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Annesorhiza tilneyae (Apiaceae), a new species from the Western Cape, South Africa, validation of the name *Annesorhiza asparagoides*, and an updated identification key to the species in the genus

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ABSTRACT

Annesorhiza Cham. & Schltdl. (Apiaceae) comprises ca. 23 species endemic to South Africa. The genus is centred in the Greater Cape Floristic Region, with only four species occurring in the summer rainfall regions. In the two decades since *Annesorhiza* was last revised, the number of recognised species has almost doubled, with 8 species subsequently described and another two transferred to the genus. The high number of new species in the genus can be attributed to the hysteranthous habit, with plants leafless at the time of flowering and fruiting, and that these species are rare, highly localised endemics. Species of *Annesorhiza* are often overlooked as they flower largely during the dry summer months, and multiple visits are required in order to recover a complete collection for accurate identification. Here we describe another new species from the Bokkeveld Mountains, *Annesorhiza tilneyae* Magee & Maswoliedza. We also validate the name *Annesorhiza asparagoides* B.-E. van Wyk with reference to the previously and effectively published descriptions and diagnoses. With several *Annesorhiza* species described since the last revision, we also provide an updated identification key to all species within the genus.

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1. Introduction

The species of *Annesorhiza* Cham. & Schltdl. are hysteranthous geophytes with summer-deciduous leaves (Tilney and Van Wyk, 2001; Van Wyk et al., 2013; Magee et al., 2011; Sobiyi et al., 2019). The genus is endemic to southern Africa with its centre of diversity strongly in the Greater Cape Floristic Region (Van Wyk and Tilney, 2011). It is a member of the tribe Annesorhizeae Magee et al., which forms part of the grade of earliest diverging lineages in the subfamily Apioideae sl. (referred to as the protoapioids, Magee et al., 2010). The tribe currently consists of six genera, four of which are southern African (*Annesorhiza, Chamarea* Eckl. & Zeyh., *Ezosciadium* B.L.Burtt and *Itasina* Raf.), one European (*Molopospermum* W.D.J.Koch) and another restricted to North Africa and the Canary Islands (*Astydamia* DC.).

Annesorhiza is currently distinguished from the closely related *Itasina* and *Chamarea* (Magee et al., 2010) largely by the shape and dimensions of the fruit (Magee et al., 2011; Van Wyk et al., 2013). *Chamarea* fruits are smaller, and ovoid to urceolate, without wings or prominent ribs; those of *Annesorhiza* are generally larger and oblong, usually with well-developed primary ribs (Vessio, 2001; Magee et al., 2011; Van Wyk et al., 2013); and *Itasina* can have either ovoid or oblong fruit, but is readily distinguished by the simple, filiform leaves (Van Wyk et al., 2013). Vessio (2001), in her unpublished dissertation, suggested that *Annesorhiza* be expanded to include *Chamarea*. The expanded circumscription was however never formalised and the three genera continue to be recognised as distinct (Van Wyk et al., 2013). Further studies, including molecular phylogenetics, are required to resolve the circumscriptions of these three genera.

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Taxonomic study of *Annesorhiza* is challenging as the plants are leafless when in flower and fruit, so that multiple visits are required to obtain a complete collection. The species also usually flower during the dry summer months, and so are often overlooked by collectors. Twelve species of *Annesorhiza* were recognised in the last formal taxonomic revision of the genus by Tilney and Van Wyk (2001). Almost a decade later, Magee and Manning (2010) described a thirteenth species, *Annesorhiza calcicola* Magee & J.C.Manning, a small, late flowering species restricted to a handful of exposed limestone outcrops on the West Coast of South Africa. The following year, Magee et al. (2011) transferred two species previously included in *Peucedanum* L., viz. *P. triternatum* Eckl. & Zeyh. and *P. filicaule* (Eckl. & Zeyh.) B.-E. van Wyk & Tilney (Van Wyk and Tilney, 2001), to *Annesorhiza*, and described an additional five new species in the genus (*A. bracteosa* Magee, *A. elsiae* Vessio et al., *A. laticostata* Magee, *A. radiata* Magee, and *A. refracta* Magee). These seven species were treated as part of a species complex, the *A. triternata* group, that differed from other species of *Annesorhiza* by their mostly less sturdy synflorescences, ternate leaves with linear ultimate leaflets, branched resin canals in the petals, and *Peucedanum*-like fruit that were marginally winged and dorsally ribbed. As with *Annesorhiza calcicola*, the five new species from the *A. triternata* group are all highly localised, rare endemics (Magee et al., 2011), and almost all are considered to be endangered (von Staden, 2012, 2013; von Staden and Helme, 2016; von Staden et al., 2015). Since then, another two new, highly localised species of *Annesorhiza* have been described, *A. asparagoides* B.-E. van Wyk (Van Wyk and Tilney, 2011; von Staden, 2012) and *A. articulata* Magee (Magee, 2015; von Staden et al., 2015), bringing the current number of recognised species within the genus to 22. It has subsequently come to our attention that *A. asparagoides* was not validly published, as more than one gathering was inadvertently cited by Van Wyk and Tilney (2011) as the type (ICBN Art. 40.2, Turland et al. 2018).

Here we describe yet another new species, with ternate leaves and marginally unwinged fruit, known from only two localities along the Bokkeveld Mountains of South Africa, and validate *A. asparagoides* with reference to the previously and effectively published descriptions and diagnoses (ICBN Art. 38.1, Turland et al. 2018), as was previously done by Magee (2021) for *A. radiata* and *A. laticostata*. As the number of species recognised within the genus has practically doubled since the last taxonomic revision, we also provide an updated identification key to all the species of *Annesorhiza*.

2. Taxonomy

2.1. Key to the species of *Annesorhiza* (adapted from Tilney and Van Wyk, 2001 and Magee *et al.*, 2011)

1a. Mericarps with marginal wings broader than dorsal ribs:
  2a. Petals with branched resin canals:
    3a. Leaves procumbent, with rachis and pinnae prominently refracted; ultimate leaflets 2- or 3-partite ..... ***A. refracta***
    3b. Leaves erect to spreading, with rachis and pinnae straight; ultimate leaflets 2- or 3- sect:
      4a. Peduncular bracts of synflorescence well-developed and foliose; involucel bracts ovate, ca. 2 mm wide; calyx lobes truncate ..... ***A. bracteosa***
      4b. Peduncular bracts of synflorescence reduced and scale-like; involucel bracts narrowly to broadly oblong, ca. 1 mm wide; calyx lobes acute to tridentate ..... ***A. triternata***
  2b. Petals with a single unbranched resin canal:
    5a. Terminal umbel transversely ovate in outline, with (5)6 to 18 spreading rays ± equal in length; stylopodium shortly conical; umbellules of secondary umbels composed largely of functionally males flowers; root somewhat ellipsoid ..... ***A. radiata***
    5b. Terminal umbel obtriangular in outline, with rays 3 to 5 (6) suberect rays prominently unequal in length; stylopodium narrowly conical; umbellules of secondary umbels composed largely of hermaphroditic flowers with only tertiary umbels functionally male; root pencil-like:
      6a. Mericarps with prominent to narrowly winged dorsal ribs; mature fruits twice as long as wide; Breede River Valley..... ***A. laticostata***
      6b. Mericarps with filiform to somewhat evident dorsal ribs; mature fruits three times as long as wide; Cederberg Mountains..... ***A.filicaulis***
1b. Mericarps with marginal and dorsal ribs equally well-developed:
  7a. Petals with branched resin ducts:
    8a. Leaves not articulate; rachis not winged; ultimate leaflet segments linear; in alpine vegetation ..... ***A. elsiae***
    8b. Leaves articulate; rachis conspicuously winged; ultimate leaflet segments very narrowly elliptic to lorate; in seasonally moist, lowland vegetation ..... ***A. articulata***
  7b. Petals with single unbranched resin duct:
    9a. Leaves with needle like segments:
      10a. Ultimate leaflet segments < 60 mm long; leaves glaucous; umbel rays prominently unequal; rays less than 4 ..... ***A. lateriflora***
      10b. Ultimate leaflet segments > 65 mm long; leaves green; umbel rays subequal; rays more than 6:
        11a. Leaves mostly trifid; sepals relatively long, ≥ 0.5 mm long; fruit ribs not expanded into wings; restricted to Eastern Cape Province ... ***A. schlechteri***
        11b. Leaves invariably multifid; sepals small, ≤ 0.3 mm long; fruit ribs with or without short wings; not Eastern Cape:
          12a. Leaf segments acicular; rays 55–60 mm long; fruit ribs expanded into short blunt wing-like structures; summer rainfall regions ..... ***A. flagellifolia***
          12b. Leaf segments narrowly linear; rays 8–25 mm long; fruit ribs lacking wing-like structures; Western Cape ..... ***A. tilneyae***
    9b. Leaves not in needle like segments:
      13a. Ultimate leaflet segments deeply divided to near the axis:
        14a. Flowers and fruits homomorphic:
          15a. Leaves or at least the petioles hairy; persistent leaf bases forming a dense fibrous mass around the base of plant; roots at least 15:
            16a. Leaf blade ± bipinnate, segments acuminate ..... ***A. fibrosa***

16b. Leaf blade ± pinnate, segments acicular ..... ***A. asparagoides***

15b. Leaves and petioles glabrous; persistent leaf bases sparse, not as above; roots 1 to 3:

17a. Ultimate leaf segments few and widely spaced; flowering stalks thick, usually ± 4 mm diam.; high altitude fynbos in Western Cape ..... ***A. burttii***

17b. Ultimate leaf segments with densely crowded teeth; flowering stalks thin, usually 2 mm diam.; high altitude grassland of Limpopo, Mpumalanga and Swaziland ..... ***A. wilmsii***

14b. Flowers and fruits heteromorphic:

18a. Ribs of fruit extended into well-developed wings; fruits > 3 mm wide ..... ***A. macrocarpa***

18b. Ribs of fruit not forming well-developed wings; fruits ± 2 mm wide ..... ***A. thunbergii***

13b. Ultimate leaflet segments variously lobed but not divided beyond the middle of the lamina:

19a. Leaves (and petioles) glabrous:

20a. Ultimate leaf segments relatively large, deltoid, deeply divided at base; roots at least 10; flowers and fruits homomorphic; flowering time August and September ..... ***A. altiscapa***

20b. Ultimate leaf segments relatively small, oblong, sessile; roots 1 to 3; flowers and fruits heteromorphic; flowering time November to May ..... ***A. nuda***

19b. Leaves, at least the petioles, hairy:

21a. Plants small in stature (inflorescence < 0.3 m tall, leaves < 150 mm long); fruit < 5 mm long; peduncles pilose, greyish-black; petals white; roots solitary ..... ***A. calcicola***

21b. Plants large in stature (inflorescence > 1.6 m tall, leaves > 160 mm long); fruit > 6 mm long; peduncles glabrous, yellowish-brown; petals yellow; roots in a cluster of several roots:

22a. Leaf hairs confined to petiole and main veins ..... ***A. latifolia***

22b. Leaf hairs over entire lamina, not confined to petiole and main veins ..... ***A. grandiflora***

2.2. Species treatment

Annesorhiza tilneyae Magee & Maswoliedza, sp. *nov.* Type: South Africa. Western Cape, Calvinia (3119): Foot of Vanrhynspas [Vanrhyn's Pass] (–AC), stony hill, leaves only, 9 Oct 2013, *Magee and Manning 1048* (NBG, holo.!; PRE, iso.!).

Deciduous geophytes. *Roots* unknown. *Leaves* basal in a rosette, suberect to spreading, cuneate in outline, doubly 3-sect. *Ultimate leaflets* 2- or 3-sect, segments linear, (8–)16–31(–65) × ± 0.5 mm, acute, concolourous, glabrous, margins thickened, entire, involute, midrib prominent. *Synflorescences* with terminal primary umbel subtended by (3)5 to 8(15) smaller, secondary and tertiary umbels; peduncular stalk glabrous, nodes subtended by reduced, scale-like peduncular bracts. *Umbels* compound, obtriangular in outline; involucral bracts 4 or 5, lanceolate to narrowly lanceolate, 1–2 × ± 0.5 mm, acuminate, glabrous; rays 4 to 8, suberect, unequal, 8–25 mm long at anthesis, glabrous; involucel bracts 4 or 5, narrowly lanceolate, ± 1 × ± 0.5 mm, acuminate, glabrous; raylets 5 to 12, 2–7 mm long, glabrous. *Flowers* hermaphroditic in primary, secondary and tertiary umbels calyx lobes 5, obtuse; petals 5, broadly ovate to elliptic, yellow, acuminate with tips inflexed, glabrous, resin canal unbranched; stamens 5, anthers reflexed; ovary laevigate; stylopodium conical; styles erect to suberect. *Fruits* isodiametric, oblong or elliptic in dorsal view, 5.0–5.5 × ± 1 mm; mericarps homomorphic, glabrous, immaculate when dry, median and lateral ribs 3, ± equal, marginal ribs 2, sometimes broader than median and lateral ribs; commissural vittae 2; vallecular vittae 4; commissure narrow, carpophore bipartite; druse crystals present, scattered throughout the mericarp. Fig. 1.

2.2.1. Distribution and ecology

Annesorhiza tilneyae is known from only two populations at the foot of the Bokkeveld mountains (Fig. 2). The species was collected in well-drained loamy soil in Bokkeveld Sandstone Fynbos. Although this vegetation unit is currently considered to be least threatened, it has been poorly studied and is rich in endemics (Mucina and Rutherford, 2006).

2.2.2. Etymology

The species is named for Patricia May Tilney, whose work focused on the contribution of anatomy in exploring relationships particularly in African Apiaceae.

2.2.3. Diagnostic characters

Annesorhiza tilneyae has ternately divided leaves, with 2- or 3-sect ultimate leaflets with linear ultimate segments; a 4- to 8-rayed primary umbel with up to four secondary umbels; an unbranched resin canal in the petals; and marginally ribbed fruit. The ternately divided leaves place *A. tilneyae* within the *A. triternata* group, where it shares marginally ribbed fruit and hermaphroditic flowers in the secondary and tertiary umbels with *A. elsiae* and *A. articulata. Annesorhiza tilneyae* differs from these two species by the unbranched resin canal in the petals. *Annesorhiza elsiae* is further distinguished by primary umbels with only two or three rays, and a much-branched synflorescence bearing more than six secondary and tertiary umbels; and *A. articulata* by the articulated leaves with narrowly elliptic to lorate ultimate leaflet segments.

2.2.4. Additional specimens examined

South Africa. WESTERN CAPE: **3118 (Vanrhynsdorp):** Western base of Maskam, 12 km S of Vanrhynsdorp; Widouw 309, 250 m, (–DB), leaves only, 5 Aug 2015, *Helme 8515* (NBG). **3119 (Calvinia):** Foot of Vanrhynspas, (–AC), leaves only, 27 July 1999, *Goldblatt and Manning 11072A* (MO); leaves only, 25 Jan 2017, *Manning 3596* (NBG); plants in flower, leaves absent, 31 Mar 2017, *Magee 1182* (NBG); plants in fruit, leaves absent, 17 June 2018, *Powell s.n.* (NBG).

2.3. Validation of Annesorhiza asparagoides

Annesorhiza asparagoides B.-E. van Wyk, sp. *nov. Annesorhiza asparagoides* B.-E.van Wyk *nom. inval.,* S. Afr. J. Bot. 77: 244 (2011). Type: South Africa, Western Cape, 3219 (Wuppertal): Koudeberg Pass (–AC), 4 Oct 2009, *Van Wyk, Hulley and Tilney 4452* (excluding dried leaves, inflorescences and fruits added on 1 February 2010) (NBG, holo.; PRE, JRAU-image!, iso.).

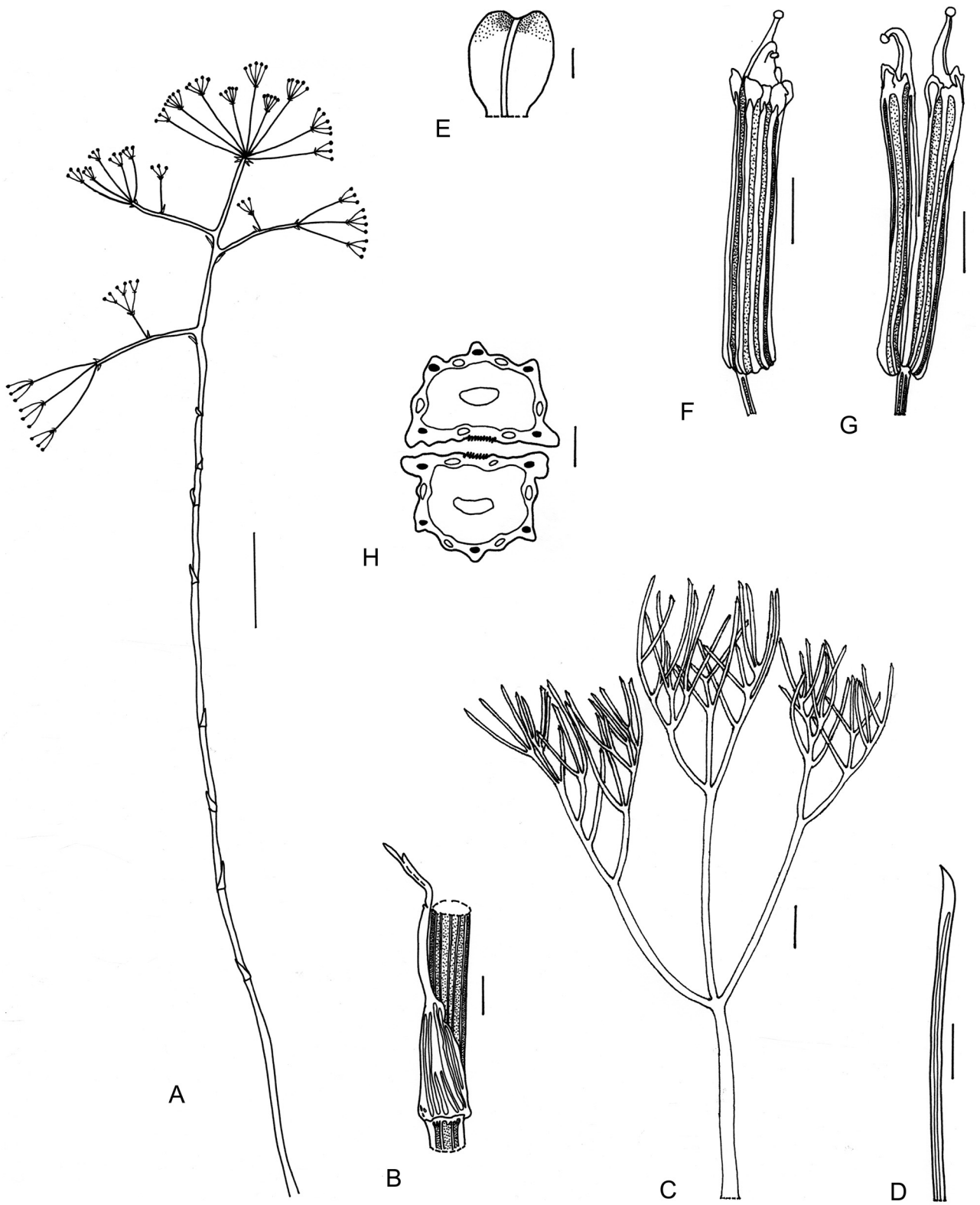

Fig. 1. *Annesorhiza tilneyae*. A, schematic drawing of synflorescence structure; B, peduncular bract; C, single leaf; D, ultimate leaf segment; E, dorsal surface of petal; F, lateral view of fruit; G, dorsal view of fruit (mericarps parting, held together by carpophore); H, transverse section through mature fruit. A & E, *Magee 1182* (NBG); B & F–H,: *Powell s.n.* (NBG); C & D, *Manning 3596* (NBG). Scale bars: A, 20 mm; B, 2 mm; C, 10 mm; D, 1 mm, E, 200 μm; F, 1 mm; G, 1 mm; H, 200 μm.

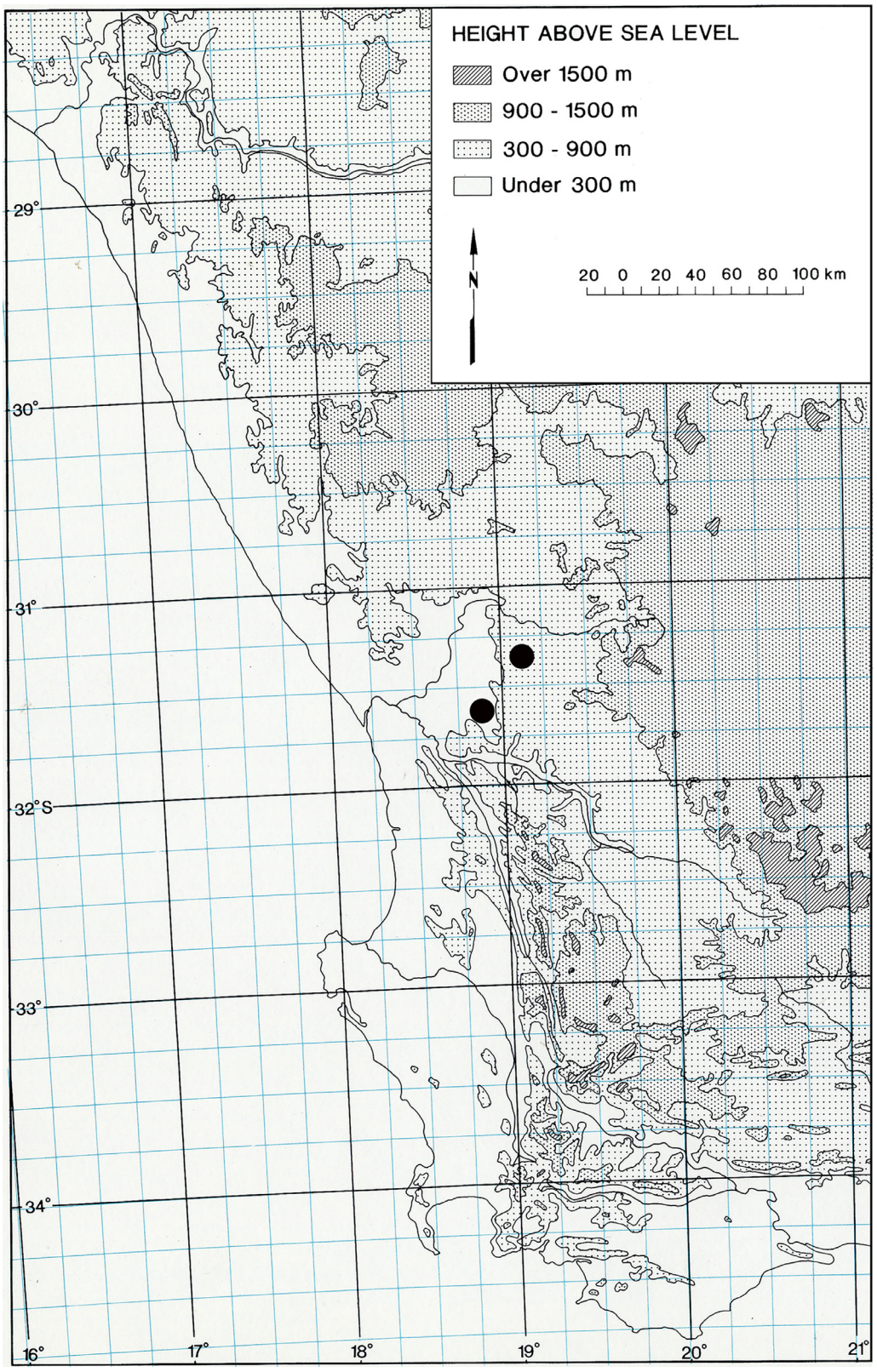

Fig. 2. Distribution of *Annesorhiza tilneyae*.

Author contributions

M. Maswoliedza: Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation. **J.C. Manning:** Writing – review & editing, Supervision. **A.R. Magee:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Identification of the new species.

Declaration of competing interest

The authors declare that they have no competing interests.

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