

Dauresia and *Mesogramma*: one new and one resurrected genus of the Asteraceae-Senecioneae from Southern Africa

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Abstract

Dauresia B. NORD. & PELSER is described as a new genus of the Asteraceae-Senecioneae. A single species is recognized here, viz., *D. alliariifolia* (O. HOFFM.) B. NORD. & PELSER, restricted to Namibia. It is clearly distinguished from the core of *Senecio* on basis of morphological and molecular evidence. In a phylogeny based on ITS sequence data, *Dauresia* appears basal to *Senecio* s. str. and the 'synotoid group', which includes i. a. *Synotis* (C. B. CLARKE) C. JEFFREY & Y. L. CHEN and *Cissampelopsis* (DC.) MIQ. In floral morphology the new genus has some 'tussilaginoïd' traits such as discoid white-flowered capitula, an ecalyculate involucre and a polarized endothecium.

Another genus is resurrected as *Mesogramma* DC. with the single species *M. apiifolium* DC. It is an annual herb known from Namibia, Angola, Botswana, and the South African provinces Transvaal, Orange Free State, and the Cape. Although previously placed in *Senecio*, its closest affinities are with the *Cineraria* group of Southern African genera, especially with *Bolandia* G. V. CRON (CRON et al., in press).

Introduction

The Senecioneae constitute one of the largest tribes of the family Asteraceae, with a worldwide distribution, 150 genera and about 3,500 species (NORDENSTAM, submitted). The phylogeny of the tribe is not yet well understood, but now intensely studied by

a team consisting of JOACHIM KADEREIT (Mainz), BERTIL NORDENSTAM (Stockholm), LINDA WATSON and PIETER PELSER (Oxford, Ohio), and ILSE BREITWIESER and STEVE WAGSTAFF (Landcare Research, New Zealand). Our ambition is to cover all of the genera and most of the sections within *Senecio*, analysing nuclear and plastid DNA sequence data.

This paper is concerned with two taxa previously placed in *Senecio* L., as *S. alliariifolius* O. HOFFM. and *S. apiifolius* (DC.) BENTH. & HOOK.f. ex O. HOFFM.

The distribution of the former species is restricted to Namibia, where material was studied and collected by the senior author in 1963 and 1974 (cf. NORDENSTAM 1974). It gave the impression of a singular taxon, because of the stems with white bark, white-woolly leaf-axils and long-petiolate, cordate, subcarnose, and palmately veined leaves. The involucre consists of five bracts in spiral arrangement and lacks a calyculus. The capitula are homogamous and discoid and usually white-flowered. Both the morphological and molecular data unequivocally suggest the recognition of a new genus.

The second species, i.e. *S. apiifolius*, also occurs in Namibia, but has a wider distribution and extends into Angola, Botswana, and several of the South African provinces. It was already described as the genus *Mesogramma* DC. by DE CANDOLLE (1838) and was later synonymized with *Senecio* by BENTHAM & HOOKER (1873, also ex HOFFMANN 1892) and since then remained in oblivion.

Material and methods

Both taxa have been studied in the field, and additional herbarium material mainly in Stockholm (S) has been examined. Distribution data from herbarium specimens in PRE, S and WIND (abbreviations according to HOLMGREN et al. 1990) were used to construct distribution maps using the ArcView program (cf. Acknowledgements). For micro-morphological observations using light-microscopy, floral parts were boiled in water and subsequently dissected and mounted in HOYER'S solution.

As part of our ongoing effort to reconstruct the evolutionary history of tribe Senecioneae, the phylogenetic position of *Dauresia* and *Mesogramma* in Senecioneae was explored with maximum parsimony analyses of an ITS sequence data set composed of 516 species of 108 genera of Senecioneae. These analyses were carried out with the parsimony ratchet method as implemented in PAUPRat v.1.0 (SIKES & LEWIS 2001) to find islands of shortest trees. The shortest trees found with this analysis were subsequently used as starting trees for TBR branch swapping in a heuristic search in PAUP* 4.0b10 (SWOFFORD 2001). Bootstrap support (FELSENSTEIN 1985) was estimated with 5,000 bootstrap replicates using fast stepwise addition. The studies performed to examine the position of *Dauresia* and *Mesogramma* are

preliminary, and the results of our molecular phylogenetic analyses will be more elaborately presented and discussed elsewhere in due time.

1) *Dauresia* B. NORD. & PELSER, gen. nov.

Herba perennis aliquando suffruticosa ramosa glabra (praeter axillas foliorum plerumque albolanatas), cortice albo striato. Folia alterna petiolata, lamina ovato-rotundata vel cordata ad reniformi subcarnosa margine dentata. Capitula corymbosa homogama discoidea. Involucrum ecalyculatum sed interdum bracteis exterioribus una vel duabus involucro aequilongis; involucri bractee quinque subuniseriatae ovatae. Flosculi numerosi hermaphroditi, corolla tubulosa profunde quinquelobata. Antherae basi caudatae; cellulae endothecii parietibus horizontalibus solum noduliferis; collum filamentum subcylindricum. Styli rami intus areis stigmaticis separatis, apice subtruncati papillati. Cypselae dense papilloso-hirsutae madefactae mucosae. Pappi setae pluriseriatae minute barbellatae albae persistentes.

Type: *D. alliariifolia* (O. HOFFM.) B. NORD. & PELSER.

***Dauresia alliariifolia* (O. HOFFM.) B. NORD. & PELSER, comb. nov.**

Basionym: *Senecio alliariifolius* O. HOFFM. ("*alliariefolius*"), Bot. Jahrb. 10: 280 (1888). - Type: MARLOTH 1480, in saxosis inter convalles "Huseb" et "Dariep", Damara-land, 450 m, Jun. 1886 (B holotype†, PRE isotype!). In HOFFMANN op. cit. cited as "Hereroland, Dariep, in saxosis desertis, alt. 400 m, flor. Jun. 1886".

Suffrutescent herb or halfshrub 0.3–1 m high, branching, glabrous (except for leaf-axils). Stems and branches striate, with white bark. Leaves alternate, long petiolate (petioles –5 cm long); leaf-blade entire, thickish and subcarnose, cordate, rounded or reniform, 4–5 cm long and wide, grossly to shallowly dentate, palmately veined; upper leaves gradually smaller and transcending into lanceolate bracts; leaf-axils white-woolly. Capitula several in umbellate corymbs, homogamous, discoid, ca. 1 cm long and wide. Involucral bracts 5, subuniseriate, ovate, 5–10 mm long, 2–3.5 mm wide, with ca. 5 resiniferous veins, glabrous, obtuse; calyculus absent but subinvolucral bracts often present, 1–2, equally long as the involucral bracts or longer, but narrower, linear-lanceolate to narrowly spatulate, 7–10 mm long and 1.5–2.5 mm broad. Receptacle convex, alveolate, glabrous. Florets ca. 25–35, bisexual; corolla 7–8 mm long, white or yellowish, tubular and gradually widening above, deeply 5-lobed; lobes lanceolate, 3–3.5 mm long, ca. 0.6 mm wide, usually without midvein but with distinct marginal veins, apex cucullate with minute papillae, otherwise glabrous. Anthers ca. 3 mm long, shortly caudate; filament collar very short, subcylindrical and only slightly enlarged towards the base; endothecial tissue strictly polarized with numerous short cells having thickenings only on horizontal walls; apical appendage narrowly ovate, acute or shortly acuminate. Style branches linear, ca. 1.5 mm long, stigmatic areas distinctly

separated and extending a little on the dorsal side, apex slightly obtuse with a short cone and with short papilliform sweeping-hairs arranged in a median tuft and two lateral shorter tufts. Cypselas subterete, 3–4 mm long, somewhat constricted at the apex, densely papillate-hirsute with appressed short obtuse trichomes, mucilaginous when soaked, with ca. 5 low and broad indistinct ribs; carpodium short, indistinct. Pappus bristles numerous, pluriseriate, persistent, white, densely barbellate with fine acute lateral teeth. – Fig. 1.

Distribution: Only known from Namibia and mostly in the northwestern and central districts (Map, Fig. 2). Some collections from southernmost Namibia deviate in certain respects including floret colour (\pm yellow) and seem to represent a second taxon of the genus (NORDENSTAM, in prep.)

Dauresia is not yet recorded outside Namibia, but may very well be found in southern Angola and the northwestern Cape Province (Little Namaqualand), South Africa, since the genus occurs rather close to the borders of these countries.

Selected specimens examined:

(district abbreviations as in MERXMÜLLER 1967)

NAMIBIA. **Distr. SW:** 61 km NE of Swakopmund on Usakos road, gravelly desert, 13.VII.1974, NORDENSTAM & LUNDGREN 777 (PRE, S); near the junction of Khan and Swakop Rivers, at 'Tsawichab', along Swakop, gorge from the Namib plain, II.1963, KERS 697 (S). **Distr. OM (Nb):** Brandberg, upper Tsisab Valley, on rocks, 6.V.1963, NORDENSTAM 2566 (S); Brandberg, SE side, c. 8 km S of Tsisabschlucht, 20.VI.1961, W. GIESS 3700 (S, WIND). **Distr. OM:** 2 miles S of Ugab River bridge on road from Welwitschia to Omaruru, red granite koppie, 2.IV.1963, DE WINTER & HARDY 8207 (PRE, S).

The generic name is derived from an indigenous name of the Brandberg, highest mountain of Namibia. The Damara name Dâures means 'Burning Mountain' (KINAHAN 2000).

HOFFMANN (1888) noted the singularity of this species and commented: "Species habitu peculiari, involucri squamis latis oligophyllo et pappi setis barbellatis insigne, qui characteres etiam in specie tasmanica, *S. centropappo*, observatur". Our preliminary results of phylogenetic studies using ITS sequence data indicate that the Australian *Senecio centropappus* F. MUELL. (syn. *Centropappus brunonis* HOOK. fil., *Brachyglottis brunonis* (HOOK. fil.) B. NORD.; NORDENSTAM 1978) is only distantly related. It groups with other Australian taxa in and around *Brachyglottis* J. R. FORST. & G. FORST. in a clade with a basal position in the 'tussilaginoïd' alliance.

However, the singularity of *Dauresia alliariifolia* observed by HOFFMANN remains undisputed. Some features were mentioned in the introduction and additional

comments should be made. The involucre has five broad phyllaries which are spirally arranged with basally partly overlapping margins. The arrangement can be called subuniseriate. Although here regarded as ecalyculate, the involucre often has one or two subtending bracts equalling the phyllaries in length. The homogamous and usually white-flowered ecalyculate capitula suggest a 'tussilaginoid' affinity, as do additional floral characters. Thus the endothecial tissue of the anthers is strictly polarized as in most 'tussilaginoid' genera, in contrast to the generally radial endothecium of 'senecioid' genera (NORDENSTAM 1978). Also, the filament collar is not distinctly balusterform, but subcylindrical and only slightly dilated basally. On the other hand, the styles have separated stigmatic areas as in many of the 'senecioid' genera. Tailed anthers are not acceptable in *Senecio* s. str. but are a general feature of the 'synotoid' group (JEFFREY 1992). This is a group of Central and East Asiatic genera (e.g., *Synotis* (C. B. CLARKE) C. JEFFREY & Y. L. CHEN, *Cissampelopsis* (DC.) MIQ.) and African-Malagassy-Mascarene genera (e.g., *Mikaniopsis* MILNE-REDH., *Humbertacalia* C. JEFFREY, *Hubertia* BORY) with truly 'senecioid' style and anther morphology including a radial endothecium. In spite of this, *Dauresia* may be allied to this group, with which it shares the caudate anthers and often palmately veined leaves.

It should be noted, however, that several 'tussilaginoid' genera also have caudate anthers (BREMER 1994, NORDENSTAM, submitted) and not seldom palmately veined leaves. Morphologically *Dauresia* takes a somewhat intermediate position between the 'senecioid' and 'tussilaginoid' groups and thus obliterates the distinction between the traditionally distinguished two subtribes Senecionineae and Tussilaginineae. However, molecular data place the genus clearly in a 'senecioid' context (cf. below).

The pollen morphology of *Dauresia* has not yet been investigated, but the exine of the pollen grains appears to be unusually smooth with only minute spinulae. Further palynological studies are called for.

In conclusion, *Dauresia* is a monotypic (or bispecific) genus with an isolated position in the tribe. Although the ITS phylogeny indicates a basal position to the core of *Senecio*, some floral characters indicate an affinity to the 'tussilaginoid' complex, which is otherwise not well represented in Africa.

2) *Mesogramma* DC.

Monotypic: *M. apiifolium* DC., Prodr. 6: 304 (1838); DC. in DELESSERT, Icones selectae 4, t. 58 (1838).

Syn.: *Senecio apiifolius* (DC.) BENTH. & HOOK. fil. ex O. HOFFM., Nat. Pflanzenfam. IV(5): 298 (1892), comb. non rite publ.; *S. apiifolius* (DC.) BENTH. & HOOK. fil. ex

MENDONCA, Contrib. Conhec. Fl. Angola, I. Compos. 119 (1943). – Type: Ufern des Gariép, DRÈGE 2823 (G-DC lectotype, selected here; S isolectotype).

Further syn.: *Senecio peculiaris* DINTER, Fedde, Repert. 30: 94 (1932). – Type: DINTER 4252, Garius bei Warmbad, im Rivier an dauernd feuchten Stellen des “Wasserfalles”, 30.XI.1922 (B†).

The genus *Mesogramma* DC. is here resurrected as a monotypic genus in the Asteraceae-Senecioneae on morphological and molecular (ITS) evidence. The single species *M. apiifolium* DC. is an annual herb distributed in Namibia, Angola, Botswana and several provinces of South Africa (Map, Fig. 4).

When DE CANDOLLE described *Mesogramma*, he included a single species, *M. apiifolium* DC. with a reference to the same species as “DC. in Delessert, Ic. Sel. 4 t. 58”. However, the *Icones selectae* were published in February 1838, whereas the *Prodromus* vol. 6 was published in early January 1838 (STAFLEU & COWAN 1976), and accordingly the latter publication has priority.

The genus *Mesogramma* was included in *Senecio* by BENTHAM & HOOKER (1873), although they did not make the actual combination. This was done later by HOFFMANN (1892), who referred to it as *S. apiifolius* (DC.) BENTH. & HOOK. fil. This has been generally accepted as the valid combination under *Senecio* and the species has been cited frequently as *S. apiifolius* (DC.) BENTH. & HOOK. fil. ex O. HOFFM. (e.g., MERXMÜLLER 1967, ARNOLD & DE WET 1993). However, the Index Kewensis refers to another combining author by citing *S. apiifolius* BENTH. & HOOK. fil. ex MENDONCA, Contrib. Conhec. Fl. Angola, I. Compos. 119 (1943).

The generic status of this taxon has not been considered again until now. Although DE CANDOLLE did not explicitly state the characters that distinguish *Mesogramma* from *Senecio*, it can be gathered from his generic description that he emphasized the venation of the involucre bracts and the disc floret corollas. This is also reflected in his choice of generic name (from Gr. *mesos*, middle, and *gramma*, line or letter). He placed the genus closest to *Cineraria* L. (cf. discussion below).

The famous explorer of South West African flora, KURT DINTER, encountered the species and found it so special that he described it as *Senecio peculiaris* DINTER (1932) without realizing its identity with *S. apiifolius*. DINTER’s choice of epithet is not explained, but probably he was inspired by the strongly resiniferous phyllaries and the black papilla-lined cypselas, which he describes in some detail.

Description:

Annual glabrous erect herb, branching from the base. Leaves cauline, alternate, petiolate (petiole –3 cm long) to sessile (esp. upper leaves), leaf-blade ovate-lanceolate, grossly dentate or pinnatilobate with 5–6 lobes on each side, apically

mucronate, 3–7 cm long, 1–3 cm wide; upper leaves gradually smaller. Peduncles 3–8 cm long, nude except for 1–2 subulate bracts. Capitula 1–2 or up to 12 and laxly corymbose. Involucre calyculate; calyculus bracts 2–5, subulate, ca. 1 mm long. Involucral bracts 10–21, almost biseriate, lanceolate, 4–6 mm long, 0.8–1 mm wide, green with scarious margins, midribbed with a thin blackish resin vein and with two lateral blackish resin ducts; lateral resin stripes of inner bracts broad and glandular-dotted. Capitula radiate, yellow-flowered. Receptacle slightly convex, glabrous, minutely foveolate. Ray-florets 8–13, female, fertile; style bilobed; tube cylindrical, ca. 2 mm long; lamina oblong, 4–5 mm long, 1.5 mm wide, 4-veined. Disc-florets numerous (ca. 30–70), hermaphroditic. Corolla tubular, gradually widening above, 5-lobed, distinctly 5-veined with black veins from corolla tips down to the base of the tube; corolla lobes triangular-ovate, 0.5–0.7 mm long, with thin lateral veins in addition to the dark midvein. Anthers sagittate or minutely caudate; apical appendage narrowly ovate, obtuse; endothelial cells elongate, radial (but those of dehiscence zone shorter and polarized); filament collar distinctly balusterform. Style with dark resin vein branching into the style branches; base swollen, placed on a short stylopodium; style branches linear-oblong with separated stigmatic areas, apically truncate with rather long sweeping-hairs. Cypselas subtriquetrous or somewhat compressed, constricted apically and basally, ca. 1 mm long, black, with 3 lines of white papilliform obtuse duplex hairs, mucilaginous when soaked, and apically and basally with a crown of longer hairs with rounded tips; carpodium distinct with 4–6 rows of sclerified cells. Pappus bristles numerous (ca. 20), uniseriate, basally connate, ca. 3 mm long, white, barbellate with acute teeth, caducous. – Fig. 3.

Selected specimens examined:

(district abbreviations as in MERXMÜLLER 1967)

NAMIBIA. **Distr. GR:** Marienbrunn, 3.VIII.1974, O. H. VOLK 01370 (M, S), Farm Gaikos (GR 729), 6.V.1974, O. H. VOLK 01106 (M, S). **Distr. OM:** Farm Etemba, NW corner of Erongo Mountains, 19.VII.1974, NORDENSTAM & LUNDGREN 925 (S, WIND). **Distr. KAR:** Ameib, S of Erongo, E of 'Bull Party', 11.VII.1974, NORDENSTAM & LUNDGREN 718 (PRE, S). **Distr. LUS:** At the ferry E of Sendlingsdrift, 21.IX.1972, MERXMÜLLER & GIESS 28649 (M, S). **Distr. BET:** Farm Daus (BET 27), 28.VI.1974, W. GIESS 13413 (S, WIND). **Distr. WAR:** Ai-Ais, Fish River riverbed, 26.VI.1974, NORDENSTAM & LUNDGREN 136 (S, WIND).

SOUTH AFRICA, CAPE. Kimberley, Rooivlakte, VIII.1936, M. WILMAN 3601 (PRE, S); L. Namaqualand, Gariep, "*Mesogramma apifolium* DC.", DRÈGE (S).

Some unusual morphological characteristics of *Mesogramma* were already noted by earlier authors. These include the arrangement and morphology of the involucral bracts, which are almost biseriate, with the inner ones partly overlapped by the margins of the outer ones. The inner phyllaries in *Mesogramma* are morphologically

different from the outer ones, most noticeably by the very distinct black resin ducts.

The cypselas of *Mesogramma* are also unusual in the tribe, being subtriquetrous and completely black, and provided with three lines of short white papilliform duplex hairs. In addition, the cypselas are both apically and basally constricted and provided with a crown or ring of longer papilliform trichomes.

The closest relative of *Mesogramma* is without doubt *Bolandia* G. V. CRON, a new genus of two species previously placed in *Cineraria* L. (CRON et al., in press). Characters in common between the two genera include the herbaceous habit, the presence of resin ducts e.g. in the involucre bracts and disc-floret corollas, and the black cypselas with short papilliform white duplex hairs becoming mucilaginous when wet.

Mesogramma differs from *Bolandia* by the absence of tomentum, the calyculate involucre, the branching (non-scapose) flowering stems, the glabrous (non-glandular) ray-floret tubes, the disc-floret styles lacking a central tuft of papillae, and the homomorphic cypselas with three lines of hairs. The distribution ranges of the two genera are vicariant, or allopatric, *Bolandia* occurring disjunctly in the Western and Eastern Cape and Lesotho, and *Mesogramma* having a larger range further north, mainly in the Orange Free State, Botswana and Namibia.

Molecular data

COLEMAN et al. (2003) included both *D. alliariifolia* and *M. apiifolium* (as *S. alliariifolius* and *S. apiifolius*, respectively) in their phylogenetic studies in *Senecio* sect. *Senecio* using ITS sequence data. In these analyses, both species formed a clade together with *Cineraria platycarpa* (misidentified as *Stilpnogyne bellidioides*, G. V. CRON, pers. comm.). This clade was found sister to a clade composed of *Senecio* species, *Crassocephalum crepidioides*, and *Erechtites hieraciifolia*. These findings indicated an isolated phylogenetic position of *S. apiifolius* and *S. alliariifolius* relative to other species of *Senecio* (Fig. 5).

Ongoing phylogenetic studies of a much larger ITS sequence data set (presently composed of 516 species of 108 genera of Senecioneae; PELSER et al., unpublished) confirm that both species are only distantly related to *Senecio* and to each other. In a preliminary maximum parsimony phylogeny of Senecioneae, *Dauresia* is placed sister to a clade composed of *Aetheolaena*, *Arrhenechthites*, *Cissampelopsis*, *Crassocephalum*, *Culcitium*, *Erechtites*, *Hasteola*, *Iocenes*, *Lasiocephalus*, *Robinsonia*, *Senecio* s.s., and *Synotis*. Although bootstrap support for this phylogenetic position of *Dauresia* is very low (< 50%), there is strong bootstrap support (99%) for the hypothesis that the genera *Aetheolaena*, *Culcitium*, *Hasteola*, *Iocenes*, *Lasiocephalus*, and *Robinsonia* are more closely related to *Senecio* s.s. than

Dauresia is (cf. Fig. 5).

In close agreement with the morphological evidence discussed above, *Mesogramma* is found most closely related to the new genus *Bolandia* (99% bootstrap support). This clade is in turn closely related to *Cineraria*, although this relationship is only weakly supported (56%).

Although these preliminary results need to be confirmed with more detailed analyses using both nuclear and plastid DNA sequence data for a larger taxon sampling, *S. apiifolius* and *S. alliariifolius* are clearly quite distantly related to *Senecio* s.s. and have to be excluded from this genus to approach a monophyletic *Senecio* concept.

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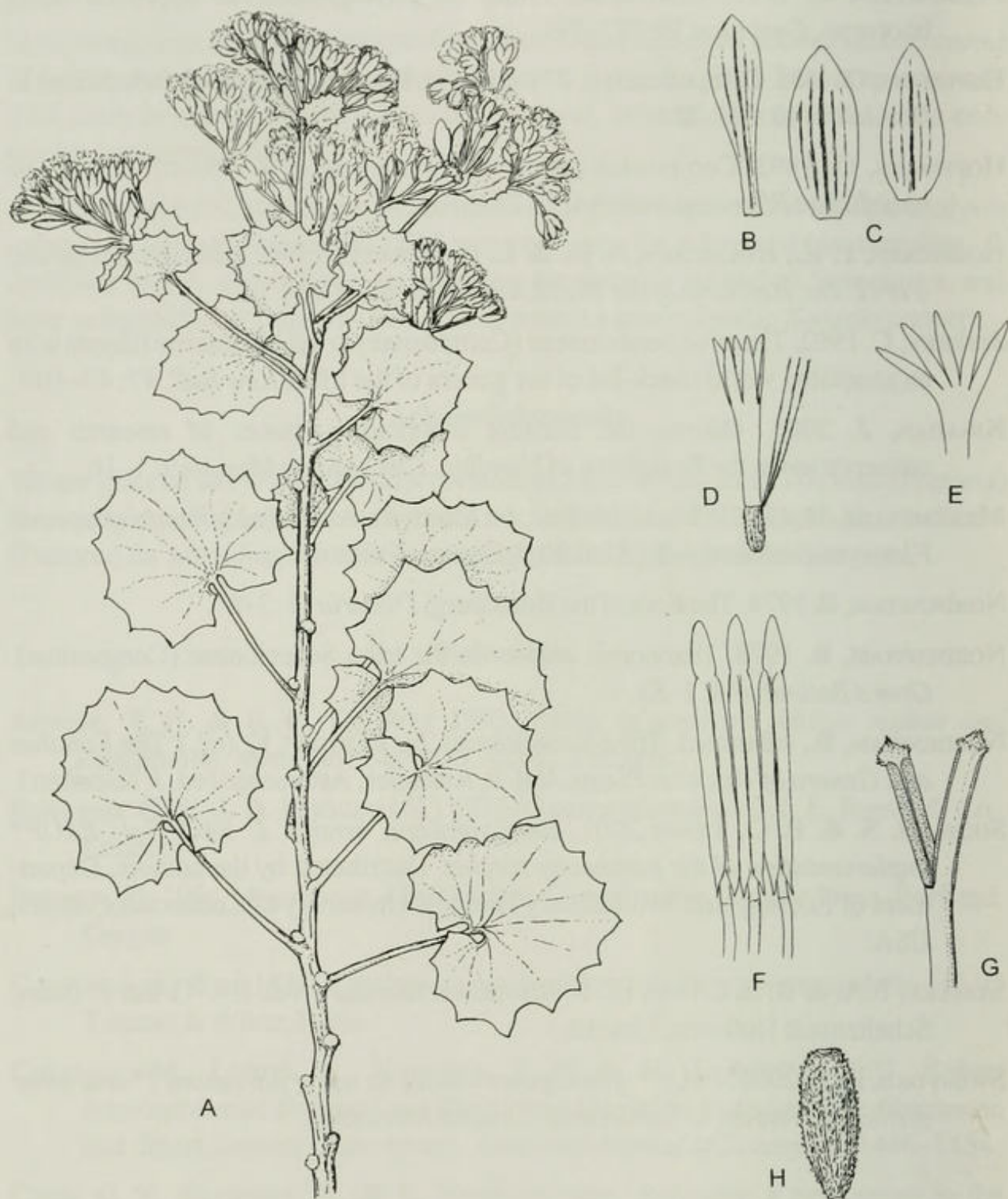


Fig. 1. *Dauresia alliariifolia* (O. Hoffm.) B. Nord. & Pels.

A Habit, $\times \frac{1}{2}$. B Subinvolucral bract, $\times 2.5$. C Outer and inner involucre bract, $\times 2.5$. D Floret, $\times 2.5$. E Corolla laid out, $\times 5$. F Anthers, $\times 10$. G Style branches, $\times 10$. H Cypsela, $\times 5$. A–G GIESS 3700 (S); H KERS 697 (S). Del. B. NORDENSTAM.

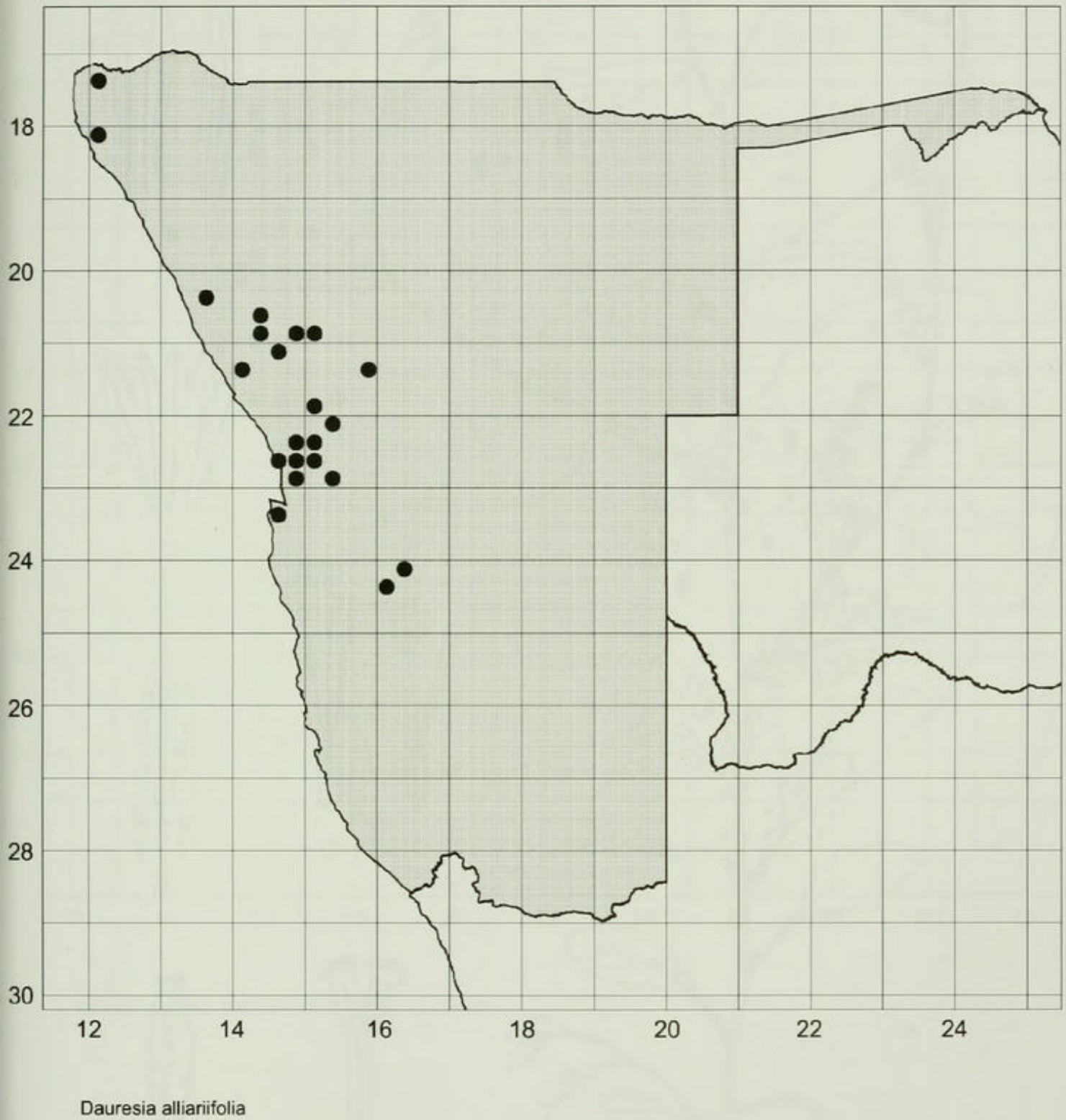


Fig. 2. Distribution of *Dauresia alliarifolia* (O. HOFFM.) B. NORD. & PELSNER.

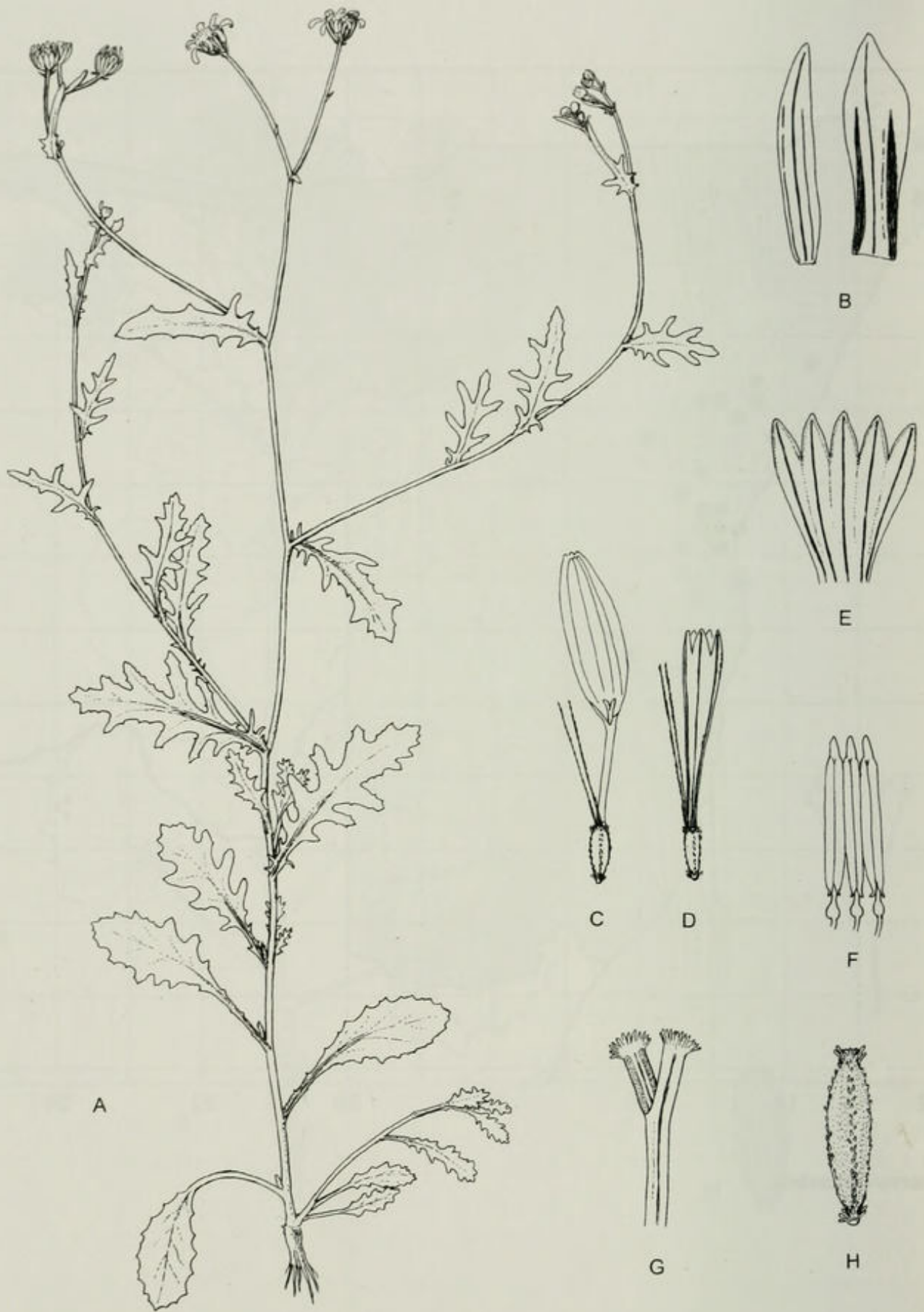
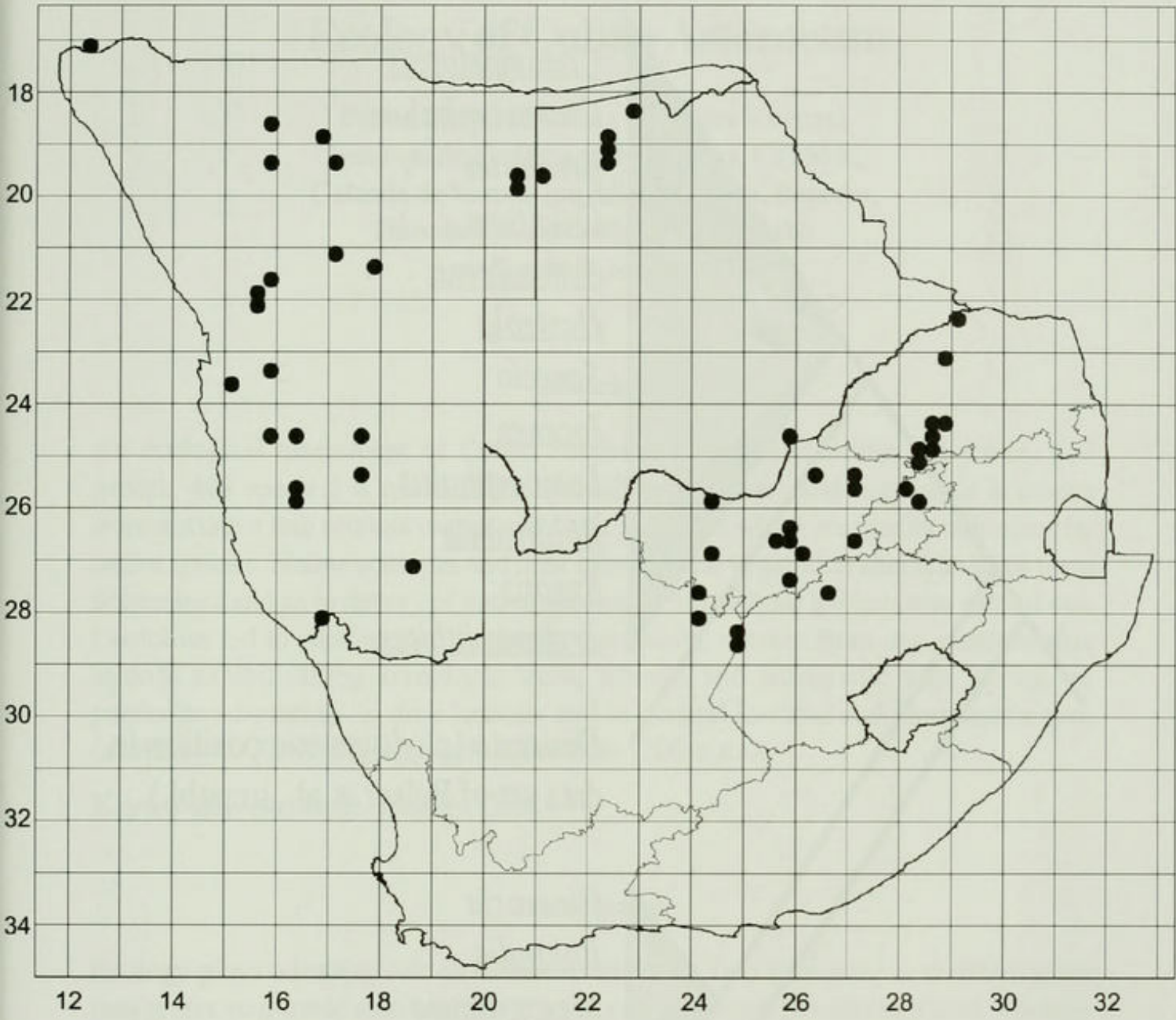


Fig. 3. *Mesogramma apiifolium* DC.

A Habit, $\times \frac{1}{2}$. B Outer and inner involucre bract, $\times 5$. C Ray-floret, $\times 5$. D Disc-floret, $\times 5$. E Corolla of disc-floret laid out, $\times 10$. F Anthers, $\times 10$. G Style branches of disc-floret, $\times 20$. H Cypsela of ray-floret, $\times 20$. NORDENSTAM 925 (S). Del. B. NORDENSTAM.



Senecio apiifolius (DC.) Benth. & Hook.f. ex O.Hoffm.

Fig. 4. Distribution of *Mesogramma apiifolium* DC.

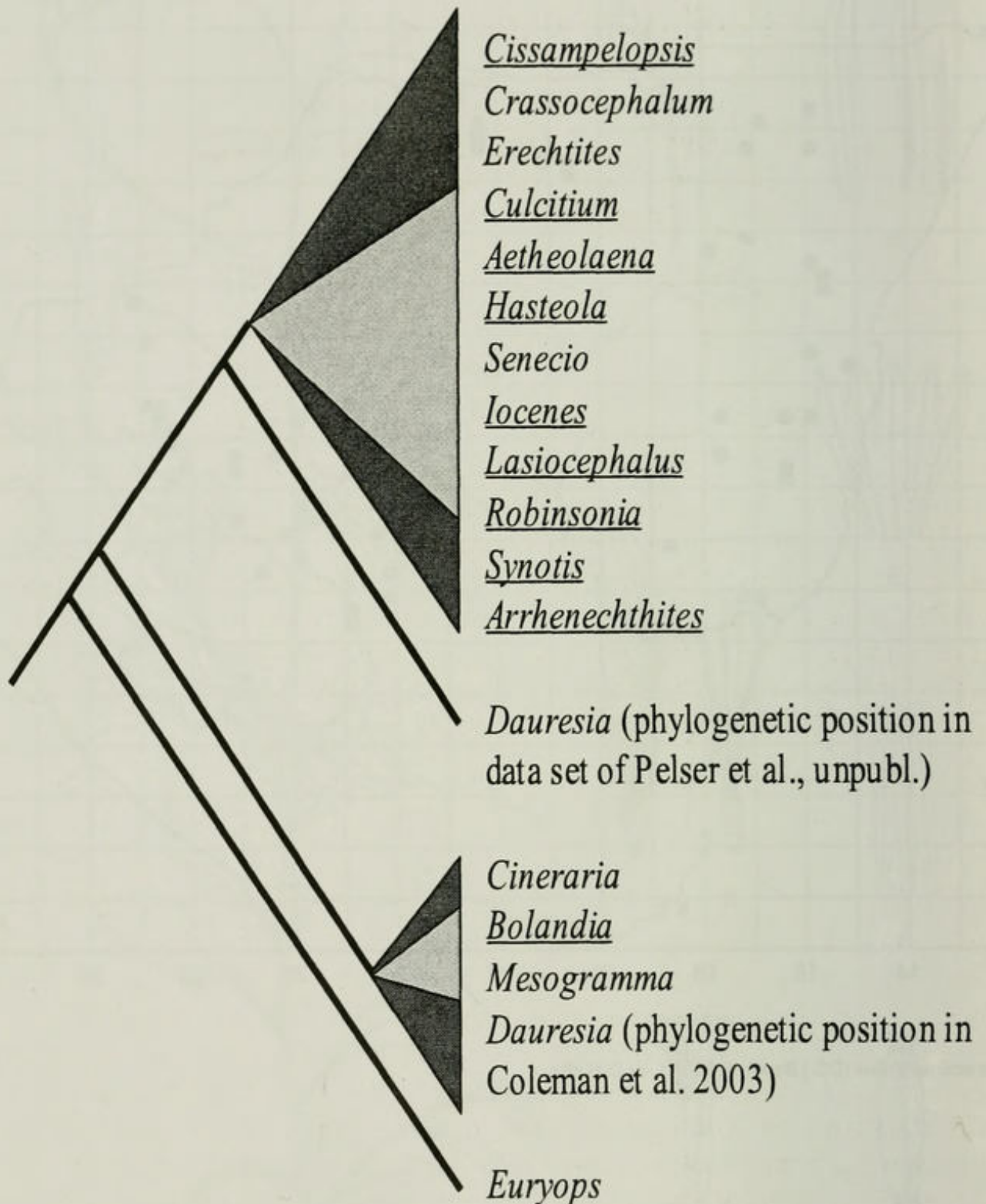


Fig. 5. Schematic representation of the phylogenetic position of *Dauresia* and *Mesogramma* in Senecioneae, redrawn from COLEMAN et al. 2003 and supplemented with select taxa from the ITS data set of PELSNER et al. (unpubl.). Genera that are underlined were not included in COLEMAN et al. 2003. Triangles represent clades within which no further relationships are shown. The light-grey clades fall within the dark-grey clades.



Nordenstam, Bertil and Pelser, Pieter B. 2005. "Dauresia and Mesogramma: one new and one resurrected genus of the Asteraceae-Senecioneae from Southern Africa ." *Compositae newsletter* 42, 74–88.

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