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# Taxonomic revision of the southern African species of the genus *Cynoglossum* L. (Boraginaceae)

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## Taxonomic revision of the southern African species of the genus *Cynoglossum* L. (Boraginaceae)

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### Abstract

The aim of the study is to provide a revision of the genus *Cynoglossum* in southern Africa. The genus is taxonomically problematic within the family Boraginaceae, due to the morphological similarities it shares with other closely related genera in the family. *Cynoglossum* plants are low-growing biennial, perennial, or rarely annual herbs which are recognizable by their hairy stems and leaves, the latter are usually basal and long petiolate. Based on the latest checklist, a total of eight species of this genus are listed for the study region: *C. alticola*, *C. amabile*, *C. austroafricanum*, *C. coeruleum* var. *mannii*, *C. hispidum*, *C. lanceolatum*, *C. obtusicalyx* (endemic to South Africa), and *C. spelaicum*. The occurrence of *C. amabile* in the region, however, requires further investigation since the only existing specimen was collected within a protected area in the KwaZulu-Natal Province. Two specimens collected in the Doornpoort area in Pretoria, Gauteng Province, assigned to this species appear to have been misidentified. Diagnostic characters are described, correct nomenclature, synonyms, typification, distribution maps, as well as the key for identifying the studied species are provided.

Keywords: Boraginaceae, *Cynoglossum*, Taxonomic revision, Southern Africa,

### Introduction

The genus *Cynoglossum* L. of the tribe Cynoglosseae (family Boraginaceae), commonly known as hound's tongue, is widely distributed, and represented by an approximation of 75 known species (Joshi 2016). The name *Cynoglossum* is derived from the Greek words 'cynos' (of a dog) and 'glossa' (tongue), depicting the texture and shape of the leaves in species of the genus (Retief 2005). This genus was established by Linnaeus (1753) to accommodate six species that he described at the time, namely, *Cynoglossum officinale* L., *C. virginianum* L., *C. cherifolium* L., *C. apenninum* L., *C. linifolium* L., and *C. omphaloides* L. Species of this genus are primarily distributed in warmer and temperate regions of Europe, Asia (especially in the Mediterranean regions) and in the upland parts of tropical Africa and Madagascar, with a few species introduced in North America and Australia (Selvi et al. 2011).

The genus is complex and has been noted by several botanists such as Miller (2005), Sutorý (2010), Selvi and Sutorý (2012), to be taxonomically challenging within the family Boraginaceae due to the narrow morphological variation between the species,

which has rendered identification difficult. An article by von Staden et al. (2013), mentioned that taxonomically problematic genera are most likely to result in poor collection and misidentification. The latter case has become a reality for the southern African species of *Cynoglossum*, whereby members of this genus are also confused with species from other closely related genera such as *Lithospermum* L. and *Myosotis* L., and members of the tribe Eritrichieae Gürke. *Lithospermum* and *Myosotis* members are characterized by ovoid nutlets with broad basal attachment scars and flat gynobases, while in *Cynoglossum* the nutlets are depressed-ovoid or subcircular with scars restricted to the apical half of the ventral surface and have narrowly conical gynobases (Weigent et al. 2013; Otero et al. 2014). Eritrichieae are differentiated from *Cynoglossum* based on the shape of the gynobase, i.e., narrow pyramidal to subulate gynobase and mostly small nutlets, as opposed to broadly pyramidal gynobase and mostly larger nutlets for *Cynoglossum* (Hasenstab-Lehman and Simpson 2012; Weigent et al. 2013). According to Ihsan and Shehbaz (1991), *Cynoglossum* can also be distinguished from the closely related genera *Solenanthus* Ledeb. and *Trachelanthus* Klotzsch, in having included stamens instead of exerted ones and lastly, from *Pardoglossum* Barbier and Mathez in having slim, glabrous glochids on the nutlets, instead of swollen glochids that are densely packed with minute papillae. The fruits in members of this genus and the floral morphological characters, are normally considered to be of diagnostic importance. The nutlets of tropical *Cynoglossum* are generally smaller than those of species found in the temperate regions (Ihsan and Shehbaz 1991).

In the southern African region, this genus has not yet been taxonomically revised since the last treatment by Wright (1904), where he recognised two species, *C. enerve* Turcz (now *C. hispidum* Thunb.) and *C. micranthum* Desf. He cited two species, namely, *C. leptostachyum* DC. and *C. hispidum* Thunb. as being imperfectly known. Hilliard and Burt (1986) recorded the occurrence of *C. coeruleum* var. *manii* (Baker & C.H. Wright) Verdc. [recognised in southern Africa as *C. geometricum* Baker & C.H. Wright] for the first time in this region, while Retief and Van Wyk (1996) recorded *C. obtusicalyx* Retief & A.E. Van Wyk, the only species endemic to South Africa. While a comprehensive revision is still lacking for southern African species, revisionary work has been undertaken mainly at regional or country level, for example East Africa (Verdcourt, 1991), China (Shu, 1995), Comoro Islands and Madagascar (Miller 2005), Italy (Selvi and Sutory 2012), Nepal (König et al. 2015), and Taiwan (Hsiao and Liu 1998). According to the recent checklist, there are eight species of *Cynoglossum* occurring in southern Africa, namely *C. alticola* Hilliard & B.L. Burt, *C. amabile* Stapf. & J.R. Drumm, *C. austroafricanum* Hilliard & B.L. Burt, *C. geometricum* Baker & C.H. Wright, *C. hispidum* Thunb., *C. lanceolatum* Forssk., *C. obtusicalyx* Retief & A.E. Van Wyk (endemic to South Africa), and *C. spelaum* Hilliard & B.L. Burt (Germishuizen and Meyer 2003). This paper aims to provide a taxonomic revision of the southern African species, to provide a diagnostic key, as well as to lay out their distribution maps in the region.

## Materials and methods

A total of 316 specimens loaned from the National Herbarium Pretoria (PRE) and other South African regional and local herbaria, including Schonland Herbarium (GRA), Natal Herbarium (NH), Bews Herbarium (NU), Compton Herbarium (NBG) and South African Museum (SAM), were examined for distribution and morphological data. The type specimens of relevant species were studied online from the JSTOR website

(<https://plants.jstor.org/>). Voucher specimens and plant material were collected during several field trips conducted throughout South Africa and Lesotho between October 2018 and December 2019. Specimens collected were deposited in JRAU (herbarium acronyms following Thiers (2019)). Vegetative and reproductive morphological characters were observed on three specimens of each taxon where possible, using a naked eye and scanning electron microscope (SEM). Trichomes from leaf samples and mature nutlets were examined using either a TESCAN VEGA3 SEM or the Phenom Desktop SEM. For TESCAN VEGA3 SEM analysis, samples were mounted on aluminium stubs and sputter-coated with gold before viewing under microscope. For the Phenom Desktop SEM analysis, samples were mounted on the aluminium stubs and directly viewed under microscope. Inflorescence structures were studied from the freshly collected samples, herbarium samples, as well as from the original author's descriptions (in a case where all the specimens did not contain any inflorescence to study). Line drawings representing both the vegetative characters and fruits were made for all the species. Maps were plotted using the program CorelDraw Graphics Suite X7.

## Morphological characters of *Cynoglossum* species in southern Africa

### *Vegetative morphology*

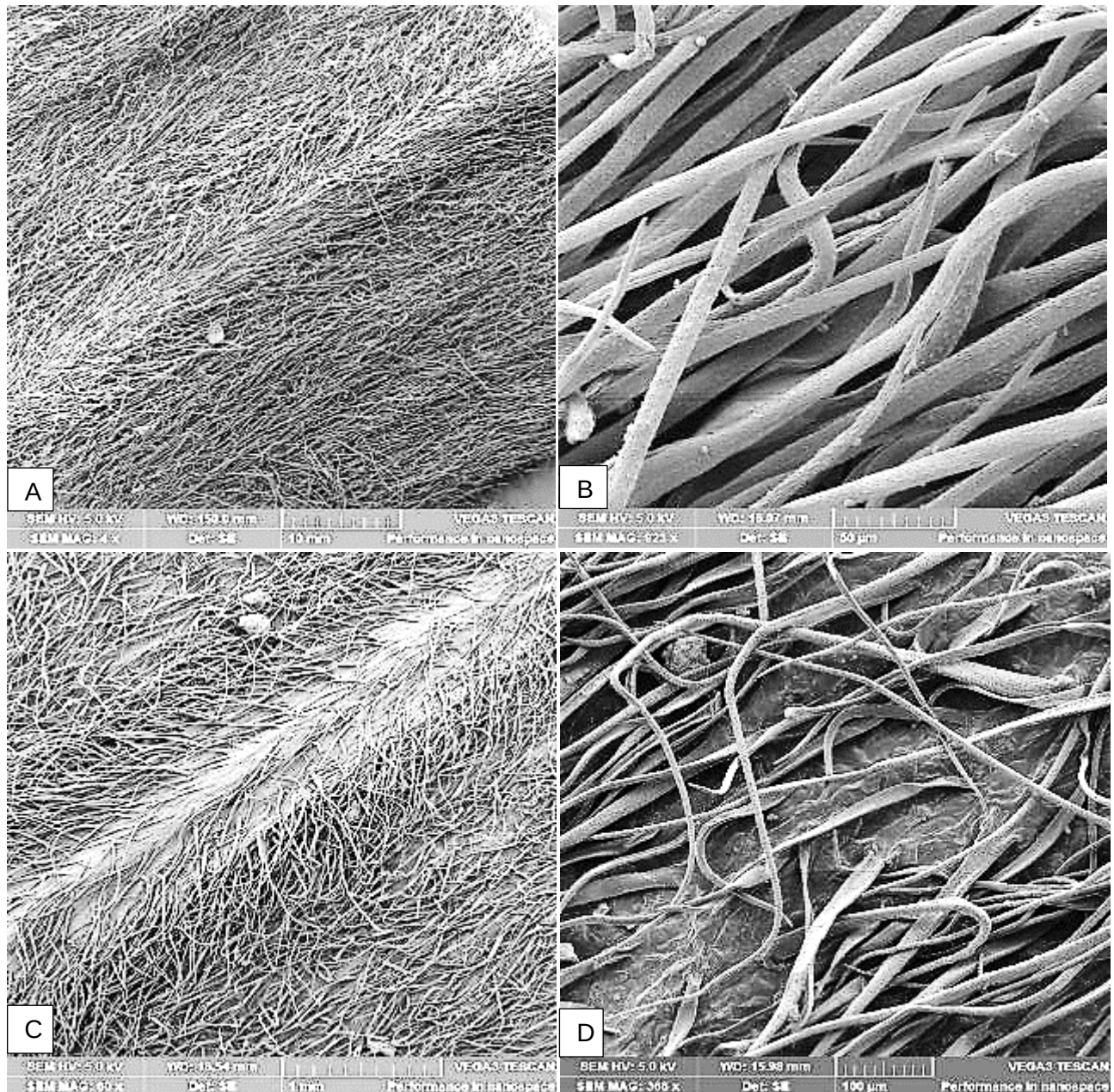
Members of this genus are either perennial, biennial, or rarely annual herbs which are recognizable by their hairy stems and leaves. Roots are thickened cream white taproots with small lateral roots. The stems are erect, hollow, simple at the base, and usually branched above. The basal leaves are deciduous, long petiolate, lanceolate-obtuse shaped, cross-venulate, with smooth margins, and are clustered at the lower parts of the stem forming a rosette, covered with simple trichomes on both the adaxial and abaxial surface. The stem leaves are alternate, sessile, or petiolate, lanceolate-obtuse shaped, with smooth margins. Trichomes on the leaves sometimes have a white base (*C. austroafricanum*, *C. coeruleum* var. *mannii* and *C. lanceolatum*). Vegetative morphology is of limited diagnostic value in distinguishing between southern African species, however a closer look at the trichomes has shown that they may be used to distinguish between similar species. For example, both *C. alticola* and *C. obtusicalyx* have a cluster of soft, woolly trichomes which differ in shape (cylindrical with a pointed tip in *C. alticola*, vs flat surface and spherical with a blunt tip in *C. obtusicalyx*) and density (denser in *C. alticola* than in *C. obtusicalyx*) as observed in Figure 1.

### *Reproductive morphology*

The inflorescence is a cyme which is often dichotomously branched with spreading panicles. Flowers are either pedicelled or subsessile, with five parted corollas; corolla white with a blue throat, blue, violet, or magenta (*C. hispidum*), or rarely white (*C. spelaum*). The stamens are included and arise from the base of the tube, they have short filaments and elliptic to oblong shaped anthers. The style is short and relatively thick, with a capitate stigma. The fruit is a schizocarp of four nutlets attached apically to a narrowly conical gynobase. The nutlets are ovoid with a convex dorsal surface. At maturity, the nutlets produce glochidia, which are sharp hair-like spines or bristles tipped with barbs. The glochidia are either swollen at the base or not bulbous-based,



they either cover the whole surface or are well spaced and vary in number. The structure and shape of glochidia display an important distinguishing character amongst the southern African species, with each species portraying a unique character as can be seen in Figure 2.



**Figure 1:** SEM micrographs of the adaxial leaf surfaces and the midrib of (A & B) *C. alticola*; (C & D) *C. obtusicalyx*; (B) close-up of *C. alticola* displaying cylindrical trichomes with pointed end; (D) close-up of *C. obtusicalyx* displaying flat trichomes with blunt tip. Vouchers: A & B from L.C.C. Liebenberg 5789 (PRE); C & D from J.P.H. Acocks 8509 (PRE).

## Taxonomic treatment

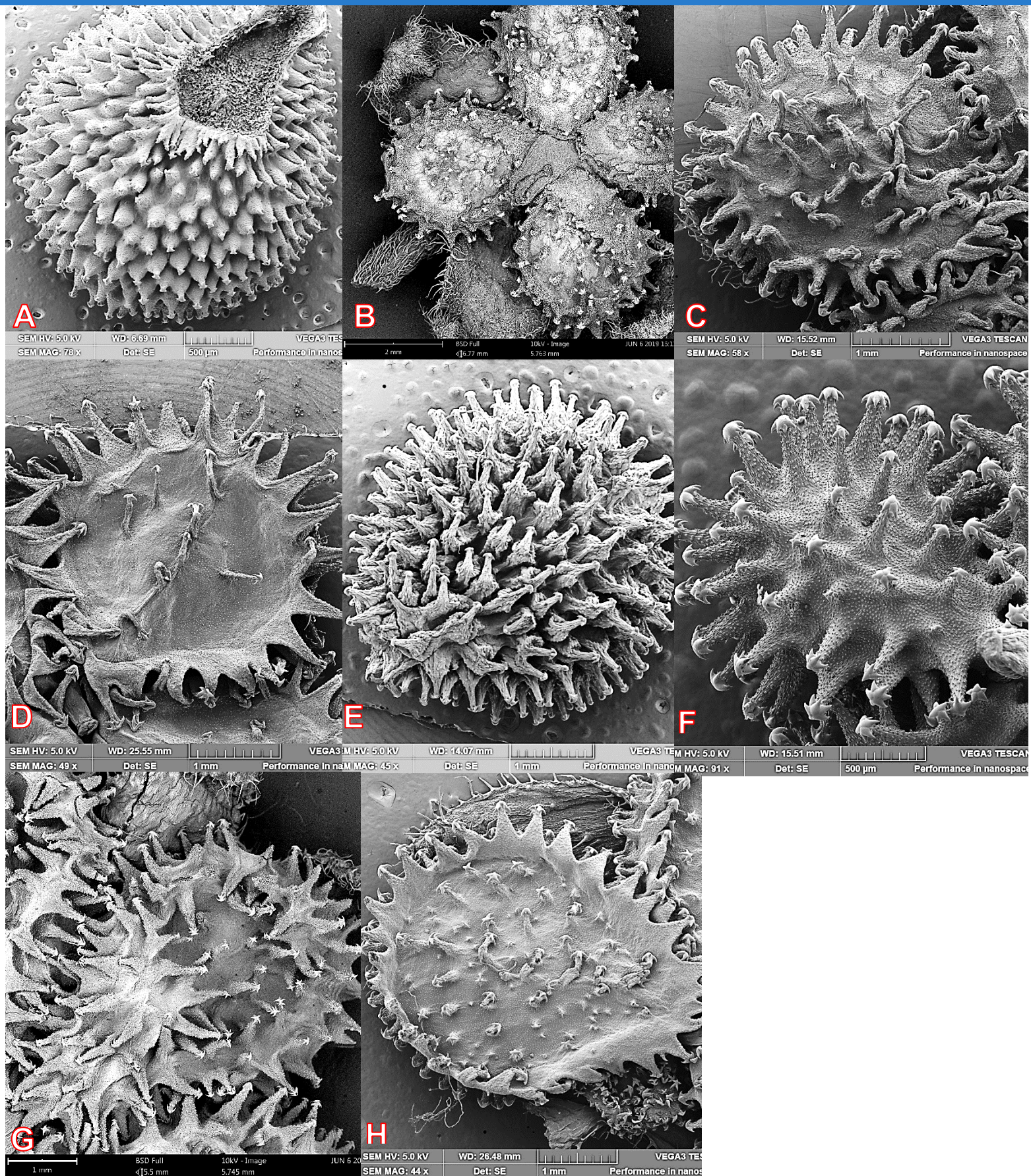
*Cynoglossum* L., Sp. Pl. 1: 134 (1753) & Gen. Pl.: 5 (1754); Benth. and Hook. f., Gen. Pl. 2: 848 (1876); C.H. Wright in Fl. Cap. 4: 13 (1904); Baker and C.H. Wright in Fl. Trop. Afr. 4 (2): 51 (1905); Brand in Engl., Pflanzenr. 4: 252 (1921); Al-Shehbaz in J. Arnold Arbor.: 112 (1991), Selvi and Sutory in Pl. Biosyst. 146 (2): 461-479 (2012); Hilger *et al.* in Biodivers. Data J. 3: e4831 (2015). Type species: *C. officinale* L.

*Paracynoglossum* Popov. Fl. URSS xix.: 717 (1953). Type species: *P. denticulatum*

(DC.) Popov.

Perennial or biennial herbs, often tall and slightly branched. Stems and leaves canescent. *Indumentum* white, simple or tubercled. *Leaves* alternate, lanceolate, obtuse or spatulate, entire; first year basal leaves form a rosette, lanceolate or obtuse, often long petiolate. *Racemes* usually elongate, rarely bracteate, sparingly branched or loosely paniculate. *Flowers* pedicelled or subsessile; blue or violet with distinct veins, rarely white. *Calyx* five-partite, scarcely enlarged in fruit, patent or reflexed. *Corolla* tube short, throat closed with obtuse or arched scales; five-lobed, imbricate, obtuse, patent. *Stamens* five, fixed in the corolla tube, included, with short filaments, anthers ovoid or shortly oblong, obtuse. *Ovary* with four distinct lobes from an almost flat receptacle; style short or rather long; stigma small, flat or sub capitate; ovules horizontal, fixed to the central angle of the cell. *Nutlets* four, depressed, scarcely produced at the apex, convex or flat on the dorsal side or surrounded by an elevated margin, glochidiate (hair-like spines or short prickles). *Seeds* straight or slightly curved.





**Figure 2:** SEM micrographs of the nutlets of the eight listed species of *Cynoglossum* (A) *C. alticola*; (B) *C. amabile*; (C) *C. austroafricanum*; (D) *C. coeruleum* var *mannii*;



(E) *C. hispidum*; (F) *C. lanceolatum*; (G) *C. obtusicalyx*; (H) *C. spelaeum*. Voucher specimens: A from L.C.C. Liebenberg 5789 (PRE); B from J. Stewart 2021 (NU); C from O.M. Hilliard and B.L. Burt 11803 (PRE); D from T.B. Sikhakhane 440 (NH); E from S.P. Bester 12958 (PRE); F from S.P. Bester 4653 (PRE); G from J.P.H. Acocks 8509 (PRE); H from A. Nicholas and B. Isaacs 1965 (PRE). SEM images scale bars: A, F= 500 µm; B=2 mm; C-E, G-H= 1 mm.

*Diagnostic key to the species:*

- 1a. Soft woolly hairs covering the entire plant; nutlets thickened; glochidia densely arranged on the nutlet... **1. *C. alticola***
- 1b. Stiff bristle hairs covering the entire plant; nutlets slightly swollen; glochidia sparsely spaced on the nutlet ... **2**
- 2a. Nutlets 5 mm wide; glochidia thick at the base, fruit stalk up to 2 cm long... **5. *C. hispidum***
- 2b. Nutlets less than 5 mm wide; glochidia uniformly shaped, fruit stalk up to 1 cm long... **3**
- 3a. Inflorescences clustered at the apex; corolla bluish purple; glochidia dense at the margins and centre of the nutlet..... **2. *C. amabile***
- 3b. Inflorescences not clustered at the apex; corolla blue to white; glochidia dense at the margins and few at the centre of the nutlet... **4**
- 4a. Spreading long trichomes covering the whole plant; corolla longer than 7 mm long .... **7. *C. obtusicalyx***
- 4b. Sparsely shorter trichomes covering the whole plant; corolla shorter than 4.25 mm long ..... **5**
- 5a. Corolla white with blue throat:
  - 6a. Trichomes not thickened on both leaf surfaces; glochidia evenly distributed across the nutlet..... **6. *C. lanceolatum***
  - 6b. Trichomes with thickened white base on the abaxial leaf surface; glochidia on the median line and centre of the nutlet ..... **4. *C. coeruleum* var. *mannii***
- 5b. Corolla uniformly coloured:
  - 7a. Leaves brightly green coloured on both surfaces, lanceolate-obtuse shaped; corolla pale blue; length of glochidia uniform throughout the nutlet; .... **3. *C. austroafricanum***
  - 7b. Leaves grey green on the abaxial surface, dark green on the adaxial surface, spatulate-obtuse shaped; corolla white; marginal glochidia longer than acentric glochidia; .... **8. *C. spelaeum***

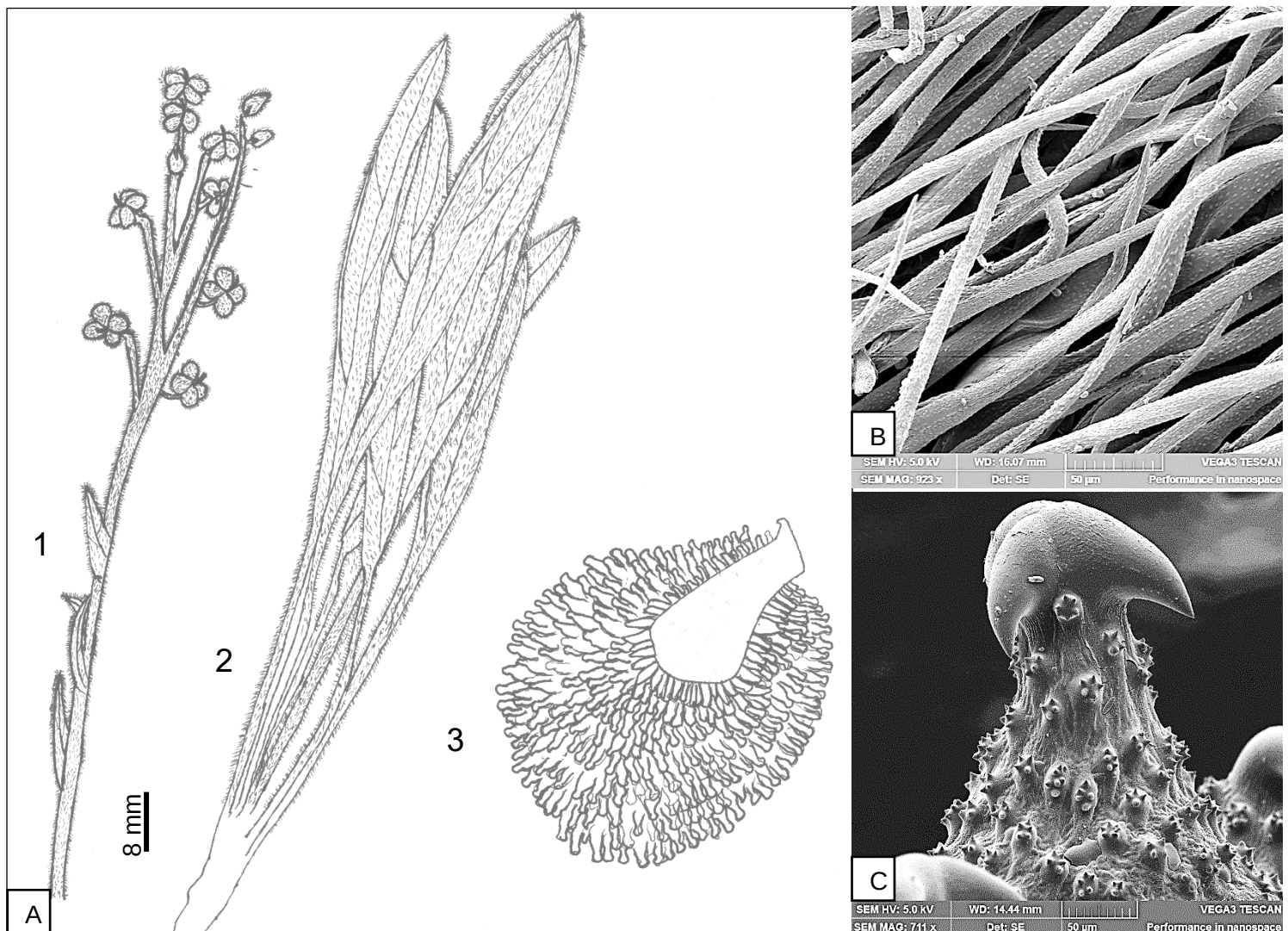
**1. *Cynoglossum alticola* Hilliard & B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 43 (3):343 (1986).**

**Type.** South Africa. Eastern Cape, Barkly East District (3027): Ben McDhui (-DB), 5 Feb 1983, O.M. Hilliard and B.L. Burt 16468 (E-image!, holotype; NU-image!, isotype).



Perennial herbs, 0.2–0.6 m in height. *Basal leaves* 76–270×8–18 mm, lanceolate, densely pubescent, persistent; margins entire. *Stem leaves* 35–120×5–10 mm, lanceolate, apex acute, base cuneate, margins entire, soft woolly hairs. *Trichomes* spread equally on both the adaxial and abaxial leaf surfaces, unicellular hair base, not bulbous on both leaf surfaces. *Inflorescence* racemose, clustered at the apex; pedicel 4–10 mm long, lengthening considerably in fruit. *Calyx* ca. 4 mm long, lobes elliptic-oblong, densely hairy on inner surface, apices obtuse. *Corolla* deep blue; lobe 4×3 mm diameter, oblong, round apex. *Nutlets* convex, 6–9×5–6 mm; glochidia short and thick at the base, densely packed on nutlet, tips multi-angular (Figure 3).

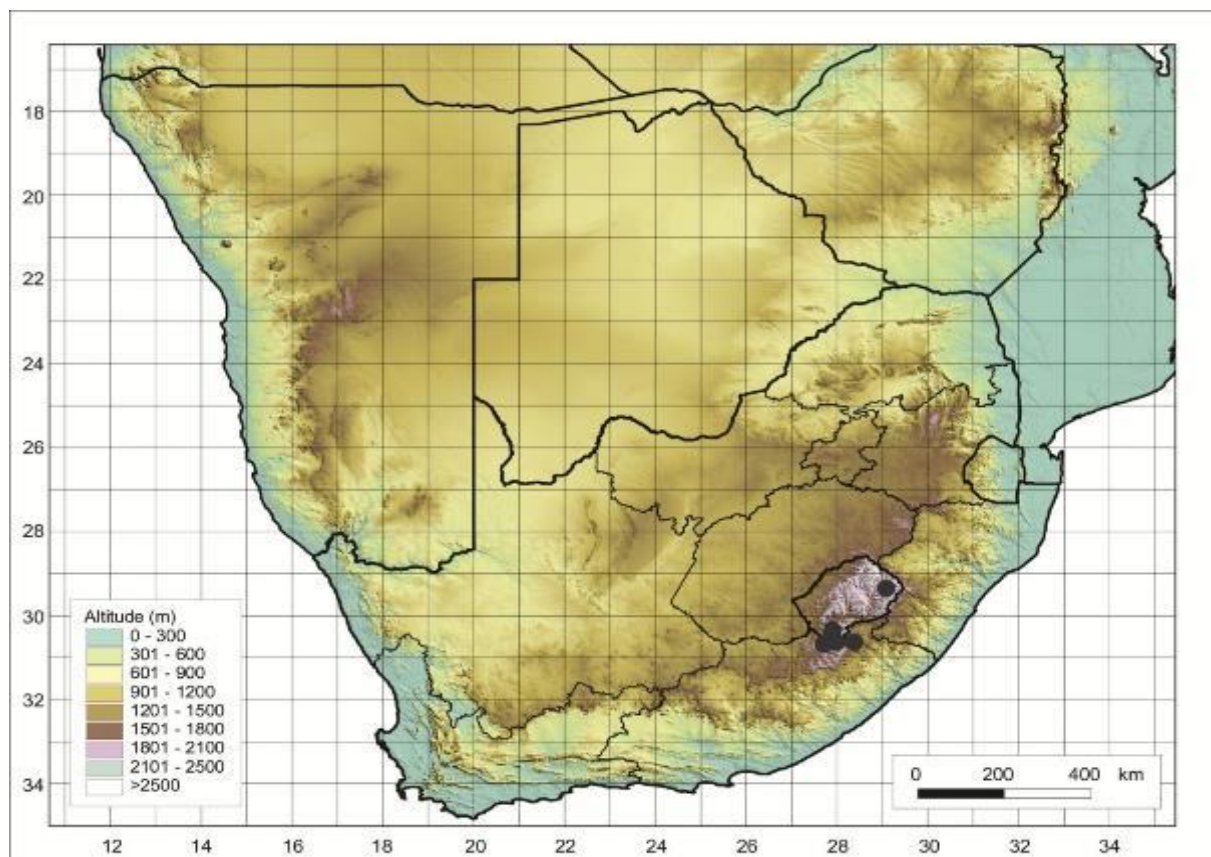
**Diagnostic characters.** *Cynoglossum alticola* can be distinguished by its thick, convex nutlets. Among the southern African species, it has a unique appearance due to the presence of woolly trichomes that cover the whole plant. Furthermore, it has larger nutlets (6–9×5–6 mm) than other species (less than 6×5 mm). According to Hilliard and Burt (1986), this species is related to *C. alpinum* (Brand) B.L. Burt from the highlands of Ethiopia, with which it shares nutlet shape and size, as well as the leaf texture and colour. The difference is observed on the fornicies (small crests in the corolla tube of a plant), as in *C. alticola* they are broad and short while in *C. alpinum* they are long and narrow.



**Figure 3:** Vegetative and reproductive morphology of *Cynoglossum alticola*, (A) Line drawings of: 1. A branch showing fruiting arrangement at the apex of the stem and stem leaves; 2. Long petiolate basal leaves; 3. Nutlet. (B) SEM micrograph showing trichomes on the leaves. (C) SEM micrograph showing thick and shorter glochidia on the nutlet. Voucher: L.C.C. Liebenberg 5789 (PRE). Drawing scale bar: 8 mm. SEM images scale bars: B= 50 µm; C= 50 µm.

**Distribution and habitat.** The species is restricted to the Eastern Cape Province in South Africa and Lesotho (Figure 4), where it is found growing on mountainous terrain and on damp slopes near streams.

**Additional specimens examined.** South Africa. Eastern Cape: **3028 (Matatiele):** Drakensberg, near Barkly East (-CA), 19 Dec 1982, P.B. Phillipson 705 (PRE); between Malpas and Nek (-CA), 13 Dec 1995, T. Dold and M. Cocks 2058 (GRA). Lesotho. **2929 (Underberg):** Mokhotlong District (-AC), Jan 1953, L.C.C. Liebenberg 5789 (PRE); 28 Feb 1947, A. Jacot Guillarmod 997 (PRE).



**Figure 4:** Known distribution of *Cynoglossum alticola*.



**2. *Cynoglossum amabile* Stapf & J.R.Drumm. in Bull. Misc. Inform., Roy. Bot. Gard., Kew 6:202 (1906).**

**Type.** China. Yunnan, Mengtsze, 1894, *W. Hancock* 133 (K-image! [3 sheets], lectotype, designated by Verdcourt 1991).

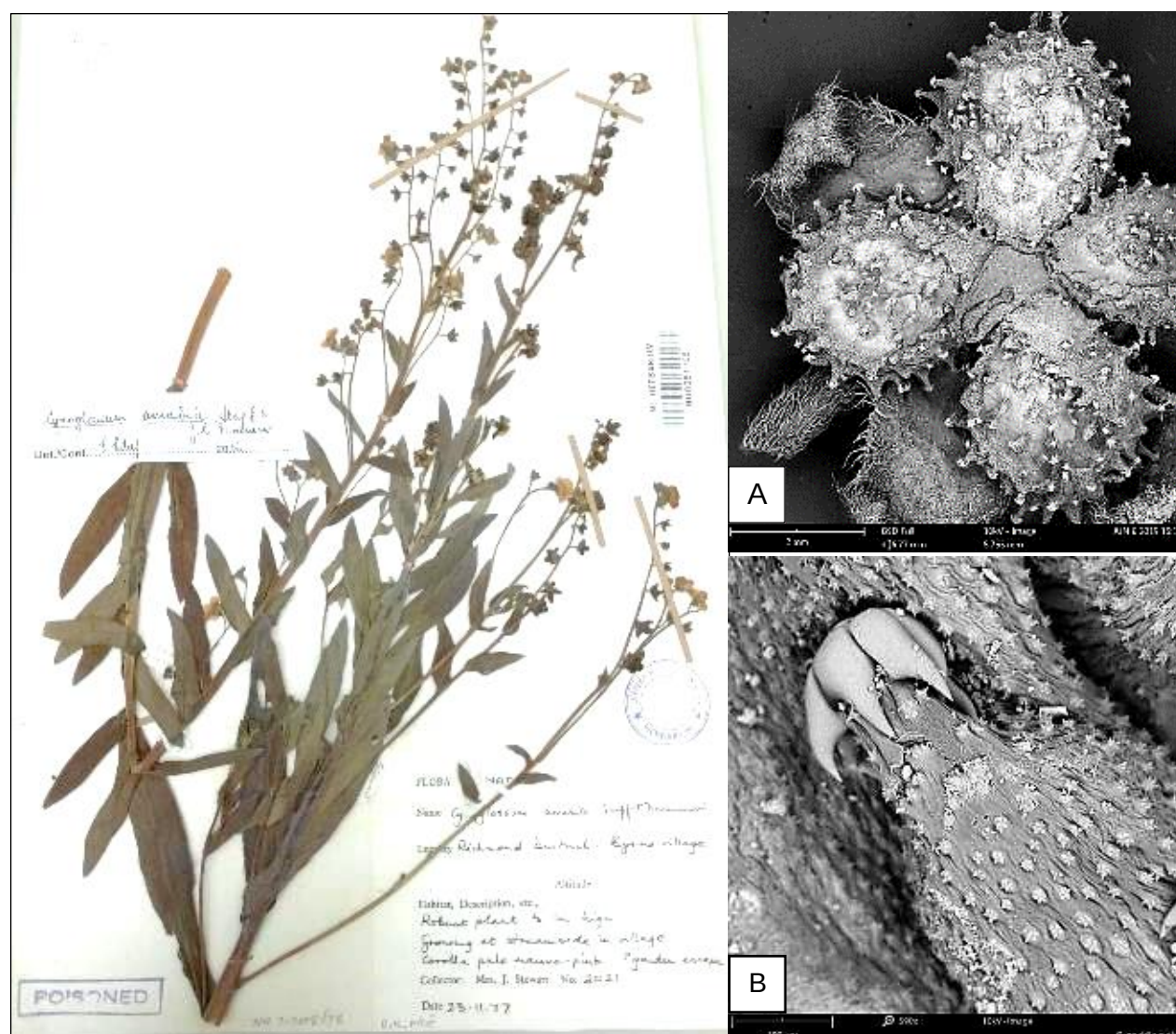
Perennial herb, 0.6 m in height. *Basal leaves* 50–100×20–35 mm, lanceolate-elliptic shaped, softly hairy, deciduous, margins entire. *Stem leaves* 40–100×9–20 mm, lanceolate shaped, apex acute, base cuneate, entire margins, densely covered with white brittle hairs. *Trichomes* soft, upright, bulbous based. *Inflorescence* raceme, clustered at the apex, pedicels 5–8 mm long, lengthens considerably in fruit. *Calyx* ca. 3 mm long, lobes ovate, grey pubescent, apex subacute. *Corolla* bluish purple; lobe 7×9 mm diameter, segments round. *Nutlets* ovoid, 2–4×3–4 mm, convex shaped; glochidia short, thick, marginal glochidia are more distinct than the central glochidia (Figure 5).

**Diagnostic characters.** Amongst the southern African species, *C. amabile* can be confused with *C. lanceolatum* due to their small-sized nutlets (between 2–4×2.5–4) and flowers. However, the two species are easily distinguished by their flower colour (*C. lanceolatum* has white corolla with blue throat, whereas *C. amabile* has bluish purple corolla). This species was also reported by Stapf and Drummond (1906) and König *et al.* (2015) to be like *C. furcatum* Wallich (from Nepal, China, Bhutan, Vietnam, Thailand, Philippines, and India), based on flower and fruit size. The difference can be observed in the inflorescences, whereby *C. furcatum* is a much larger plant with inflorescences up to 1 m tall, and *C. amabile* is up to 0.6 m tall.

**Distribution and habitat.** *Cynoglossum amabile* is widely distributed in southern China where it is usually grown for ornamental purposes and naturalised in many parts of the world (Xu *et al.*, 2009). According to Germishuizen and Meyer (2003), this species is only found in KwaZulu-Natal Province where it grows in open, disturbed sites, on gravel slopes and sandy, dry riverbanks

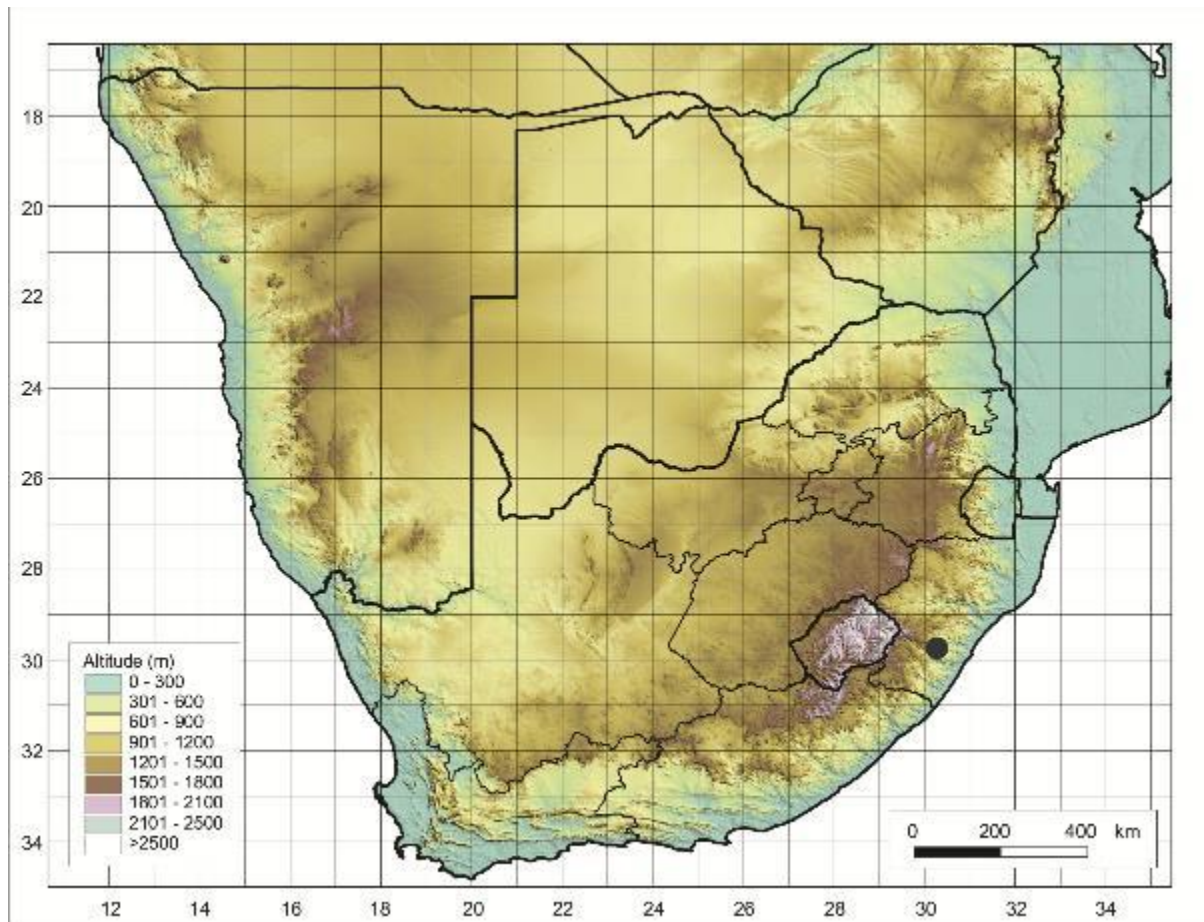
**Additional specimens examined.** South Africa. KwaZulu-Natal: **2930 (Pietermaritzburg):** Richmond District, Byrne Village (-CD), 23 Nov 1977, J. Stewart 2021 (NU).

**Taxonomic notes.** *Cynoglossum amabile* has been described as a widespread species which grows in disturbed habitat and can be grown as an ornamental (König *et al.* 2015). This species has only been collected once in South Africa by J. Stewart in 1977, since then there are no later records or observations of this species in this region. Attempts to locate this species in the wild were futile. It is questionable whether this species occurs naturally in the southern African region since its single known locality is within a protected area in KwaZulu-Natal.



**Figure 5:** *Cynoglossum amabile*. SEM micrograph of (A) Fruit nutlets; (B) Glochidia. Voucher specimen: J. Stewart 2021 (NU). SEM images scale bar: A= 2 mm; B= 100 µm





**Figure 6:** Recorded distribution of *Cynoglossum amabile* in southern Africa.

**3. *Cynoglossum austroafricanum* Weim. ex Hilliard & B.L. Burtt in Notes Roy. Bot. Gard., Edinburgh 43(3):347 (1986).**

**Type.** South Africa. KwaZulu-Natal, Underberg (2929): Cobham Forest Reserve, Sipongweni, c.6500ft (-CB), 21 Feb 1981, O.M. Hilliard and B.L. Burtt 14072 (E-image! [2 sheets], holotype; K-image!; NU-image! [3 sheets], isotype).

*Cynoglossum austroafricanum* Weim., Jacot Guillarmod, Fl. Lesotho: 233 (1971); Gibbs Russell et al., in Mem. Bot. Surv. S. Afr. 48:109 (1984), *nomen nudum*

Perennial or biennial herbs, 0.3–0.5 m in height. *Basal leaves* 100–190×15–30 mm, lanceolate-obtuse, softly hairy, persistent margins entire. *Stem leaves* 45–100×10–21 mm, narrowly lanceolate to linear lanceolate shaped, acute apex, cuneate base, margins undulate, covered with stiff hairs. *Trichomes* unicellular, with thick round base on the adaxial surface, simple on the abaxial surface. *Inflorescences* dichotomously branched, loose cymes at the apex, pedicels 4–9 mm long, and lengthens considerably in fruit. *Calyx* ca. 2–3 mm long, lobes obtuse, pubescent on the outer surface, glabrous on the inner surface, apex acute. *Corolla* pale blue; lobes 2.75–4.25 mm in diameter, cruciform, apex obtuse. *Nutlets* ovoid, 3.0–3.5×2.5–3.0 mm; glochidia more spread towards the margins, thin, tip multi-angular (Figure 7).

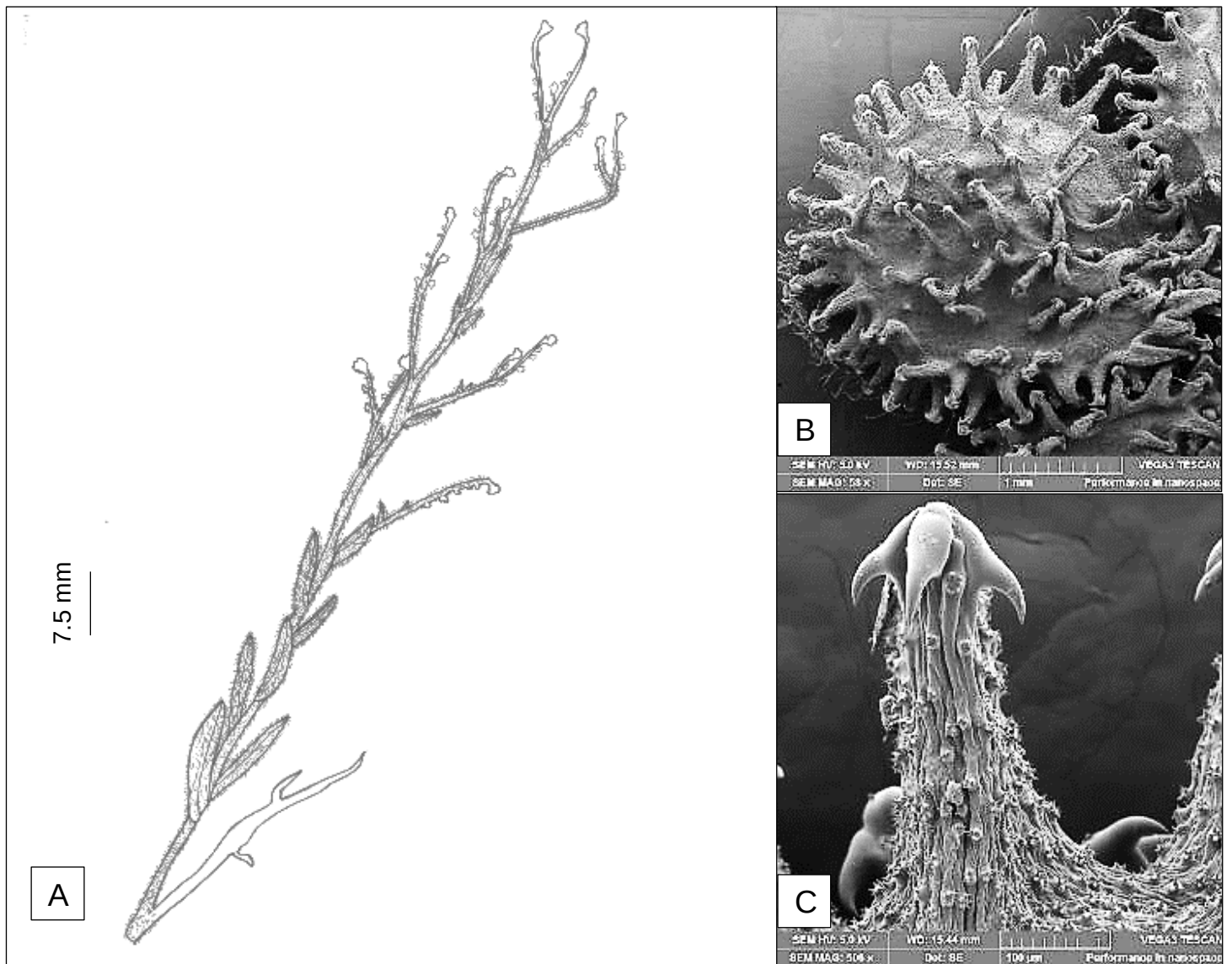
**Diagnostic characters.** Amongst the southern African species, *Cynoglossum austroafricanum* can be confused with either *C. lanceolatum* or *C. coeruleum* var.

*mannii*. This species differs from the two by the colour of the corolla (white corolla with pale blue throat vs pale blue corolla throughout in *C. austroafricanum*). This latter observation was also noted by Hilliard and Burt (1986).

**Distribution and habitat.** The species is distributed in South Africa (North-West, Gauteng, Mpumalanga, Free-State, KwaZulu-Natal, and Eastern Cape Provinces), eSwatini and Lesotho (Figure 8), where it occurs in shady, disturbed areas, and sandy, dry riverbanks.

**Additional specimens examined.** South Africa. LIMPOPO: **2430 (Tzaneen):** Lekgalameetse Nature Reserve (-AA), 7 Oct 1986, *N. Stalmans* 1404 (PRE). NORTH-WEST: **2626 (Lichtenburg):** Lichtenburg (-AA), Feb 1918, *L. Kretzshmar* 17065 (PRE). GAUTENG: **2528 (Pretoria):** Brooklyn (-CA), 1 Feb 1931, *A.O.D. Mogg* 16451 (PRE). MPUMALANGA: **2430 (Pilgrim's rest):** Pilgrim's rest, next to the old railway line (DD), 31 Jan 2019, *A.N. Moteetee* and *L.K. Madika* AL06 (JRAU). **2530 (Mashishing):** Mashishing (-AB), Apr 1910, *M. Crosby* 1989 (PRE); Mashishing District (-CA), 8 Feb 1904, *J. Burt-Davy* 1472 (PRE). **2630 (Carolina):** Between Oshoek border post and Carolina (-BA), Jan 1906, *H. Bolus* 12161 (PRE). FREE STATE: **2828 (Bethlehem):** Golden Gate (-AB), 22 Jan 1951, *A. Wiezer* 22485 (NBG). **(Fouriesburg):** Bethlehem (-CA), 8 Jan 1918, *G. Potts* 3246 (PRE); Witsieshoek (-DB), 28 Feb 1975, *O.M. Hilliard* and *B.L. Burt* 8665 (NU). KWAZULU-NATAL: **2730 (Vryheid):** Oshoek District, Wakkerstroom (-AC), 18 Jan 1961, *N.J. Devenish* 480 (PRE); Amajoba District Municipality area, Luiperdkloof farm, Natural Heritage site no.47 (-AD), 25 Jan 2011, *A.M. Ngwenya* 3601 (NH). **2829 (Harrismith):** Cathedral Peak (-CC), 18 Feb 1983, *O.M. Hilliard* and *B.L. Burt* 16298 (NU); 12 Jan 1984, *J. Scott* 76 (NH). **2830 (Dundee):** Hattingspruit Station (-AA), Dec 1929, *D. Johnston* 268 (NU). **2929 (Underberg):** Mpendhle District, upper Loteni Valley (-AD), 5 Feb 1985, *O.M. Hilliard* and *B.L. Burt* 18103 (NU, PRE); Loteni Nature Reserve (-BC), 24 Dec 1978, *O.M. Hilliard* and *B.L. Burt* 11803 (PRE); Polela River (-CB), 21 Apr 1973, *M.A. Rennie* 379 (NU); 23 Mar 1977, *O.M. Hilliard* and *B.L. Burt* 9793 (NU); 17 Feb 1982, *O.M. Hilliard* and *B.L. Burt* 15520 (NU). **2930 (Pietermaritzburg):** Gate farm Keerom-Cottingham (-CC), 23 Mar 1969, *R.G. Strey* 8420 (NH). **2931 (Stanger):** Tugela valley (-AA), 14 Feb 1926, *Bayer* 47 (NU). **3029 (Kokstad):** Hillside (-CA), Jan 1956, *P. Thompson* 2 (NU); on banks of streams near Kokstad (-CB), Dec 1883, *W. Tyson* 1839 (NBG), 17 Jan 1957, *L.E. Taylor* 5473 (NBG). **3030 (Dumisa):** Port Shepstone (-AD), 22 Oct 1997, *J. Arkell* 353 (NH). EASTERN CAPE: **3128 (Umtata):** Transkei, on the summit of Baziya Mt. (-AD), 23 February 1988, *T. Strever* 917 (PRE); Walter Sisulu University, Area 3: East of In-Service centre (-DB), 14 Feb 2001, *N. Nombekela* 102 (NH). **3126 (Queenstown):** Hangklip (-DD), Feb 1960, *H. Koepowitz* 13147 (GRA). **3129 (Port St. John's):** Ntabankulu Mountain, Gome Forest Station, Tabankulu (-AB), 11 Nov 1996, *T. Dold*, *E. Cloete* and *R. White* 2940 (GRA). **3227 (Stutterheim):** Fort Cunynghame Station (-AD), Nov 1894, *T.R. Sim* 1860 (NU); no date 1897, *T.R. Sim* 20420 (NU). eSwatini. **2631 (Mbabane):** Forbes Reef (-AA), 14 Apr 1960, *R.H. Compton* 30035 (NBG); Mbabane (-AC), 17 Jan 1951, *A. Wuze* 22393 (NBG). Lesotho. **2828 (Bethlehem):** Leribe District, LHDA Phase 1A (-AD), 11 Jan 1996, *P.B. Phillipson*, *C. Mokuku*, *R. Judd*, and *C. Hobson* 4473 (GRA); Leribe (-AD), no date, *M. Dieterlen* 70 (NBG; NH). **2927 (Maseru):** Thaba Bosiu (-BC), 1 Mar 1978, *M. Schmitz* 8205 (PRE); Mahlatsa (-BB), 18 Jan 1941, *A. JacotGuillarmod* 51 (GRA); Sefikeng Ha

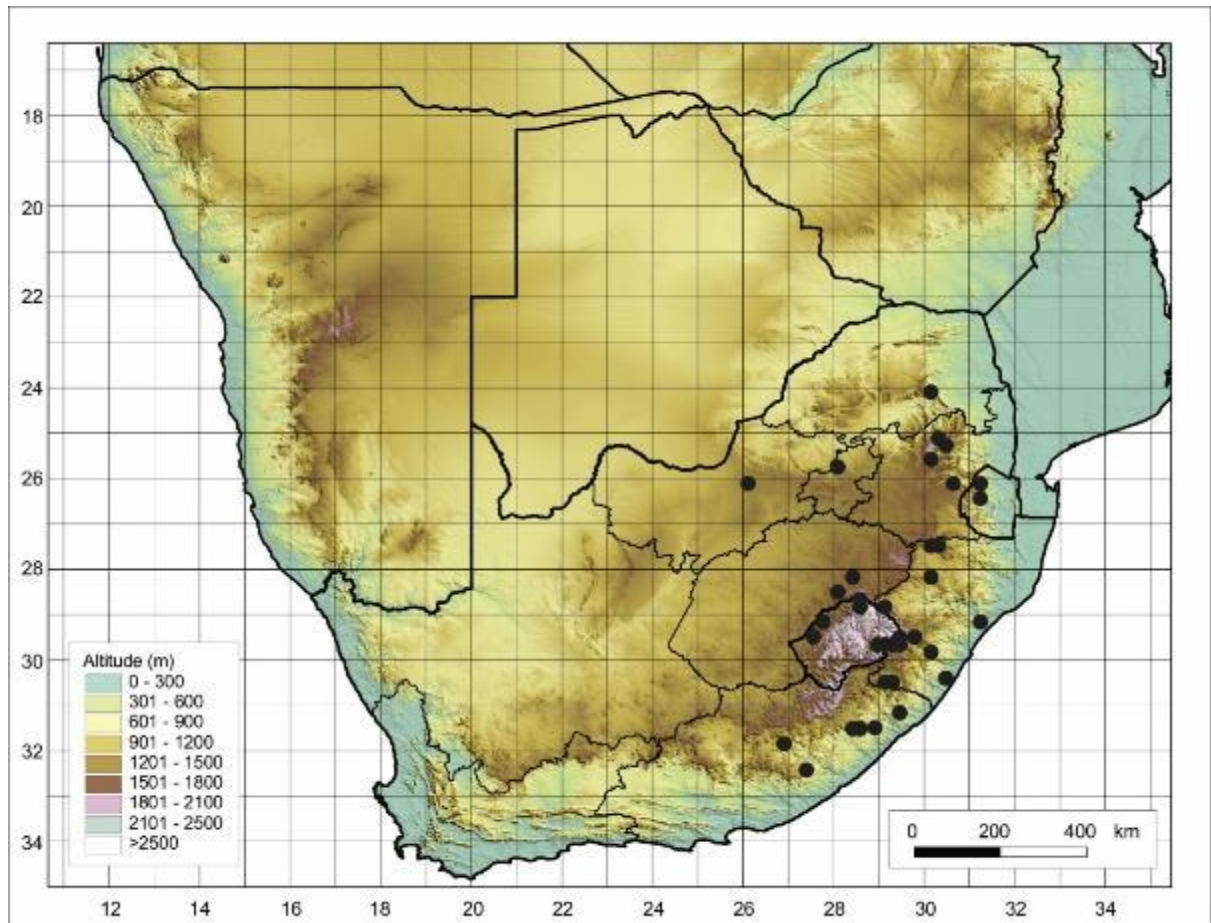




**Figure 7:** Vegetative and reproductive morphological features of *Cynoglossum austroafricanum*. (A) Line drawing of the branching pattern of the fruit stalk, and the alternating stem leaves. (B) SEM micrograph of fruit nutlet, with the arrangement of glochidia around the nutlet. (C) SEM micrograph of the glochidia. Voucher specimen: O.M. Hilliard and B.L. Burt 11803 (PRE). Drawing scale bar: 7.5 mm. SEM scale bar: B=1 mm; C= 100 µm.

Fako (-BD), Oct 2018, A.N. Moteetee 56 (JRAU); 30 Dec 2018, A.N. Moteetee 59 (JRAU). **2929 (Underberg):** Mokhotlong (-AC), Mar 1949, A. Jacot Guillarmod 1072 (PRE), 25 Feb 1949, W.J. Barker 21515 (NBG).

No locality details: 27 Nov 1888, H. Medley 4576 (NH); Dec 1946, E. Meston 50 (NU).



**Figure 8:** Known distribution of *Cynoglossum austroafricanum* in southern Africa.

**Taxonomic Notes.** According to Hilliard and Burtt (1986) this species was described by Dr H Weimarck without selecting a type species, therefore in typifying it they retained the specific epithet.

**4. *Cynoglossum coeruleum* var. *mannii* (Baker & C.H. Wright) Verdc. in Fl.Trop. E. Africa, Boraginac.: 110 (1991).**

Type: Cameroon: Mount Cameroon, Dec 1862, *Mann* 2005 (K-image, lectotype!, here designated; K-image [2 sheets] isolectotype!).

*Cynoglossum mannii* Baker & C.H.Wright, in Oliver et al., Fl. Trop. Afr., 4(2.1): 52 (1905). Type as above.

*Cynoglossum geometricum* Baker & C.H. Wright, in Oliver et al., Fl. Trop. Afr. 4(2.1): 52 (1905). Type: Nyasaland [Malawi], Mount Chiradzulu, no date, A. Whyte s.n. (K-image! lectotype, here designated). Notes: The specimen was selected as a lectotype by B.L. Burtt on the sheet but was never designated formally.

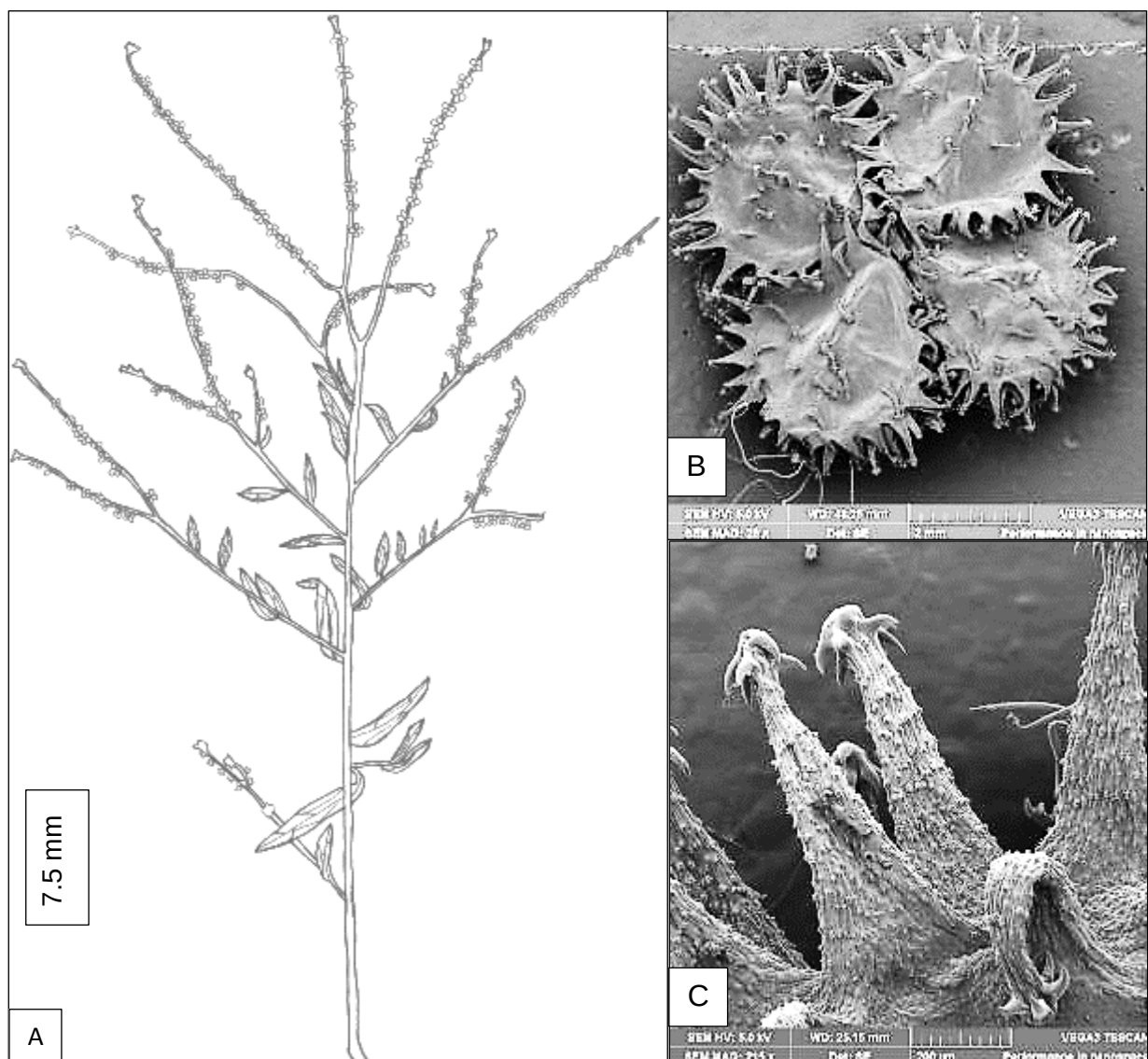
*Paracynoglossum geometricum* (Baker & C.H. Wright) R.R. Mill. in Notes Royal. Bot. Gard., Edinb. 41 (3): 478 (1984). Type: Same as above.

*Cynoglossum coeruleum* subsp. *geometricum* (Baker & C.H. Wright) S. Edwards in Fl. Ethiopia & Eritrea 5: 93 (2006), *nom. inval.*



Perennial, biennial, or annual herbs, 1.2 m in height. *Basal leaves* 90–190×28–56 mm, lanceolate-obtuse, softly hairy, deciduous, margins entire. *Stem leaves* 35–90×7–25 mm, lanceolate, apex acute, base acute to obtuse, covered with moderately stiff hairs margins entire. *Trichomes* bulbous based on the upper surface of the leaf, sometimes simple on the lower surface. *Inflorescences* terminal axillary cymes, few branches spreading dichotomously; pedicel 4–8 mm long, lengthens considerably in fruit. *Calyx* ca. 21 mm long, lobes ovate-oblong, adpressed-hairy outside, smooth inside, apex acute. *Corolla* white with pale blue throat; lobes ca. 2.1 mm in diameter, campanulate. *Nutlets* ovoid, 3–4×2.5–3.5 mm; glochidia more marginal and on the median line (Figure 9).

**Diagnostic characters.** This variety can be easily confused with *C. lanceolatum* due to the dichotomous branching of the inflorescence but can be distinguished from it by the distribution and density of the glochidia in the nutlets. The glochidia on the nutlets of *Cynoglossum coeruleum* var. *mannii* are more marginal and on the median line, whereas they are equally distributed around the whole nutlet in *C. lanceolatum*.



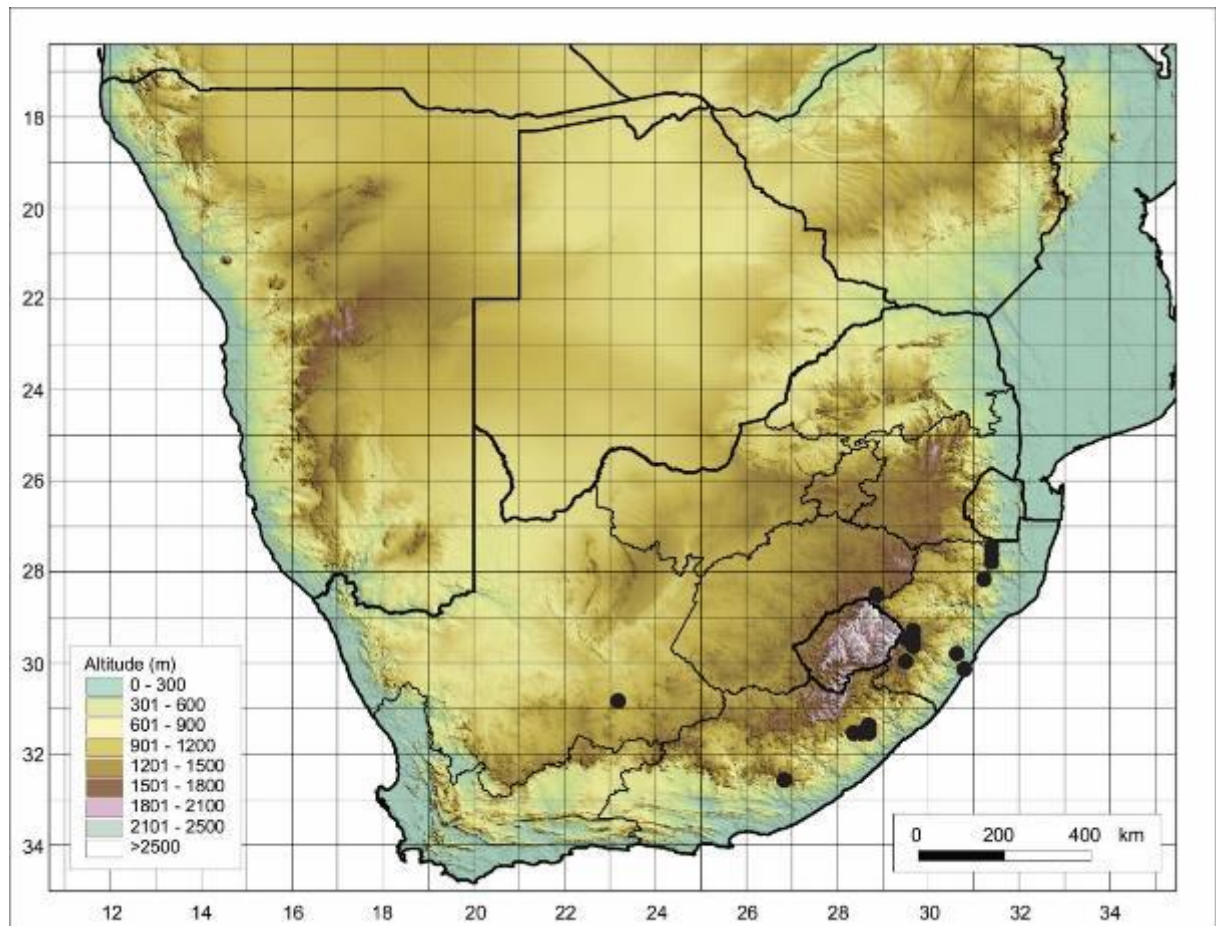
**Figure 9:** Vegetative and reproductive morphological features of *Cynoglossum coeruleum* var. *mannii*. (A) Line drawing of dichotomous branching of the fruit stalk. (B) Marginal and median line glochidia on the nutlet. (C) Glochidia evenly sized. Voucher specimen: *T.B. Sikhakhane 440* (NH). Drawing scale bar: 7.5 mm. SEM scale bar: B=2 mm; C= 200 µm.

**Distribution and habitat.** This variety is endemic to South Africa where it is known only from KwaZulu-Natal and Eastern Cape Provinces (Figure 10). It is also reported from Malawi, Mozambique, Zambia, and Zimbabwe (Mill and Miller 1984). It is found in disturbed grassland and sandy areas

**Additional specimens examined.** South Africa. KWAZULU-NATAL: **2731 (Louwsburg):** Itala Nature Reserve (-AD), 10 Dec 1987, *M. Jordaan 7064* (NH); 9 Dec 1987, *A.G. Hutchings 2530* (NU); Zululand District Municipality Area, Abaqulusi Municipality Area, Tygerskloof Farm (-CD), 24 Jan 2012, *A.M. Ngwenya and D.G.A. Styles 4034* (NH); 7 Mar 2019, *A.N. Moteetee and L.K. Madika AL010* (JRAU). **2828 (Bethlehem):** Royal Natal National Park (-DB), 17 February 1984, *O.M. Hilliard and B.L. Burtt 17658* (NBG; NU). **2831 (Nkandla):** Nhlazatshe farm, (-AA), 4 Mar 1994, *T.B. Sikhakhane 440* (NH). **2929 (Underberg):** Mpendhle District, Loteni Nature Reserve (-AD), 1 Feb 2001, *A.M. Ngwenya 1940* (NH), Loteni, upper reaches of river (-BC), 31 Mar 1984, *O.M. Hilliard 8218* (NU, PRE), Sipongweni Mountain (-CD), 20 Mar 1987, *O.M. Hilliard and B.L. Burtt 8249* (PRE). **2930 (Pietermaritzburg):** On the Phezulu Game Estate, Botha's Hill (-DC), 22 Jan 2005, *D. Styles 2280* (NH). **3030 (Port Shepstone):** M. Stainbank's farm, mid Illovo (-BB), 23 Dec 2008, *A. Young 942* (NU). EASTERN CAPE: **3023 (Britstown):** Kamberg (-CC), 21 Mar 1983, *O.M. Hilliard 8208* (NU). **3128 (Umtata):** Baziya Mission (-CB), 12 Feb 1981, *O.M. Hilliard and B.L. Burtt 13952* (NU); Nenga River, (-DB), 26 Oct 2001, *E. Cloete 6342* (GRA). **3226 (Fort Beaufort):** Hogsback (-DB), Apr 1956, *R. Collett 9775* (GRA); Apr 1955, *A.R.H. Martin 9678* (GRA); Apr 1962, *A. Jacot Guillarmod 5544* (GRA); 12 Apr 1955, *L.M. Johnson 1152* (GRA); 4 Mar 1973, *M. Bradley 55* (GRA).

**Taxonomic notes.** (i) The original name *C. geometricum* by Baker and Wright (1905) seem to be accepted in the Flora of southern Africa (FSA) since the species was first noted in the region by Hilliard and Burtt (1986). It was suggested by Mill and Miller (1984) that plants which are characterized by the nutlets bearing glochidia only in a median line and margins should be given the epithet *geometricum*, either at specific rank or usually at subspecific rank. The workers at Kew informally treated these plants as *C. coeruleum* variety although the necessary combination was not made (Mill and Miller, 1984). In line with the foregoing argument, Verdcourt (1991) relegated Baker and Wright's *C. mannii* to variety level as *C. coeruleum* var. *mannii*. Even though Gibbs Russell et al. (1988) updated the list of names, literature, and useful synonyms for 24 000 southern African plants, the name *C. geometricum* was maintained. This name is also used in the Plant of southern Africa: an annotated checklist created by Germishuizen and Meyer (2003). (ii) There are three sheets of *Mann 2005* in Royal Botanic Gardens, Kew (K), the one with the barcode number K000418935 is chosen as a lectotype because it displays most of the important characters of the species which can be used to distinguish this species from the rest, such as the inflorescence character and the branching pattern.





**Figure 10:** Known distribution of *Cynoglossum coeruleum* var. *mannii* in southern Africa.

**5. *Cynoglossum hispidum* Thunb., Prodr. Plant. Cap. 1:34 (1794); Roemer and Schultes in Syst. Veg., ed. 15 bis 4: 79,761 (1819); C.H. Wright in F.C. 4(2):14(1904); Brand in Engl. Pflanzenr. 78 [4,252]:146 (1921).**

**Type.** South Africa. Precise locality unknown, Lange Kloof, *Thunberg* 168 sub THUNB-UPS 3996 (UPS, microfiche! holotype).

*Cynoglossum glomeratum* Pursh in Fl. Amer. Sept. 2:729 (1813).

**Type.** United States of America, Louisiana, no date, *Bradbury* s.n. (PH-image! holotype).

*Cynoglossum enerve* Turcz. Bull. Soc. Imp. Naturalistes Moscou 1:259 (1840), E.Mey. ex DC., Prodr.10:154 (1846).

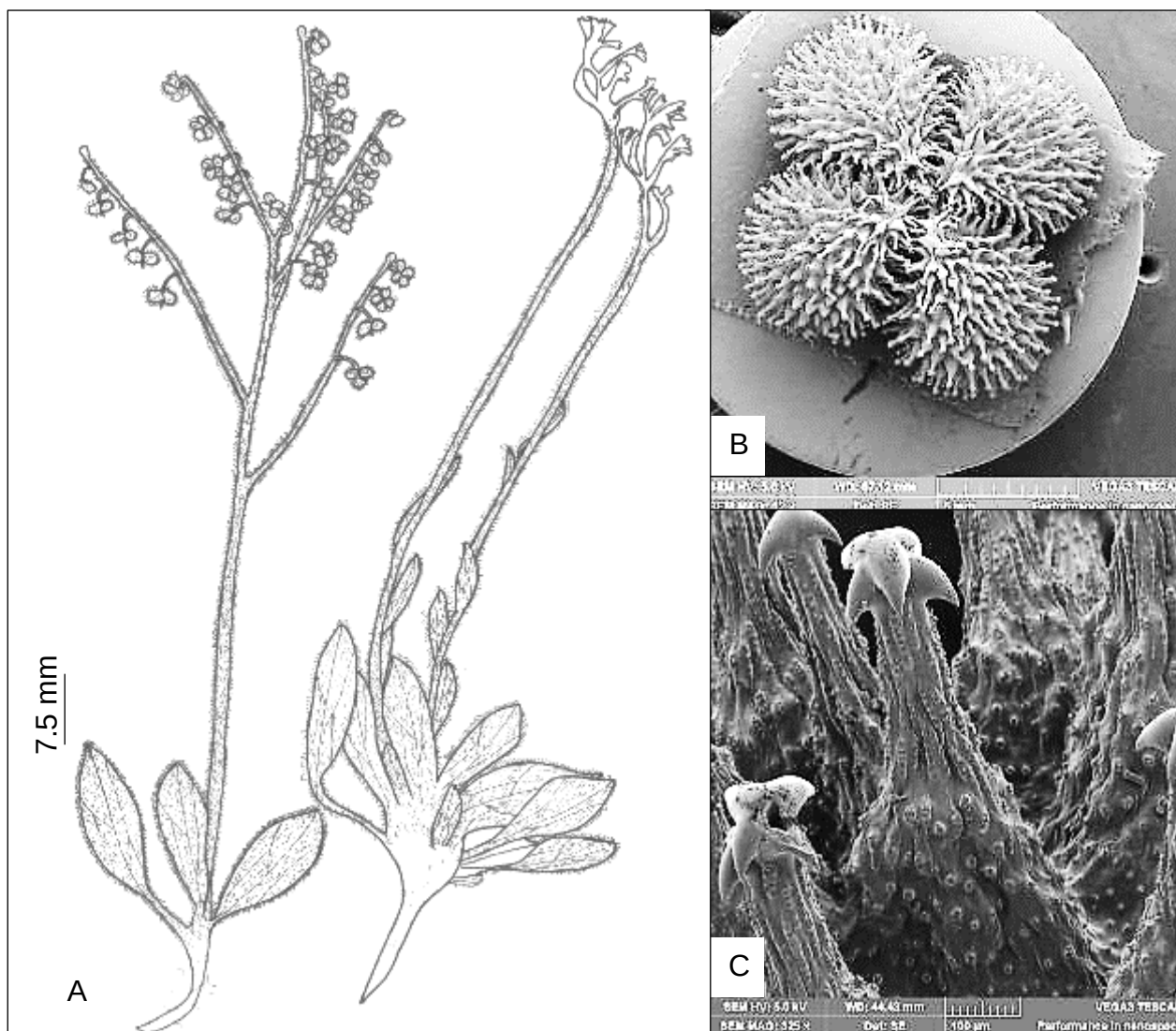
**Type.** South Africa. Eastern Cape, between Omcamwubo and Omcamcaba, no date, *Drège* d (HAL-image! lectotype, here designated; GDC-image! [3 sheets], isolectotype). [Note: The HAL specimen is chosen as a lectotype because the specimen displays the diagnostic characters of the species].

*Echinospermum enerve* E.Mey. ex DC. Prodr. 10:154 (1846), *nom. nud.*

Perennial or biennial herbs, 0.5–0.76 m in height. *Basal leaves* 80–250×15–25 mm, lanceolate-obtuse, densely pubescent, deciduous, margins entire. *Stem leaves* 60–80×5–12 mm, oblong-lanceolate, apex acute, base cuneate, covered with brittle hairs, margins entire. *Trichomes* bulbous based on the upper surface of the leaf, sometimes simple on the lower surface. *Inflorescence* terminal axillary cyme, branches spreading dichotomously; pedicel up to 20 mm long, lengthens considerably in fruit. *Calyx* ca. 5–10 mm long, lobes obtuse, outer surface packed with bulbous-based trichomes, apex acute. *Corolla* magenta; lobes ca. 5 mm in diameter, cruciform. *Nutlets* convex, 5–6×3–5 mm, highly pubescent; glochidia short and thick at the base, tips multiangular (Figure 11).

**Diagnostic characters.** The species can be confused with *C. lanceolatum* with which it shares a similar branching pattern of the inflorescences and upright brittle hairs covering the whole plant. However, the two differ in the colour of the corolla (magenta-purplish vs. white with blue throat in *C. lanceolatum*) and pedicel length (2 cm long opposed to less than 2 cm long in *C. lanceolatum*).

**Distribution and habitat.** This species is widely distributed across all provinces of South Africa. It can also be found in eSwatini and Lesotho (Figure 12). It mostly occurs in open grasslands, grassy slopes, woodland marshes, and disturbed areas like abandoned lands.



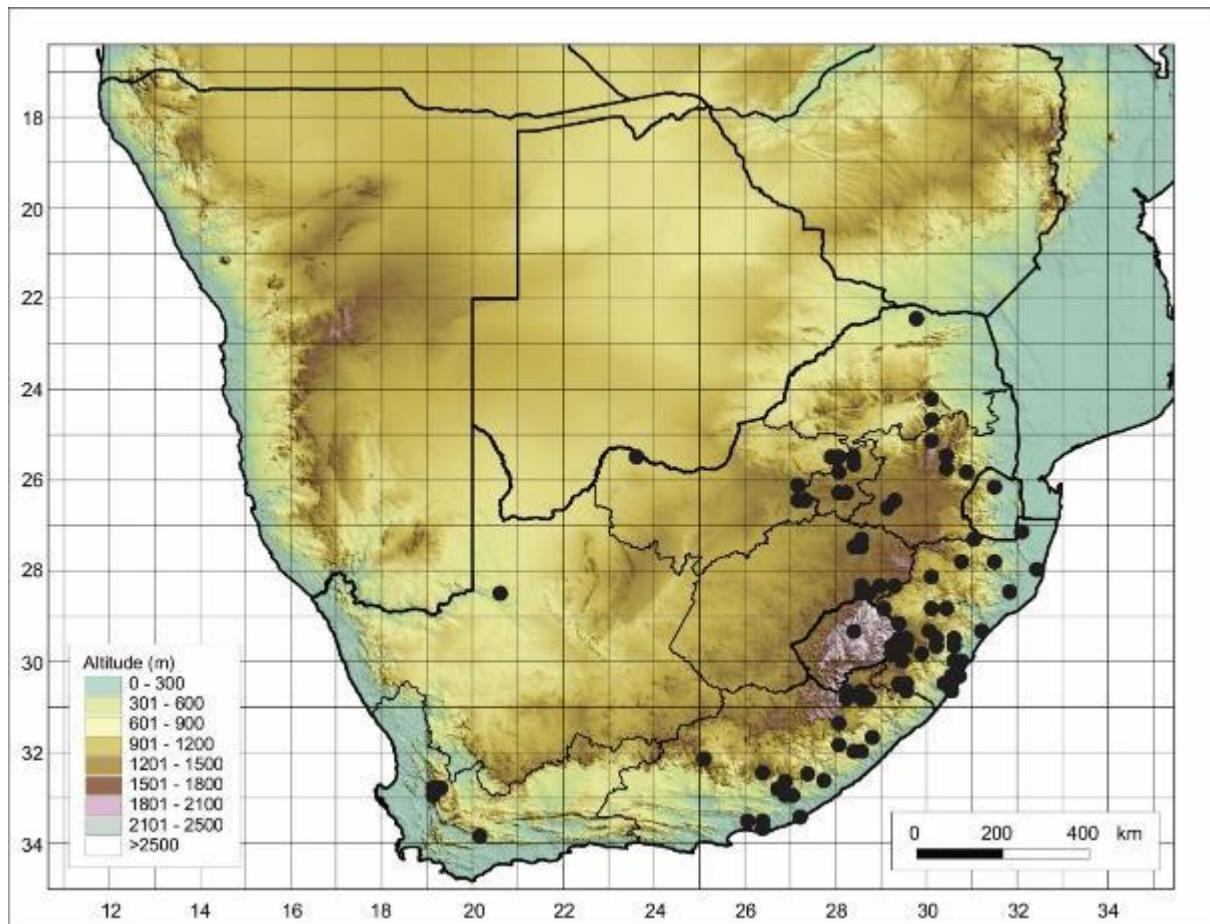


**Figure 11:** Vegetative and reproductive morphological features of *Cynoglossum hispidum*. (A) Line drawing of obtuse shaped, rosette base leaves, terminal branched fruits, terminal flowers. (B) Densely packed with glochidia nutlets. (C) Glochidia wide at the base, with multiangular tip. Voucher specimen: S.P. Bester 12958 (PRE). Drawing scale bar: 7.5 mm. SEM scale bar: 5 mm; C= 100 µm.

**Additional specimens examined.** South Africa. LIMPOPO: **2229 (Waterpoort):** Evelyn valley (-BD), Feb 1944, *RUC Biology Expedition 417* (GRA). **2430 (Tzaneen):** Lekgalameetse Nature Reserve (-AA), 4 Dec 1985, *M. Stalmans 790* (PRE); Sekhukhune District, Leolo Mountains (-CA), 14 Mar 2007, *B. Sachse 471* (PRE). NORTH-WEST: **2523 (Pomfret):** Forbes (-DA), 29 Oct 1959, *B. Dlamini s.n.* (NH). **2627 (Potchefstroom):** Goedgedacht (-AA), 1 May 1932, *J.D. Sutton 676* (PRE); Losberg, Elandsfontein (-BC), 11 Dec 1934, *J.J. Theron 725* (NH); Potchefstroom (-CA), 23 Nov 1946, *W.J. Louw 1525* (PRE). GAUTENG: **2528 (Pretoria):** Brooklyn (-CA), 16 Sep 1928, *A.O.D. Mogg 15247* (PRE); 6 Apr 2019, *A.N. Moteetee and L.K. Madika AL014* (JRAU); 1931, *A.O.D. Mogg 16601* (PRE); 30 Sep 1943, *A.O.D. Mogg 17001* (PRE); Doornpoort/ Hartbeesfontein (-CB), 24 Jan 2004, *S.P. Bester 4656* (PRE); Irene District (-CC), Oct 1929, *A.A. Obermeyer 27651* (PRE). **2628 (Johannesburg):** Vereeniging District (-AC), 23 Nov 2007, *S.P. Bester 8268* (PRE); Suikkerbosrand Nature Reserve (-AD), 7 Apr 1970, *A. Lambrechts 265* (PRE). MPUMALANGA: **2530 (Mashishing):** Boschhoek (-AA), 16 Nov 1933, *R.S.N. Young A375* (PRE); Verlorenkloof Reserve, Welgedacht (-AD), 28 Nov 2008, *S.P. Bester 8679A* (PRE); Machadodorp, Farm Grootvlei (-CB), 21 Oct 1988, *P. Burgoyne 457* (PRE); Songimvelo Game Reserve (-DD), 10 Dec 1992, *M. Jordaan 2490* (PRE). **2629 (Bethal):** Bethal (-AD), 14 Dec 2010, *R. Leendertz 9386* (PRE). **2630 (Carolina):** Ermelo District, Spitskop (-CA), Dec 1915, *R. Potts 5007* (PRE). NORTHERN CAPE: **2820 (Kakamas):** Krantzkop (-DA), Nov 1911, *J. Thode 4768* (NBG). FREE STATE. **2728 (Frankfort):** Farm Reitfontein (-BC), 28 Jan 1983, *E. Retief 1071* (PRE). **2828 (Bethlehem):** Qwaqwa National Park (-BC), 22 Nov 1994, *P.C. Zietsman 2558* (NH); Golden Gate National Park (-DA), 12 Dec 1988, *Gertenbach and Groenewald 8929* (PRE); Witsieshoek (-DB), 10 Mar 2015, *S. Parbhoo 81* (NH). **2829 (Harrismth):** Harrismith (-AC), 17 Mar 1981, *M.L. Jacobsz 3092* (PRE); 18 Nov 1978, *M.L. Jacobsz 1299* (PRE); Rensburgskop (-AD), 10 Dec 1962, *M.L. Jacobsz 199* (NBG; PRE). KWAZULU-NATAL: **2730 (Vryheid):** Oshoek District, Wakkerstroom (-AD), 19 Nov 1962, *N.J. Devenish 954* (PRE); Klipspruit Dam (-DD), 10 Feb 2005, *S.P. Bester 6540* (NH, PRE). **2731 (Louwsburg):** Zululand District municipality (-CD), 29 Oct 2000, *T. Edwards and C. Potgieter s.n.* (NU); 26 Jan 2012, *A.M. Ngwenya and D.G.A. Styles 4085* (NH). **2732 (Ubombo):** Ingwavuma (-AA), 22 Nov 1969, *E.J. Moll 4680* (NH, PRE). **2829 (Harrismith):** Cathedral Peak (-CC), 10 Nov 1956, *D.J.B. Killick 1115* (PRE); 13 Oct 1984, *J. Scott 251* (NH). **2830 (Dundee):** Dundee District (-AA), 26 Nov 1964, *N.E. Shirley s.n.* (NU); Klipriver District, Elandslaagte (-CD), 23 Oct 1964, *N.E. Shirley s.n.* (NU). **2831 (Nkandla):** Empangeni (-DB), 9 Jul 1965, *H.J.T. Venter 1917* (PRE). **2929 (Underberg):** Giants Castle Game Reserve (-AB), 8 Feb 1966, *W.R. Trauseld 575* (PRE); (-AD), 8 Nov 2001, *T.R. Green 1217* (NU); Mpendhle District (-BC), 5 Jan 1983, *O.M. Hilliard and B.L. Burt 16218* (PRE); Underberg District (-CB), 3 Feb 1975, *O.M. Hilliard and B.L. Burt 7942* (NU); 3 Feb 1976, *O.M. Hilliard and B.L. Burt 8905* (NU); 24 Mar 1977, *O.M. Hilliard and B.L. Burt 9818* (NU); 11 Jan 1978, *M.A. Rennie 911* (NU); 27 Jan 1982, *M.A. Rennie 1307* (NU); 13 Feb 1983, *O.M. Hilliard and B.L. Burt 17234* (NU); 6 Jan 1984, *O.M. Hilliard and B.L. Burt 17290*

(PRE); Underberg District (-CC), 19 Jan 1984, *O.M. Hilliard* and *B.L. Burt* 17346 (NU); 9 Jan 1986, *O.M. Hilliard* and *B.L. Burt* 18998 (NU); Hlogoma Mountain (-DC), 30 Nov 2015, *S.M. Berruti* 513 (NH); Donnybrook (-DD), 7 Nov 2013, *D.G.A. Styles* 4579 (NH); 8 Mar 2019, *A.N. Moteete* and *L.K. Madika* AL011 (JRAU). **2930 (Pietermaritzburg):** Lidgetton (-AC), 23 Mar 1920, *A.O.D. Mogg* 6894 (PRE); 29 Sep 1964, *E.J. Moll* 1036 (NU, PRE); 13 Jan 1988, *B. Grove* 98 (NU); Umgeni River (-CA), 20 Oct 1984, *J. Manning* 538 (NU); 8 Mar 2019, *A.N. Moteete* and *L.K. Madika* AL013 (JRAU); Ukulinga farm (-CB), 8 Mar 1982, *J.C. Manning* 212 (NU); Nagle Dam (-DA), 15 Sep 1957, *M.J. Wells* 1676 (NU); Cliffdale road (-DC), 17 Aug 2002, *D.G.A. Styles* 9141 (NU); 30 Jul 2003, *P. Wragg* 205 (NU); 7 Nov 2014, *D.G.A. Styles* 4925 (NH). **2931 (Stanger):** Groutville (-AD), 14 Oct 1965, *E.J. Moll* 2500 (NU, PRE). **3029 (Kokstad):** Insizwa (-CA), 24 Feb 1972, *R.G. Strey* 10827 (NU); Kokstad District (-DA), 1968, *C.J. Piek* 53 (NH); 25 Feb 1978, *T.A. Coleman* 985 (NH); no date, *F.M. Getliffe* and *T. Edwards* 1266 (NU). **3030 (Port Shepstone):** M. Stainbank's farm, mid Illovo (-BB), 24 Sep 2009, *A. Young* 1155 (NU); Umzinto District (-BC), 3 Sep 1983, *K. Balkwill* and *J.C. Manning* 828 (NU); 20 Oct 1997, *A.M. Ngwenya* 1538 (NH); Port Shepstone (-CB), 3 Oct 1937, *A.O.D. Mogg* 13873 (PRE); (-CD), 20 Sep 1955, *S. McNeil* 142 (NU). **3030 (Umzinto):** Vernon Crookes Nature Reserve (-BC), 3 Sep 1983, *K. Balkwill* and *J.C. Manning* 808 (NU); 29 Sep 1984, *C.F. Kennedy* 32 (NU). WESTERN CAPE: **3219 (Cape Town):** Riviergrond in pypsteelbosse (-CC), 18 Dec 1980, *W.J. Hanekom* 2600 (PRE); Kouebokkeveld Berge, (-CC), 24 Nov 1998, *W.J. Hanekom* 3120 (NBG). **3322 (Oudtshoorn):** Outeniqua Mountains (-CC), 9 Nov 1986, *J.H.J. Vlok* 1693 (PRE). EASTERN CAPE: **3027 (Barkly East):** Farm Faskally near England (-DA), 9 Nov 1995, *J.E. Victor* 1586 (PRE); Ben McDui (-DC), 6 Jan 1997, *T. Dold* and *M. Cocks* 3495 (GRA). **3028 (Umtata):** Maclear District (-CA), 16 Jan 2016, *S.P. Bester* 13207 (PRE); Maclear (-CC), 7 Nov 1993, *S.P. Bester* 1535 (NH); Kloof (-DD), 28 Feb 1946, *R. Story* 950 (PRE). **3128 (Umtata):** Hill above Mhlanfane Forest Station (-BC), 31 Jan 1983, *O.M. Hilliard* and *B.L. Burt* 16341 (NU); Lady Frere, Engcobo (-CC), 25 Nov 1990, *E. Cloete* 590 (NH); (-DB), 21 Oct 1953, *G.C. Theron* 1604 (PRE); Elliotdale District (-DC), 11 Jul 1966, *J.L. Gordon-Gray* 529 (NH). **3129 (Umtata):** Baziya, Tembuland (-CC), no date, *Baur* 257 (K-image); Blesbok flats Cathcart Div. Cape, 1838, *Drége* s.n. (K-image); between St John's River and Umtsikaba River, Pondoland, 1838, *Drége* s.n. (K-image!). **3225 (Elandsfontein):** Elandsfontein (-AA), 13 Dec 2005, *S.P. Bester* 6347 (GRA, PRE). **3226 (Fort Beaufort):** Along gravel road to Sada off the R67 (-BD), 8 Feb 1995, *J.E. Victor* and *D.B. Haare* 392 (PRE); Mpofu Game Reserve (-DA), 28 Feb 2006, *C.L. Bredenkamp* 3338 (PRE); Menzieberg, Amatole Mountains (-DB), 6 Jan 1986, *P.B. Phillipson* 1185 (GRA), Fort Beaufort road, 2 miles (3.22 km) from Alice (-DD), 22 Oct 1939, *M.H. Giffen* 264 (PRE). **3227 (Stutterheim):** Stutterheim (-AD), 5 Dec 1942, *J.P.H. Acocks* 9399 (PRE); Pirie Mission (-CC), exact date not provided 1888, *T.R. Sim* 20419 (NU, PRE); 5 Aug 2014, *S. Mgcwua* 117 (GRA); King William's Town (-DB), Nov 1891, *H.G. Flanagan* 1193 (PRE). **3326 (Grahamstown):** Faraway (-AD), 4 Dec 1980, *A. Jacot Guillarmod* 8473 (GRA); Nov 1942, *E. Archibald* 669 (GRA); Alexandria (-CB), 10 Aug 1953, *S. Johnson* 691 (GRA); 11 Feb 1953, *W. Marais* 185 (PRE). **3327 (Peddie):** Peddie District (-AC), 5 Nov 1993, *T. Dold* and *A. Boo* 481 (GRA). eSwatini. **2631 (Mbabane):** Forbes reef (-AA), 29 Oct 1959, *B. Dlamini* s.n. (NBG). Lesotho. **2928 (Marakabei):** Ntiboho valley (-AC), 2 Jan 1947, *A. Jacot Guillarmod* 279 (GRA). **2929 (Underberg):** Thaba Ntšo, Sehlabathebe National Park (-CC), 4-14 Jan 1973, *Jacot Guillarmod*, *Getliffe* and *Mzamane* 65 (PRE); 13 Feb 1976, *A. Beverly* 471 (PRE).





**Figure 12:** Known distribution of *Cynoglossum hispidum* in southern Africa.

Unknown localities: Feb 1895, *Maurice and Evans* 474 (NH); Feb 1939, *J. Wylie* 30120 (NH); Apr 1943, *B. Fischer* 464 (NU); 15 Dec 1943, *W.F. Barker* 2796 (NBG); 18 Nov 1952, *H.B. Gilliland* 26862 (PRE); 18 Dec 1966, *R.G. Strey* 7047 (NH); Mar 2000, *T. Edwards* 2088 (NU).

## **6 *Cynoglossum lanceolatum* Forssk in Fl. Aegypt. Arab: 41 (1775).**

**Type.** Yemen, Al Hadiyah, Mar 1763, *P. Forsskal* 312 (C-image! holotype).

*Cynoglossum hirsutum* Thunb., Prodr. Pl. Cap.: 34 (1794).

Type: South Africa. Precise locality unknown: Roggerveld, *C.P. Thunberg* 168, sub THUNB-UPS 3995 (UPS-microfiche! holotype).

*Cynoglossum micranthum* Desf.: 220 (1804), *nom. nud.*

*Cynoglossum canescens* Willdenow in Enum. Pl.: 180 (1809).

Type: Precise locality unknown, *C.L. Willdenow*, s.n. (B-W-image, lectotype, designated by König et al. 2015).

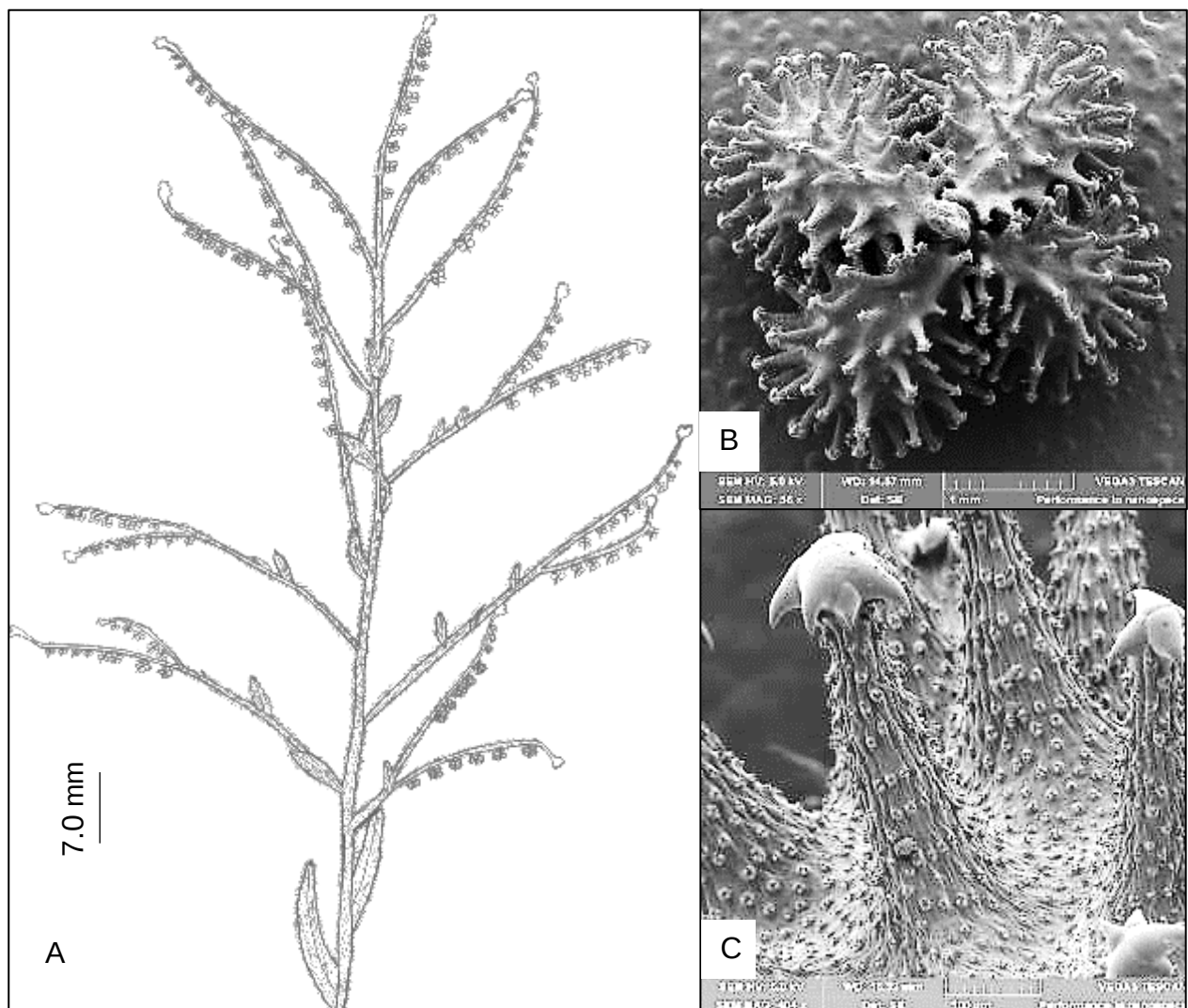
*Cynoglossum racemosum* Roxb. in Fl. Ind.: 2:6 (1824), *nom. illeg.*

*Paracynoglossum lanceolatum* (Forssk.) R.R.Mill. in Notes Roy. Bot. Gard. Edinb.: 474 (1984). Type: same as above.

Annual or biennial herbs, 0.5–0.9 m in height, covered with simple hairs. *Basal leaves* 85–180×15–23 mm, lanceolate-obtuse, blade elliptic, softly hairy, deciduous. *Stem leaves* 40–65×8–18 mm, lanceolate, apex acute, base cuneate, covered with moderately stiff hairs. *Trichomes* brittle, simple on both leaf surfaces. *Inflorescence* dichotomously branched axillary cyme, pedicel 1–1.5 mm long. *Calyx* ca. 1–1.5 mm long, lobe ovate-obtuse, pubescent on the outer surface, inner surface glabrous, apex acute. *Corolla* white with pale blue throat; lobes ca. 1×1 mm, campanulate. *Nutlets* ovoid-convex, 3–4×2.5–3.5 mm, fully pubescent; glochidia equally thick and long (Figure 13).

**Diagnostic characters.** Amongst the southern African species, *C. lanceolatum* is similar and possibly related to *C. coeruleum* var. *mannii* with which it shares the branching pattern of the inflorescence, flower colour, and nutlet size. The two species can be distinguished by the density of the glochidia on the nutlets and distribution. *Cynoglossum lanceolatum* nutlets are completely covered with glochidia, whereas in *C. coeruleum* var. *mannii* glochidia tend to be more marginal and acentric.

**Distribution and habitat.** *Cynoglossum lanceolatum* originates from Yemen (König et al. 2015) but reported from Africa (Ge-Ling et al. 1995), Pakistan, India (Joshi 2016), the Mediterranean, and throughout Asia (Verdcourt 1991) and Madagascar (König et





**Figure 13:** Morphological characters of *Cynoglossum lanceolatum*. (A) Line drawing of the fruiting branch. (B) Glochidia evenly distributed on the nutlet. (C) Glochidia uniform size, with multiangular tip. Voucher specimen: S.P. Bester 4653 (PRE). Drawing scale bar: 7.0 mm. SEM scale bar: B= 1 mm; C= 100 µm.

al. 2015). In South Africa it occurs widely in all provinces, it also occurs in eSwatini and Lesotho (Figure 14). It is a widespread species that grows in disturbed habitats throughout parts of Africa.

**Additional specimens examined.** South Africa. LIMPOPO: **2229 (Waterpoort):** Wylies Poort (-DD), 17 Oct 1938, J.P.M. Acocks 1295 (PRE). **2230 (Messina):** Sibasa District (-CD), 21 Jun 1977, G. Hemm 163 (PRE). **2329 (Polokwane):** Polokwane Nature Reserve (-CD), 12 Jan 1979, Bredenkamp and Van Vuuren 307 (PRE). **2330 (Tzaneen):** Letaba (-CA), 2 Apr 1958, J.C. Scheepers 219 (PRE); Woodbush Forest Reserve (-CC), Jan 1923, H. Wafen 22973 (PRE); 1 Feb 2019, A.N. Moteetee and L.K. Madika AL07 (JRAU). **2428 (Modimolle):** Waterberg, Kwaggasnek-Alma Road (-CC), 13 Feb 1981, K.L. Immelman 118a (PRE). **2429 (Zebediela):** Zebediela (-AA), 5 Feb 1967, B.J. Huntley 1033 (PRE); **2430 (Pilgrim's Rest):** Sekhukhune District Municipality, Leolo Mountain, SE of Tama Kgoshi (-CA), 14 Mar 2007, B. Sachse 466 (PRE). NORTH-WEST: **2526 (Zeerust):** Zeerust along road to Koster (-CA), 4 Feb 1976, F. van der Meulen 597 (PRE). **2527 (Rustenburg):** Rustenburg (-CA), 27 Dec 1949, S.M. Johnson 854 (NBG). **2626 (Lichtenburg):** Municipal Caravan Park (-AA), 19 Mar 1978, A. Balsinhas and Harding 3303 (PRE). **2627 (Potchefstroom):** Carletonville, A. Bailey Nature Reserve (-AD), Apr 1983, S. van Wyk 180 (PRE); Mooiriver (-CA), 9 Mar 1984, B. Ubbink 1257 (PRE). **2724 (Taung):** West of Harz River near Taung, 120 km north of Kimberley (-DB), 11 Feb 1948, R.J. Robin 3628 (PRE). GAUTENG: **2528 (Pretoria):** Brooklyn (-CA), 20 May 1915, C.A. Smith 191 (PRE); 24 May 1915, C.A. Smith 194A (PRE); 10 Dec 1915, A.O.D. Mogg 11846 (PRE); Nov 1925, C.A. Smith 1220 (PRE); Doornpoort, Airport Road (-CA), 26 Oct 2009, S.P. Bester 9734 (PRE); 14 Nov 2018, A.N. Moteetee and L.K. Madika AL01 (JRAU); Doornpoort/ Hartbeesfontein (-CB), 24 Jan 2004, S.P. Bester 4653 (PRE); Brooklyn (-CC), 11 Apr 1920, K.A. Landsdell 864 (PRE). **2628 (Johannesburg):** Randburg, Lanseria (-AA), 20 Nov 2018, A.N. Moteetee and L.K. Madika AL02 (JRAU); Suikkersbosrand (-CB), 27 Dec 1971, G.J. Bredenkamp 594 (PRE). MPUMALANGA: **2429 (Zebediela):** Mashishing District (-DD), 8 January 1939, Barnard and Mogg 860 (PRE). **2430 (Pilgrim's Rest):** Malta near Marinella (-AA), 16 Aug 1984, M. Stalmans 114 (PRE); Ohrigstad Dam Nature Reserve (-DC), 22 May 1973, N. Jacobsen 2861 (PRE). **2529 (Emalahleni):** Loskop Dam (-AD), 12 Jan 1967, G.K. Theron 1129 (PRE). **2530 (Mashishing):** Witklip (-BD), 4 Dec 1973, J.P. Kluge 359 (PRE); Lowveld Botanical Gardens (-BD), 18 Dec 1974, E.J. Van Jaarsveld 199 (NBG); Waterval Onder, Ntsinini (-CD), 26 Dec 2008, K.W. Grieve 250 (PRE); 23 Jan 2011, K.W. Grieve 342 (PRE); Barberton (-DD), 24 Jan 2000, J.J. Meyer 2603 (PRE). **2531 (Beersrust):** White River District (-AC), Apr 1983, W. Jacobsen 5363 (PRE). **2630 (Carolina):** Chrissiesmeer (-AC), 5 Jan 1972, G.K. Theron 2402 (PRE); Chrissiesmeer, on road to Lochiel (-BA), 6 Mar 1986, M. Crosby 273 (PRE). **2730 (Vryheid):** Farm Doornhoek along Assegai river (-AA), 15 Dec 2006, S.J. Siebert 3246 (PRE). FREE STATE: **2729 (Volksrust):** Vrede (-CB), 5 Feb 1987, L. Smook 6455 (PRE). **2828 (Bethlehem):** Golden Gate National Park (-DA), Jan 1963, L.C.C. Liebenberg 6831 (PRE); Witsieshoek (-DB), Mar 1917, H.A. Janod 17317 (PRE). **2829 (Harrismith):**

Harrismith District (-AC), 8 Mar 1974, *M.L. Jacobsz* 2036 (PRE). KWAZULU-NATAL: **2729 (Utrecht)**: Volksrust (-BD), Jan 1928, *C.A. Smith* 5730 (PRE). **2730 (Vryheid)**: Oshoek District, Wakkerstroom (-AB), 26 Dec 2002, *S.J. Siebert* and *F. Siebert* 2279 (PRE); Vryheid Nature Reserve (-DC), 23 Feb 1988, *C.J. Youthed* 11 (NH); 7 March 2019, *A.N. Moteetee* and *L.K. Madika* AL09 (JRAU). **2731 (Louwsburg)**: Louwsburg District, Itala Nature Reserve (-CB), 15 Jan 1978, *D.J. McDonald* 443 (PRE). **2828 (Bethlehem)**: Crocodile River (-DB), 16 Dec 1893, *R. Schlechter* 3980 (NH); Royal Natal National Park (-DB), 17 Feb 1984, *O.M. Hilliard* and *B.L. Burt* 17662 (NU); Tugela gorge (-DB), 6 Feb 1982, *O.M. Hilliard* and *B.L. Burt* 15454 (PRE); Tugela valley (-DD), 14 Feb 1926, *A.J.W. Bayer* 47 (PRE). **2829 (Harrismith)**: Ladysmith (-DB), 1 Nov 1965, *N.E. Shirley s.n.* (NU). **2831 (Nkandla)**: Nkandla, Ferncliff Nature Reserve (-CA), 14 Feb 1994, *H. Kennedy* 533 (NU); University of KwaZulu-Natal (-DD), 27 May 2003, *S.J. Siebert* 2333 (NH). **2929 (Underberg)**: Loteni Nature Reserve (-AD), 13 Dec 1978, *M.L. Jacobsz* 3937 (PRE); Mpendhle District (-BC), 24 Dec 1978, *O.M. Hilliard* and *B.L. Burt* 11804 (NU, PRE); Polela District (-CB), 6 Apr 1974, *M.A. Rennie* 545 (NU); Waterfall (-DD), Mar 2002, *T. Edwards* 2731 (NU). **2930 (Pietermaritzburg)**: Victoria (-AA), 12 Apr 1955, *S.M. Johnson* 1152 (NH); Tweedie (-AC), 31 Dec 1927, *Forbes* 293 (NH); 28 Feb 1982, *K.L. Immelman* 260 (PRE); Loskop District (-AD), 11 Feb 1946, *B.L. Howlett* 80 (NH); Pietermaritzburg (-CB), 29 Feb 1976, *M. Grice s.n.* (NU); 14 Oct 1987, *Renecken* 6 (GRA); Botanic Garden Estate (-CB), 8 Dec 1991, *D.G. Stielau* 135 (NH, PRE); Cottingham (-CC), 23 Mar 1969, *R.G. Strey* 8420 (NU); Durban Road (-CD), 19 Nov 1950, *J.G. Lawn* 1820 (NH); Umgeni Water Board, (-DA), 20 Oct 1984, *J. Manning* 536 (NU); Inanda (-DB), Dec, *J. Medley-Wood* 370 (NH); 25 Nov 1983, *H.H. Hilger* 35 (PRE); Pinetown District (-DD), 28 Nov 1913, *J.M. Wood* 12373 (NU). **3029 (Kokstad)**: Harding, Victoria East (-CA), 30 Apr 1955, *G.L. Lewis* 4914 (PRE); Harding, Alfred District (-DB), 2 Mar 1983, *O.M. Hilliard* and *B.L. Burt* 16755 (NU). **3030 (Port Shepstone)**: Dumisa (-AD), 9 Dec 1992, *A.M. Ngwenya* 1071 (NH). No locality details, 30 Jan 1948, *B.S. Fischer* 1426 (NU). WESTERN CAPE: **3318 (Cape Town)**: Zondagsfontein (-DC), Dec-Mar 1930-1, *J. Thode* A2838 (NH); 18 Oct 1943, *B.S. Fischer* 498 (NU). EASTERN CAPE: **3128 (Mjika)**: Mahlahlane Forest (-BC), 6 Mar 1985, *A. Hutchings* 1590 (GRA). **3129 (Port St. John's)**: Kloof above Port St. Johns (-DA), 31 Jan 1936, *M.C. Gillett* 1257 (PRE). **3226 (Fort Beaufort)**: Amatole Mountain (-DB), 1 May 1986, *P.B. Phillipson* 1492 (PRE); Fort Beaufort (-DD), 21 Mar 1977, *G.E. Gibbs Russell* 3735 (GRA). **3326 (Grahamstown)**: Grahamstown Nature Reserve (-BC), Feb 1917, *J.C. Jane* 17131 (PRE); 1 Apr 1952, *A.R.H. Martin* 9466 (GRA); Featherstone Kloof (-BC), 18 Jul 2001, *C.J. Kayombo* and *A.A. Merti* 3719 (GRA). **3227 (Stutterheim)**: Stutterheim District (-CB), 28 Jan 1979, *O.M. Hilliard* and *B.L. Burt* 12427 (NU); Kababu Hills (-CA), 5 Feb 1936, *M.C. Gillett* 1325 (PRE); East London (-DB), 11 Dec 2001, *J.J. Meyer* 4067 (PRE).

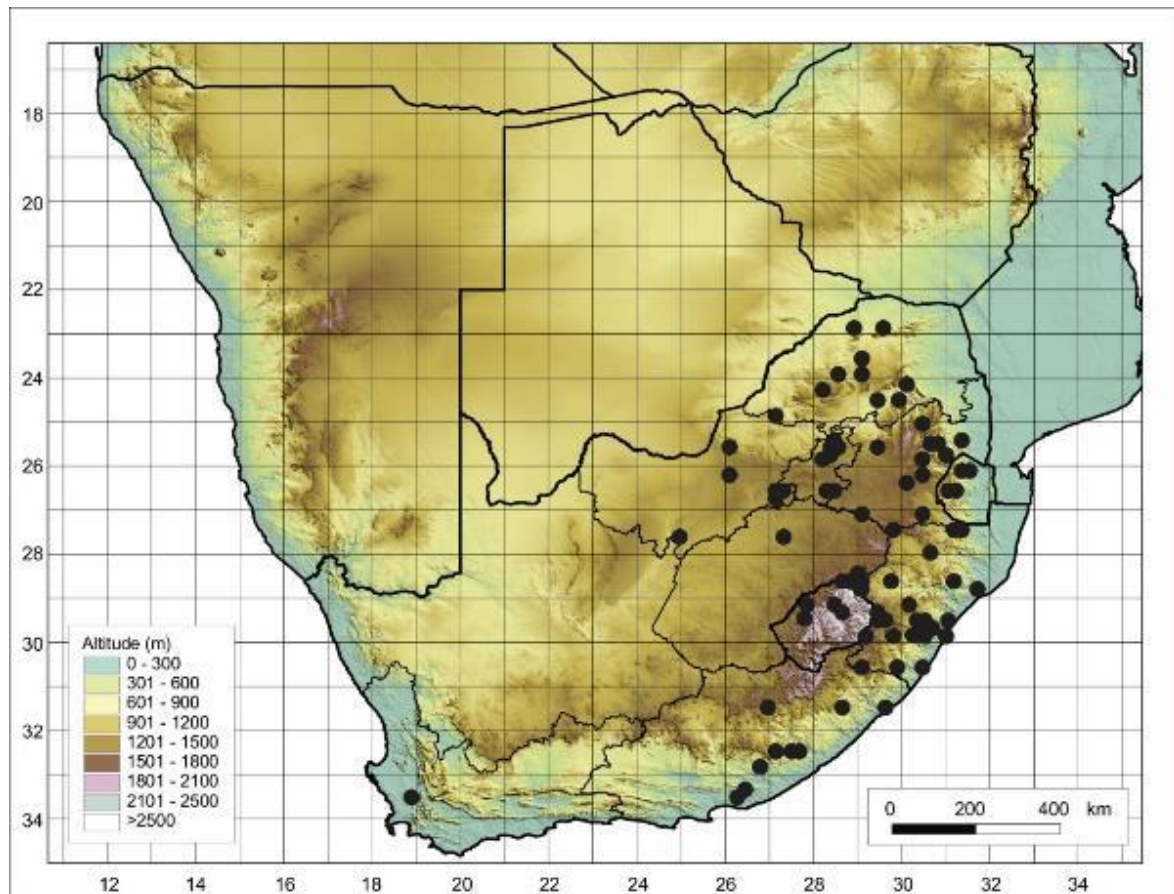
eSwatini. **2631 (Hhoho)**: Hhoho District, Masilela area on Maphalaleni road along Mucucene Hills (-AB), 27 Jan 1994, *G. Germishuizen* 7173, 7174 (PRE); 24 Jan 1994, *S.R. Hobson* 2048 (PRE); Hlambanyathi valley (-AC), 27 Nov 1954, *R.J. Compton* 24864 (NBG); Mbabane (-AC), 14 Jan 1955, *R.J. Compton* 24834 (PRE).

Lesotho. **2927 (Maseru)**: Monethi's, Berea (-BB), 1 Jan 1957, *A. Jacot Guillarmod* 1910 (PRE); Mountain Road (-BD), Mar 1977, *M. Schmitz* 7317 (PRE). **2928 (Marakabei)**: Loskop (-AB), 11 Apr 1980, *B.N. Ubbink* 974 (NH); Molika-lika (-AC), 7 Jan 1954, *A. Jacot Guillarmod* 1674 (PRE). **2929 (Underberg)**: Thaba Ntšo,



Sehlabathebe National Park (-CC), 4-14 Jan 1973, *Jacot Guillarmod, Getliffe, and Mzamane 142* (PRE).

**Taxonomic notes.** The specimen in the National Herbarium Pretoria (PRE) collected in the Doornpoort area in Gauteng Province (Voucher number: *S.P. Bester 9734* (PRE)) belongs to *C. lanceolatum* and not to *C. amabile* since it has characters which are typical of this species, i.e., white corolla with a blue throat instead of bluish-purple corolla and divaricately branched instead of clustered at the apex.



**Figure 14:** Known distribution of *Cynoglossum lanceolatum* in southern Africa.

**7. *Cynoglossum obtusicalyx* Retief & A.E. van Wyk in S. Afr. J. Bot. 62(3): 169-172 (1996).**

**Type.** South Africa. Western Cape, Worcester (3319): 20 km E. of Ceres (-AD), 21 Oct 1958, *Acocks 19893* (PRE-image! holotype; NBG, isotype).

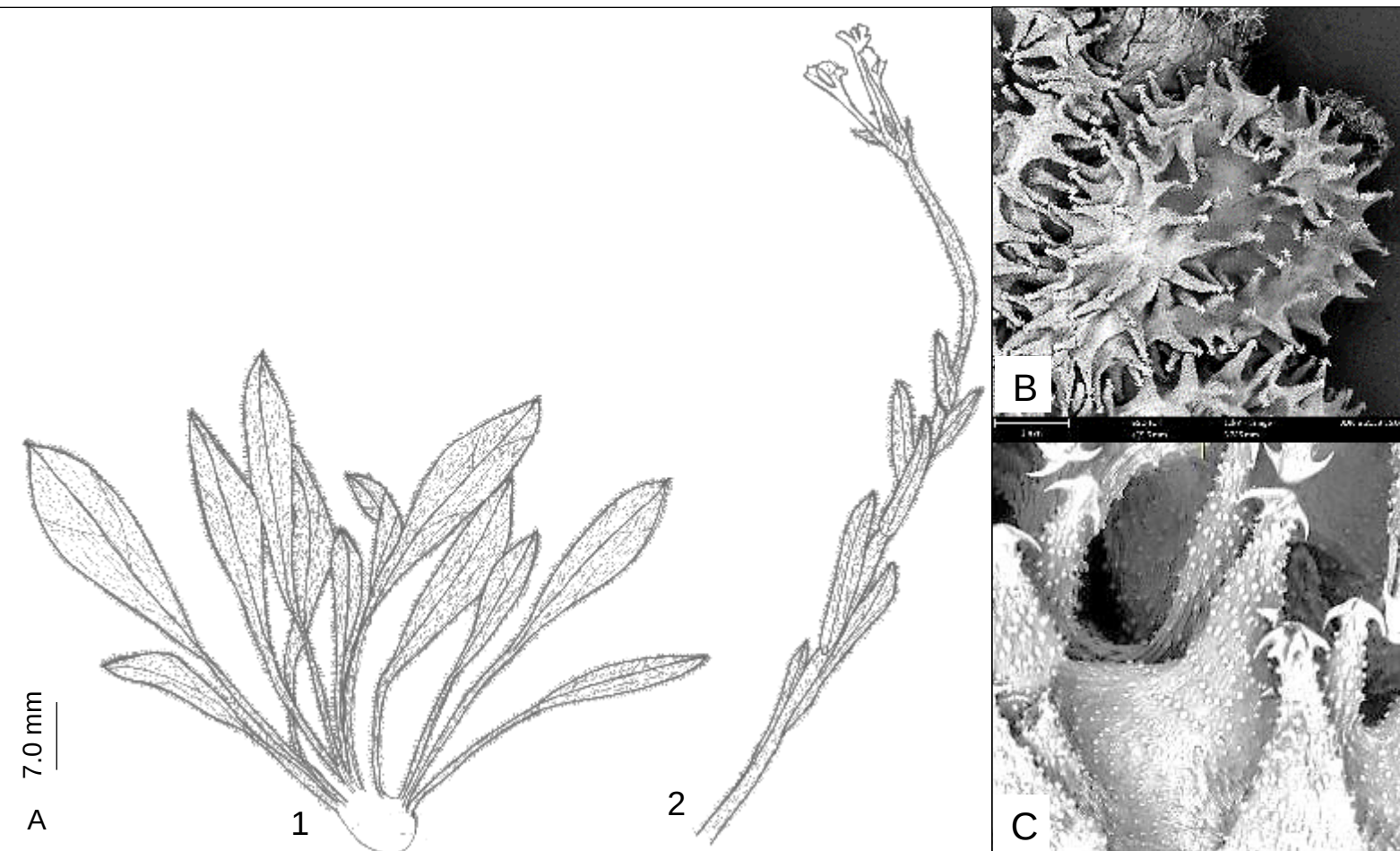
Perennial or biennial herbs, ca. 0.45 m in height. *Basal leaves* 175–250×5–18 mm, obtuse, densely pubescent, persistent, margins entire. *Stem leaves* 50–65×5–10 mm, obtuse-lanceolate, apex acute, base cuneate, soft hairs. *Trichomes* woolly, soft, non-bulbous based, unicellular, long, thin. *Inflorescence* dichotomously branched terminal cymes, pedicel 5–10 mm long, lengthens considerably in fruit. *Calyx* ca.1.0–1.6 mm

long, lobe oblong, densely pubescent, apices broadly obtuse-truncate shaped. *Corolla* pale blue; lobes 5×7 mm diameter, ovate. *Nutlets* ovoid-convex, densely echinulate with glochidia (Figure 15).

**Diagnostic characters.** The stems and leaves of *Cynoglossum obtusicalyx* are densely covered with soft, woolly trichomes which makes it similar to *Cynoglossum alticola*. However, the two species differ in flower colour and size (deep blue corolla, 4×3 mm vs pale blue corolla, 5×7 mm in *C. obtusicalyx*). *Cynoglossum obtusicalyx* has pale blue flowers with corolla 5–7 mm long whereas *C. austroafricanum* has bright blue flowers with corolla 2.75–4.25 mm long. The two species also show variation in trichome texture and density, i.e., sparsely hairy with short, stiff hairs on both the stem and leaves in *C. austroafricanum* vs densely arranged long, woolly hair on both the stem and leaves in *C. obtusicalyx*.

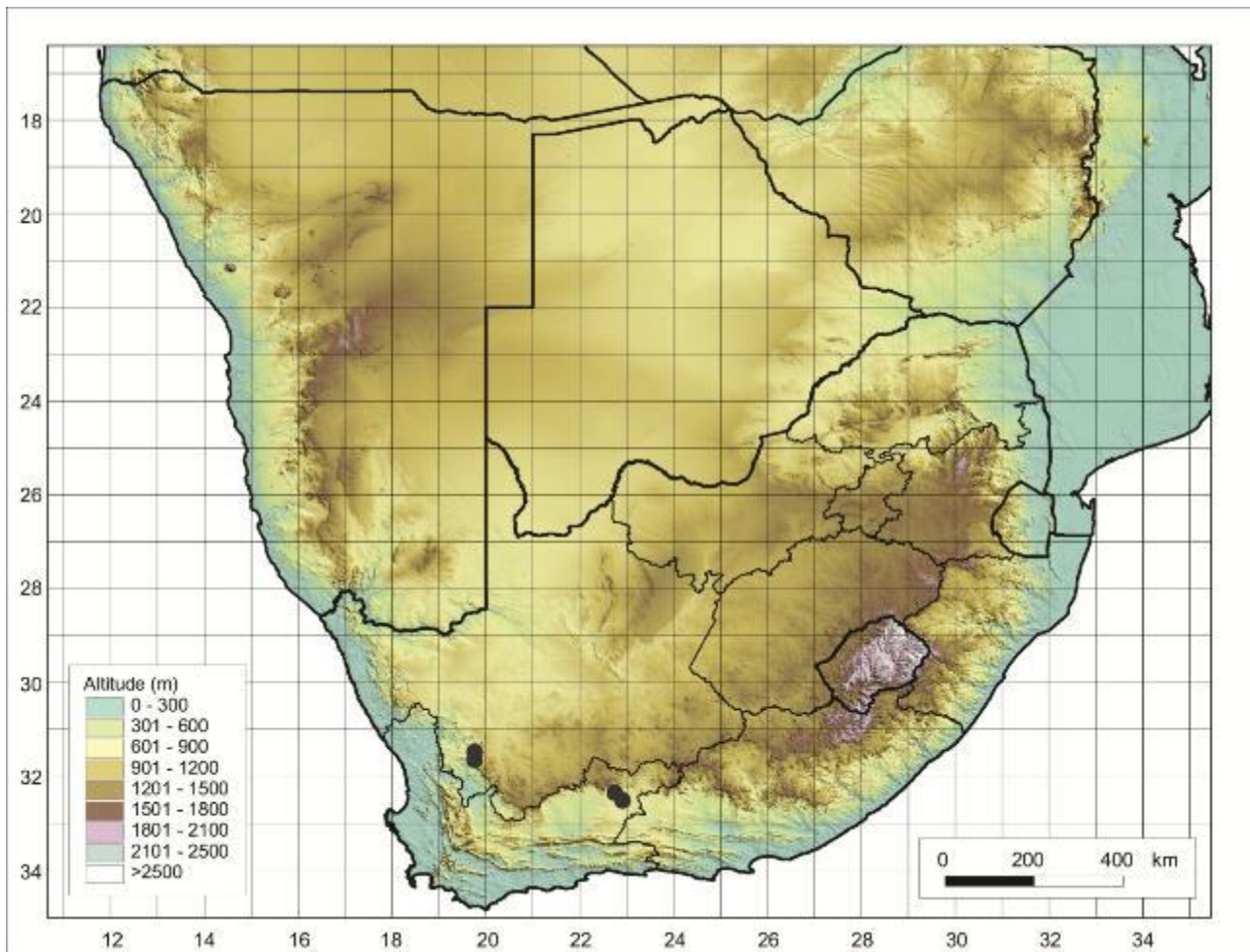
**Distribution and habitat.** *Cynoglossum obtusicalyx* is endemic to South Africa where it has been recorded from Calvinia, Worcester, and Beaufort West in the Northern and Western Cape Provinces (Figure 16), it occurs in mountainous areas, often growing on screes below cliffs.

**Additional specimens examined.** South Africa. NORTHERN CAPE: **3119 (Calvinia)**: Calvinia District (-BD), 22 Sep 1955, *J.P.H. Acocks* 8509 (PRE); 22 Sep 1955, *D.A Leistner* 394 (PRE; NBG). WESTERN CAPE: **3222 (Beaufort West)**: Mountain View farm (-BD), 17 Apr 1978, *G. Russell* and *R. Hermann* 4272 (PRE).





**Figure 15:** Vegetative and reproductive morphological features of *C. obtusicalyx*. (A) 1. base leaves, 2. stem with alternate stem leaves and terminal flowers. (B) SEM micrograph of a nutlet. (C) SEM micrograph of glochidia around the nutlet. Voucher: J.P.H. Acocks 8509 (PRE). Drawing scale bar: 7.0 mm. SEM images scale bar: B= 1 mm; C= 200 µm.



**Figure 16:** Known distribution map of *C. obtusicalyx* in southern Africa.

**8. *Cynoglossum spelaeum*** Hilliard & B.L.Burt in Notes Roy. Bot. Gard., Edinburgh 37(2): 287 (1979).

**Type.** South Africa. KwaZulu-Natal, Underberg (**2929**): Underberg District, Cobham Forest Station, Polela valley (-CD), 20 Mar 1977, O.M. Hilliard and B.L. Burt 9728 (E, holotype image! K-image!, NU-image! PRE-image! [2 sheets] isotype).

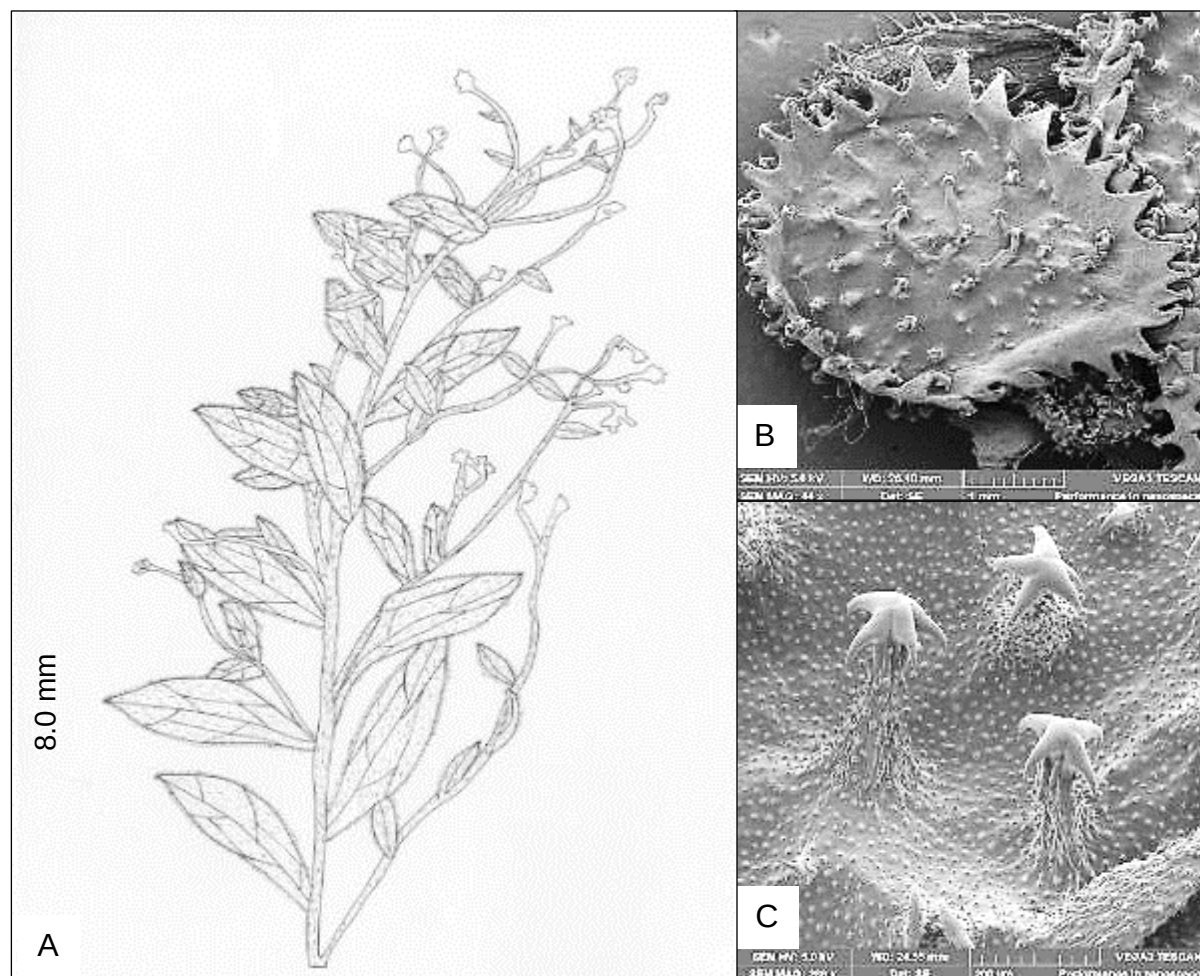
*Cynoglossum basuticum* Weim.ex Guillarmod, Fl. Lesotho 233 (1973), *nom. nud.*



Perennial herbs, ca. 40–50 cm in height. *Basal leaves* 13.0–23.5×2.5–3.5 cm, spatulate-obtuse, soft hairs, deciduous, margins entire. *Stem leaves* 4–8×1.0–2.5 cm, obtuse shaped, dark green adaxial surface, grey green abaxial surface, smooth margins, soft hairs, sparsely packed. *Trichomes* unicellular, simple on both leaf surfaces, soft. *Inflorescence* corymbose panicle; threadlike pedicel 5 mm long. *Calyx* ca. 1.5–2.0 mm long, lobes lanceolate-oblong, softly hairy on the outer surface, inner surface smooth, apex acute. *Corolla* white; lobes ca. 3×3 mm diameter, obtuse. *Nutlets* ovoid, ca. 4×5 mm; glochidia more marginal and acentric, marginal glochidia are longer compared to the acentric glochidia (Figure 17).

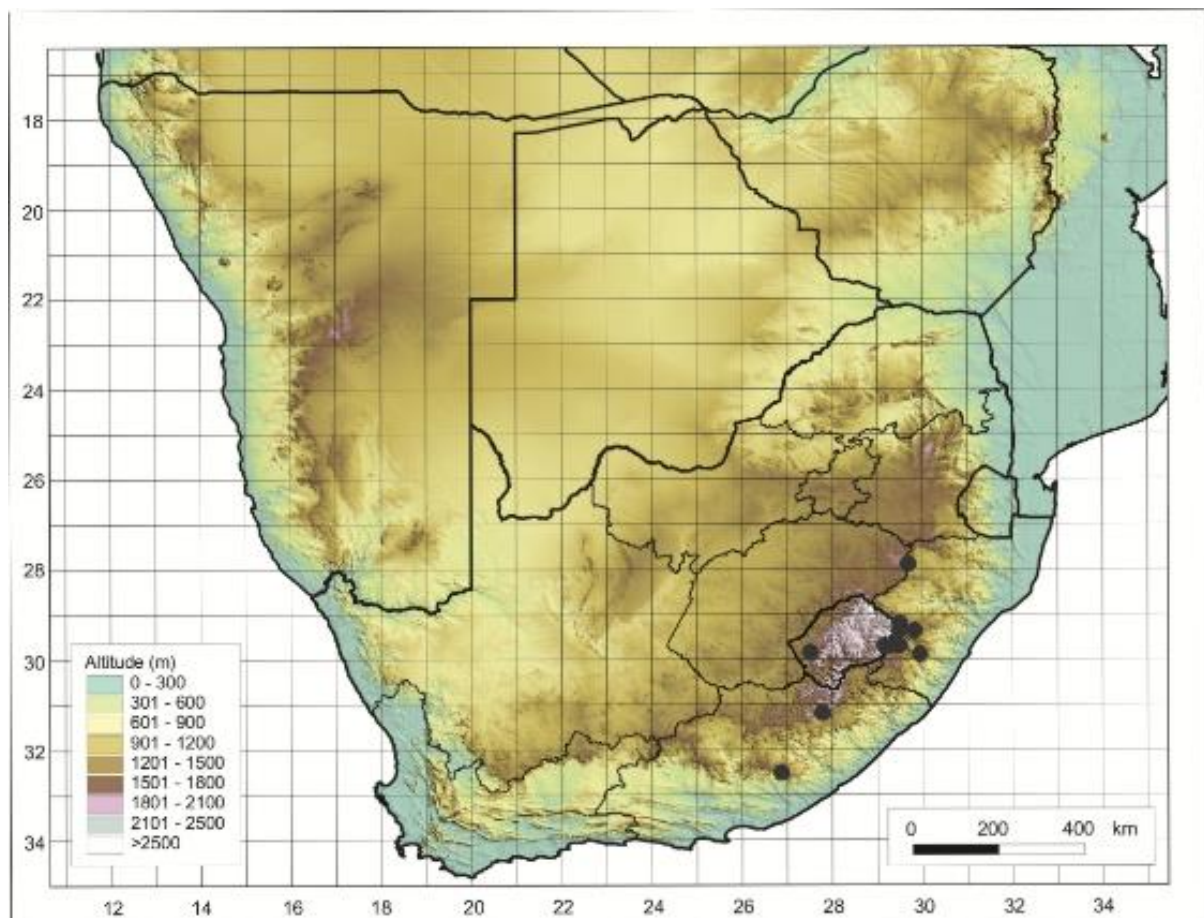
**Diagnostic characters.** This species is characterised by leaves that are sparsely covered with hairs that have a softer feel, which distinguishes it off sharply from all the other southern African species which have either brittle or woolly hairs. The abaxial leaf surface has a grey-greenish appearance which is also a unique character of this species.

**Distribution and habitat.** The species is distributed in South Africa (Eastern Cape, Free-State, and KwaZulu-Natal Provinces) and Lesotho (Figure 18). It grows in loose sandy soil at the edge of an overhang, slightly within the dripline.



**Figure 17:** Morphological features of *C. spelaeum*. (A) Line drawing of a fruiting branch showing stem with alternate, sessile, spatulate leaves. (B) SEM micrograph of nutlet showing more marginal and acentric glochidia. (C) Close up SEM micrograph showing glochidia with multiangular hooks. Voucher specimen: A. *Nicholas* and B. *Isaacs* 1965 (PRE). Drawing scale 8.0 mm. SEM images scale bars: B= 1 mm; C= 200  $\mu$ m.

**Additional specimens examined.** South Africa. KWAZULU-NATAL: **2729 (Utrecht):** Ncandu State Forest (-DC), 8 May 1984, A. *Nicholas* and B. *Isaacs* 1965 (PRE). **2929 (Underberg):** Allandale, Lion's River District (-BC), 24 Jan 1978, O.M. *Hilliard* and B.L. *Burt* 11258 (NU); Giant's Castle Nature Reserve (-BC), 07 Jan 1988, A. *Abbott* 4064 (NH); 3 Feb 1976, O.M. *Hilliard* and B.L. *Burt* 8904 (NU); 2 Jan 1978, O.M. *Hilliard* and B.L. *Burt* 11172 (NU); 20 Nov 1985, O.M. *Hilliard* and B.L. *Burt* 18242 (NU, PRE); Bulwer District (-DD), 8 Jan 1974, M.A. *Rennie* 507 (NU); 8 Mar 2019, A.N. *Moteetee* and L.K. *Madika* AL012 (JRAU). EASTERN CAPE: **3127 (Lady Frere):** Elliot District (-BB), 22 Jan 1979, O.M. *Hilliard* and B.L. *Burt* 123427 (NU). **3226 (Fort Beaufort):** Amatole Mountain (-DB), 16 Feb 1986, P.B. *Phillipson* 1294 (PRE). Lesotho. **2927 (Maseru):** Laikopile Mountain (-CD), Jan 1918, A. *Dieterlen* 40799 (PRE).



**Figure 18:** Known distribution of *Cynoglossum spelaeum* in southern Africa.

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