 Sep 1935, *Letty 276* (PRE); Faure (–BA), 13 Sep 1942, *Barker 1665* (NGB); 16 Sep 1946, *Compton 15,987* (NGB); Faure, Vergenoegd Farm Extension -Portion 653–15 (–BA), 20 Oct 2007, *Boucher 7450* (NGB); Kuilsriver, Faure, Vergenoegd 653, 0.7 km N of N2, 0.4 km E of R310 (–BA), 6 Oct 2005, *Helme 3659* (NGB); Somerset West (–BB), 4 Sep 1942, *Parker 3716* (BOL); 1 Sep 1953, *Parker 4906* (NGB); Firgrove (–BB), 3 Sep 1942, *Compton 13,456* (NGB); farm near Somerset West (–BC), Oct 1928, *Levyns 2545* (BOL); Somerset West (–BB), clay sandy places in flats, 2 Oct 1921, *Nel 1267* (NGB); SW of Somerset West, (–BB), 9 Sep 1974, *Mauve 4950* (PRE); Gordon's Bay, flats in Gustrouw area, vacant erf at top of Lemoenboom (–BB), 10 Sep 2003, *Helme 2822* (NGB); Gordon's Bay Flats, open plot next to Seascape Rd (–BB), 3 Aug 1993, *Buys 430* (NGB); between Gordon's Bay and Sir Lowry's Pass (–BB), 6 Sep 1931, *Levyns 3210* (BOL); Gordon's Bay Flats (–BB), Sep 1921, *Bolus 9945* (BOL); Strand, at R44 road, between Octopus Road and Janbruin Road (–BB), 26 Sep 2004, *Mucina 260,904/19*

(NGB); Strand, erf 14,335, Weltevreden area, just west of High School (–BB), 27 Aug 2009, *Helme 6420* (NGB); Strand, Harmony Reserve (–BB), 31 Aug 2000, *Runnalls 1032* (NGB). **3419 (Caledon)**: Papenvlei [Elim] (–DB), Sep 1896, *Anon s.n.* SAM 18,647 (SAM).

Imprecise locality: Cape, *Pappé 18,645* (SAM).

3. *Echiostachys spicatus* (Burm.f.) *Levyns in J. Linn. Soc., Bot. 49: 447 (1934)*; *Echium spicatum* Burm.f., Fl. Ind. Prod. Cap. Pl.: 4 (1768). *Lobostemon spicatus* (Burm.f.) H.Buek. in Linnaea 11: 145 (1837). *L. spicatus* (Burm.f.) I.M.Johnst. in J. Arnold Arbor. 34: 293 (1953), nom. superfl. Type: South Africa, Western Cape, 'Cape of Good Hope', *Anon., s.n.* (G-DEL-803494, lecto.-image!, designated by Nordenstam and Buys in Taxon 60: 1190 (2011); G-DEL-80395-image!, isolecto.).

Echium caudatum Thunb., *Prod. Pl. Cap.: 33 (1794)*; *Thunberg, Fl. Cap.: 165 (1823)*; *Candolle, Prod. 10: 13 (1846)*. *Lobostemon caudatus* (Thunb.) H.Buek in Linnaea 11: 147 (1837); C.H.Wright in Fl. Cap. 4 (2): 40 (1904). Type: South Africa, Western Cape: Cap Bonae Spe', *Thunberg s.n.* (UPS-THUNB4095, lecto., designated by Nordenstam & Buys in Taxon 60(4): 1991 (2011); MEL6887-image!, isolecto.).

Lobostemon eriostachyus H.Buek in Linnaea 11: 148 (1837); C.H. Wright in Fl. Cap. 4(2): 40. *Echium eriostachyum* (H.Buek) DC. & A.DC., *Prod. 10: 14 (1846)*. Type: Western Cape, Cape Town (3318): 'Blauwberg' [Blouberg] (–CB), Oct–Nov without year, *Ecklon & Zeyher s.n.* (MEL238909, lecto.-image!, designated here.) [Other original material: South Africa, Western Cape, Vredenburg (3217): 'Saldanabay' [Saldanha Bay] (–DD), *Ecklon & Zeyher s.n.*] *Note*: We designated the MEL collection as lectotype as it is the only original material that we have been able to locate. Duplicates of other *Lobostemon* species described by *Buek (1837)* are available online [<https://plants.jstor.org> accessed Nov 2022] but only this one of *L. eriostachyus*.

Lobostemon latifolius H.Buek in Linnaea 11: 147 (1837); C.H. Wright in Fl. Cap. 4(2): 39 (1904). *Echium latifolium* (H.Buek) DC. & A. DC., *Prodr. 10: 14 (1846)*. Type: South Africa, Western Cape, Vredenburg (3217): 'Saldanha Bay' (–DD), Aug.–Sept., *Ecklon & Zeyher s.n.* (not located).

Echium alopecuroideum DC. & A.DC., *Prodr. 10: 15 (1846)*. *Lobostemon alopecuroideus* (DC. & A.DC.) C.H.Wright in Fl. Cap. 4(2): 39 (1904). Type: South Africa, Western Cape, Cape Town (3318): 'Zwischen Groenekloof und Saldanhabaai, unter 500 Fuss, September, October', *Drège 7854* (G-DC [G00137543], holo.; G350028-image!, K418997-image!, K418998!-image, P571978, P599438, W, iso.).

Common name: Sandveld Boragebrush, White Boragebrush

Caespitose perennial herbs; rootstalk cylindrical tapering. *Radical leaves*, several (to 12), sub-erect, oblanceolate or elliptic, 140–450 × 15–50 mm, obtuse or subacute, narrowed and petiole-like below, abaxial and adaxial surfaces usually appressed strigose-villous with a mix of long and short trichomes ± 1–2 mm long, trichomes simple or pustular, white, petiole-like base sericeous, occasionally leaves subglabrous but always ciliate. *Flowering stem* arising laterally to leaf tuft, flexed outwards at base then erect, 200–400 mm long, usually villous with patent hairs 1–2 mm long, and densely sericeous at base, occasionally glabrous or glabrate; cauline leaves sub-erect, smaller than radical leaves, obtuse or subacute, usually strigose-villous or occasionally glabrous or glabrate. *Inflorescence* a dense, ovoid or cylindrical pseudo-spike of numerous 1 to 3 (4)-flowered cymules, 45–175 × 20–50 mm; pedicels 1–2 mm long, strigose-pilose; bracts oblanceolate or elliptic, 5–10 mm long, lowermost bracts somewhat leaf-like. *Calyx* slightly accrescent to 12 mm in fruit, sepals linear-oblanceolate, 5–10 mm long, obtuse, densely sericeous. *Corolla* funnel-shaped, ± 12 mm long, white (rarely flushed pale pink); tube ± 10 mm long, outer surface very sparsely villous mainly opposite filament insertion, inner surface bearded between filament bases, lobes ovate, ± 2 mm long; central veins glabrous. *Stamens* inserted ± 5 mm from base of corolla tube, subequal or usually one shorter than the rest, ± 10 mm long, longest stamen exerted ± 4 mm beyond the tube, shortest exerted ± 2 mm; filaments bearded at base for 4–6 mm with hairs running shortly onto tube below

filament insertion; anthers ± 0.5 mm long. Style 13–17 mm long, exerted ± 4 mm beyond the tube, sparsely villous in lower two thirds. Nutlets ellipsoid-attenuate, inner surface with median ridge, $\pm 3.5 \times 1.5$ mm, obscurely striate-reticulate, echinulate with longer glassy trichomes along the striae, pale gray. Flowering time: Sep–Oct (Figs. 1D, E and 6).

Distribution and ecology: *Echiostachys spicatus* is a narrow endemic of the West Coast of Western Cape, South Africa, from St Helena Bay and Hopefield to near Koeberg (Fig. 7); restricted to deep coastal sands in Sand Plain Fynbos, from near sea level to 100 m a.s.l.

Diagnosis and relationships: *Echiostachys spicatus* is a relatively large species up to 400 mm high, with radical leaves 140–450 mm

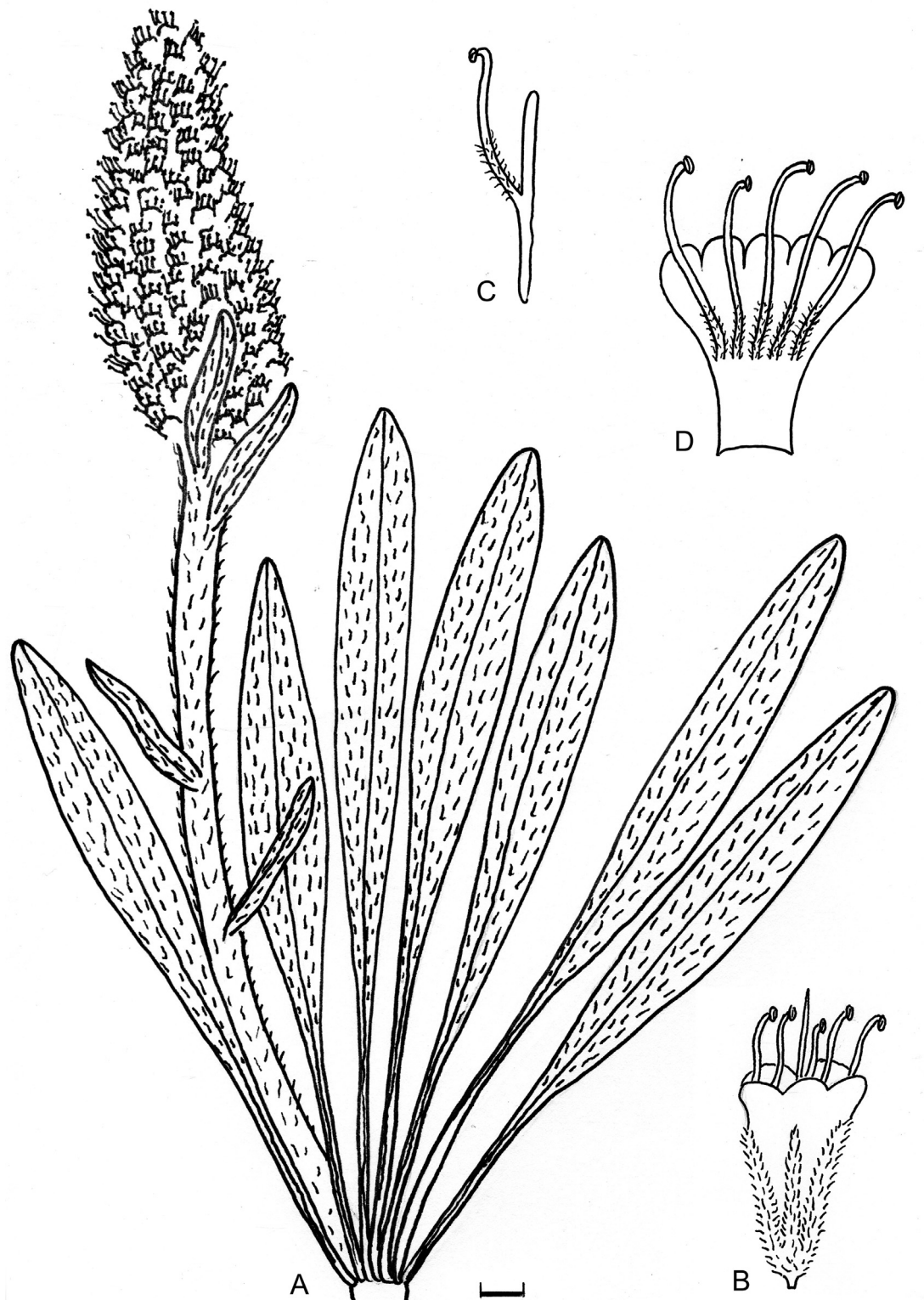


Fig. 6. *Echiostachys spicatus*. Western Cape, Koperfontein, Hiddlemost 1846 (NBG). A, whole plant; B, detached flower; C, corolla opened out; D, single stamen showing bearded filament base. Scale bar: A = 20 mm; B–D = 2.5 mm. Artist: N. Velani.

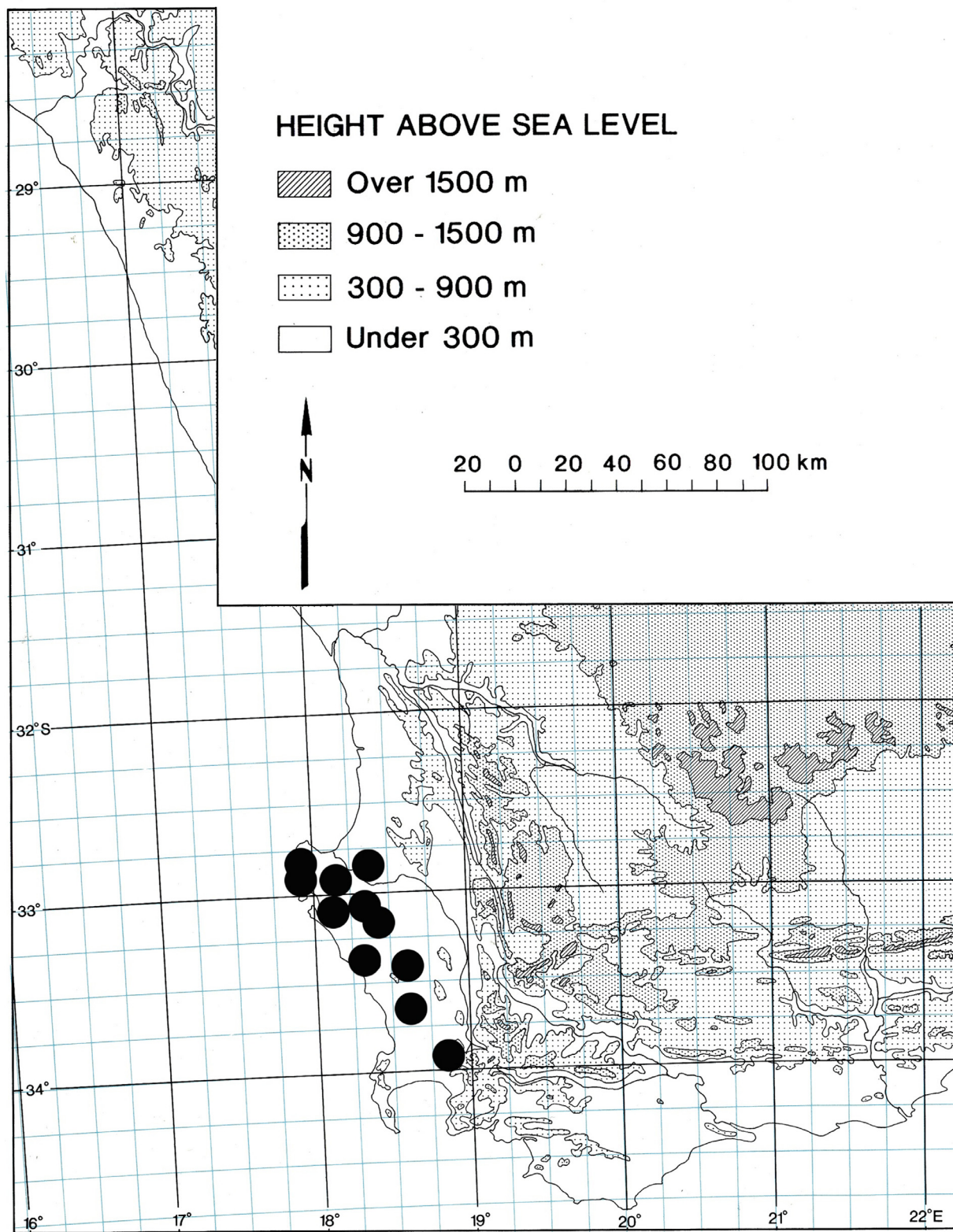


Fig. 7. Distribution of *Echiostachys spicatus*.

long, and characteristic large, pure white (rarely flushed pink) flowers with corolla 12 mm long. Most populations have addressed-strigose foliage and villous flowering stems, but the northern populations from the Vredenburg Peninsula are distinctive in their subglabrous foliage, the upper surface ± glabrous and the lower surface sparsely strigose only towards the margins in the distal part of

the blade and along the midrib, and the lower part of the flowering stem also glabrous. The habitat of the species in deep sandy soils in Sand Plain Fynbos is also characteristic.

The large flowers immediately distinguish *E. spicatus* from the other two species in the genus, which have the corolla 5–9 mm long. In addition, the calyx is densely covered with long sericeous

As discussed under *E. incanus*, Linnaeus (1782) incorrectly misapplied the name to material of *E. incanus*, leading to confusion in its application among subsequent authors.

Specimens examined

SOUTH AFRICA. Western Cape. **3217 (Vredenburg)**: Brittaniana Bay, (–DC), 15 Sep 1974, Taylor 5190 (PRE); St Helena Bay, (–DC), Oct 1918, Marloth 8008 (PRE); Jacobsbaai turnoff from Vredenburg–Saldanha road (–DD), 15 Oct 2007, Manning 3113 (NBG); Saldanha Bay (–DD), 13 Sep 1931, Levyns 3213 (BOL); Saldanha, Farm 957, between aerodrome and Saldanha Steel (–DD), 100 m, 15 Oct 2011, Helme 7096 (NBG). **3218 (Clanwilliam)**: Klipfontein (–CC), Ecklon & Zeyher 1240 (BOL, SAM); Salt Pans near Zoutkloof [Soutkloof] (–CD), 11 Sep 1943, Steyn 568 (NBG). **3318 (Cape Town)**: Maarmanskop, flats east of fourstead [?homestead] (–AA), 300' [91 m], 5 Oct 1977, Thompson 3538 (NBG, PRE); Langefontein 37, just north of old radio base (–AA), 18 Nov 2011, Helme 7387 (NBG); between Hopefield and Langebaan Road (–AB), sandveld, 18 Sep 1974, Goldblatt 2699 (NBG, PRE); Klein Berg River (–AB), Oct 1902, Bolus 6300 (BOL); Hopefield (–AB), Sep 1905, Bolus 12,474 (BOL); Sep 1925, Nel 14,936 (NBG); 1930, Ryswyk 11,641 (NBG); 3 Sep 1944, Compton 15,973 (NBG); fields near Hopefield (–AB), Aug 1934, Letty 262 (PRE); 1.6mi [2.6 km] ESE of Hopefield, (–AB), 13 Oct 1959, Acocks 20,670 (PRE); between Hopefield and Koperfontein (–AB), 1 Sep 1944, Lewis 3239 (BOL); Koperfontein (–AB), Oct 1930, Ryswyk s. n. (NBG); 21 Sep 1940, Compton 9467 (NBG); 14 Sep 1953, Hiddlemost 1846 (NBG); 13 Sep 1974, Mauve & Oliver 124 (PRE); Koeberg road, 14 miles [22 km] from Cape Town (–DA), Nov 1924, Bolus 18,318 (BOL).

Imprecise locality: Darling, 27 Sep 1890, Guthrie 2051 (NBG)

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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