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A revision of the genus Annesorhiza (Apiaceae)

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The genus *Annesorhiza* is revised and twelve species are recognized, of which two are newly described: *A. altiscapa*, *A. burttii*, *A. fibrosa*, *A. flagellifolia*, *A. grandiflora*, *A. lateriflora*, *A. latifolia*, *A. macrocarpa*, *A. nuda*, *A. schlechteri*, *A. thunbergii* and *A. wilmsii*. *A. marlothii* is reduced to synonymy under *A. lateriflora*, a species hitherto poorly known as *Peucedanum lateriflorum*. *A. thunbergii* is only known from the type specimen. *A. elata*, *A. hirsuta* and *A. villosa* are sunk under *A. grandiflora*. *A. filicaulis* has recently been excluded from *Annesorhiza* on the basis of fruit structure. A key to the species is provided, an update on the nomenclature, typification of names and distribution maps are provided for all the species.

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Introduction

Annesorhiza Cham. & Schlechtd. is a genus of perennial herbs, endemic to southern Africa. The genus forms part of the subfamily Apioideae, tribe Ammineae, subtribe Seselinae (Drude 1898). It is closely related to *Chamarea* Eckl. & Zeyh. and some species hitherto placed in *Peucedanum*, but no other close relatives are known. The last revision of the genus (Sonder 1862) included seven species, only three of which are retained here.

The name *Annesorhiza* is a latinisation of "anyswortel" (anise root) which is the vernacular name applied to several species (Sonder 1862). Adamson (1938) also used the generally accepted spelling *Annesorhiza* and we have retained this original spelling in our work even though *Anesorhiza* might seem more correct.

All the species of the genus *Annesorhiza* are endemic to southern Africa and many of them smell strongly of aniseed. The roots of some species, particularly *A. macrocarpa*, were once a popular vegetable and were commonly sold at vegetable markets. This popularity has been lost, and no information on the nutritional value of the roots is available.

Annesorhiza is treated in its conventional circumscription in this paper. Despite considerable effort there are still many unanswered questions. One of the difficulties encountered is that *Annesorhiza* plants are often overlooked and therefore poorly represented in herbarium collections. The leaves of most species of the genus are hysteranthous, necessitating three separate visits to a plant to obtain complete material. A further complication in interpreting the material is that, in some herbarium specimens, there is no proof that the flowering and/or fruiting material and the leaves are actually from the same species. Similar problems have been experienced by Burtt (1991) with the genus *Chamarea*. We therefore urge plant collectors to gather complete material so that the full extent of diversity in this genus and in *Chamarea* can be established. A detailed study of other genera and species with hysteranthous, triternate leaves (such as *Peucedanum triternatum* and *P. filicaulis*) is currently underway, and this, together with a complete reassessment of the variation

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in *Chamarea*, may reveal new clues about phylogenetic relationships and the correct taxonomic hierarchy for these taxa.

A survey of the taxonomic value of leaf, flower, fruit and root anatomy has revealed a wealth of potentially useful taxonomic characters. Even though these cryptic characters are not always logically correlated with morphological discontinuities, much emphasis is given to anatomical characters in this revision because they provide a deeper understanding of relationships in this poorly known group.

Materials and methods

Specimens from the following herbaria were studied: BOL, GRA, JRAU, NBG, PRE, S and UPS. Details of the material used in the anatomical studies of the root and leaf are supplied in Table 1. Suitable portions were embedded in glycol methacrylate according to the method of Feder & O'Brien (1968) and stained using the periodic acid-Schiff/toluidine blue (PAS/TB) method. Epidermal peels for study of stomatal complexes were prepared using the technique of Ram & Nayyar (1974). Flower and fruit anatomy is discussed in Van Wyk & Tilney (1994) but some additional specimens were studied and are included in Table 1. Slides are housed at JRAU. Authorities for species names are given in the taxonomic part and are not repeated elsewhere.

Discussion of selected characters

A summary of characters and character states is presented in Table 2. Repeated attempts to devise a rigorous hypothesis of relationships by cladistic methods showed that there is considerable incongruence in the data. Our arrangement of species in the formal taxonomic part of this paper is therefore based on an intuitive assessment of critical characters, such as the single, fleshy root in the presumably basal species (shared by *Chamarea*, a potential sister group of *Annesorhiza*) and the unusual needle-like leaf segments of the presumably derived (terminal) taxa.

Habit

Plants have a very short axis on which radical leaves are produced each year. In general, leaves are only formed after fruiting. The flowering stem is erect and may reach a height of about 1.6 m in some members. Illustrations of type specimens are given with all but one species descriptions as an aid to identification. An illustration of the type specimen of *A. thunbergii* was included in Burtt (1991) and is therefore not duplicated here.

Roots

The aromatic roots of *Annesorhiza* species vary in number and degree of fleshiness. In some species (*A. burttii*, *A. lateriflora, A. nuda, A schlechteri* and *A. wilmsii*) usually one or two but up to three or rarely five roots are produced each year, whereas in others (*A. altiscapa*, *A. fibrosa*, *A. grandiflora*, *A. latifolia* and *A. macrocarpa*) several roots are formed. In both cases, the previous year's root(s) are usually still present. Similarly, Burtt (1991) noted the presence of two tuberous roots, unequal in size, in a number of herbarium specimens of *Chamarea*. When *A. fibrosa* is uprooted, the fleshy outer portion of the roots tends to break away from the central "fibrous" portions. A similar phenomenon was observed in the type specimen of *A. marlothii* (*Marloth* 9694b), now included in *A. lateriflora* (see below). A complete evaluation of root characters is not possible, because roots in two of the species are unknown (*A. flagellifolia* and *A. thunbergii*) and, in three other species, poorly known (*A. burttii*, *A. lateriflora* and *A. schlechteri*).

Where suitable material was available, transverse sections were studied and the results are summarized in Table 2. All specimens of *A. burttii* and *A. nuda* are easily distinguished by having a prominent sclerenchyma layer, about three cells thick, situated adjacent to, or a few cell layers removed from, the periderm (Fig. 1a). A similar continuous cylinder of fibres has been recorded by Lemesle (1926) in the stem of *Chamarea capensis* (Thunb.) Eckl. & Zeyh. (syn. *Carum capense* Sond.). In *A. altiscapa*, *A. grandiflora* and *A. latifolia*, and, to a lesser extent, in *A. lateriflora, A. nuda* and A. *wilmsii*, the vittae are arranged in several more or less concentric rings (Fig. 1b), whereas in *A. burttii*, *A. fibrosa* and *A. schlechteri* only about two rings are present – an inner one and one adjacent to the periderm (Fig. 1c). The vittae in *A. wilmsii* are particularly small and may be arranged in distinct circles in some parts of the root. In *A. macrocarpa* (Van Wyk, Winter & Tilney 3483), a row of very small vittae, associated with starch-containing cells, is present below the periderm. In addition, it has starch-containing cells radiating from the central vascular tissue, forming a very distinctive pattern (Fig. 1d), readily visible even with the naked eye. A few very large vittae are associated with these "spokes". In the rehydrated specimen (Fellingham 930), this distinctive pattern is not apparent but, as

Table 1. Material of *Annesorhiza* species used for anatomical studies. Flowering and/or fruiting material not examined in Van Wyk & Tilney (1994) is also included.

Taxon	Voucher specimens	Plant parts studied
A. altiscapa	Perry & Snijman 2310 (NBG)	Root, stomata
	Van Wyk 174 (JRAU)	Petiole
	Van Wyk 3533 (JRAU)	Root
A. burttii	Esterhuysen 14779 (BOL)	Young fruit
	Esterhuysen 20863 (BOL)	Stomata
	Esterhuysen 23945 (BOL)	Root, young fruit, fruit
	Esterhuysen 35280 (BOL)	Petiole
A. fibrosa	Barker 9791 (NBG)	Root, hairs
	Goldblatt 7401 (NBG)	Flower, young fruit
	Van Wyk 3597 (JRAU)	Root, petiole, hairs, stomata
A. flagellifolia	Wood 3870 (BOL)	Lamina, fruit
	Wood 15993 (SAM)	Petiole, stomata
A. grandiflora	Acocks 17566 (PRE)	Petiole
	Acocks 18611 (PRE)	Fruit
	Compton 16042 (NBG)	Petiole
	Ecklon & Zeyher 2218 (GRA)	Fruit
	Ecklon & Zeyher 2251 (GRA)	Petiole, flower, young fruit
	Loubser 3480 (NBG)	Petiole
	MacOwan 1879 (BOL)	Hairs
	Van Wyk 3513 (JRAU)	Root, petiole, stomata
A. lateriflora	Marloth 9694b (PRE)	Root, flower
	Perry & Manning 3737A (NBG)	Lamina, petiole, fruit
	Snijman & Manning 1251 (NBG)	Lamina, petiole, fruit
A. latifolia	Van Berkel 428 (NBG)	Petiole
	Van Berkel 458 (NBG)	Hairs
	Van Wyk 3674b (JRAU)	Root, petiole, stomata, flower, young fruit
A. macrocarpa	Fellingham 930 (NBG)	Root
	Van Wyk et al 3483 (JRAU)	Root, petiole
	Zeyher 584 (GRA)	Stomata
A. nuda	Metelerkamp 641 (BOL)	Root, flower
	Pillans 18711 (BOL)	Flower
	Van Wyk et al 3491 (JRAU)	Root, petiole, stomata
A. schlechteri	Baur 422 (NBG)	Root
	Rattray 18 (GRA)	Root, petiole
	Schlechter 6488 (GRA)	Lamina
	Sim s.n. (PRE)	Petiole, stomata
A. thunbergii	Thunberg 7161 (UPS)	Fruit
A. wilmsii	Compton 24609 (NBG)	Stomata
	Compton 25216 (NBG)	Root
	Moss 7155 (WITS)	Young fruit
	Venter 4428 (PRE)	Root
	Werdermann & Oberdieck 2038 (PRE)	Fruit
	Young A208 (PRE)	Root
	Winter 126 (JRAU)	Petiole, stomata
	Winter 1175 (JRAU)	Root, petiole, stomata, fruit

Table 2. Comparison of characters and character states of the roots, leaves and fruits in *Annesorhiza* species.

Annesorhiza species	*A. nuda*	*A. burttii*	*A. thunbergii*	*A. macrocarpa*
Number of roots				
1-3	+	+	?	-
several	-	-	?	+
Root sclerenchyma (Fig. 1)				
below periderm	+	+	?	-
highly lignified cap associated with vascular tissue	-	-	?	-
Position of vittae in roots (Fig. 1)				
several concentric rings	+	-	?	-
± two concentric rings	-	+	?	-
rings of small and large vittae	-	-	?	+
Starch distribution in roots (Fig. 1)				
dispersed	-	-	?	-
concentrated around vittae	+	+	?	+/-
radial ± throughout	-	-	?	+/-
Division of leaf (Fig. 2)				
needle-like	-	-	-	-
broad	+	-	-	-
finely divided	-	+	+	+
Pubescence				
on lamina and petiole	-	-	-	-
confined to veins and petiole	-	-	-	-
absent	+	+	+?	+
Sub-epidermal tissue of petiole (Fig. 4)				
sclerenchyma only	-	-	?	+
collenchyma with or without sclerenchyma	+	+	?	-
Mericarp symmetry (Figs 6 & 7)				
homomorphic	-	+	-	-
heteromorphic	+	-	+	+
Fruit size (mm)				
length	4.5-7	5	7	8-12 (-14)
width	2	2	2	(3-) 4-5 (-6)
Fruit rib size				
wings present	+	-	-	+
ribs prominent and rounded	-	-	-	-
wings absent	-	+	+	-
Sepal length (Fig. 5)				
0.3 mm or shorter	+	+	?	+
0.5 mm or longer	-	-	?	-
Fruit wall character (Figs 6 & 7)				
hypodermis lignified	+	-	+	-(+)
hypodermis with occasional lignified cells	-	+	-	-
hypodermis with no lignified cells	-	-	-	+(-)
lignified cells between vascular bundle & vittae	-	-	-	-
endocarp lignified	-(+)	-	+	-(+)

A. grandiflora	*A. latifolia*	*A. altiscapa*	*A. fibrosa*	*A. wilmsii*	*A. flagellifolia*	*A. schlechteri*	*A. lateriflora*
-	-	-	-	+	?	+	+
+	+	+	+	-	?	+?	+?
-	-	-	-	-	?	-	-
-	+	-	+	-	?	-	-
+	+	+	-	+	?	-	+
-	-	-	+	-	?	+	-
-	-	-	-	-	?	-	-
-	-	-	-	+/-	?	+	+
+	+	+	+	+/-	?	-	-
-	-	-	-	-	?	-	-
-	-	-	-	-	+	+	+
+	+	+	-	-	-	-	-
-	-	-	+	+	-	-	-
+	-	-	+	-	-	-	-
-	+	-	-	-	-	-	-
-	-	+	-	+	+	+	+
-	+	+	+	+	+	+/-	-
+	-	-	-	-	-	+/-	+
+	+	+	+	+	+	+	+
-	-	-	-	-	-	-	-
6-7	6	6-7	?	4-6 (-7)	5-8	5	3
2-3	2.5	2	?	2.5-3.5	2.5	2.5	1.2
-	-	-	-	-	-	-	-
-	-	-	-	-	+	-	-
+	+	+	+	+	-	+	+
+	+	+	+	+	+	-	+
-	-	-	-	-	-	+	-
+	+	-(+)	-	-	+	-	-
-	-	-	-	-	-	-	-
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-(+)	+	-(+)	+	-	+	-	-

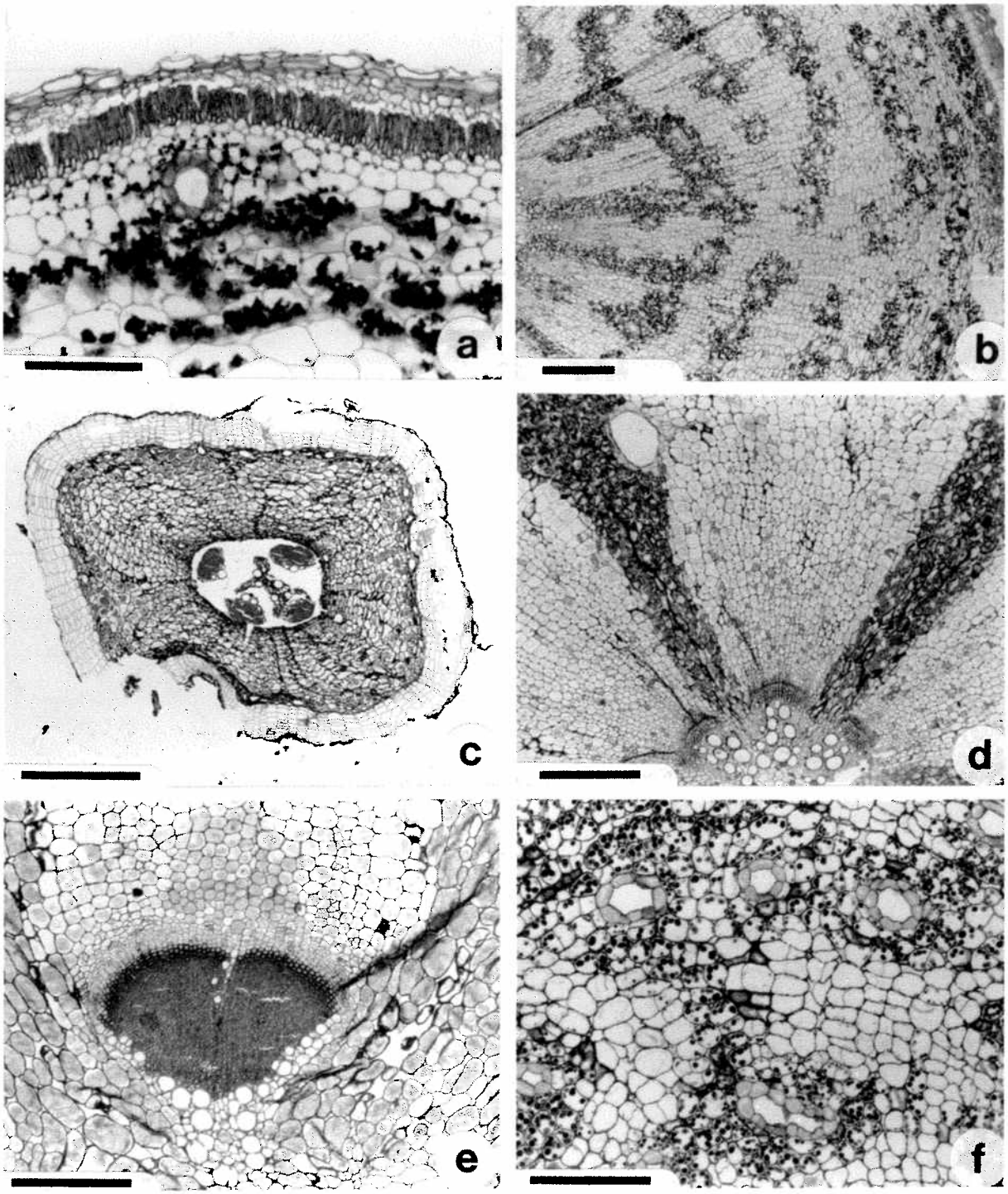

Fig. 1. Transverse sections of portions of the roots of selected species of *Annesorhiza* showing anatomical features: (a) *A. nuda* (Van Wyk, Winter & Tilney 3491). Note the hypodermal sclerenchyma cells. Scale bar = 0.2 mm. (b) *A. altiscapa* (Van Wyk 3533). The concentric arrangement of vittae, and annular and radiating arrangement of starch-containing cells can be seen. Highly lignified cells are absent from the vascular tissue. Scale bar = 0.5 mm. (c) *A. fibrosa* (Barker 9791), with highly lignified cells associated with the xylem, and two concentric rings of vittae. Scale bar = 0.5 mm. (d) *A. macrocarpa* (Van Wyk, Winter &

this specimen appears to be an atypical form of *A. macrocarpa* in several respects (see discussion of this species), further studies are necessary to ascertain the variation present. In *A. altiscapa*, *A. burttii*, *A. fibrosa*, *A. grandiflora*, *A. latifolia*, *A. nuda* and *A. wilmsii* (Compton 25216 & Winter 1175), mainly the cells near the vittae contain starch (Fig. 1f) or have higher concentrations of starch. In *A. grandiflora* and *A. wilmsii* (Compton 25216) the pattern of starch-containing cells is essentially annular throughout, whereas in *A. altiscapa, A. latifolia* and *A. wilmsii* (Winter 1175), it is annular except for the innermost area where a radiating arrangement of starch-containing cells occurs (Fig. 1b). In *A. lateriflora*, *A. schlechteri* and A. *wilmsii* (Venter 4428 & Young A208) most of the cells have high concentrations of starch. Very conspicuous masses of highly lignified sclerenchyma cells are associated with the vascular tissue of *A. fibrosa* and *A. latifolia* (Fig. 1c & e) and form a major component of the central "fibrous" portion mentioned in connection with *A. fibrosa* above. These are developed to a lesser degree in *A. macrocarpa*, *A. lateriflora*, *A. nuda* and *A. wilmsii* (Winter 1175) where the cap is small and the cells do not have highly lignified walls (Fig. 1d). Such a cap is absent in *A. altiscapa, A. burttii, A. grandiflora, A. schlechteri* and most specimens of *A. wilmsii* (Fig. 1b). Several of the species studied have anomalous secondary thickening in the form of numerous concentric bundles with central xylem, a feature reported by Metcalfe & Chalk (1950) in certain members of the family.

Roots, macroscopically as well as microscopically, thus appear to be of much taxonomic importance (Table 2) especially in view of the hysteranthous nature of the leaves of this genus which often makes identification very difficult. Unfortunately, very few herbarium specimens possess roots or observations of the roots.

Leaves

In most species of *Annesorhiza*, all the leaves of plants in full fruit are shrivelled and dying. However, this is not clear-cut and green leaves may be present for varying periods during flowering and fruiting. Some species (*A. burttii*, *A. fibrosa*, *A. macrocarpa* and *A. nuda*), appear to have more strongly hysteranthous leaves than others and would rarely have leaves when flowering, apart from fading or shrivelled ones. This feature is not correlated with summer or winter rainfall since *A. macrocarpa* grows in both these regions (see Fig. 12) and *A. altiscapa*, which frequently has leaves during flowering, occurs in a similar winter rainfall region to *A. fibrosa* and *A. nuda* (Figs 9 & 14). Further study is necessary to ascertain to what extent the time of leaf production or the length of time a leaf persists, varies from year to year and whether this variation is due to climatic conditions or not. The remains of old leaf bases may frequently be visible as fibres but only in *A. fibrosa* (and to a lesser extent in *A. wilmsii*) do they form a dense mass (Fig. 17).

The typical structure of the pinnately compound leaf is shown schematically in Fig. 2a. There are three basic forms - leaves that are finely divided and usually displaying a single very prominent vein which include *A. burttii*, *A. fibrosa*, *A. macrocarpa*, *A. thunbergii*, and *A. wilmsii* (Fig. 2b-e), those with somewhat broad segments in which the reticulate venation is often clearly visible as found in *A. altiscapa*, *A. grandiflora*, *A. latifolia* and *A. nuda* (Fig. 2f-i), and leaves consisting of needle-like segments as in *A. flagellifolia*, *A. lateriflora* and *A. schlechteri* (Fig. 2j-l).

Hairiness is a useful character where leaves are present. Hairs are found in *A. fibrosa*, *A. grandiflora* and *A. latifolia*. They are generally of the long multicellular cylindric type (Fig. 3a & b) but in *A. latifolia* a shorter type (Fig. 3c) is also present. The vestiture in *A. fibrosa* and *A. grandiflora* varies considerably in density. In these two species the lamina is hairy, whereas in *A. latifolia* the hairs are confined to the main veins and petioles.

Where possible, transverse sections of petioles were studied (Figs 4a-h). However, the full extent of variation in some of the species needs to be investigated when additional material becomes known. The shape varies from circular (Fig. 4a) to oval (Fig. 4b & c). The vascular bundles form a complete or almost complete circle around the periphery. Eleven vascular bundles were most commonly encountered (Fig. 4a & c) and were found in at least one sample of

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Tilney 3483), showing radial arrangement of starch-containing cells and a small cap of cells, not highly lignified, associated with the vascular tissue. Scale bar = 0.5 mm. (e) *A. latifolia* (*Van Wyk* 3674b), having a conspicuous mass of highly lignified sclerenchyma associated with the vascular tissue. Scale bar = 0.2 mm. (f) *A. grandiflora* (Van Wyk 3513), with starch concentrated around vittae. Scale bar = 0.2 mm.

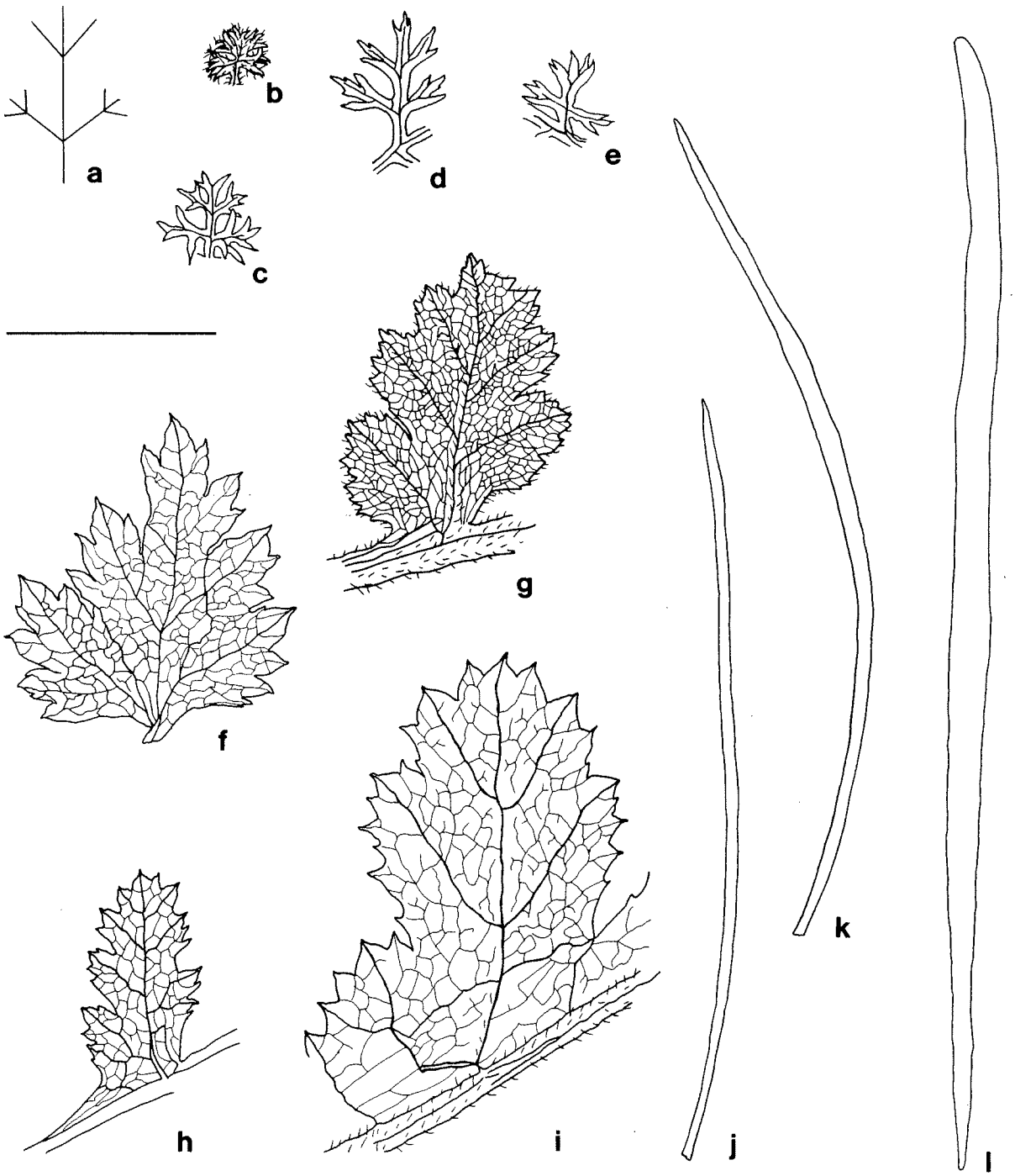


Fig. 2. Leaf structure of *Annesorhiza*: (a) Typical pattern of branching of compound leaves. (b)-(l) Appearance of leaflets of the various species: (b)-(e) Finely divided segments with single prominent vein: (b) *A. fibrosa* (Barker 9791) (c) *A. wilmsii* (Hilliard & Burtt 14295) (d) *A. macrocarpa* (Bolus 4531) (e) *A. burttii* (Esterhuysen 14779). (f)-(i) Broad segments with clear reticulate venation: (f) *A. altiscapa* (Schlechter 10940) (g) *A. grandiflora* (Ecklon & Zeyher 741) (h) *A. nuda* (Bolus 37185) (i) *A. latifolia* (Van Berkel 428). (j)-(l) Needle-like segments: (j) *A. flagellifolia* (Wood s.n. sub 15993 (SAM) NBG). (k) *A. schlechteri* (Rattray 18) (l) *A. lateriflora* (Marloth 9694b). Scale bar = 10 mm.

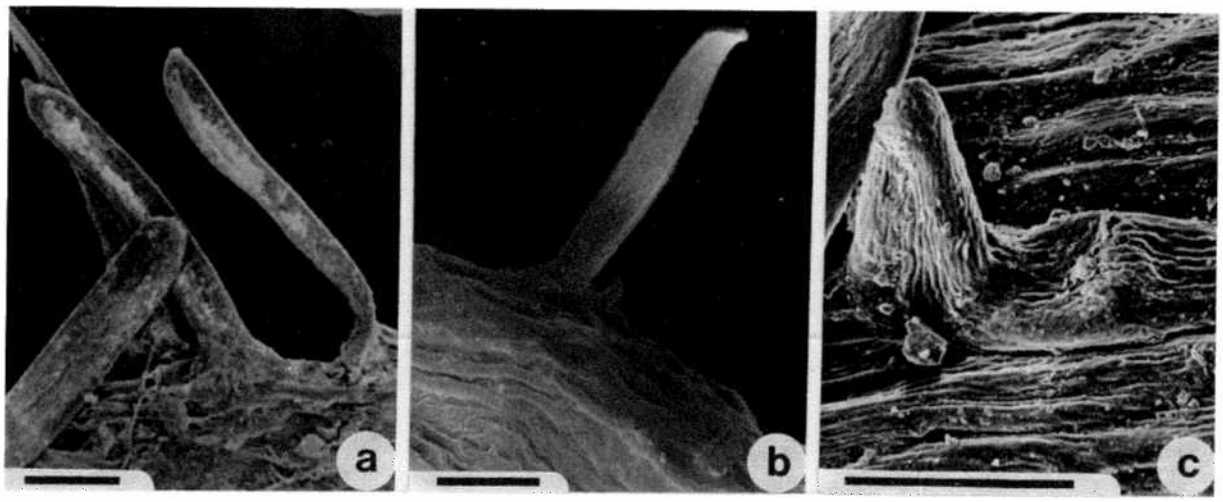


Fig. 3. SEM micrographs of hairs of *Annesorhiza* species. Long cylindrical hairs of (a) *A grandiflora* (MacOwan 1879) and (b) *A. fibrosa* (Van Wyk 3597). Scale bars = 0.1 mm. (c) Short hair of *A. latifolia* (Van Berkel 458). Scale bar = 5 μm.

most species. However, the number is not constant within a species and varies between five and 17, the latter being present in the markedly broad-leafed *A. latifolia*. *Annesorhiza lateriflora* leaves appear to have fewer vascular bundles in the petiole (five and seven) instead of at least nine in all the other species. Medullary bundles, characteristic of the genus *Glia* Sond., were not observed in any of the specimens. Lignified cells, in addition to tracheids and vessels, may or may not be associated with the vascular tissue. In some species where this occurs, a portion of the phloem only (or, rarely the xylem only) is lignified and, in others, lignification is associated with both the xylem and the phloem. This is particularly well developed in the phloem of *A. fibrosa* (Fig. 4e), a characteristic feature of this species mentioned in connection with roots above. Sub-epidermal strands of collenchyma and/or sclerenchyma nearly always occur and are particularly prominent opposite the vascular bundles (Fig. 4f-h). Collenchyma, with or without sclerenchyma over the vascular bundles, is found in *A. burttii*, *A. grandiflora*, *A. lateriflora*, *A. nuda* and *A. schlechteri* (Sim s.n.). Sclerenchyma only is present in *A. altiscapa*, *A. fibrosa*, *A. flagellifolia*, *A. latifolia*, *A. macrocarpa*, *A. schlechteri* (Rattray 18) and *A. wilmsii*. Vittae are commonly found to the outside and inside of each vascular bundle (Fig. 4f). In some specimens, additional vittae are present but this character does not seem to have any taxonomic significance. Most of the petioles have central cavities at maturity (Fig. 4a).

Leaf segments of *A. flagellifolia*, *A. lateriflora* and *A. schlechteri* were found to be similar in structure and show marked xerophytic characters such as a thickened margin and midrib, thick cuticle, epidermal cells with considerably cutinized outer periclinal cell walls and numerous hypodermal fibres. However, the full extent of variation in these three species needs to be investigated when additional material becomes known.

In a study of the stomatal complexes of ten species, anomocytic and occasionally, anisocytic types were found throughout, sometimes with both types occurring on a single specimen (e.g. of *A. latifolia* and *A. wilmsii*).

Flowers

The flower in *Annesorhiza* is typical of the family (Fig. 5). It shows a broadly conical stylopodium, an oblong ovary and whitish or yellow ovate or obovate petals with incurved tips. The sepals are much reduced in size in all species (Fig. 5a) except in *A. schlechteri* where they are relatively large and distinctive (Fig. 5b). Since sepals also persist in the fruit (Fig. 6a), their taxonomic usefulness is increased. The two carpels making up each ovary may be alike (homomorphic) or different (heteromorphic). This character, which is discussed more fully under fruits, is also useful for identification purposes especially in the absence of leaves.

Fruits

Annesorhiza has conspicuously ribbed fruits which

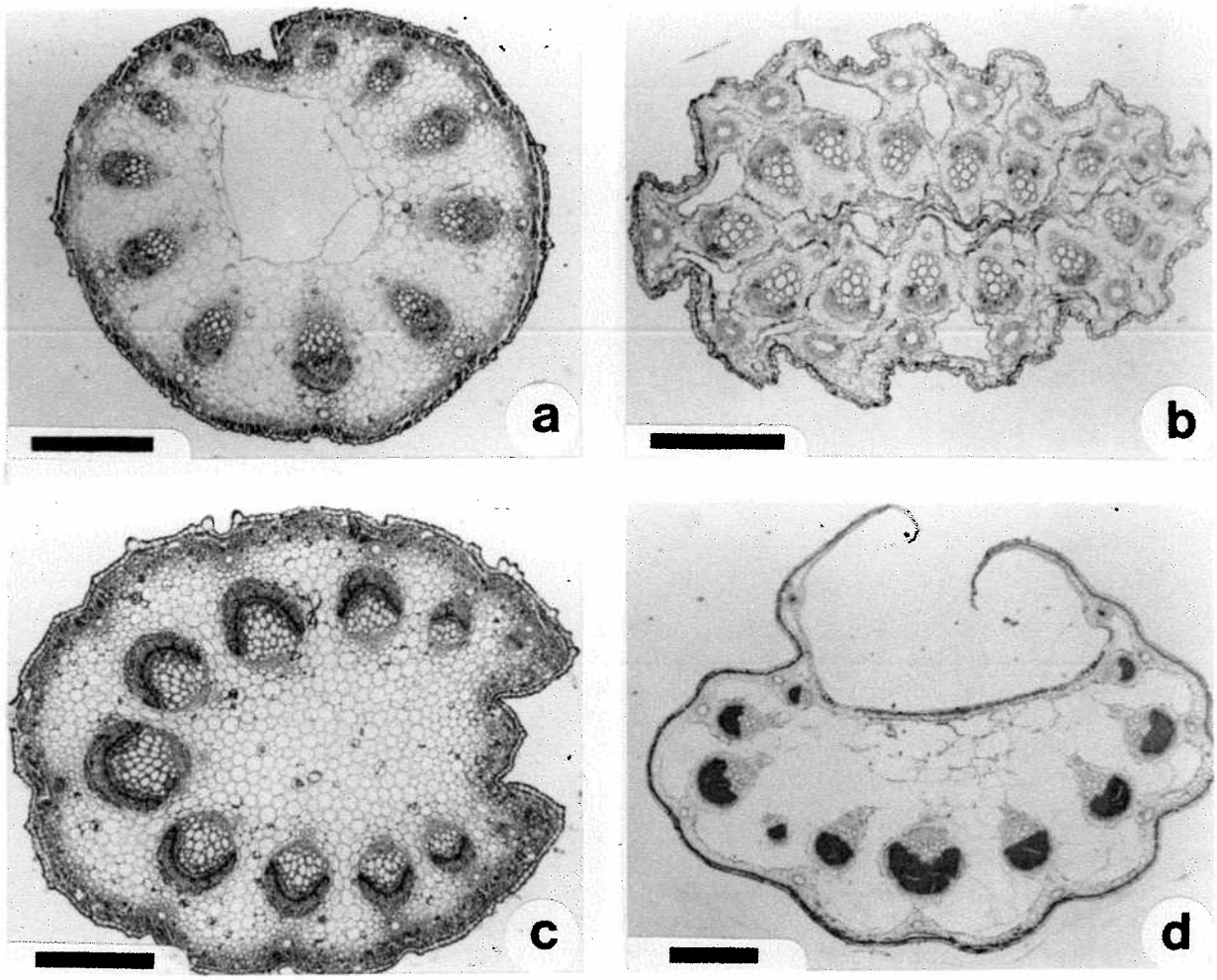
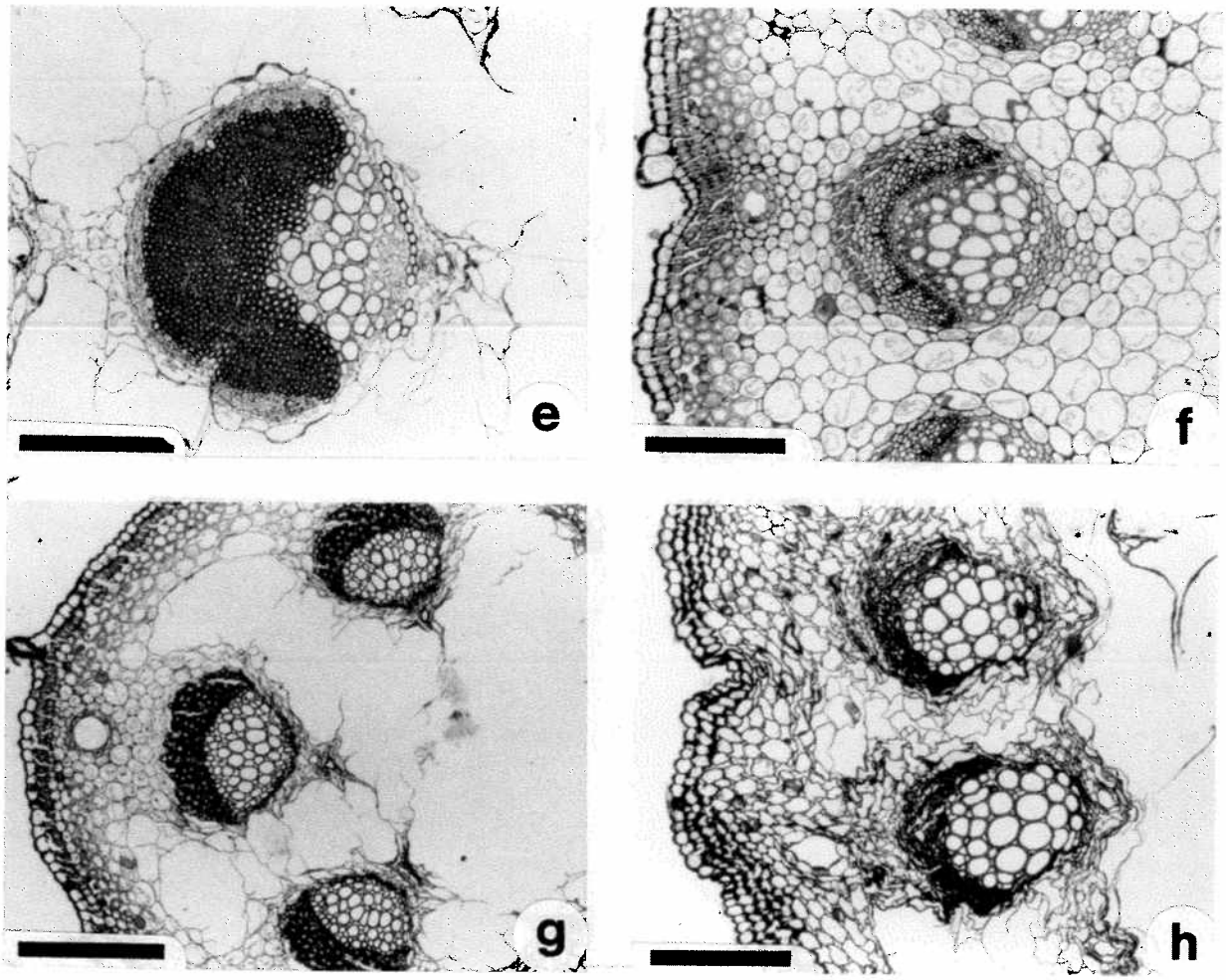


Fig. 4. Transverse sections through petioles of selected *Annesorhiza* species to show some of the characteristic features and variation: (a). *A wilmsii* (Winter 126). Note the circular shape of the petiole and the central cavity. Eleven vascular bundles are present. Scale bar = 0.5 mm. (b) *A. grandiflora* (Van Wyk 3513). The petiole is elliptic in transverse section. Scale bar = 0.5 mm. (c) *A. wilmsii* (Winter 1175). Scale bar = 0.5 mm. (d) *A. fibrosa* (Van Wyk 3597). Scale bar = 0.5 mm. (e) *A. fibrosa* (Van

may have homomorphic mericarps (the two mericarps similar) or heteromorphic mericarps (the two mericarps distinctly dissimilar). In the species with homomorphic mericarps (*A. altiscapa*, *A. burttii*, *A. fibrosa*, *A. flagellifolia*, *A. grandiflora*, *A. lateriflora*, *A. latifolia*, *A. schlechteri* & *A. wilmsii*), the ribs are generally not expanded into distinct wings (Fig. 6a & b). In *A. flagellifolia*, the ribs are somewhat wing-like and the commissural wings are much larger than the dorsal wings on either side (Fig. 6c). In *Annesorhiza* the four commissural ribs are characteristically somewhat larger than the other ribs. This development is taken to its extreme in what was previously *A. filicaulis* (now *Peucedanum filicaulis*), and was the major reason for its transfer to *Peucedanum* (Van Wyk & Tilney 2001). In *A. macrocarpa* (Fig. 6d & e) and *A. nuda* (Fig. 6f), which both have distinctly heteromorphic mericarps, all the sepaline ribs and the two commissural petaline ribs are expanded into wings. *A. thunbergii*, also heteromorphic, differs somewhat from these two species in that the ribs are much enlarged, but not really wing-like (Fig. 7a). The genus is further characterized by enormously expanded and lignified vascular bundles (Fig. 7a-c). The presence of additional lignified cells in various positions can be used to distinguish some of the species (Table 2 & Fig. 7b-c).

The large size of the fruits of *A. macrocarpa*, as the name implies, is a distinguishing feature of the



Wyk 3597). Large numbers of highly lignified cells are present. Scale bar = 0.2 mm. (f) *A. wilmsii* (Winter 1175). The characteristic position of the vittae to the outside and inside of the vascular bundles is shown. Scale bar = 0.2 mm. (g) *A. fibrosa* (Van Wyk 3597). Sub-epidermal sclerenchyma cells can be seen. Scale bar = 0.2 mm. (h) *A. grandiflora* (Acocks 17566). Sub-epidermal collenchyma is visible. Scale bar = 0.2 mm.

species (Fig. 6d & e). Most of the mesocarp consists of slightly lignified cells which extend right up to the expanded vascular bundles (except in Fellingham 930). The cells immediately adjacent to the epidermis are non-lignified (except in Fellingham 930) as well as those surrounding the vittae. Similar lignification occurs in the homomorphic mericarps of *A. flagellifolia* although the lignification includes the sub-epidermal layer as well (Fig. 7b). There is no distinct hypodermis in either of these species. *Annesorhiza nuda* (Fig. 6f) and *A. thunbergii* (Fig. 7a) have smaller fruits than *A. macrocarpa* (Fig. 6e) and a conspicuous layer of thickly lignified hypodermal cells. The cells adjacent to the expanded vascular bundles are non-lignified or, rarely, very slightly lignified. Such a structure is also found in *A. macrocarpa* (Fellingham 930). The endocarp of *A. thunbergii* is lignified which is not the case in *A. macrocarpa* or *A. nuda* (except in Hilliard & Burtt 14816 and Bohnen 7541 respectively). Thus the species with heteromorphic fruits can be distinguished from one another on the basis of fruit anatomy. Other aspects relating to the taxonomic value of fruit wall structure in the genus have been discussed in Van Wyk & Tilney (1994) and the main features are summarised in Table 2. The new species, *A. burttii*, not included in the 1994 paper, has very occasional lignified cells in the sub-epidermal layer. Mature fruits of the other new species, *A. fibrosa*, are unknown but the young fruits clearly show lignified

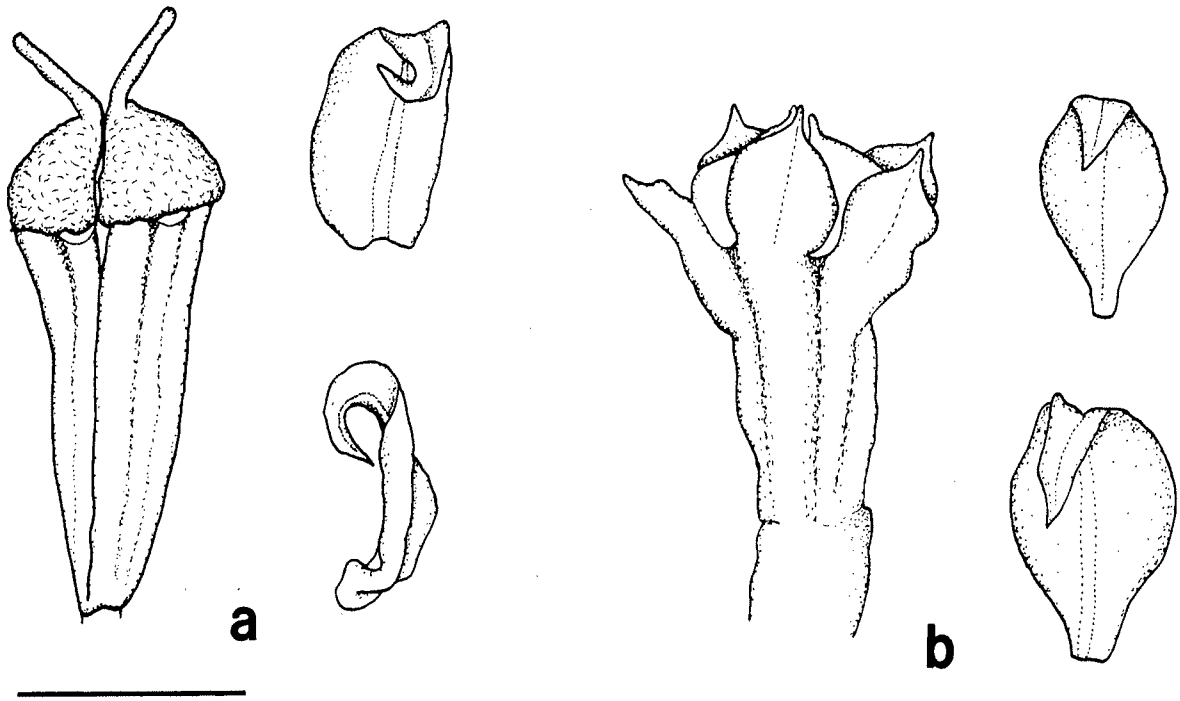


Fig. 5. Flowers of two *Annesorhiza* species showing the sepals, ovary & stylopodium (left) & the petals (right): (a) *A. altiscapa* (Steyn 434). Note the small sepals. (b) *A. schlechteri* (Britten 4593). Note the large sepals unique to this species. Scale bar = 1 mm.

cells (besides those in the vascular bundles) only in the endocarp. Further study has revealed that *A. wilmsii* consistently has groups of lignified cells between the vascular bundles and vittae in mature fruits although the young fruits in Mohle 116 & Moss 7155 show no sign of lignified cells (apart from xylem). Such groups of lignified cells are present in one specimen of *A. schlechteri* (Germishuizen 1784) but absent from the other (Flanagan 2685). The fruits of *A. lateriflora* resemble the latter but are considerably smaller. The relatively long persistent sepals (at least 0.5 mm) are unique to *A. schlechteri* (Fig. 6a). The fruits of *A. grandiflora* all have lignified hypodermal cells. In all specimens studied (except Acocks 17566) (Fig. 7c), this was several layers thick, closely resembling the hypodermis structure of *A. latifolia*. *Annesorhiza grandiflora* (Acocks 18611), an example of the "Sutherland form" of this species - see below - has a lignified endocarp and, apart from more rounded ribs, appears to be identical to *A. latifolia*. The marked similarity between the fruits of *A. grandiflora* and *A. latifolia* reflects their close relationship (they may turn out to be extreme forms of a single species, see below). Most of the species thus have a unique combination of fruit characters (Table 2).

Taxonomy

Annesorhiza Cham. & Schlechtd. in Linnaea 1: 398, Tab. V: Fig. 4 (1826); Sonder in Fl. Cap. 2: 544 (1862); Drude in Pflanzenfam. 3(8): 215 (1898) excl. subgen. *Stenosemis*; Marloth in Fl. of S. A. Vol. 2, pp. 237-241 (1925); Adamson in J. S. Afr. Bot. 4: 61-63 (1938); Dyer in Gen. sthn Afr. Fl. Pl. Vol. 1, pp. 425-426 (1975); Burtt in Edinb. J. Bot. 48: 177-182 (1991); Pimenov & Leonov, Gen. Umbel., p. 21 (1993). – Type species: *A. capensis* Cham. & Schlechtd. (now *A. nuda*).

Perennial herbs. Roots often fleshy and pencil-like, one to three (rarely five) or in clusters. Leaves in basal rosette, usually developing after flowering and fruiting; sometimes large, hairy or glabrous; petiolate; pinnatipartite or multisect, or pinnate with the pinnae lobed; petioles broad at base. Inflorescence a compound umbel, scapes almost leafless, rays of unequal length. Involucral bracts distinct, simple, relatively large or mostly small, usually persistent in fruit. Involucel of small lanceolate or narrowly ovate bracteoles with acute apices. Flowers with bicarpellate, inferior ovary; some may be functionally male. Calyx pentamerous, lobes small and cusp-like,

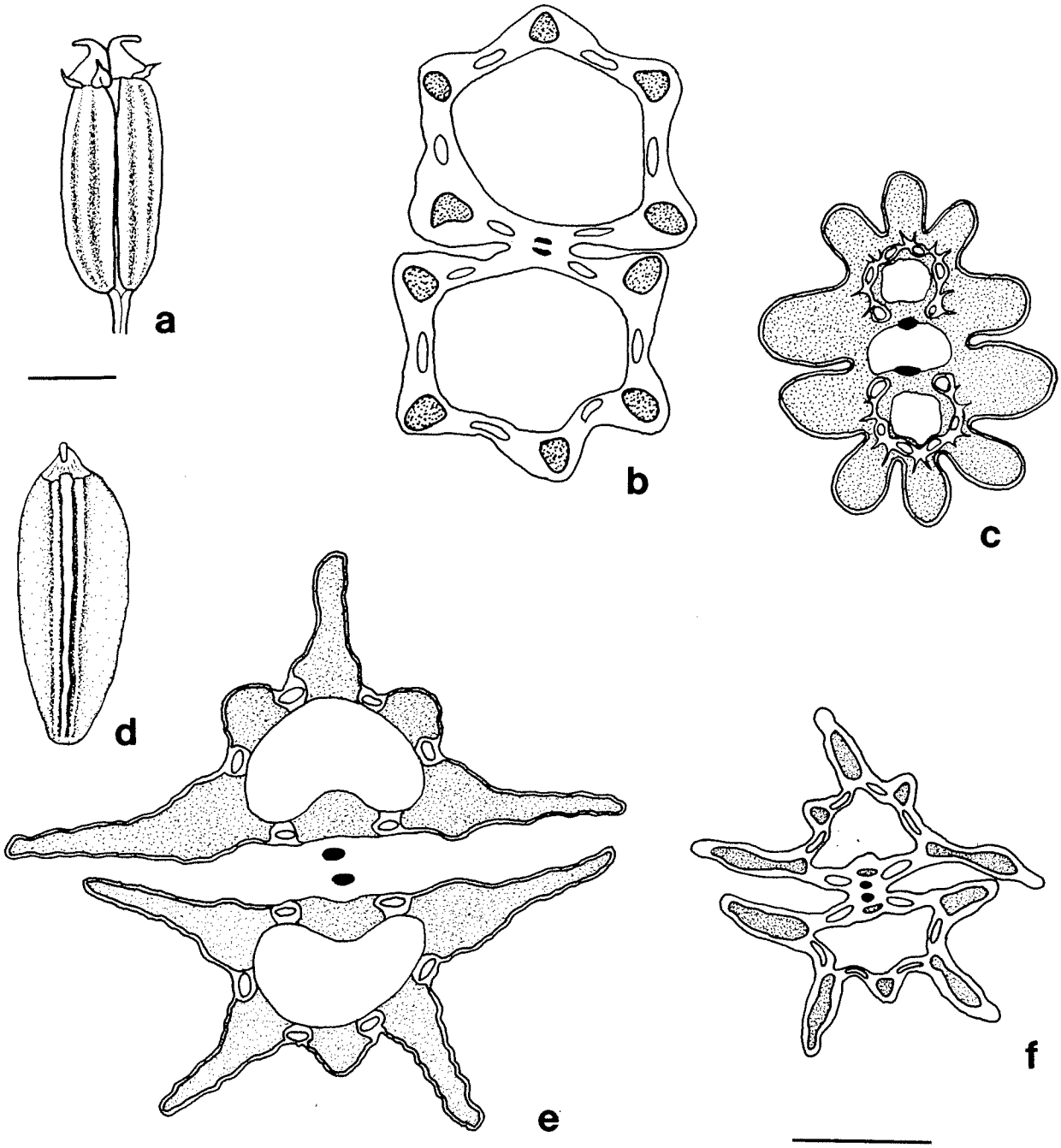


Fig. 6. Fruit structure in *Annesorhiza*: (a) Homomorphic fruit (two mericarps shown) of *A. schlechteri* (Britten 4593); sepals persist. Scale bar = 3 mm. (b)-(c) Homomorphic fruits; transverse sections. Scale bar = 1 mm: (b) *A. wilmsii* (Winter 1175); this basic fruit morphology is also typical of *A. altiscapa*, *A. burttii*, *A. fibrosa*, *A. grandiflora*, *A. latifolia* & *A. schlechteri*. (c) *A. flagellifolia* (Wood 3870); short, blunt, wing-like structures. (d) Heteromorphic fruit (single mericarp shown) of *A. macrocarpa* (Adamson 2876); distinct wings present. Scale bar = 3 mm. (e)-(f) Heteromorphic fruits; transverse sections; all the sepaline ribs and two commissural petaline ribs are expanded into wings. Scale bar = 1 mm: (e) *A. macrocarpa* (Van Wyk et al. 3483). (f) *A. nuda* (Flanagan 2432).

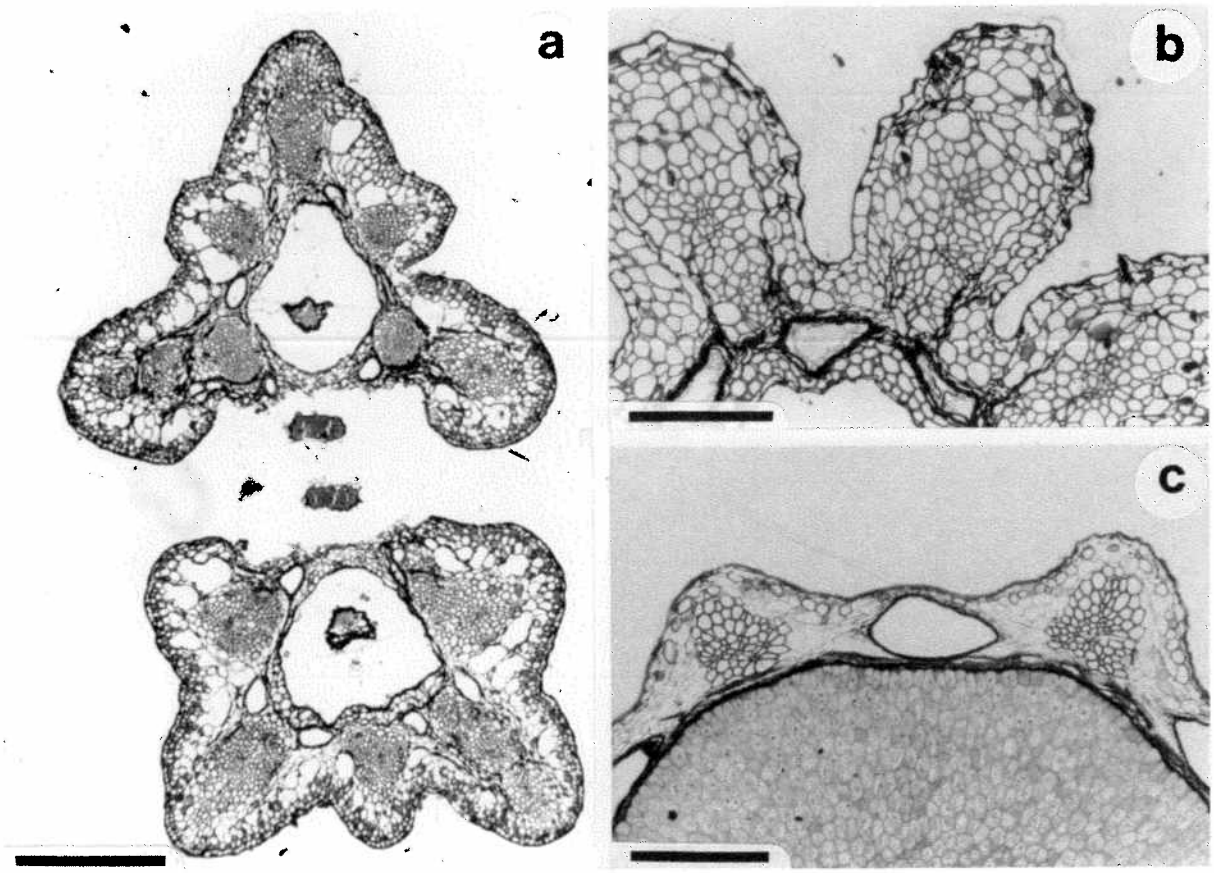


Fig. 7. Fruit structure in *Annesorhiza*: transverse sections: (a) cremocarp of *A. thunbergii* (Thunberg 7161); heteromorphic; ribs expanded but not wing-like. Scale bar = 0.5 mm. (b)-(c) portions of fruit walls. Scale bar = 0.2 mm: (b) *A. flagellifolia* (Wood 3870); slightly lignified cells make up most of the wing-like structure. (c) *A. grandiflora* (Acocks 17566); single layer of lignified hypodermal cells. Note the characteristically expanded and lignified vascular bundles.

or large in one species. Petals pentamerous, whitish to yellow, elliptic or ovate, acuminate, with inflexed apex, keeled on face, glabrous. Stamens pentamerous. Stylopodia broadly conical or cushion-like. Fruits usually at least 5 mm long, oblong, crowned with calyx-teeth and stylopodium, ribs conspicuous and expanded into short blunt wing-like structures in one species or into distinct wings in two species; mericarps homomorphic or heteromorphic, flat on inner face, prominently veined, when heteromorphic, then one 3-ribbed and other 4-ribbed; carpophore bipartite.

Diagnostic characters: Species of *Annesorhiza* are distinguished by the expanded and lignified vascular bundles in the fruit wall (also in *Glia* and *Chamarea*), the hysteranthous leaves (presently only known also to occur in *Chamarea* and some species of *Peucedanum*), the heteromorphic fruits of some species, the often-present fleshy pencil-like roots (shared only with *Chamarea*) and the large number of vascular bundles in the petioles (usually at least eleven). The plants are usually much larger than species of *Chamarea* (larger leaves, taller scapes, larger and differently shaped fruits). Burtt (1991) used the shape and length of the fruit as a key character to distinguish *Annesorhiza* from *Chamarea*: fruits ovate (and abruptly narrowed towards the stylopodium), up to 4 mm long - *Chamarea*; fruits oblong and more than 5 mm long - *Annesorhiza*. Our measurements show that size is indeed a useful guide (Table 2), but less reliable than the more obvious difference in shape. The fruits of *A. lateriflora* are 3 mm long, those of *A. wilmsii* 4 to 6 mm long, and those of *A. nuda* may be 4.5 mm long. Some of the new species of *Chamarea* described by Burtt such as *A. snijmaniae* (based on Perry & Snijman 2092) and A. aff. *gracillima* (Esterhuysen 19944) have distinctly lignified vascular bundles in their fruit together with

hysteranthous leaves, exactly as in *Annesorhiza*.

Key to the species of Annesorhiza

1 Leaves in needle-like segments 2
1 Leaves not in needle-like segments 4

2 Leaves mostly trifid; sepals relatively long (at least 0.5 mm) and cuspidate (Fig. 5b); fruit ribs not expanded into wings; distribution in the Eastern Cape Province ..... 11. *A. schlechteri*
2 Leaves invariably multifid; sepals small (less than 0.3 mm long) with short projection (Fig. 5a); fruit ribs with or without short wings; distribution not in the Eastern Cape Province 3

3 Fruits 5-8 mm long, ribs expanded into short blunt wing-like structures; distribution in KwaZulu-Natal and Mpumalanga ..... 10. *A. flagellifolia*
3 Fruits 3 mm long, ribs not expanded into short blunt wing-like structures; distribution in Northern Cape Province ..... 12. *A. lateriflora*

4 Leaves finely divided (Fig. 2b-e) 5
4 Leaves with broad leaf segments (Fig. 2f-i) 9

5 Flowers and fruits homomorphic 6
5 Flowers and fruits heteromorphic 8

6 Leaves or at least the petioles hairy; margins of ultimate segments of leaflets deeply and similarly indented (Fig. 2b); roots at least 15; persistent leaf bases forming a dense fibrous mass around the base of the plant ..... 8. *A. fibrosa*
6 Leaves and petioles glabrous; margins of ultimate segments of leaflets indented to varying depths (Fig. 2c-e); roots 1 to 3; persistent leaf bases sparse, not as above 7

7 Ultimate leaf segments few and widely spaced (Fig. 2e); flowering stalks thick, usually about 4 mm in diameter; distribution in high altitude fynbos, restricted to mountains of Western Cape Province (Fig. 9) ..... 2. *A. burttii*
7 Ultimate leaf segments with densely crowded teeth (Fig. 2c); flowering stalks thin, usually 2 mm in diameter; distribution in high altitude grassland of the Northern Province, Mpumalanga and Swaziland (Fig. 12) ..... 9. *A. wilmsii*

8 Ribs of fruit extended into well-developed wings; fruits more than 8 mm long and 3 mm wide ..... 4. *A. macrocarpa*
8 Ribs of fruit not forming well-developed wings; fruits ± 7 mm long and ± 2 mm wide. (A poorly known species) ..... 3. *A. thunbergii*

9 Leaves, or at least the petioles, hairy 10
9 Leaves (and petioles) glabrous 11

10 Leaf hairs confined to petiole and main veins; roots thick and fleshy ..... 6. *A. latifolia*
10 Leaf hairs over entire lamina, not confined to petiole and main veins; roots usually thin and not markedly fleshy ..... 5. *A. grandiflora*

11 Ultimate leaf segments relatively large, deltoid, deeply divided at the base (Fig. 2f); roots at least 10; flowers and fruits homomorphic; flowering time August and September ..... 7. A. *altiscapa*
11 Ultimate leaf segments small, oblong, sessile (Fig. 2h); roots 1 to 3; flowers and fruits heteromorphic; flowering time November to May ..... 1. *A. nuda*

1. A. nuda (Ait.) B. L. Burtt

In Edinb. J. Bot. 48(2): 179 (1991). – Type: Cult. RBG Kew, 1780 Seed from Cape, P. Russell, (holo., BM). (See Burtt 1991, pp. 257-258).

≡ *Bupleurum nudum* Aiton, Hort. Kew. 1: 331 (1789), ed. 2, 2: 122 (1811). [*Buprestis (Bupleurum nudum* Ait.) Spreng. in Naturk. Verh. Holl. Maatsch. Weten. 7(1): 122 (1814).]

≡ *Tenoria nuda* (Ait.) Spreng. in Neue Schriften Naturf. Ges. Halle 2(1) (Umbell. Prodr.) 32 (1813).

= *Annesorhiza capensis* Cham. & Schlechtd. in Linnaea 1: 399 (1826); Sonder in Fl. Cap. 2: 545 (1862) excl. syn.; Adamson in J. S. Afr. Bot. 4: 61 (1938) & in Adamson & Salter, Fl. Cape Pen. 623 (1950); Bond & Goldblatt, Pl. Cape Flora, 140 (1984); Bond & Goldblatt, Pl. Cape Flora, 140 (1984). – Type: Cape, Constantia, Bergvliet farm, Purcell 335 (SAM!, sheet a, neotype, designated here; SAM!, sheet b, sheet c, isotypes). Note: No duplicates of the three original syntype specimens in B (known to be destroyed by fire) have yet come to light. These were "Table Mt"., Chamisso s.n.; "Lion Mt & Rondebosch", Bergius s.n.; "Paerdebund", Mund & Maire .

≡ *Oenanthe capensis* (Cham. & Schlechtd.) D. Dietr. Syn. Pl. 2: 953 (1840). – Type as above.

= *Annesorhiza montana* Eckl. & Zeyh., Enum. 344, no. 2214 (1837). – Lectotype (chosen by Burtt 1991): Cape, mountain near Cape Town, Ecklon & Zeyher 2214 (S!, herb. Sonder no. 166; S!, SAM!, isolecto.).

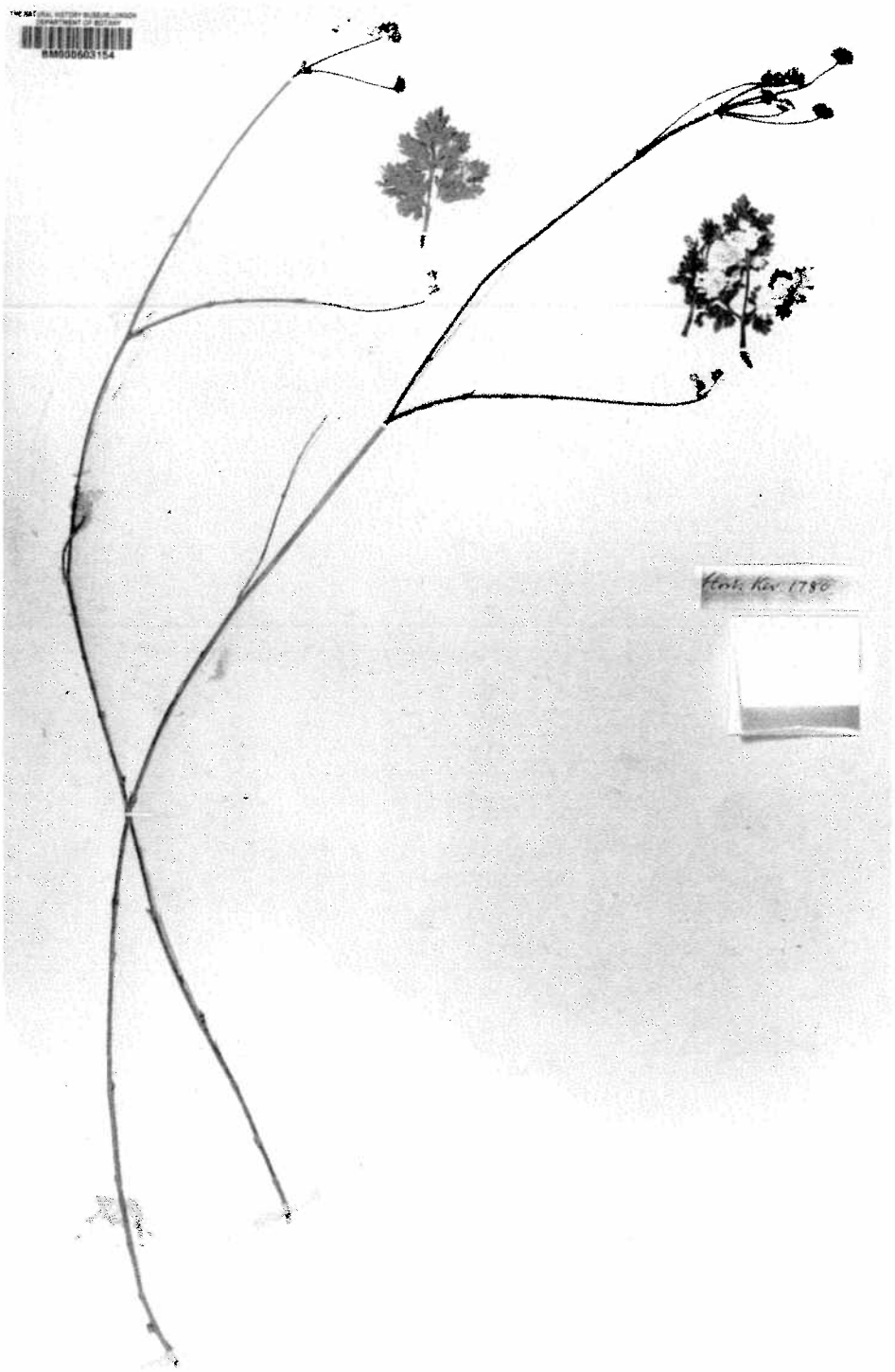


Fig. 8. The holotype of *Annesorhiza nuda*.

≡ *Oenanthe montana* (Eckl. & Zeyh.) D. Dietr. Syn. Pl. 2: 953 (1840). – Type as above.

Roots 1-3, new root formed each year, remains of old also present, very fleshy throughout length. Leaves coarsely dissected, glabrous, produced in winter but frequently persist during flowering and fruiting, leaf bases persist as conspicuous fibres. Petioles up to ± 150 mm long. Basal pinnae with petiolules up to ± 30 mm long, usually bipinnate. Upper pinnae pin-

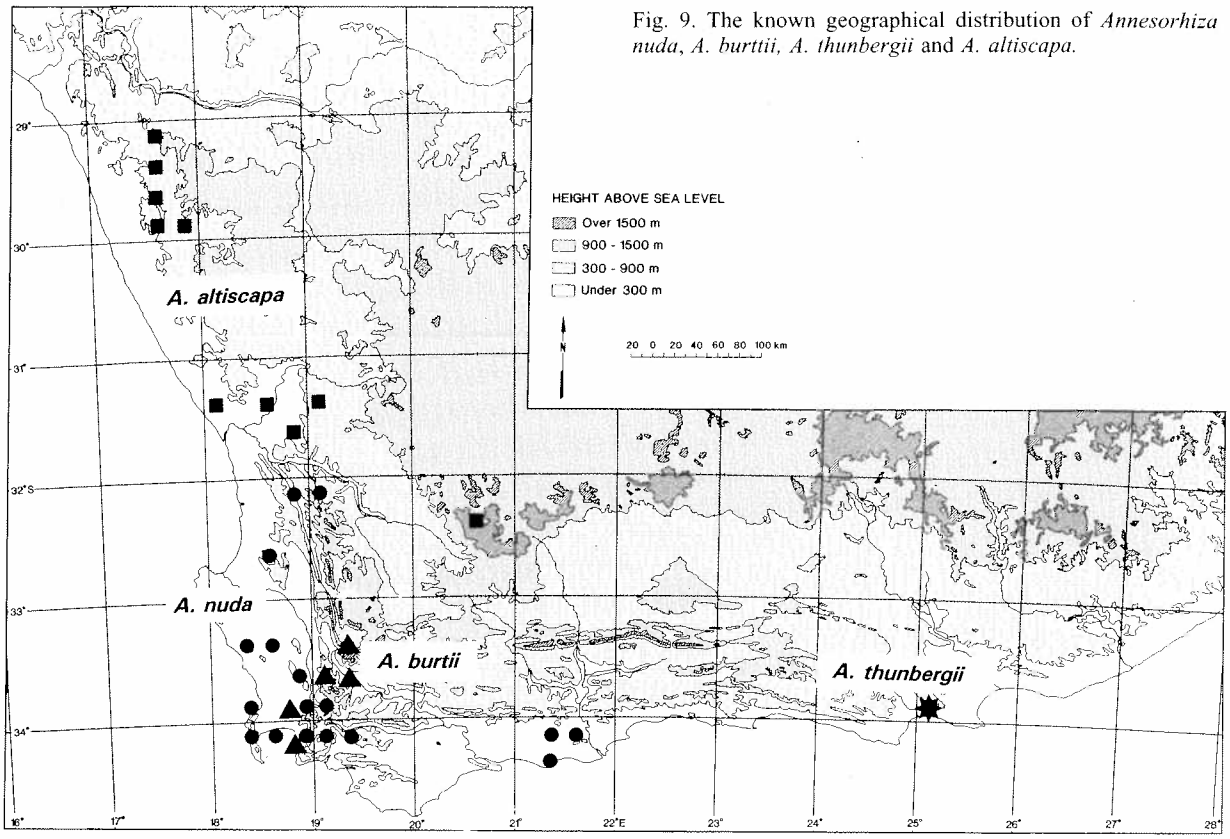


Fig. 9. The known geographical distribution of *Annesorhiza nuda*, *A. burttii*, *A. thunbergii* and *A. altiscapa*.

nate. Ultimate leaflet segments relatively large, narrowly ovate, base usually broad, margins indented to varying depths (Fig. 2h). Inflorescence scape up to ± 1 m and usually smooth with 3-7 umbels per scape, main umbel of 3-7 rays. Involucral bracts small, persistent, acuminate. Involucel of narrowly ovate, acuminate bracteoles. Calyx lobes cuspidate, minute. Petals white to yellow. Fruits ± 4.5-7 mm long, ± 2 mm wide, mericarps heteromorphic (Fig. 6f).

Notes. The appearance of *A. nuda* is shown in Fig. 8 and the characteristic features are listed in Table 2. It is very similar to *A. grandiflora* in distribution and leaf form but differs in having glabrous leaves; also, a single root is usually formed each year and the fruits are heteromorphic. It tends to be a smaller and less robust plant. The roots of *A. nuda* and *A. burttii* have a distinct sclerenchyma layer below the periderm; this is absent from all other species. Specimens from the eastern part of the distribution (Bredasdorp to Still Bay) differ from the typical form in the larger involucral and involucellar bracts, slightly larger fruits which tend to have sharp wings (tapering as seen in transverse section) rather than blunt-tipped as in the typical *A. nuda*. The leaves appear to be quite different; they are deeply dissected while the terminal segments are sparsely and coarsely dentate as opposed to the much broader segments with the more numerous shallower dentations of the typical *A. nuda*. Anatomically, the fruits appear almost identical. This form of the species needs to be investigated in more detail in future studies since it may possibly be a distinct taxon. The fact that this plant occurs on limestone soils is a further indication that it may differ genetically from the typical *A. nuda* but we find no distinct discontinuities to justify formal recognition of it.

Annesorhiza nuda is found in the extreme south western part of the Cape (Fig. 9) where it grows on clayey soils and, towards the east, along the coast near the Gouritz River, on limestone soils. The recorded flowering time is November to May. In the "typical" specimens, flowering appears to be mainly in February and March and occasionally in April and May (except for Salter 1696 [BOL] which has fruits even in December). In the eastern part of the distribution area, flowering is essentially in December (except for Pillans 8711 where it is recorded in February). Vernacular names include soetanyswortel ("sweet anise root") and vlakte anyswortel ("plains

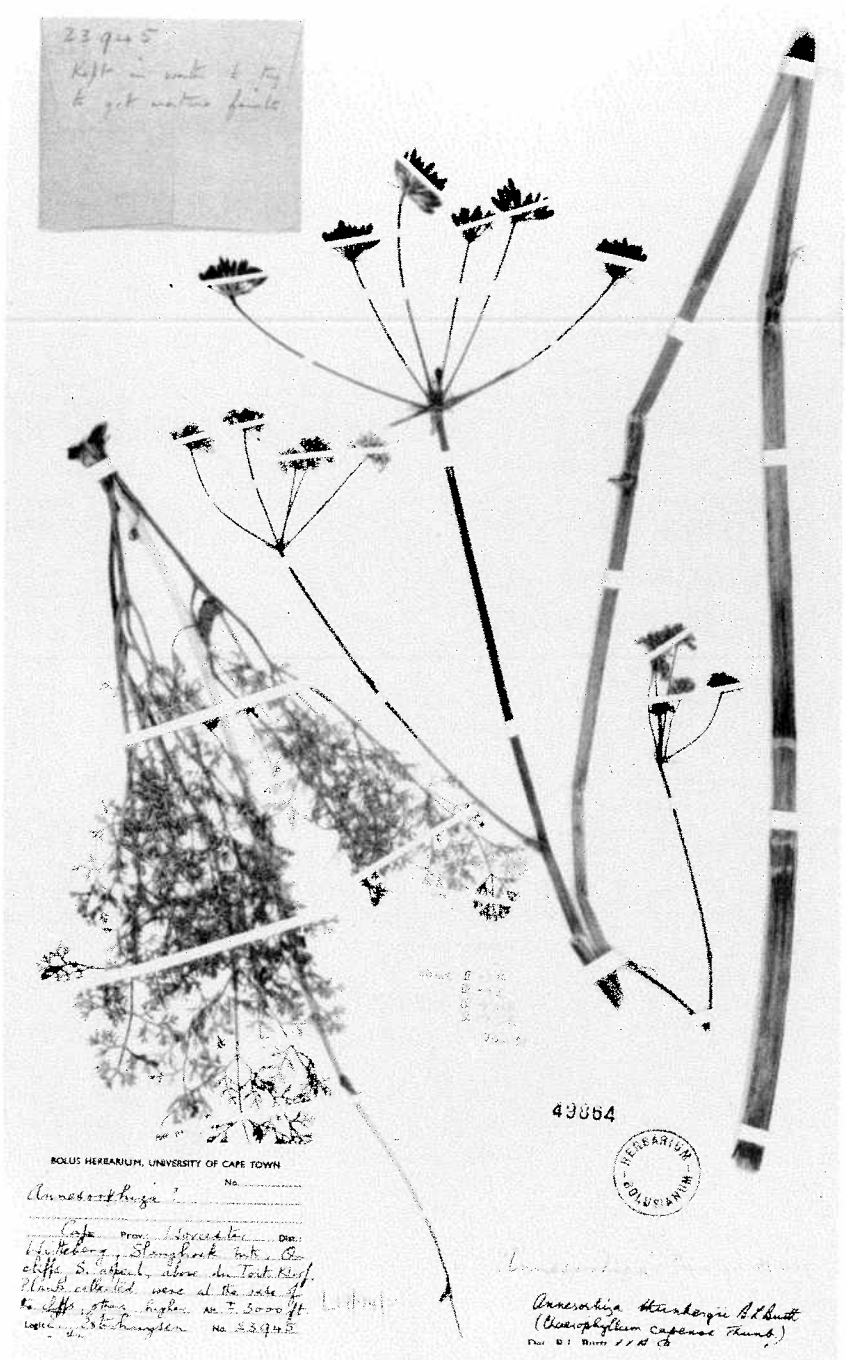


Fig. 10. The holotype of *Annesorhiza burttii*. Note the finely divided leaves and the thick flowering stalk.

anise root").

Selected additional specimens. Cape Peninsula: Devil's Peak, lower slopes, Adamson 2837 (BOL); Near Rondebosch, Bolus 4571 (BOL); Cape Peninsula: Wynberg Hill, Bolus 13310 (BOL); Hall s.n. (NBG); Simonstown: Bergvliet Farm, Peter's Hill, Constantia, Purcell 335 sheets b & c (NBG); Cape Peninsula: Wynberg Hill, Salter 8992 (= Salter 8752) (NBG); Cape Town: Table Mtn., above Claremont, Schlechter 739 (BOL); Jonkershoek, Schubert 26 (JRAU); Paarl Mountain, Van Wyk, Winter & Tilney 3491 (JRAU).

2. A. burttii B-E. van Wyk sp. nov.

Annesorhizae nudae, *A. thunbergii* et *A. macrocarpae* similis sed mericarpiis aequalibus differt. Etiam ab *A. nuda* foliis tenuius divisis, et *A. macrocarpa* radice unica differt. – Type: Cape, Worcester district, Slanghoek Mts., Witteberg, Esterhuysen 23945 (BOL!, holo.; K, E, MO, STE, iso.).

Roots single or with the remains of the previous season's root, thick and fleshy throughout. Leaves finely dissected, glabrous, hysteranthous but fading leaves may be present while flowering, leaf bases inconspicuous, not persistent. Petioles up to ± 170 mm long. Basal pinnae with petiolules up to 100 mm long, usually bipinnate. Upper pinnae may be bipinnate or pinnate. Ultimate leaflet segments relatively small and narrow, dissected, base narrow, margins indented to varying depths (Fig. 2e). Inflorescence scape up to 1.3 m and essentially smooth with usually 1-6 umbels per scape, main umbel of 5-7 rays. Involucral bracts relatively large, persistent. Involucel of small to relatively large bracteoles with acute apices. Calyx lobes cuspidate, up to 0.3 mm long. Petals yellow. Fruit ± 5 mm long, ± 2 mm wide, mericarps homomorphic, without wings (Fig. 6b).

Notes. This species is similar to *A. nuda*, *A. thunbergii* and *A. macrocarpa* but differs in the homomorphic, wingless fruits. It also differs from *A. nuda* in the more finely dissected leaves and from *A. macrocarpa* in the single root. The distinctive appearance of *A. burttii* is shown in Fig. 10 and the diagnostic characters are listed in Table 2. The leaves are finely dissected as in *Chamarea* with ultimate leaf segments narrow (± 1.5 mm wide) and the single main vein prominent. The flowering stalks tend to be robust - about 4 mm in diameter. *Annesorhiza wilmsii*, which also has finely dissected leaves, has flowering stalks about half the thickness as well as a different habitat and a distribution quite distinct from *A. burttii* (cf Figs 10 & 18).

Annesorhiza burttii reduces the apparent morphological isolation of *A. nuda* and *A. macrocarpa* (the two species with winged, heteromorphic fruits) from the rest of the genus because it has homomorphic fruits. It also combines the root characters of the former with the leaf characters of the latter. The new species is named after Mr B.L. Burtt who has made an important contribution to the taxonomy and nomenclature of the southern African Apiaceae. Burtt (1991) included this species under the poorly known *A. thunbergii*, but the fruit of the latter has proven to be heteromorphic (see below).

Annesorhiza burttii is known only from the mountains of the Western Cape Province (Fig. 9) where it tends to grow on inaccessible ledges and in cracks on cliffs or at the base of cliffs. The recorded flowering time is November and December.

Additional specimens examined. Ceres: Mitchell Peak, Waaihoek Mtns., shady ledge on S.W. slopes, Esterhuysen 14779 (BOL, PRE); Paarl: Donker Kloof, Haalhoek, Sneeukop, near waterfall, Esterhuysen 20863 (BOL); Worcester: Witteberg, cliffs, S aspect, Esterhuysen 22314 (BOL); Stellenbosch: Simonsberg, kloof on W side, nearest Helshoogte, growing from cracks in cliff face, Esterhuysen 35280 (BOL); Paarl: Dragoon Buttress, Groot Drakenstein Mtns., on ledge on steep slope, Esterhuysen 35654 (BOL); Ceres: Witels Kloof, on ledges at base of cliffs, west aspect, Esterhuysen s.n. (BOL).

3. A. thunbergii B. L. Burtt

In Edin. J. Bot. 48(2): 180-181 (1991), pro parte. – Type: Cape, Loerie's River, Thunberg s.n. sub THUNB-UPS 7161 (UPS!, holo.). Note: the species is known only from the single type specimen (see Fig. 8 in Burtt 1991).

≡ *Chaerophyllum capense* Thunb., Prodr. 51 (1794), Fl. Cap. 253 (1823) - non *Annesorhiza capensis* Cham. & Schlechtd. – Type as above.

= *Myrrhis capensis* (Thunb.) Spreng. in Comm. Soc. R. Sci. Goett. 2: 5 (1813) & Spec. Umb. 132 (1818). – Type as above.

Roots unknown. Leaves finely dissected, glabrous, may be present during flowering, leaf bases unknown. Basal pinnae with petiolules ± 20 mm long, bipinnate. Upper pinnae pinnate. Ultimate leaflet segments relatively small, sparsely dissected, base narrow, margins indented to varying depths. Inflorescence scape ± 0.6 m? with ± 4 umbels per scape, main umbel of ± 4 rays. Involucral bracts small, persistent, acuminate. Involucel of small narrowly ovate, acuminate bracteoles. Calyx lobes minute. Petal colour unknown. Fruits ± 7 mm long, ± 2 mm wide, mericarps heteromorphic, without distinct wings (Fig. 7a).

Notes. The characteristic features of *A. thunbergii* are given in Table 2. A photograph of the type specimen is shown in Burtt (1991). It resembles *A. macrocarpa* in the finely dissected leaves and heteromorphic fruits. However, the fruit size and structure differ from that of the other heteromorphic species where distinct wings are present.

Annesorhiza thunbergii is known only from the type locality in the Eastern Cape Province (Fig. 9)

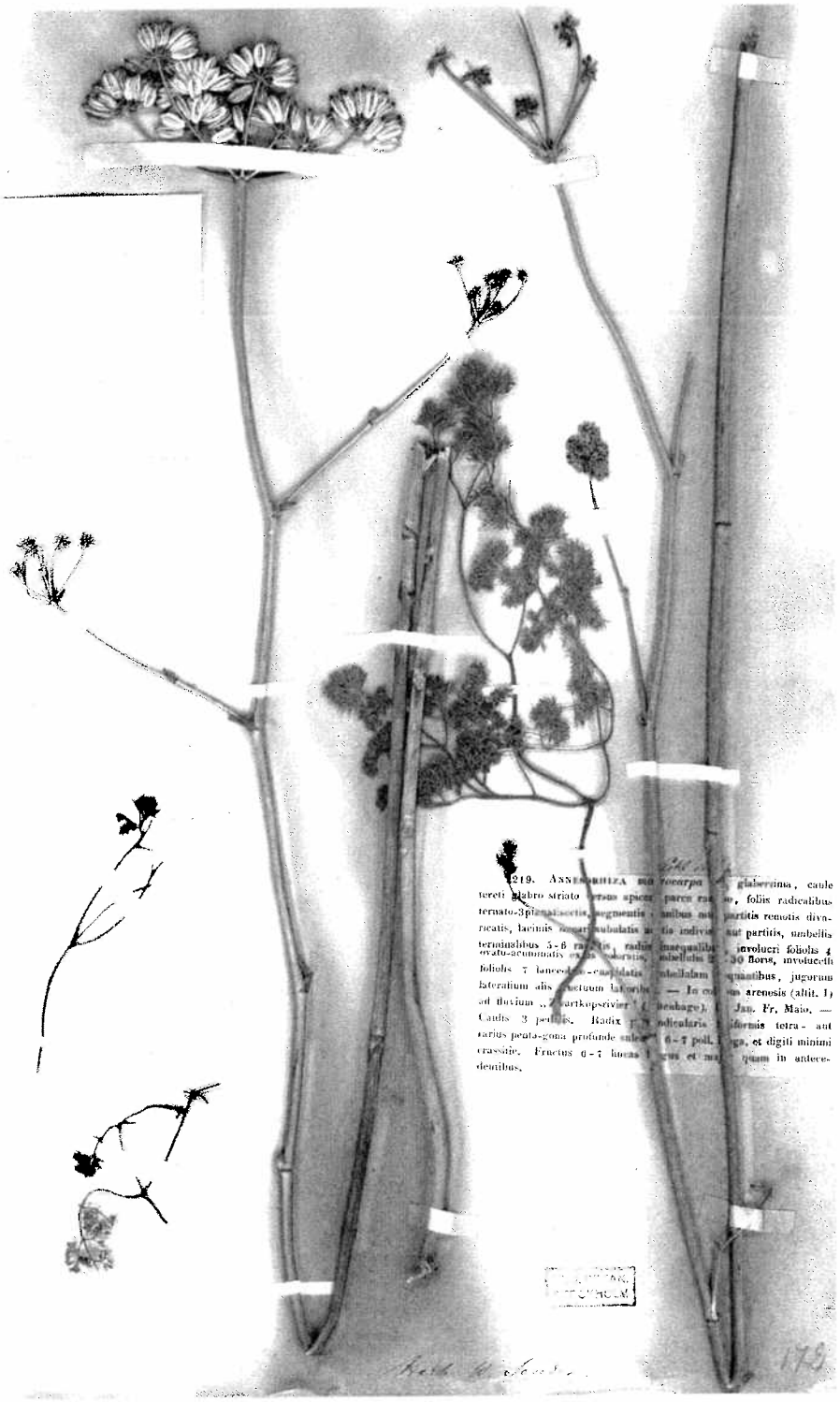


Fig. 11. The lectotype of *Annesorhiza macrocarpa*. Note the finely divided leaves and large, winged fruits.

and from a single specimen in the Thunberg collection. The exact flowering time is not known.

4. A. macrocarpa Ecklon & Zeyher

In Enum. 345 (1837); Sonder in Fl. Cap. (1862); Bond & Goldblatt, Pl. Cape Flora, 140 (1984); Burtt in Edin. J. Bot. 48(2): 179 (1991). *Oenanthe macrocarpa* (Eckl. & Zeyh.) D. Dietr., Syn. Pl. 2: 953 (1840). – Lectotype (chosen by Burtt 1991): Cape, Uitenhage, Zwartkops River, Ecklon & Zeyher 2219 (S! Sonder herb. no. 172; K!, SAM! 3 sheets, isolecto.).

= *Annesorhiza spuria* Eckl. & Zeyh., Enum. 345 (1837). – Type: Cape, Doornhoogde, Ecklon & Zeyher 2217 (S!, lecto., designated here; SAM!, isolecto.).

≡ *Oenanthe spuria* (Eckl. & Zeyh.) D. Dietr., Syn. Pl. 2: 953 (1840). – Type as above.

Roots numerous (at least 15), slightly to usually markedly fleshy and evenly thickened, ridged, smell of aniseed. Leaves finely dissected, glabrous, usually absent at time of flowering, produced in winter (from May but may persist till February), leaf bases not persistent. Petioles up to ± 400 mm long. Basal pinnae with petiolules very variable in length, frequently multicompound. Upper pinnae frequently compound. Ultimate leaflet segments relatively small, sparsely dissected, base narrow, margins indented to varying depths (Fig. 2d). Inflorescence scape up to ± 1.5 m long and smooth to striated with usually 2-4 (-6) umbels per scape, main umbel of 5-35 rays. Involucral bracts usually small, persistent. Involucel of small narrowly ovate, acuminate bracteoles. Calyx lobes minute and ± cusp-like, or a little larger, up to 0.3 mm long. Petals pale yellow. Fruits ± 8-12 (-14) mm long, (3-) 4-5 (-6) mm wide, mericarps heteromorphic, with distinct wings (Fig. 6d & e).

Notes. The typical appearance of *A. macrocarpa* is shown in Fig. 11 and the diagnostic features are given in Table 2. The distribution overlaps with several other species. However, the large, numerous roots are characteristic and distinguish the species from *A. burttii* and *A. nuda*. If leaves and/or flowers or fruits are present, it can readily be distinguished from the other species by its finely divided, glabrous leaves (Fig. 2d) and heteromorphic carpels and mericarps, the latter being particularly large (Fig. 6e). There is, however, considerable variation in the size of the inflorescences and fruits in this species. A robust form previously known as *A. spuria*, however, does not seem distinct at the species level. Following Adamson (1938), Burtt (1991) considered *A. spuria* as a synonym of *A. macrocarpa*, a view that we uphold. The root anatomy of the species is unique and interesting. There are very small and very large vittae present, and the starch-containing cells are arranged in a radial manner (Fig. 1d) , visible in a root cross-section (even with the naked eye) as a distinctive pattern resembling spokes of a wheel.

An atypical specimen from the Bredasdorp region

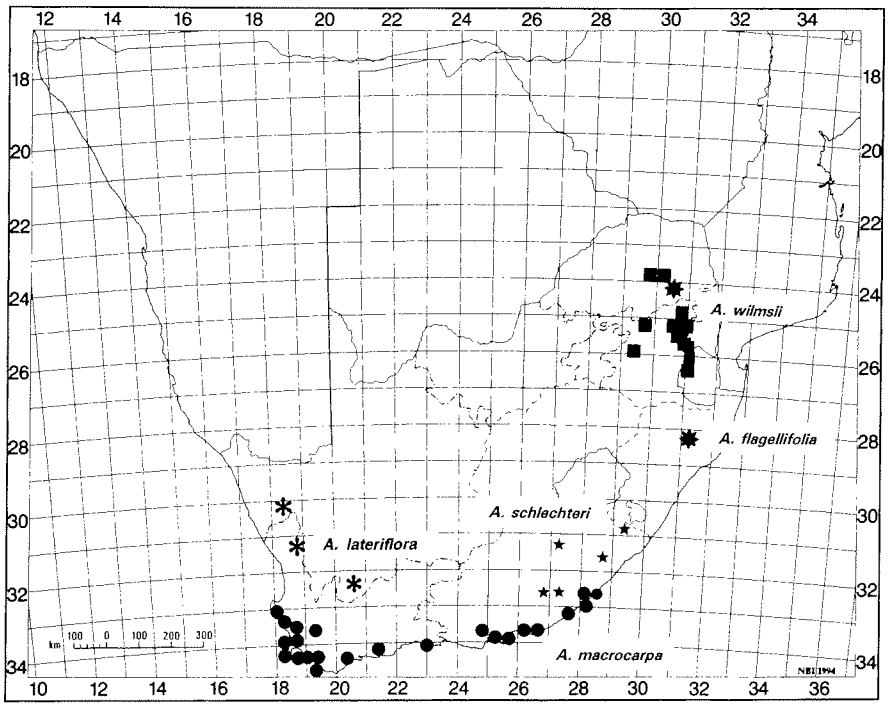


Fig. 12. The known geographical distribution of *Annesorhiza macrocarpa, A. wilmsii, A. flagellifolia, A. schlechteri* and *A. lateriflora.*

(Fellingham 930) is here considered to be a small-fruited form of *A macrocarpa*. Macroscopically the fruits of Fellingham 930 resemble those of *A. macrocarpa* except that they are smaller. However, anatomically they resemble more closely those of *A. nuda* (see discussion of selected characters above). Although only two roots are present in this specimen, it is possible that others could have been removed. Microscopically the root lacks the conspicuous outer sclerenchyma layer found in the roots of *A. nuda*. It may be worthwhile to obtain more specimens of this small-fruited plant and to confirm the relationship with *A. macrocarpa*.

Annesorhiza macrocarpa is essentially a coastal species found in the Western Cape and Eastern Cape Provinces (Fig. 12). It usually grows in large numbers on coastal and inland sand dunes. The recorded flowering time is August to February, with a peak in January.

Selected additional specimens. Cape Peninsula, coast west of Bonteberg, sand dunes, Adamson 1817 (BOL, PRE); Worcester: Worcester brickworks, deep sand, Bayer 3241 (NBG); near Kalk Bay, Bolus 4531 (BOL); Malmesbury: Burgers Post Farm, near Pella, Fynbos Biome Research Site, well-drained, sandy soil, Boucher/Shepherd 4942 (STE); Knysna: sandy hill slopes, Belvedere, Duthie sheets 866 & 866a (BOL, GRA); East London: Kidd's Beach, sandy grassland on stabilized dunes and around bush clumps, Hilliard & Burtt 14816 (NBG); St James, hillside, Marloth s.n. (BOL 58782); Simonstown, Holbaai Point, Rourke 1700 (NBG, PRE); Cape: 5.8 km from Robertson on McGregor road, Van Wyk, Winter & Tilney 3483 (JRAU); Caledon: Die Mond, Voelklip, deep sandy soil, Williams 744 (NBG).

5. A. grandiflora (Thunb.) Hiroe

Umbell. World, 676 (1979); Bond & Goldblatt, Pl. Cape Flora, 140 (1984); Burtt in Edin. J. Bot. 48(2): 178 (1991). – Type: Cape, Thunberg s.n. sub THUNB-UPS 7045 (UPS!, holo.).

≡ *Sium grandiflorum* Thunb., Prodr. 50 (1794). – Type as above.

≡ *Levisticum grandiflorum* (Thunb.) Sonder in Fl. Cap. 2: 553 (1862). – Type as above.

= *Bubon pimpinellifolium* Eckl. & Zeyh., Enum. 353 (1837). – Type: Worcester, Vier-en-twintig Rivieren, Ecklon & Zeyher 2251 (E, S, SAM!, 2 sheets, inflorescence only, the leaves are *Glia gummifera*).

= *Annesorhiza villosa* (Thunb.) Sonder in Fl. Cap. 2: 546 (1862), synon. nov. – Type: Cape, Thunberg s.n. sub THUNB-UPS 7064 (UPS!, holo.).

≡ *Sium villosum* Thunb., Prodr. 51 (1794), & Fl. Cap. ed. Schultes 262 (1823). – Type as above.

= *Annesorhiza hirsuta* Eckl. & Zeyh., Enum. 344 (1837), Sonder in Fl. Cap. 2: 546-547 (1862); Bond & Goldblatt, Pl. Cape Flora, 140 (1984); Burtt in Edin. J. Bot. 48(2): 179 (1991), synon. nov. – Type: Cape, Hottentotsholland mountains, Ecklon & Zeyher 2215 (S!, sheet A, lecto., designated here; S! sheet B, SAM!, isolecto.).

≡ *Oenanthe hirsuta* (Eckl. & Zeyh.) D. Dietr., Syn. Pl. 2: 953 (1840).

= *Annesorhiza elata* Eckl. & Zeyh., Enum. 345 (1837); Sonder in Fl. Cap. 2: 546 (1862), excl. syn. *Pimpinella capensis* Thunb. – Lectotype (chosen by Burtt 1991): Cape, Tafelberg, near Tokay, Zwarteberg, Ecklon & Zeyher 2218 (S!, sheet 179, lecto.; S!, sheet 178, S! sheet 177, isolecto.). [Note: Burtt (1991) provisionally chose Zeyher 468 (= Ecklon & Zeyher 2218 sub Herb. Sond. 179) as lectotype. We have examined the three sheets in S and all three are clearly *A. grandiflora* (*A. elata*)].

≡ *Oenanthe elata* (Eckl. & Zeyh.) D. Diet., Syn. Pl. 2: 953 (1840).] – Type as above.

Roots at least 6, slightly and evenly fleshy (except for Stirton & Zantovska 11437 where roots are very fleshy), purported to have a sweet taste. Leaves usually coarsely dissected, very hairy to sparsely hairy, often present during flowering and fruiting, leaf bases persist as somewhat inconspicuous fibres. Petioles up to ± 200 mm long, hairy. Basal pinnae with petiolules up to ± 80 mm long, sometimes partly bipinnate. Upper pinnae pinnate, pinnule base often inequilateral. Ultimate leaflet segments relatively large, ovate, base usually fairly broad, margins indented to varying depths (Fig. 2g). Inflorescence scape up to ± 2 m and striated with usually 4-8 umbels per scape, main umbel with 3-7 rays. Involucral bracts relatively large, persistent. Involucel of small narrowly ovate bracteoles, more numerous than involucral bracts. Calyx lobes cusp-like, up to 0.3 mm long. Petals yellow. Fruits ± 6-7 mm long, ± 2-3 mm wide, mericarps homomorphic, without wings (Fig. 6b).

Notes. The characteristic appearance of *A. grandiflora* is shown in Fig. 13 and the diagnostic features are listed in Table 2. *Annesorhiza grandiflora* occurs in the south western Cape where other species of the genus may also be found (Fig. 14). However, it may be distinguished by the leaves which are both broad and hairy (Fig. 2g). Hairs are usually not confined to the petiole and main veins but are also present on the lamina. Plants from the extreme eastern localities ("Sutherland form") are glabrescent, with a few hairs confined to the petioles and midribs

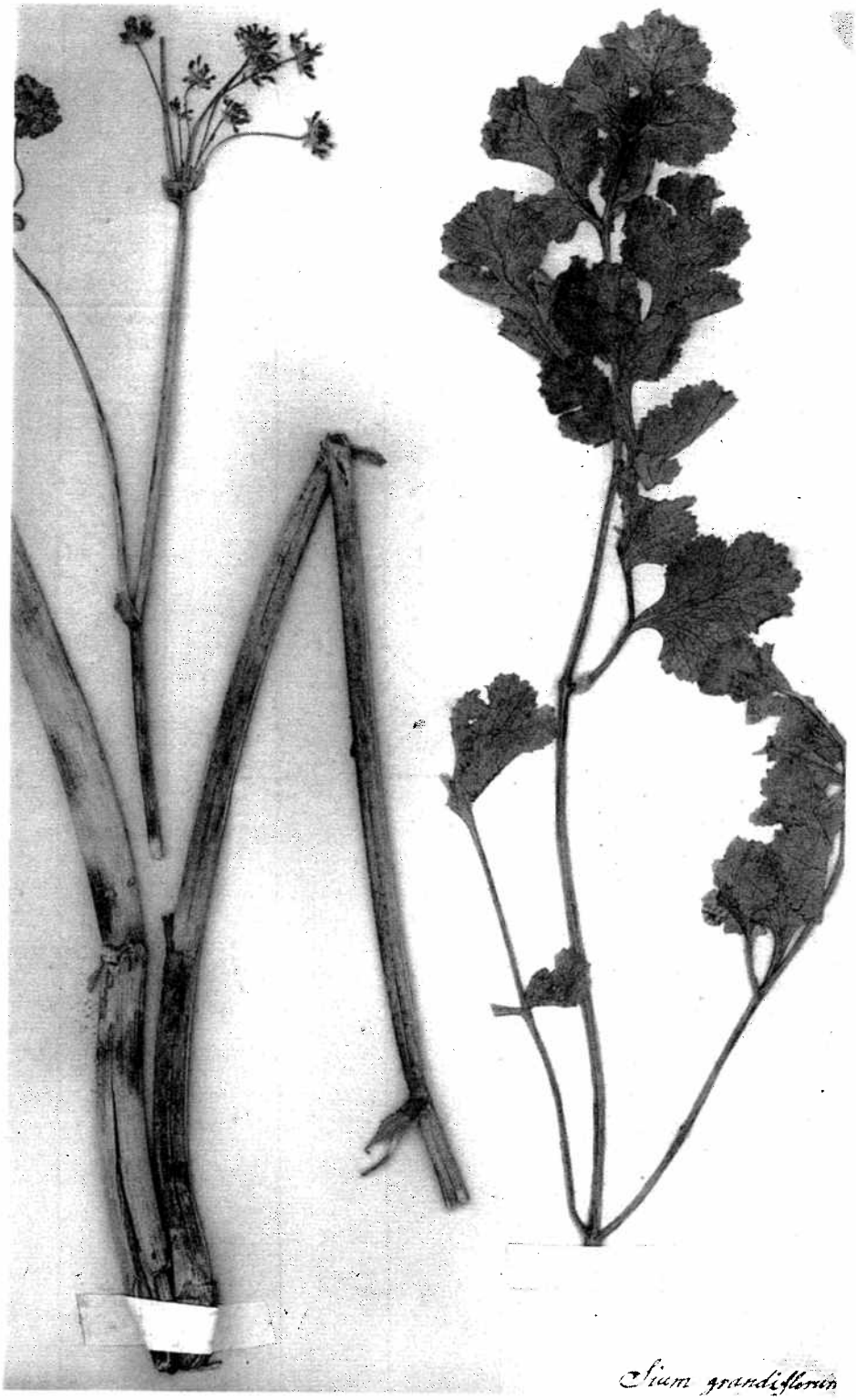


Fig. 13. The holotype of *Annesorhiza grandiflora*. The leaves are broad and hairy.

of the leaves. *Annesorhiza grandiflora* appears to be very closely related to *A. latifolia* and the latter may eventually prove to be a northern form of *A. grandiflora* rather than a distinct species. The two

species are similar except that *A. latifolia* tends to be more robust, less hairy (although two hair types (Fig. 3) were observed as opposed to a single one in *A. grandiflora*), and have a different leaf size and texture (almost "cabbage-like"). Anatomically, the roots and petioles of the more robust *A. latifolia* contain more lignified cells (Table 2) than those of *A. grandiflora*. Generally this is also true as far as the lignification of the fruits is concerned and the marked similarity between the Sutherland specimens of *A. grandiflora* and *A. latifolia*, has been remarked on earlier. The pattern of lignification provides further support to a close relationship.

Annesorhiza grandiflora is restricted to the south western and northern Cape (Fig. 14) and has been recorded on sandy and clayey soils. The recorded flowering time is mainly October and November with occasional records continuing into February.

Selected additional specimens. Calvinia: Lokenberg, Acocks 17566 (PRE); Cape Peninsula: Royal Observatory, Adamson s.n. (BOL 58769), Compton 16042 (NBG); Bolus s.n.; Stellenbosch district: Faure, Compton 14189 (NBG); Bellville: Tygerberg Nature Reserve, Loubser 3480 (NBG); slopes of Table Mountain, MacOwan 1879 (BOL, SAM); granite hills near Saldanha Bay, Marloth 8217 (PRE); Western Cape: Matroosfontein Farm, between Aurora, Stirton & Zantovska 11437 (NBG); Clanwilliam: Pakhuis Pass, near Leipoldt's grave, Van Wyk 3513 & 3615 (JRAU).

6. A. latifolia Adamson

In J. Bot. 76: 346 (1938); Burtt in Edinb. J. Bot. 48(2): 179 (1991). – Type: Namaqualand, near Leliefontein, Adamson 1482 (BOL!, holo.; BM, iso.).

Roots numerous (about 15 or more), very fleshy throughout length. Leaves large and robust, coarsely dissected, glabrous except for petiole, main veins very sparsely pilose to glabrous, leaves may persist while flowering or even fruiting (into December), leaf bases persist as somewhat inconspicuous fibres. Petioles up to ± 150 mm long, sparsely pilose. Basal pinnae with petiolules up to ± 70 mm long, fre-

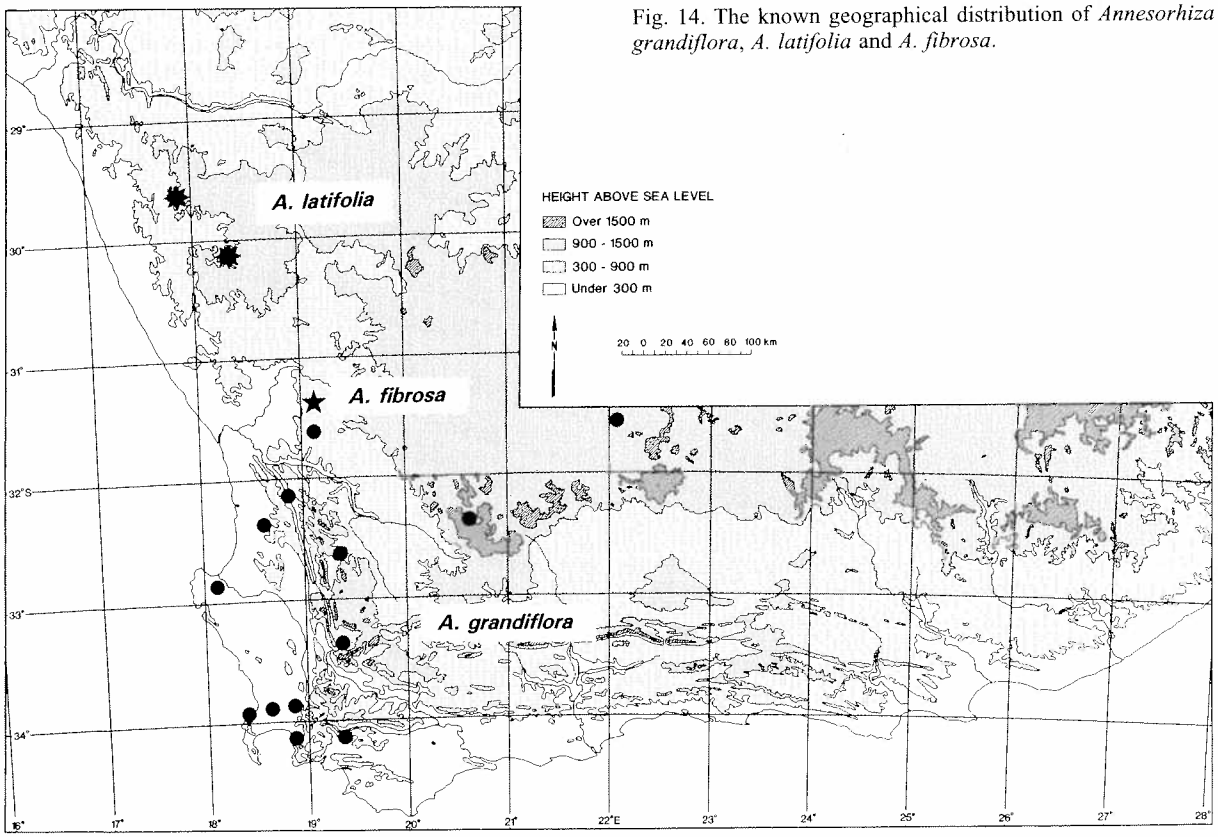


Fig. 14. The known geographical distribution of *Annesorhiza grandiflora*, *A. latifolia* and *A. fibrosa*.

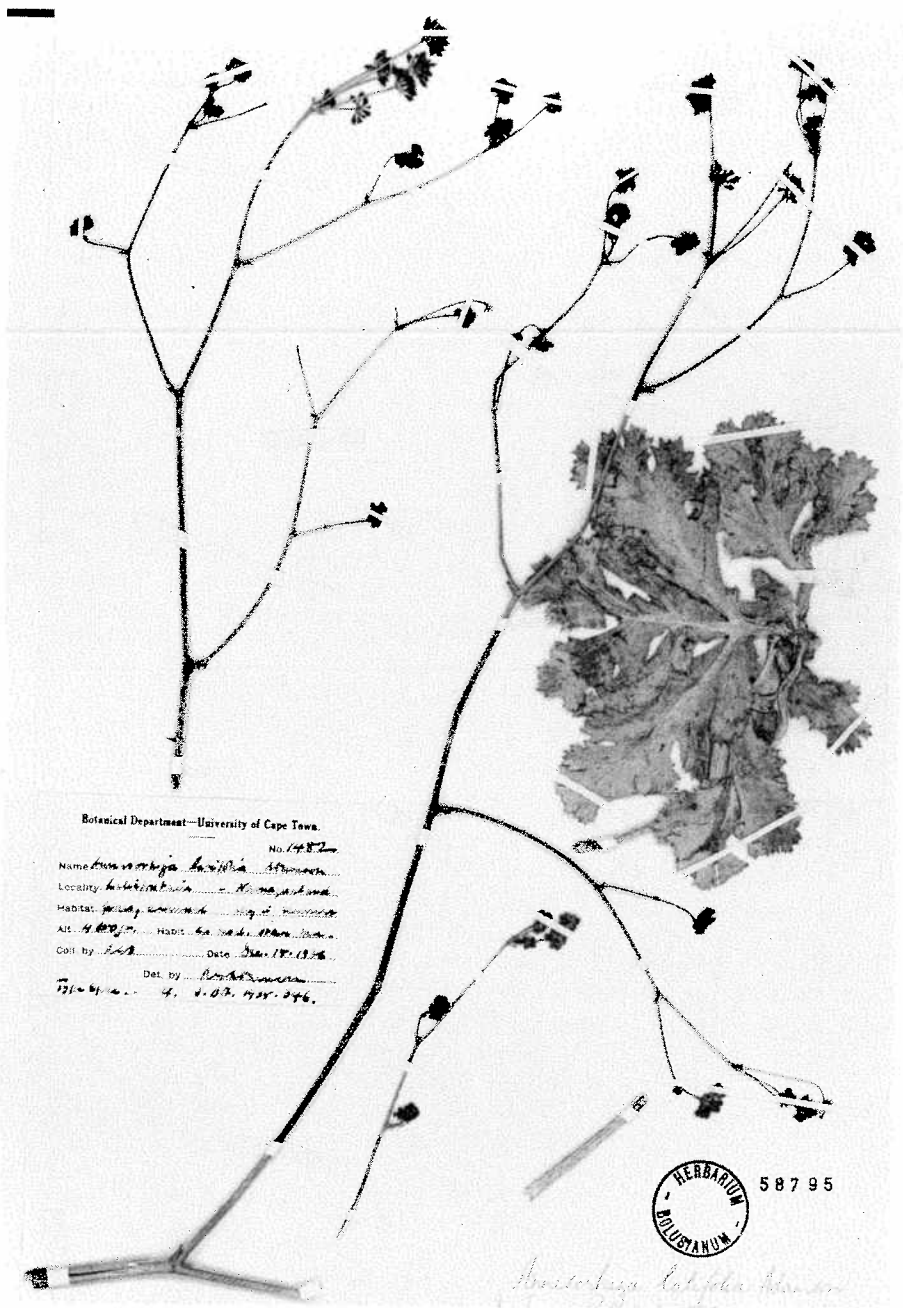


Fig. 15. The holotype of *Annesorhiza latifolia*, showing the robust appearance of the leaves.

quently bipinnate. Upper pinnae usually pinnate. Ultimate leaflet segments relatively large, ovate, base usually broad, margins indented to varying depths (Fig. 2i). Inflorescence scape up to ± 1.6 m and striated with usually 4 or 5 umbels per scape, main umbel of 3-10 rays. Involucral bracts small, persistent. Involucel of small narrowly ovate bracteoles. Calyx lobes cusp-like, up to 0.3 mm long. Petals yellow. Fruits ± 6 mm long, 2.5 mm wide, mericarps homomorphic, without wings (Fig. 6b).

Notes. The appearance of *A. latifolia* is shown in Fig. 15 and the diagnostic characters are listed in Table 2. It is a characteristically robust species, having leaves with leaflets which are particularly broad (Fig. 2i), especially at the bases. The leaves superficially resemble cabbage or lettuce leaves. Two types of hairs are present on the leaves (Fig. 3) but are re-

stricted to the main veins and petioles. The close relationship to *A. grandiflora* has been referred to under this species. The stiffer appearance of *A. latifolia* leaves is no doubt related to the greater abundance of sub-epidermal sclerenchyma in the petioles.

Annesorhiza latifolia is restricted to the western part of the Northern Cape (Fig. 14) and occurs on granitic soils. The recorded flowering time is September to December.

Additional specimens examined. Springbok district: at entrance to Klipdam Golf Course, Van Berkel 428, 468 (NBG); Springbok district: edge of gully, Van Berkel 456, 458 (NBG); Springbok, Van Wyk 3674b (JRAU).

7. A. altiscapa (Schlechter ex) H. Wolff

In Bot. Jahrb. 57: 231 (1922); Bond & Goldblatt, Pl. Cape Flora, 140 (1984); Burtt in Edin. J. Bot. 48(2): 178 (1991). – Lectotype: Namaqualand, Waterklipp, Schlechter 11164 (BOL!, lecto., designated here; BM, E, PRE!, S!, isolecto.). Northern Cape Province, Onder-Bokkeveld, Oorlogskloof, Schlechter 10940 (BM, BOL!, syntype).

Roots at least 10, slightly and evenly fleshy, purported to have a spicy taste. Leaves coarsely dissected, glabrous, frequently present while flowering, leaf bases persist as fibres. Petioles 20-210 mm long. Basal pinnae with petiolules up to ± 100 mm long, frequently partly bipinnate. Upper pinnae pinnate. Ultimate leaflet segments relatively large, triangular acute, base usually narrow, margins indented to varying depths (Fig. 2f). Inflorescence scape up to ± 1.5 m and striated with usually 5-9 umbels per scape, main umbel of 5-9 rays. Involucral bracts small, persistent. Involucel of small lanceolate bracteoles with acute apices. Calyx lobes cusp-like, up to 0.3 mm long (Fig. 5a). Petals cream-coloured to yellow. Fruits ± 6-7 mm long, ± 2 mm wide, mericarps homomorphic, without wings (Fig. 6b).

Notes. The distinctive appearance of *A. altiscapa* is shown in Fig. 16 and diagnostic characters are listed in Table 2. *Annesorhiza altiscapa* is found in areas which could overlap with the distributions of *A. fibrosa*, *A. grandiflora*, *A. latifolia* and *A. nuda* (Figs 9 & 14). However, only the latter species, like *A. altiscapa*, is completely glabrous. *Annesorhiza nuda* differs in having only a few fleshy roots (one to three) and also in the heteromorphic flowers and fruits.

This species is restricted to the western parts of the Cape (Fig. 9), usually growing on rocky slopes in clayey or sandy soils. The recorded flowering time is August and September. This plant is commonly known as anyswortel ("anise root"), "wild anise" or boklamvinkel (literally "goat kid fennel").

Selected additional specimens. Sutherland: Klipdrift, krantz in watercourse on lower slopes of Roggeveld escarpment, rare, Acocks 17785 (PRE); Van Rhynsdorp: Widouw River, Barker 3641 (NBG); Springbok: top of Spektakel Pass, sandy slope, Goldblatt 2800 (NBG); Namaqualand: 10 miles [16 km] north of Komaggas, Maguire 991 (NBG); Nieuwoudtville Reserve, growing amongst dolerite rocks, Perry & Snijman 2310 (NBG, PRE); 10940 (PRE); Van Rhynsdorp: "Zand Kraal near Giftberg", Steyn 434 (NBG); Springbok: very rocky granitic soil covered with large rocks of vein quartz, Van Berkel 397 (NBG); Calvinia: Glen Lyon, dolerite outcrop, western slope, in bush groups, Van Jaarsveld 8835 (NBG); Nieuwoudtville, on rocky hillside under large bushes usually in stone, Van Wijk 452 (GRA); Nieuwoudtville Nature Reserve, Van Wyk 174 (JRAU); Nieuwoudtville, Oorlogskloof, Van Wyk 3533 (JRAU).

8. A. fibrosa B-E. van Wyk sp. nov.

A speciebus omnibus aliis foliis parvis tenue dissectis, et massa fibrosa crassa reliquiarum foliarum circum basin plantae differt. – Type: Northern Cape Province, Calvinia district, top of Van Rhyns Pass, Barker 9791 (holo., NBG).

Roots at least 15, slightly fleshy, frequently becoming swollen nearer the apices. Leaves finely dissected, sparsely to densely hairy especially on rachis and rachillae, produced after flowering, persistent leaf remains form a thick fibrous mass around the base of the plant. Petioles up to ± 80 mm long, hairy to glabrescent. Basal pinnae with petiolules up to ± 25 mm long, partly bipinnate. Upper pinnae pinnate. Ultimate leaflet segments relatively small, finely dissected, base narrow, margins deeply and similarly indented (Fig. 2b). Inflorescence scape reaching up to at least 60 mm in height, striated with 4-7 umbels per scape, main umbel of about 3 rays. Involucral bracts small, persistent. Involucel of small lanceolate bracteoles with acute apices. Calyx lobes cusp-like, up to 0.3 mm long. Petals yellow. Fruit known only in the immature state, mericarps homomorphic, without wings (Fig. 6b).

Notes. The distinctive appearance of *A. fibrosa* is shown in Fig. 17 and the diagnostic characters are

Fig. 16. The lectotype of *Annesorhiza altiscapa*, showing the relatively large, broad, deltoid leaf segments, deeply divided at the base.

given in Table 2. *Annesorhiza fibrosa* is a small and distinctive species, easily identified by the unique thick, fibrous base of the plant and the small (up to about 170 mm long but often considerably smaller), finely dissected, hairy leaves (Fig. 2b). The roots and petioles have highly lignified tissue associated with them (Figs 1c, 4d & e). When the roots are broken, the central core of vascular tissue remains as the

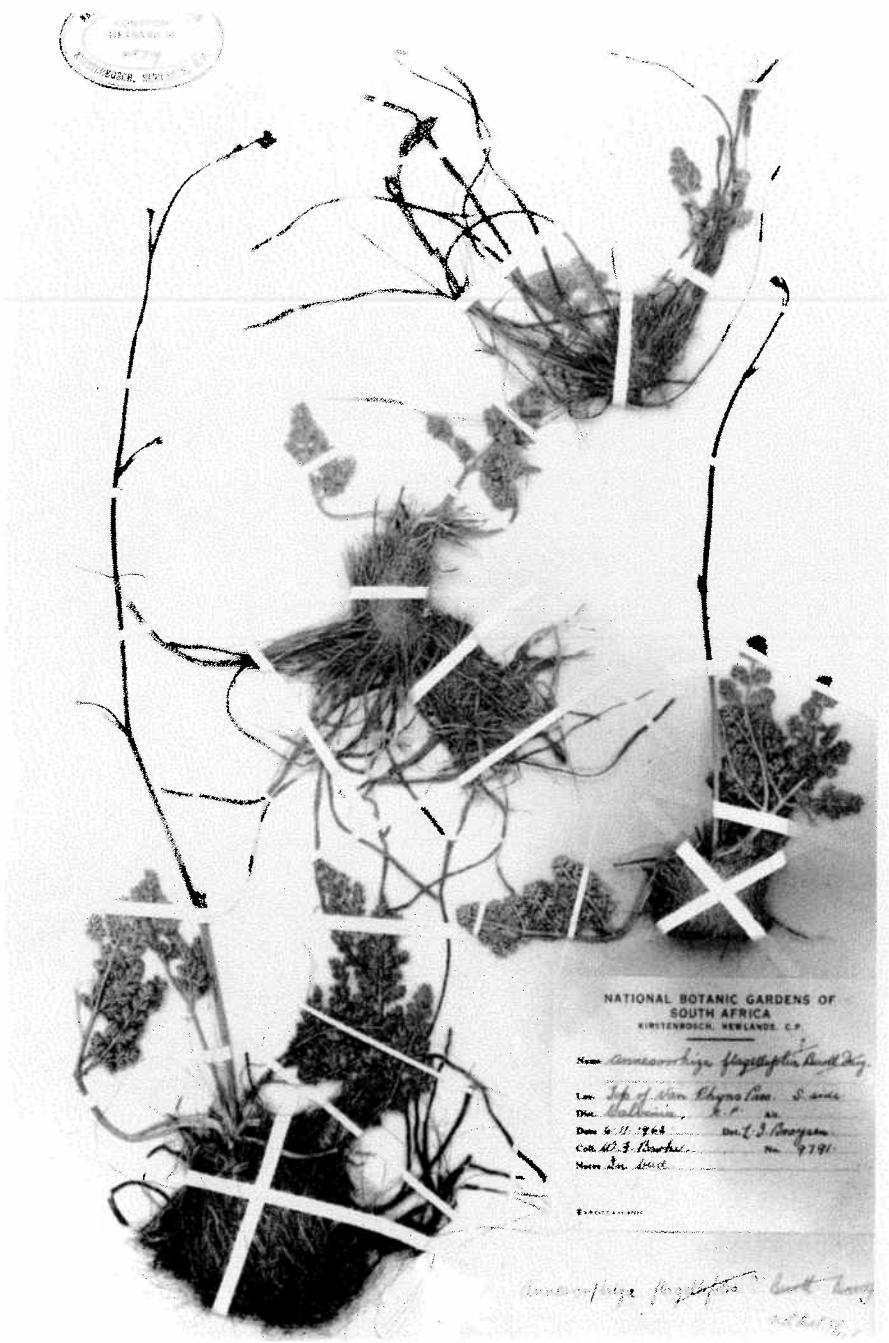


Fig. 17. The holotype of *Annesorhiza fibrosa*, showing the thick fibrous mass around the base of this small plant, the finely dissected leaves, the numerous, slightly fleshy roots and the inner fibres remaining when the roots are broken.

characteristic tough "fibres"; these easily pulled away from the outer fleshy part (Fig. 17). *Annesorhiza fibrosa* is superficially similar to *A. wilmsii*, which also tends to develop a fibrous base. The latter species has glabrous leaves, however, and occurs in the summer rainfall grassland region.

Annesorhiza fibrosa is known only from three collections from the Nieuwoudtville plateau (Fig. 14) where it grows in sandy soil in fynbos vegetation. The recorded flowering time is November.

Additional specimens examined. Calvinia: 8 km from

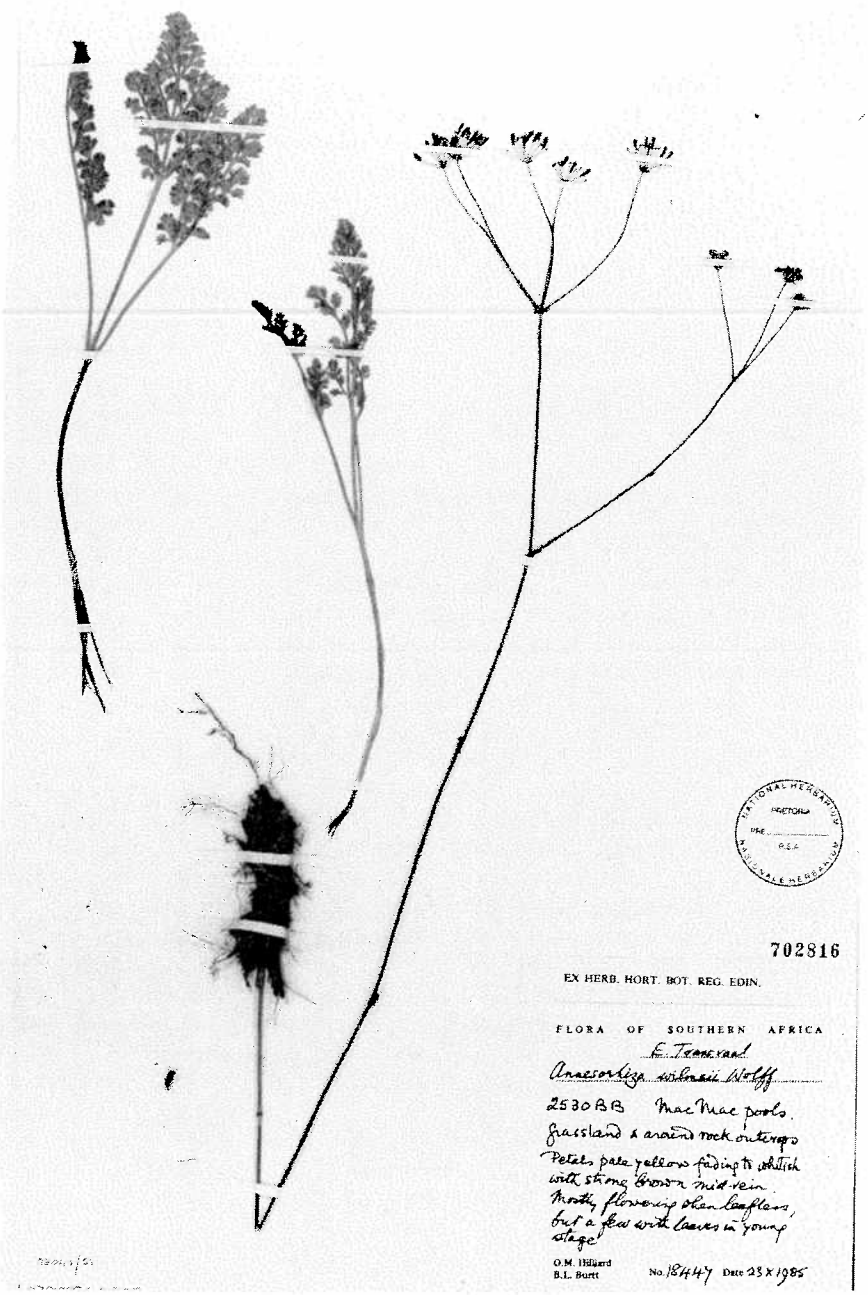


Fig. 18. The neotype of *Annesorhiza wilmsii* showing young, finely divided leaves which form largely after flowering.

Nieuwoudtville, sandstone slopes between town and escarpment on the road to Keyserfontein, Goldblatt 7401 (NBG); Northern Cape Province, Oorlogskloof, between rocks, Van Wyk 3597 (JRAU).

9. A. wilmsii H. Wolff

In Bot. Jahr. 48: 276 (1912); Burtt Davy, Man. Pl. Transvaal 2: 519 (1932); Burtt in Notes RBG Edinb. 45: 91 (1988); Burtt in Edin. J. Bot. 48(2): 182 (1991). – Type: Transvaal, MacMac Pools, Hilliard & Burtt 18447 (PRE!, neo., designated here; E, NBG,

NU, iso.). Note: The holotype ("Lydenburg", Wilms 554 in B) was destroyed by fire.

Roots 1-3, new root formed each year, only slightly fleshy. Leaves finely dissected, glabrous, produced mainly after flowering, bases persist as conspicuous fibres. Petioles up to ± 160 mm long. Basal pinnae with petiolules up to 60 mm long, usually bipinnate. Upper pinnae may be bipinnate or pinnate. Ultimate leaflet segments relatively small, dissected, base narrow, margins indented to varying depths (Fig. 2c). Inflorescence scape up to ± 0.7 m and essentially smooth with usually 1-4 umbels per scape, main umbel of 4-7 rays. Involucral bracts small, persistent. Involucel of small narrowly ovate, acuminate bracteoles. Calyx lobes cusp-like, up to 0.3 mm long. Petals yellow. Fruits ± 4-6 (-7) mm long, ± 2.5-3.5 mm wide, mericarps homomorphic, without wings (Fig. 6b).

Notes. The appearance of *A. wilmsii* is shown in Fig. 18 and the diagnostic features are listed in Table 2. *Annesorhiza wilmsii* seems to co-occur with the rare *A. flagellifolia* with which it is commonly confused. However the finely divided leaves (Fig. 2c), as opposed to the needle-like segments (Fig. 2j), and lack of wing-like structures in the fruits (cf. Fig. 6b & c) are distinctive features. Many herbarium specimens of *A. wilmsii* have been misidentified as *A. flagellifolia,* possibly because leaves usually appear on *A. wilmsii* after the main fruiting peak. The roots of *A. wilmsii* have particularly small vittae and the mature fruits have characteristic groups of lignified cells between the vascular bundles and vittae.

Annesorhiza wilmsii has a fairly wide distribution in the Northern Province, Mpumalanga & Swaziland (Fig. 12) where it occurs in rocky grassland. The recorded flowering time is August to November.

Selected additional specimens. Groblersdal: 1.2 miles [ca. 1.9 km] S by W of Monsterlus Post Office, rocky Bankenveld, Acocks 20878 (PRE); Mbabane: Ukutula, Compton 24509 sheets I & II & 25216, (NBG); Mbabane: Nduma, rock crevices, Compton 28247 (NBG, PRE); Mbabane: top of Komati Pass, rocks, Compton 29347 (NBG); Witbank, De Castro 473 (JRAU); Barberton: summit Saddleback Mtn., Galpin 1125 (BOL); Pilgrim's Rest: Blyderiverspoort, 2 km N of turnoff to resort overlooking the "Three Rondawels", Winter 126 (JRAU); Woodbush range, Haenertsburg, Winter 1175 (JRAU); Middelburg: Tautesberg, dry ground, sides of kloof, Young A181 & A208 (PRE).

10. A. flagellifolia Burtt Davy

In Man. Pl. Transvaal 2:xviii, 519 (1932), pro parte, excluding cited specimens Galpin 1125 and Moss 7155; Burtt in Notes RBG Edinb. 37: 319 (1979); Burtt in Edinb. J. Bot. 48(2): 178 (1991). – Type (chosen by Burtt 1979): Transvaal, Pietersburg distr., "rochers de Mamotsuri (Shilouvane)", Junod 810 (K!; lecto.; G, isolecto.).

Roots unknown. Leaves invariably multifid, glabrous, produced before flowering but may persist during flowering and fruiting, leaf bases unknown. Petioles up to ± 200 mm long. Basal pinnae with petiolules up to ± 70 mm long, frequently bipinnate. Upper pinnae pinnate. Pinnae frequently compound, segments linear, conduplicate, acuminate, margins entire (Fig. 2j). Inflorescence scape up to ± 0.7 m long and smooth or somewhat striated with usually 1-3 (-6) umbels per scape, main umbel of 3-6 rays. Involucral bracts small, persistent. Involucel of small narrowly ovate, acuminate bracteoles. Calyx lobes small with short projection, less than 0.3 mm long. Petals yellow. Fruits ± 5-8 mm long, ± 2.5 mm wide, mericarps homomorphic, with thick ridges resembling wings (Fig. 6c).

Notes. The characteristic appearance of *A. flagellifolia* is shown in Fig. 19 and the distinctive features are listed in Table 2. *Annesorhiza flagellifolia, A. lateriflora* and *A. schlechteri* have leaves in needle-like segments but differ in aspects mentioned under the latter species. *A. flagellifolia* may prove to be no more than a northern variant of *A. schlechteri* but since there are distinct differences (e.g. sepals, fruit anatomy), we prefer to provisionally keep them apart.

This poorly known species needs further field studies. Leafless specimens of *A. wilmsii* have been cited in the type citation by Burtt Davy (1932), who seemed to have confused the two species. The only collection with leaves and mature fruits (one of the Wood specimens) suggests that *A. flagellifolia* has the peculiar fruit morphology depicted in Figs 6c and 7b.

Annesorhiza flagellifolia is known from only a few isolated localities in the north-eastern part of South Africa (Fig. 12) but it is probably much more widely distributed than the meagre herbarium records presently show. The recorded flowering time is May.

Additional specimens examined. Near Tugela River, Wood 3870 (BOL), Wood s.n. sub SAM 15993 (NBG).

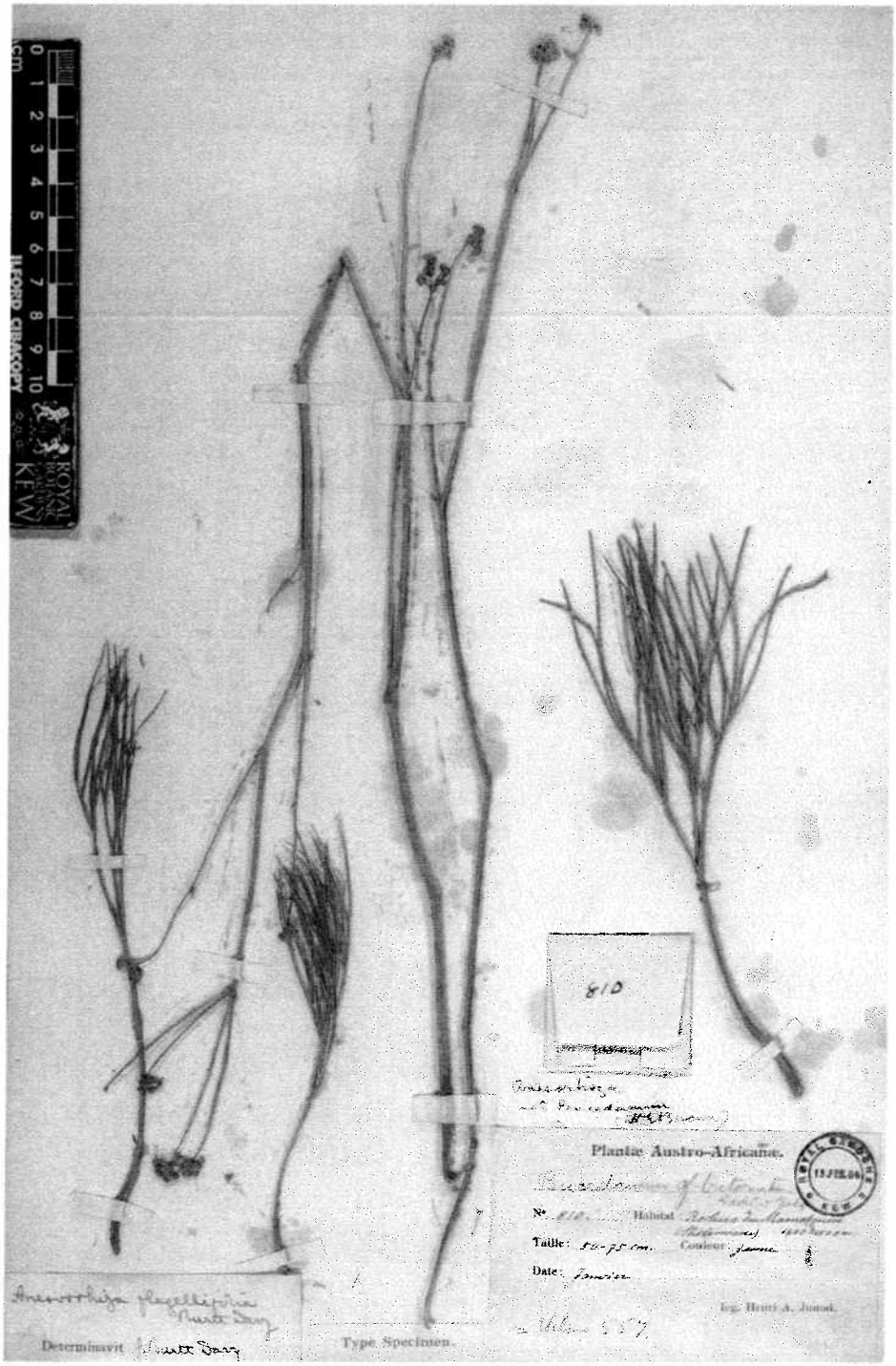


Fig. 19. The lectotype of *Annesorhiza flagellifolia*, showing the multifid leaves with their acicular segments.

11. A. schlechteri H. Wolff

In Bot. Jahrb. 48: 277 (1912); Burtt in Notes RBG Edinb. 37: 319 (1979); Burtt in Edinb. J. Bot. 48(2): 181 (1991). – Lectotype: Transkei, Mt Ayliff distr., Mt Insiswa, Schlechter 6488 (B†; BOL!, lecto., designated here; GRA!; Z photocopy!, isolecto.).

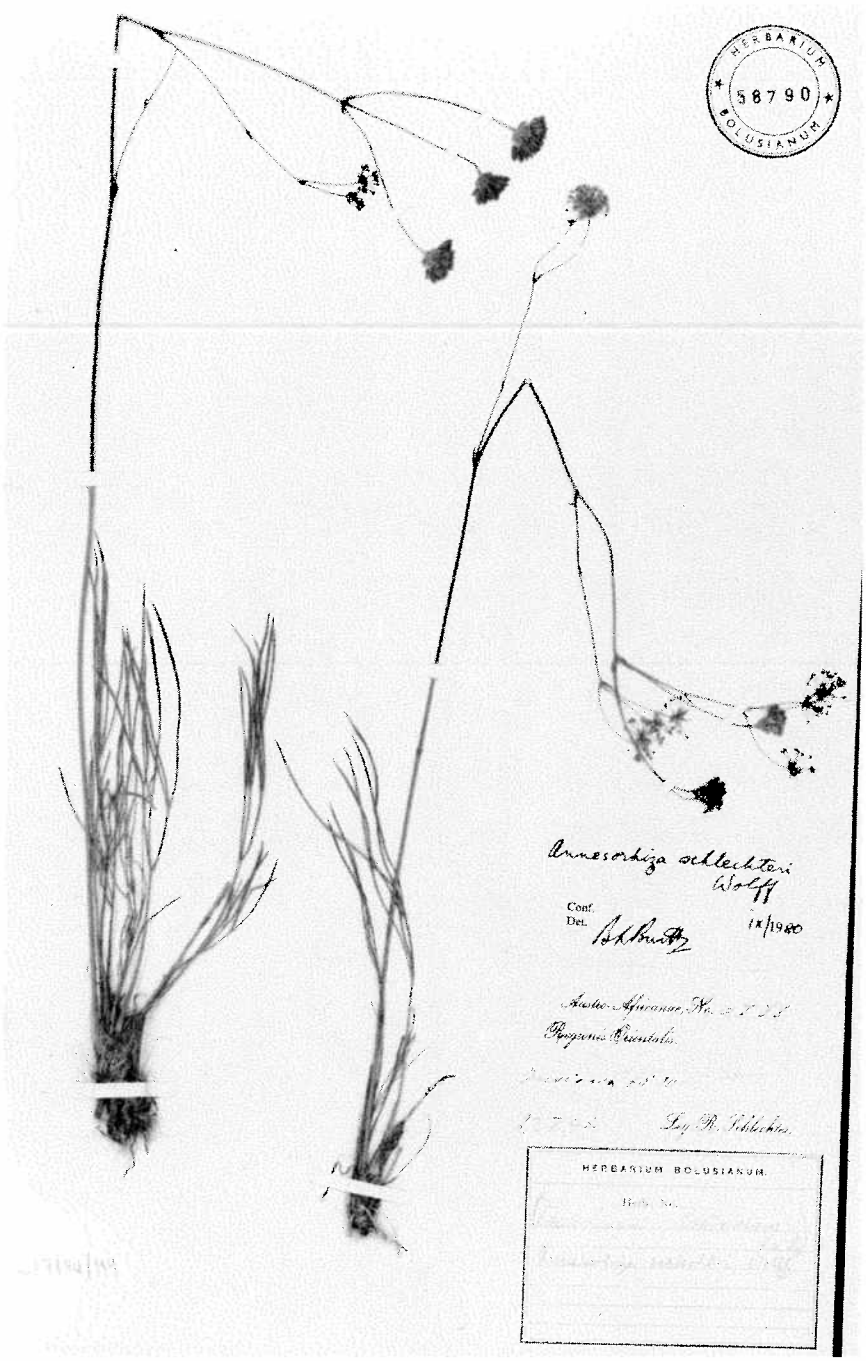


Fig. 20. The lectotype of *Annesorhiza schlechteri*. Note that some leaves are trifid.

Roots up to 5?, slightly and evenly or unevenly fleshy. Leaves mostly trifid, glabrous, produced before flowering but may persist during flowering and fruiting, leaf bases persist as fibres. Petioles up to ± 140 mm long. Pinnae may be compound, segments linear, flat with thickened margins and midrib, often conduplicate, acuminate, margins entire (Fig. 2k). Inflorescence scape up to ± 0.7 m long and usually smooth (striated when robust) with usually 2 or 3 umbels per scape, main umbel of 2-4 (-6) rays. Involucral bracts small, persistent. Involucel of small narrowly ovate, acuminate bracteoles. Calyx lobes relatively large with pronounced projection, at least 0.5 mm long. Petal colour not known. Fruits ± 5.0

mm long, ± 2.5 mm wide, mericarps homomorphic, without wings (Fig. 6b).

Notes. The typical appearance of *A. schlechteri* is depicted in Fig. 20 and the diagnostic characters are given in Table 2. *Annesorhiza schlechteri* is vegetatively very similar to *A. flagellifolia* but differs in that the leaves, which are also divided into needle-like segments, tend to have fewer segments (some with a maximum of three). The fruits differ, having ribs which are not expanded to form wing-like structures (cf Fig. 6b & c). In *A. flagellifolia* virtually the entire wing-like structure is composed of slightly lignified cells (Fig. 7b). In *A. schlechteri*, if lignified cells are present at all, they are confined to groups between the vascular bundles and vittae, and the walls are highly lignified. The sepals are relatively longer in *A. schlechteri* - at least 0.5 mm (Fig. 5b).

Annesorhiza schlechteri has a southerly distribution (Fig. 12). It has been collected in shallow water and on wet slopes above marshes. However, the xeromorphic anatomical characters suggest that the plant may be subject to seasonal stress (drought and/or cold). The recorded flowering time is January and February. In the Wood specimens of *A. flagellifolia*, collected in May, some flowers are present while in the type specimen (Junod 810), flowers are present in January. In the latter, the flowers are not attached and the possibility therefore cannot entirely be ruled out that they may be from another species such as *A. wilmsii*, although *A. wilmsii* is essentially a spring-flowering species. If this is the case, the flowering time may be a further difference between *A. schlechteri* and *A. flagellifolia*.

Additional specimens examined. "Tabase, near Baziya", Baur 422 (NBG), Bolus 10096 (BOL); Maclear: "Surat" Vlei, Britten 4593 (GRA); Eastern Cape Province: Amatole Mtns., Hogsback, marsh behind (SE of) first peak, Furness & Phillipson 25 (PRE); Transkei: Nqadu Forest N of Umtata, Goldblatt 7584 (PRE); Victoria East: Hogsback, Rattray 18 (GRA); Stutterheim: Mount Kemp, Kubusie, Sim s.n. specimen a only (specimen b is *Stenosemis*) (PRE).

12. A. lateriflora (Eckl. & Zeyh.) B-E. van Wyk, comb. nov.

Type: Namaqualand, Khamiesberg, Ecklon & Zeyher 2229 (S!, flowering specimen, lecto., designated here; S!, leaves only, isolecto.).

≡ *Athamantha lateriflora* Eckl. & Zeyh., Enum. 348 (1837). – Type as above.

≡ *Peucedanum? lateriflorum* Sonder in Fl. Cap. 2: 557 (1862); Burtt in Edin. J. Bot. 48(2): 233 (1991). – Type as above.

= *Annesorhiza marlothii* H. Wolff in Repert. Spec. Nov. Regni Veg. 19: 314 (1924); Burtt in Edin. J. Bot. 48(2): 179 (1991), synon. nov. – Lectotype: Cape, Roggeveld, Sutherland, Farm Uitkyk, Marloth 9694b (B†; PRE!, lecto., designated here).

Roots 1-3 (several?), fingerlike, fleshy. Leaves compound, trifid, up to 6-ternate, glabrous, leaf bases sheath-like, persist as papery fibres. Petioles up to 150 mm long. Pinnae segments variable, linear or acicular, terete or flat with thickened margins and midrib, often conduplicate, acuminate, margins entire (Fig. 21). Inflorescence scape up to ± 0.8 m long and usually smooth (striated when robust) with usually 2-6 umbels per scape, main umbel of 2-4 rays, similar to lower ones. Involucral bracts small, persistent. Involucel of small narrowly ovate, acuminate bracteoles. Calyx lobes small, less than 0.2 mm long. Petal colour not known. Fruits (mature?) ± 3.0 mm long, ± 1.2 mm wide, mericarps homomorphic, without wings.

Notes. The appearance of *A. lateriflora* is shown in Fig. 21 and the diagnostic characters are given in Table 2. Despite variability in the number and shape of the leaflets, we consider the incomplete type material of *A. lateriflora* (collected on the Khamiesberg) and that of *A. marlothii* (collected at Sutherland) to belong to the same species and also to agree with several recently collected specimens from near Vanrhynsdorp in Namaqualand. Previously we had no evidence that the unusual, seemingly sessile flowers of *A. marlothii* (in the envelope on the type sheet) actually came from the same plant, but several of the smaller umbels on the type specimen of *A. lateriflora* bear similar congested and subsessile flowers. *Annesorhiza lateriflora* may prove to be merely a xerophytic, small-fruited form of *A. schlechteri*, but we provisionally retain the former as a distinct species.

Annesorhiza lateriflora is known from only a few localities in the Northern Cape Province – the type locality on the Khamiesberg, Uitkyk farm near Sutherland and one or two localities near Vanrhynsdorp (Fig. 12). At the latter, it grows in rock crevices in limestone. The flowering time of this population is in summer (January) with mature fruits present until May. Leaves appear in winter and last until spring or early summer.

Additional specimens examined. "Farm Rooiberg, near Vanrhynsdorp", Perry & Manning 3737,

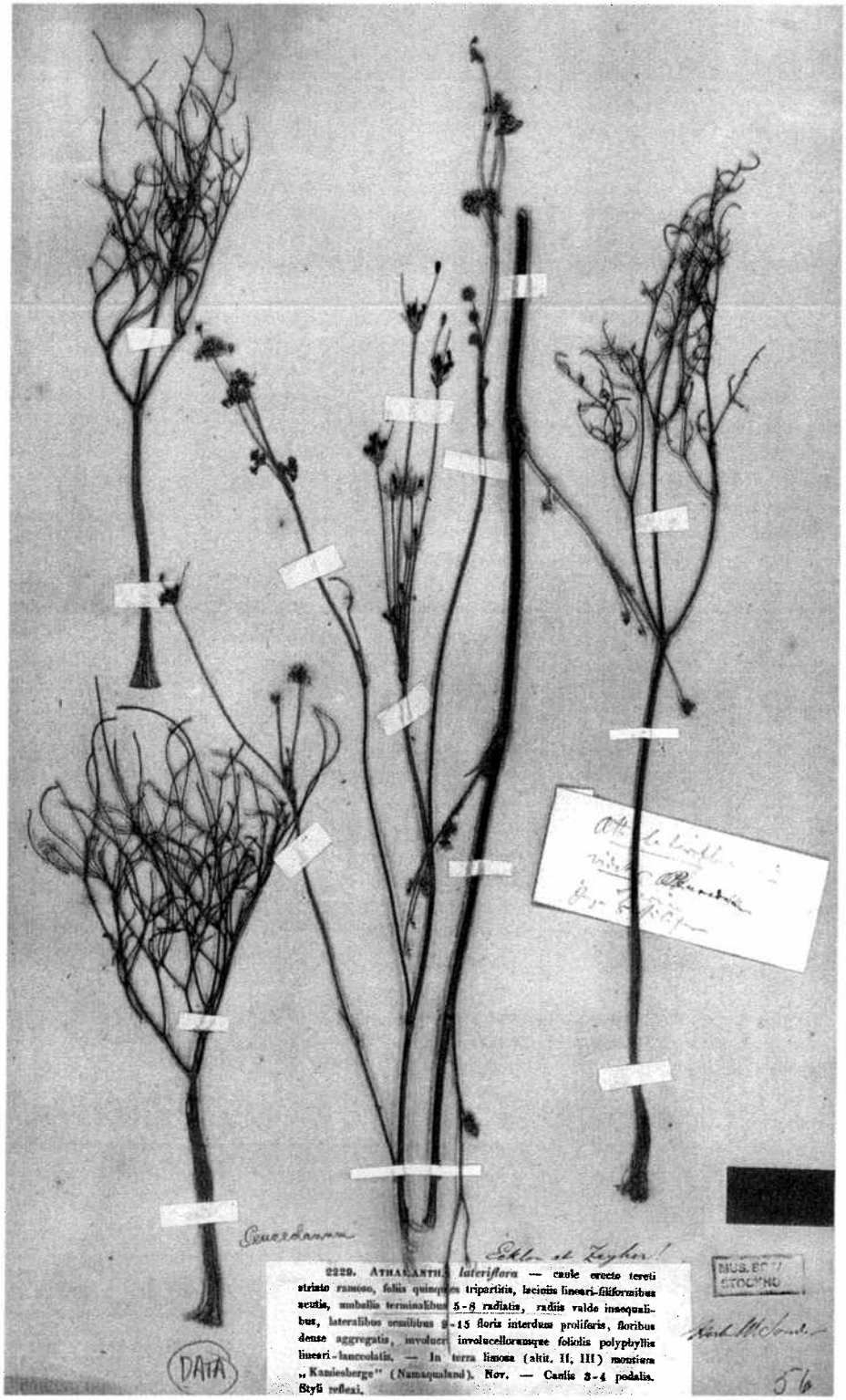


Fig. 21. The lectotype of *Annesorhiza lateriflora*, showing the multifid leaves with acicular segments and inflorescence with some subsessile flowers.

Snijman 1420, Snijman & Manning 1251 (NBG); "Farm Quaggaskop, near Vanrhynsdorp", Perry & Manning 3737A (NBG).

Excluded species

A. abyssinica A. Br. = *Heteromorpha arborescens* var. *abyssinica*
A. angustifolia (Sond.) Drude = *Stenosemis angustifolia*
A. caffra (Meisn.) Drude = *Peucedanum caffrum*
A. caffra (Eckl. & Zeyh.) Schonl. nom. illegit. = *Stenosemis caffra*
A. filicaulis Eckl. & Zeyh. = *Peucedanum filicaulis* (Eckl. & Zeyh.) Van Wyk & Tilney
A. grossulariifolia (Eckl. & Zeyh.) Hiroe = *Polemannia grossulariifolia*
A. gummifera (L.) O. Kuntze = *Peucedanum gummiferum*
A. inebrians (Thunb.) Wijnands = *Glia prolifera*
A. interrupta (Thunb.) Sweet = *Lichtensteinia interrupta*
A. striata (Thunb.) Koso-Poljansky = *Peucedanum striatum*
A. teretifolia Drude = *Stenosemis caffra*
A. verticillata (Sond.) Hiroe = *Anginon verticillatum*

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Nordic Journal of Botany

Review

Prud'homme van Reine, W. F. & Trono Jr., G. C. (eds), 2001. Plant Resources of South-East Asia 15 (1), Cryptogams: Algae. Backhuys Publishers, Leiden, The Netherlands. 318 pp. – Price: USD 90.00.

The information presented in this book is a collective effort of 25 contributors and the approach by the Prosea organization. Prosea is an acronym of Plant Resources of South-East Asia with a board of trustees (Indonesia, Malaysia, Papua New Guinea, The Philippines, Thailand, Vietnam and the Netherlands) and personel producing a 'multivolume handbook that aims to summarize knowledge about useful plants for workers in education, research, extension and industry' (about the Prosea foundation, see p. 313 -319). This volume is devoted to the algae: Blue-green algae (Cyanophyta), brown algae (Phaeophyta), red algae (Rhodophyta) and the green algae (Chlorophyta).

The book contains an introduction 75 pp., an alphabetical treatment of genera, species and groups 176 pp., literature references 23 pp., glossary 11 pp., sources of illustrations 9 pp., index of scientific names 9 pp. and of vernacular plant names 2 pp.

The introduction is divided into two main sections about 1. Macroalgae, microalgae and their importance 2. Botany - ecology - exploitation and cultivation. In general the whole chapter focuses on macro- and microalgae as human food, medicinal uses, fertilizers etc. And of course on the phycocolloids. Here we get descriptions of diverse phycocolloid structures, properties, uses and of the algal industry with valuable details on ex-and import and economic importance. There is also information about the industry in the different countries in South-East Asia. The other part of the introduction concern more general information on algae based on well known handbooks (e.g. Lüning 1990, Lobban & Harrison 1994). But also in this part you will find more about e.g. carrageenan on several pages and there is no subject index to help you. I think that a merging of the two sections would have been useful and made it easier readable.

And then the readers are totally left when you reach chapter two (p.77) - the essential part of the book. It starts with: Alphabetical treatment of genera, species and groups without telling you how many and which entities will be described on the following 179 pp. But in the contents before the numbered pages there is a list of the genera etc. supplemented with vernacular names, and here you can count 70 entities i.e. mixed red algae, brown algae, green algae and blue-greeen algae - but no systematic overview of the classes. And if you want to know what Tricleocarpa on p. 248 is, then it belongs to the Galaxauraceae - but not a word about that it also belongs to Rhodophyta. But you can look it up p. 17 under 1.1.4 Algae: definition and delimitation (this was a help from me). The background for the selection of 70 entities is not given, but as far as I can read: One third are listed for their use of phycocolloids and the rest for use of the diverse food and medicinal uses etc.

All the descriptions of the individual entities are done by the collaborators following a very distinct and detailed pattern: Family, major species and synonyms, vernacular names, origin and geographic distribution, uses, production and international trade, properties, description, growth and development, other botanical information, ecology, propagation and planting, phycoculture, diseases and pest, harvesting, yield, handling afte harvesting, genetic resources, prospects and literature. So there is a lot of very useful information for the reader about algae and their potential uses in a tropical area.

Every description is followed by a line drawing composed of a habitus illustration followed by several microscopic details. There is no magnification on the drawings!! The microscopic details are reproduced too small to be useful. The drawings are all careful and uniform in style - but with no signature!! But in the end of the book (p. 293- 301) in: Sources of illustrations, it is given that they are redrawn and adapted by P.Verheij-Hayes often from well known handbooks of world-wide origin - the Enteromorphas look very homelike, but they are also from the Netherlands!

The Glossary (p.282-292) is very detailed but p.286 hydrophylic and also hydrophyllic p.20 are wrong, it should be hydrophilic.

There is a long and rich list of literature (p.256-278).

Despite all the difficulties for the reader it is an interesting and valuable handbook about uses of algae from the tropical seas in one of the craddles of mariculture.

Aase Kristiansen