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A revision of the genus *Glia* (Apiaceae, tribe Heteromorpheae)

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Abstract

The taxonomy of the hitherto monotypic, fynbos-endemic genus *Glia* Sond. is revised, together with a re-consideration of its generic circumscription. Recent field work has revealed and clarified the existence of two new species, herein described as *G. decidua* B-E.van Wyk and *G. pilulosa* B-E.van Wyk. Both are summer-deciduous geophytes (growing at low elevations in clay or limestone) that are clearly related to the well-known *G. prolifera* (an evergreen pyrophyte found in sandy soils, mostly at higher elevations). The genus *Glia* differs from the closely related *Anginon* Raf. in the geophytic habit with a single, tuberous root (woody shrubs or shrublets in *Anginon*), the predominantly unbranched flowering stems arising from a short woody collar above the tuber (stems usually much-branched above ground level in *Anginon*), with basal rosettes of leaves (mature leaves cauline and crowded towards the branch ends in *Anginon*) and with cauline leaves (if present) strongly reduced in size (not reduced in *Anginon*). Furthermore, the leaves are sparsely and minutely hairy, at least along the margins or veins below (totally glabrous in *Anginon*) and the petioles have medullary vascular bundles (absent in *Anginon* except in seedlings or juvenile leaves). *Anginon* species are evergreen shrubs or shrublets with persistent leaves borne on woody branches but some of them (e.g. *A. verticillata*) may lose their leaves under extreme drought conditions in summer.

Keywords: Apiaceae; Cape floristic region; Generic delimitation; New species; South Africa; Taxonomy

1. Introduction

Glia is a relatively well known monotypic genus with a rather restricted distribution in the Western Cape Province of South Africa. It is one of only a small number of Cape plants for which the original *Khoi-khoi* name has been preserved. In his “Travels at the Cape of Good Hope 1772–1775” (Forbes, 1986), Thunberg recorded the vernacular name “*Gli”* and described in detail how two handfuls of the powdered and dried root were mixed with cold water and honey and allowed to ferment overnight. The result was an intoxicating mead that required only a few glasses to take effect and which was said to leave no headache. The correct identity of the plant is without doubt, as specimens of *Oenanthe inebrians* Thunberg are still available in the Thunberg Herbarium in Uppsala (THUNB-UPS). Sheet 7094 in THUNB-UPS bears the following inscription (in Thunberg’s hand) on the reverse: “e Mostert Hoek [=Winterhoek, north of Tulbagh] in Cap. b. Spei, Thunberg; Hottentottig: Gli”. This is a rare case where an old anecdote is directly linked to a voucher specimen. In describing the new genus *Glia* (the name is obviously derived from *gli*), Sonder (1862) also mentioned the use of the root in preparing an inebriating liquor. The old Afrikaans vernacular name is *moerwortel* because of the use of the root (*wortel*) as a ferment or yeast (*moer*).

Glia is one of 12 genera of the African Heteromorpheae (subfamily Apioideae), a tribe characterised by predominantly woody plants with a diversity of leaf and fruit types (Downie and Katz-Downie, 1999; Van Wyk et al., 1999; Downie et al., 2000, 2001; Van Wyk, 2001; Van Wyk and Tilney, 2003, 2004; Calviño et al., 2006). Although closely related to the genus *Anginon* Raf., the single species of *Glia* thus far known, *G. prolifera* (Burm.f.) B.L.Burtt, can be readily distinguished by the ribbed fruits, unbranched flowering stems, leafy basal foliage, minute scabrous hairs on the leaves, parsnip-like, fleshy roots, and medullary vascular bundles in the petioles of mature leaves (Allison and Van Wyk, 1997; Van Wyk et al., 1997). The outer

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walls of the epidermal cells in the fruit of both genera are heavily cutinised and the cells often have a bottle-shaped appearance in transverse section.

In a detailed phylogenetic study of the species of *Anginon* based on morphological and anatomical data, Van Wyk et al. (1997) concluded that *Anginon* was monophyletic and closely related to *Glia* — the heavily cutinised epidermal cells of the fruit were considered to be a convincing synapomorphy. *Anginon* was distinguished from *Glia* in this study by the phyllodinous mature leaves, the absence of medullary vascular bundles in mature leaves, the absence of median and dorsal ribs in the fruit, and the presence of at least some lignified cells in the commissural area of the fruit.

Molecular systematic studies of southern African Apiaceae have confirmed the close relationship between *Glia* and *Anginon* (Downie and Katz-Downie, 1999; Downie et al., 2000; Calviño et al., 2006). Some doubt was expressed by Calviño et al. (2006) about the generic status of *Glia* based on the results of nrITS sequence data, which suggested that *Glia* was embedded within a paraphyletic *Anginon*. A final decision about the fate of *Glia* could not be reached, mainly because we were aware of the existence of undescribed species. That the two genera are closely related was never in doubt, but the exact relation between *Glia* (a geophyte) and *Anginon* (woody shrubs) remained unclear.

Recent field work has confirmed the presence of two new species of *Glia* and clarified much of the uncertainty about the correct circumscription of the genus and its species. An updated taxonomy is presented here, together with some new insights into relationships and diagnostic characters.

2. Materials and methods

2.1. Morphology

Herbarium material was studied from BM, BOL, GRA, K, NBG, PRE, S and UPS. All the species were also studied in their natural habitats and the localities were visited at different times of the year.

2.2. Anatomy

Fresh leaves, flowers and fruits of all the species were collected and preserved in FAA. In some cases we also studied petioles and fruits from herbarium material, which were rehydrated before preserving in FAA. The material was infiltrated and embedded in glycol methacrylate as described in Feder and O'Brien (1968) except with a final infiltration of five days. Transverse sections were cut in standard positions (in the middle of the structure). Voucher specimens of the material sectioned are given in the figure captions.

3. Results and discussion

3.1. Characters and character states

3.1.1. Habit

Glia differs from all other woody southern African Apiaceae in the geophytic habit, with a parsnip-like, tuberous root, a short caudex, and simple (or weakly branched) stems that may be perennial or annual. The tubers can be up to 200 × 80 mm but the full range of variation is not known. *Anginon* species are all non-tuberous shrubs or shrublets with permanent woody flowering stems that are variously branched above ground level.

3.1.2. Leaves

The leaves are typically broadly laminate and foliaceous, with all or most of the leaves basal. In *G. prolifera*, there is a gradual reduction in the width of the lamina, with the upper leaves being only narrowly laminate (Fig. 1, a1–a5). The two new species, *G. decidua*) and *G. pilulosa*) have a very abrupt transition from the basal (radical) leaves to the cauline leaves. The basal leaves are foliaceous, with a broad lamina (Fig. 1b, c), while the cauline leaves are strongly reduced (small and with linear segments), few in number and sometimes absent. The petioles of all three species have medullary vascular bundles (Fig. 2). In contrast, *Anginon* species have the mature foliage cauline and congested towards the branch ends, often without a lamina and reduced to pine-needle-like phyllodes (see Figs. 1 to 5 in Van Wyk et al., 1997). Medullary vascular bundles are absent in mature leaves of *Anginon* species. Seedling and juvenile foliage (including leaves on coppice shoots) of *Anginon* may resemble those of *Glia* and may also have a few medullary vascular bundles in the petioles, but these leaves are soon lost. The ultimate leaf segments in *Anginon* are acicular or linear but not conspicuously broadly laminate as in *Glia*.

The two new species described below are both summer-deciduous. The leaves start to wither and die during the flowering period (December to January) resulting in fruiting plants that are usually leafless. The flowering stems in these two species also die back after fruiting, so that only the short woody caudex remains at ground level. In *G. prolifera*, the basal foliage often dies back in summer, leaving only the persistent cauline leaves. The flowering stems are woody and perennial but are periodically removed by fire, so that new stems emerge from ground level.

The presence of minute trichomes on the leaves of all three species of *Glia* (Fig. 3) is a useful diagnostic character to distinguish the genus from *Anginon*, where the leaves are invariably glabrous. *Glia prolifera* is usually described as glabrous [e.g. by Sonder (1862) in Flora Capensis] but closer inspection reveals the presence of minute echinate hairs, at least along the veins on the abaxial side of the lamina and sometimes on the petioles (Fig. 2a). The leaf margins are also minutely scabrous (Fig. 3 a1, a2). Similar but slightly more prominent trichomes are found on the laminas and petioles of *G. decidua* (Fig. 3 b1–b4), while *G. pilulosa* is easily distinguished by the minutely pilose petioles, leaf margins and veins (Fig. 3 c1, c2). Trichomes were also found to be taxonomically useful in the genus *Heteromorpha* Cham. & Schlechtdl. (Winter and Van Wyk, 1994).

Glia species are exceptionally variable in the colour of the leaves, which ranges from bright green or yellowish green to glaucous (covered by a white, wax layer) in all three species. This variability may be confusing, as some individuals within a population may be markedly glaucous while the others are

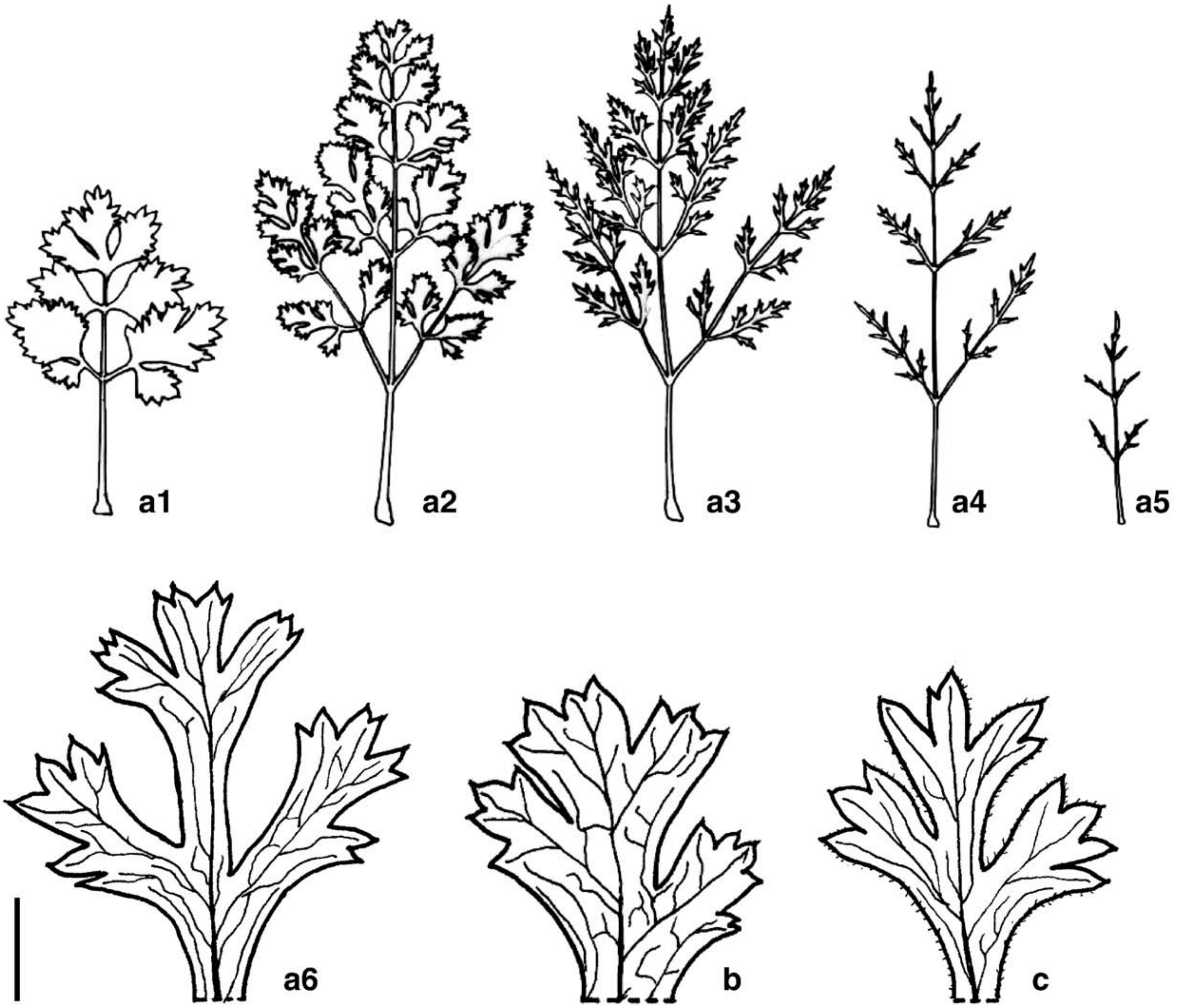

Fig. 1. Leaves (a1–a5) and ultimate leaf segments (a6–c) of *Glia* species. (a1–a5) leaves of *G. prolifera*, showing the gradual reduction from basal leaves (a1) to cauline leaves (a5); (a6) ultimate leaflet segment of *G. prolifera*; (b) ultimate leaflet segment of *G. decidua*; (c) ultimate leaflet segment of *G. pilulosa* (note the minute spreading hairs). Voucher specimens: (a1–5) Van *Wyk 3516* (cultivated at JRAU); (a6) *Van Wyk et al. 4329*; (b) *B-E. & M. van Wyk 4274*; (c) *Van Wyk et al.* 4223. Scale bar = 5 mm for bottom row and 13 mm for upper row.

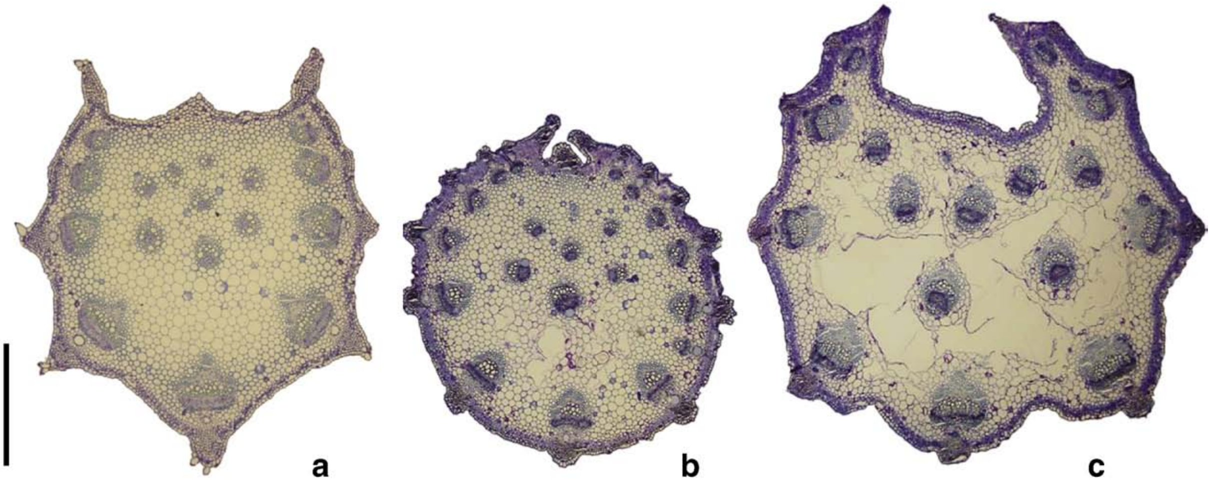

Fig. 2. Petioles of *Glia* species in transverse section to show the presence of medullary vascular bundles. (a) *G. prolifera* (note the hairs visible on the ribs); (b) *G. decidua*; (c) *G. pilulosa*. Voucher specimens: (a) *Van Wyk 3516*; (b) *B-E. & M. van Wyk 4274*; (c) *Van Wyk et al.* 4223. Scale bar = 1 mm.

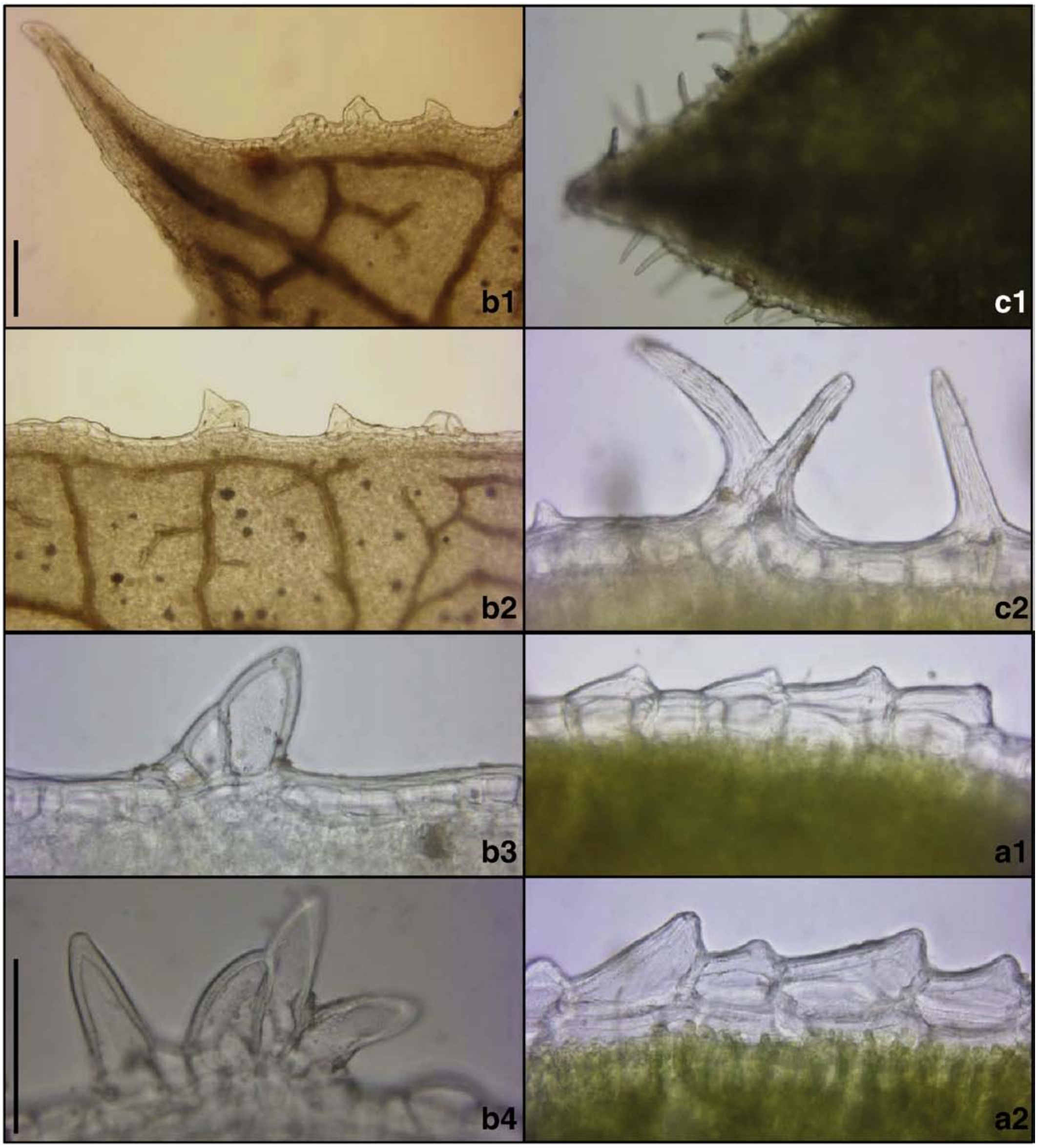

Fig. 3. Leaf margins of *Glia* species to show the distinctive hairs of *G. prolifera* (a), *G. decidua* (b) and *G. pilulosa* (c). (a1, a2) *G. prolifera* (note the very short, evenly spaced echinate/scabrous hairs); (b1–b4) *G. decidua* (note short, irregularly spaced echinate/scabrous hairs); (c1–c2) *G. pilulosa* (note the minute spreading hairs). Voucher specimens: (a) *Van Wyk et al. 4329*; (b) *B.–E. & M. van Wyk 4274*; (c) *Van Wyk et al.* 4223. Upper scale bar = 0.2 mm (for b1, b2, c1); lower scale bar = 0.1 mm (for a1, a2, b3, b4, c2).

bright green or yellowish green (e.g. Fig. 4a, b). The leaves and stems of *G. prolifera* are typically bright green or yellowish green and only rarely glaucous but the two new species (Figs. 5 and 6) often become markedly glaucous during the flowering and fruiting season in summer.

3.1.3. Inflorescences and flowers

The inflorescence consists of a single terminal umbel surrounded by slightly reduced secondary umbels, all of which appear to be hermaphroditic. In *Glia* (as in *Anginon* species) the secondary umbels may be solitary (Fig. 4c) or they may be subtended by up to five lateral umbels (i.e., third order umbels) in a racemose arrangement (see diagram in Van Wyk et al., 1997). In *G. prolifera* and *G. pilulosa* the uppermost secondary umbels usually extend above the primary umbel. The rays of the primary umbels in *G. decidua* are sometimes exceptionally long in the fruiting phase (visible in Fig. 5c).

3.1.4. Fruits

The recognition of three species in *Glia* is strongly supported by differences in the size, shape (Fig. 7) and structure of the fruits (Fig. 8). The mericarps are isodiametric in *G. prolifera* and *G. pilulosa*, so that the whole fruit (schizocarp) appears to be laterally compressed. This is clearly visible in Fig. 7a, c, where the fruits are obovate in lateral view (Fig. 7a1, c1) but narrowly oblong in dorsal view (Fig. 7a2, c2). The fruits in *G. pilulosa* are small (±4.5 × 3.5 mm in lateral view) and the ribs poorly developed or absent (Figs. 7c1 and 8c). The fruits are larger in *G. prolifera* (±6 × 4 mm in lateral view) and also differ in having isodiametric to slightly dorsally compressed, 5-ribbed

Fig. 4. *Glia prolifera*. (a, b) Stems of fruiting plants from Du Toit's Kloof Pass, showing the variation in cauline leaves: glaucous and with irregular linear segments (a) or the more usual yellowish green with shorter and broader segments (b); (c) flowering plant, one year after fire (note the cauline leaves and sparse inflorescences); (d) basal (juvenile) leaf, showing the broad segments and minutely aristate teeth; (e) green but mature fruit, showing the broadly oblong shape. Voucher specimens: (a, e) *Van Wyk et al. 4209a*; (b) *Van Wyk 4209c*; (d) *Van Wyk et al.* 4329. Photographs taken by B.-E. Van Wyk.

and narrowly winged mericarps (Figs. 4e, 7a1, 8a2–a4). *G. decidua* has the largest fruits (8–10 mm × 4–5 mm) and differs from the other two species in having dorsally compressed mericarps (Figs. 5d,e, 7b1, 8b). The ribs are thick and prominent in this species but not winged (Figs. 7b1,b2, 8b).

Anatomical details of the ovary and fruits of *Glia* species are shown in Fig. 8. In addition to the shape of the mericarps and the presence or absence of wings, the following features are noteworthy. The epidermal cells are heavily cutinised in all three species and may be somewhat bottle-shaped (as is typical also for *Anginon* species). The vittae are unremarkable except for the sporadic presence of one or two additional vittae (Fig. 8a1), again a feature found in *Anginon* and other members of the tribe Heteromorpheae. Rib oil ducts are not visible and the ribs contain much lignified tissue, especially in *G. decidua* (Fig. 8b), and the marginal ribs are often broader in *G. prolifera* (Fig. 8a2, a3 and Fig. 9). The commissural area may contain lignified cells, a feature shared with *Anginon*, as is the lignification of the endocarp in some species, notably *G. decidua* (Fig. 8b). Druse crystals are present in the commissural area and some were observed in the mesocarp surrounding the seed.

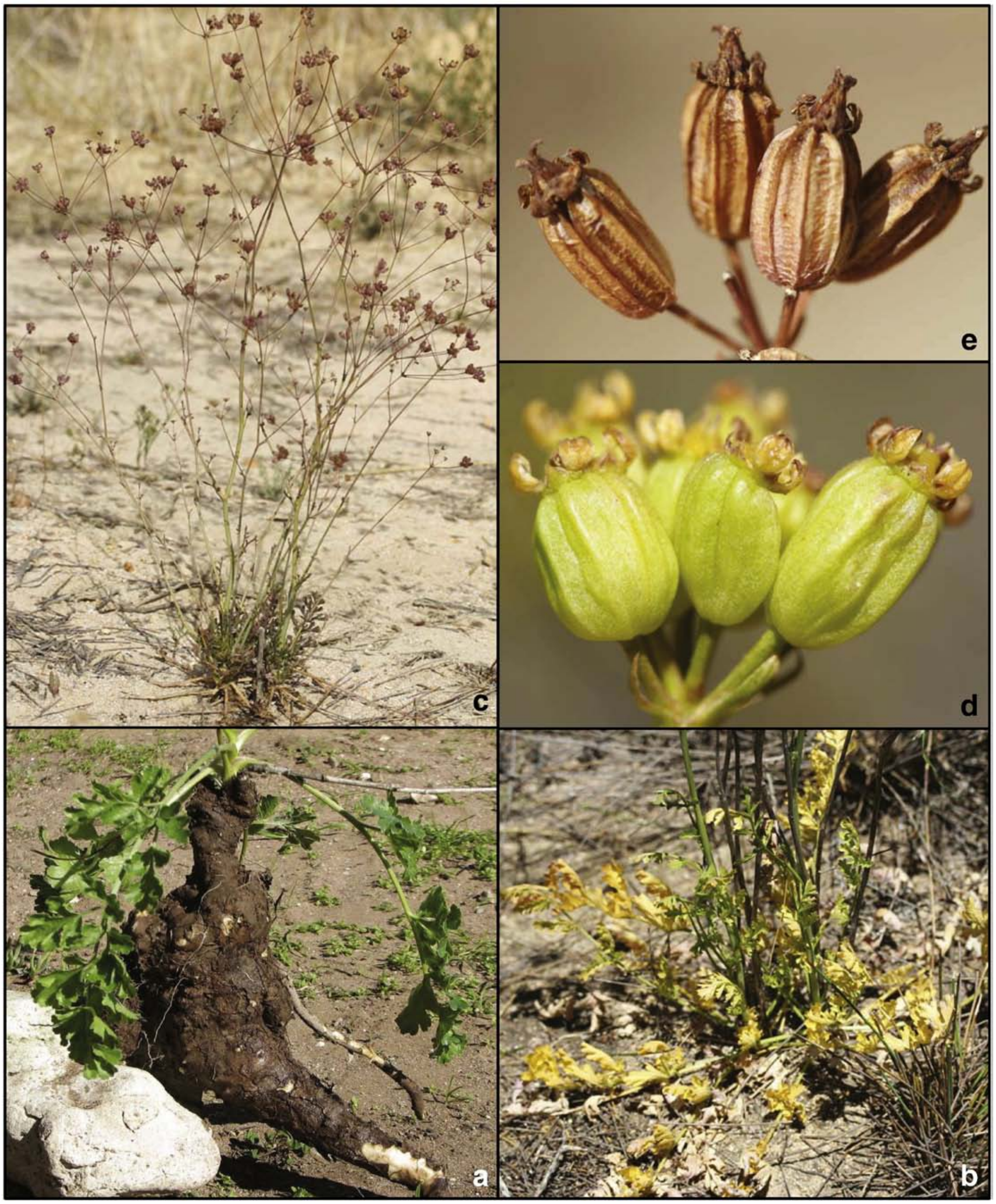

Fig. 5. *Glia decidua*. (a) Tuberous root, ca. 200 mm long and 80 mm in diameter (note the bright green basal leaves with broad segments); (b) basal part of a flowering plant at the type locality, showing the radical leaves that are starting to wither (December); (c) fruiting plant at the type locality (note the large terminal umbels); (d) green but mature fruit, showing the broadly oblong shape; (e) ripe fruit, showing distinct ribs. Voucher specimens: (b,c,d) *B.-E. & M. van Wyk 4274*; (e) *Van Wyk 4360*. Photographs taken by B.-E. Van Wyk except (a) by Mr J. Claassens.

3.2. Phylogenetic relationships

The close relationship between *Anginon* and *Glia* suggested by Van Wyk et al. (1997) was confirmed by Downie and Katz-Downie (1999) and Downie et al. (2000), using chloroplast DNA *rps16* and *rpl16* intron sequence data, respectively. Only the analyses of Downie and Katz-Downie (1999) included a broader sampling of the tribe Heteromorpheae in which the two accessions of *Anginon* and the single accession of *Glia prolifera* were recovered as part of an unresolved clade together with *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl. var. *arborescens* and two species of *Polemannia*. The most recent and most comprehensive sampling of the tribe Heteromorpheae by Calviño et al. (2006) was also unable to clarify the relationship between the two genera conclusively. The analyses of the chloroplast *rps16* intron data, despite the broader sampling of *Anginon* (16 accessions), recovered a similar polytomy to that of Downie

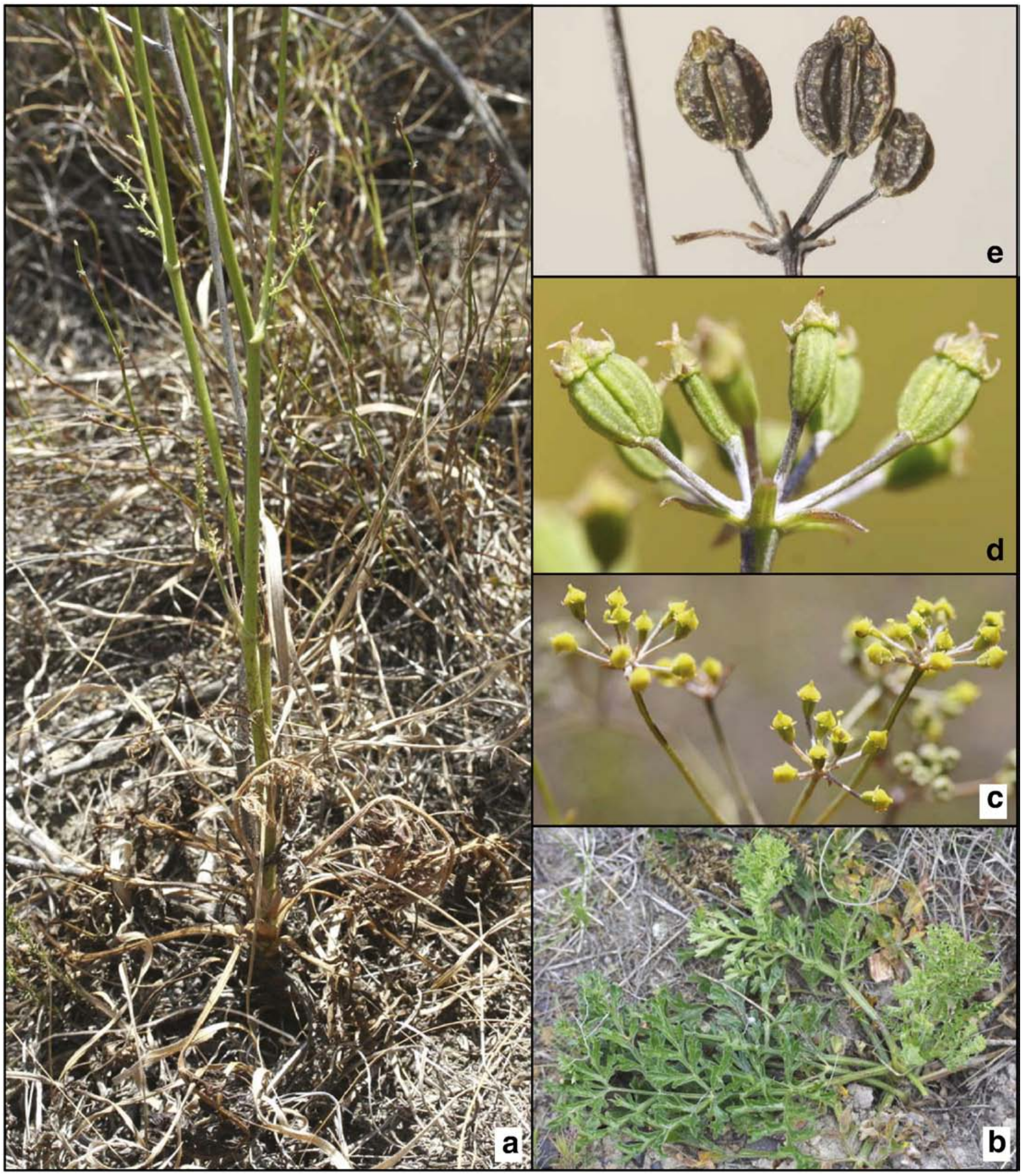

Fig. 6. *Glia pilulosa*. (a) Basal part of a flowering plant at the type locality, showing the radical leaves that have already withered (January); (b) plant before flowering, showing the pilulose leaves with broad segments (November); (c) flowers (January); (d) green fruit in January (note the shape of the fruits — narrowly oblong in dorsal view and obovate in lateral view); (e) ripe fruit (February). Voucher specimens: (a,c,d) *Van Wyk et al. 4359*; (b) *Van Wyk et al. 4223*; (e) *Van Wyk & Albrecht s.n.* Photographs taken by B.-E. Van Wyk.

and Katz-Downie (1999). However, the analyses of the nuclear nrITS sequence data were better resolved and suggested that *G. prolifera* was embedded within a moderately supported clade (BP 83%) comprising all 18 accessions of *Anginon*.

Several morphological and anatomical character states are shared with the genus *Anginon*, suggesting that the two genera are closely related and probably comprise a single lineage. Oskolski and Van Wyk (2008) showed that the wood anatomy of the two genera is also very similar. Both genera have helical thickenings on the vessel walls and marginal axial parenchyma. The most conspicuous generic differences are the geophytic habit of *Glia* with its foliaceous, radical leaves bearing minute trichomes. The geophytic habit and scabridulous foliage are evident synapomorphies for the genus and it is conceivable that *Glia* is sister group to *Anginon* and not nested within. *Anginon*, however, appears to lack significant morphological synapomorphies apart from the tendency to veromorphic foliage and further study may yet indicate that it is paraphyletic without *Glia*. A detailed molecular study still remains to be done — a challenge that should yield interesting results and provide clarity on these two alternative hypotheses. Until there is convincing evidence to the contrary we retain the two genera as separate.

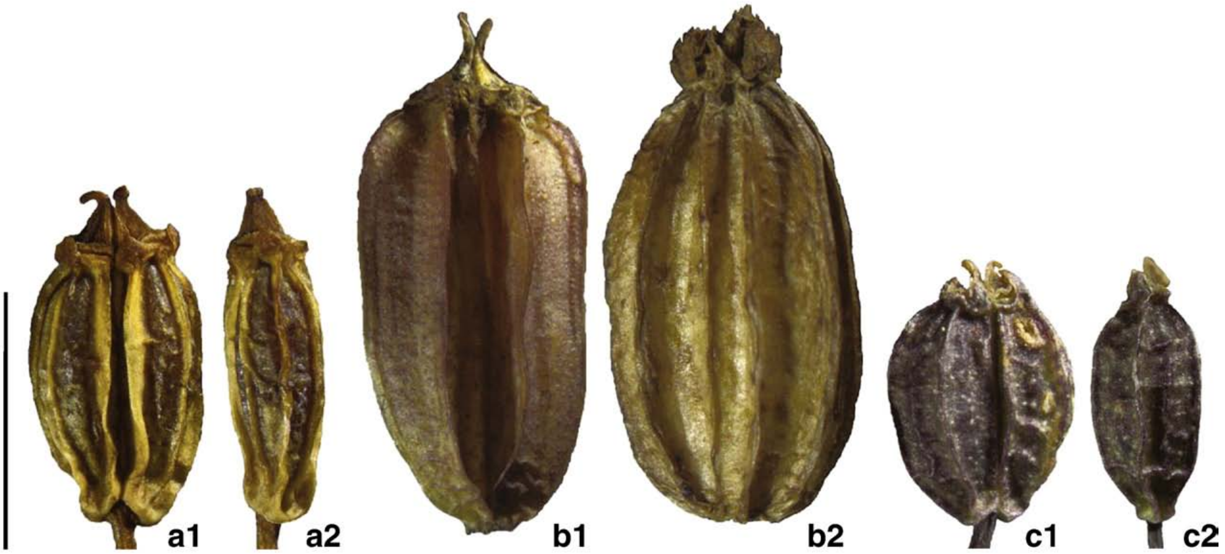

Fig. 7. Fruits of *Glia* species, taken in lateral view (left) and dorsal view (right) to show differences in size and shape. (a) *G. prolifera*; (b) *G. decidua*; (c) *G. pilulosa*. Voucher specimens: (a) *Bond 200*; (b) *Van Wyk 4360*; (c) *Van Wyk & Albrecht s.n.* Scale bar = 5 mm.

3.3. Taxonomy

3.3.1. Key to the genera

Geophytes with a single tuberous root; leaves hairy (minutely scabrous or pilose) at least along the lower veins or lamina margins; mature foliage predominantly radical (in leafy basal rosettes), the cauline leaves ± absent or greatly reduced; petioles usually with several medullary vascular bundles; flowering stems mostly unbranched, or branching at ground level only, deciduous or short-lived; leaf segments of mature leaves flat, with well-developed lamina, often deciduous ……………………………………… *Glia*

Woody shrubs or shrublets; leaves glabrous; mature foliage not radical, cauline leaves well-developed, usually congested towards the branch ends; petioles without medullary vascular bundles (except in seedling or juvenile leaves); flowering stems branched above ground level, persistent; leaf segments of mature (upper) leaves mostly reduced to needle-like phyllodes, usually without lamina, rarely deciduous .... *Anginon*

Glia Sond. in Fl. Cap. 2: 547 (1862); Adamson and Salter, Fl. Cape Penins. 618 (1950); Dyer, Gen. S. Afr. Pl. 1: 426 (1975); Wijnands, Bot. Commmelins 199 (1983); Burtt in Notes Roy. Bot. Gard. Edinb. 45: 198 (1989); Burtt, Edinb. J. Bot. 48: 208–211 (1991); Pimenov and Leonov, Gen. Umbel.: 21 (1993); Goldblatt and Manning, Cape Plants 276 (2000); Van Wyk in Leistner, Seed Pl. S. Afr. Strelitzia 10: 68 (2000). Lectotype species: *Oenanthe inebrians* Thunb. [now *G. prolifera* (Burm.f.) B.L.Burtt], designated by Burtt (1989). [Note: see Burtt (1989) for a discussion of the generic synonymy of *Glia*].

= *Ruthea* Bolle sensu Drude in Engler and Prantl, Nat. Pflanzenfam. 3(8): 179 (1898, pro parte, nom. illeg.); Phill., Gen. ed. 2: 551 (1951). ≡ *Rutheopsis* A.Hansen and Kunkel in Cuad. Bot. Canar. 26–27: 61(1976), nom. superfl. ≡ *Gliopsis* Rauschert in Taxon 31: 556 (1982), nom. superfl.

Perennial geophytes with slender, basally branched stems arising from a short, persistent woody caudex at ground level; root single, parsnip-like or larger, fleshy. *Leaves* pinnately compound, 1- to 4-pinnate, dimorphic, very variable, bright green, yellowish green or glaucous, minutely scabrous or pilose, the teeth aristate or mucronulate; basal leaves large, foliaceous, with very broad segments; cauline leaves either absent or present but then much smaller than basal leaves, with linear segments. *Inflorescence* usually branched, with or without conspicuous bracts along the peduncle; lateral branches of inflorescence with a single terminal umbel and with or without lateral umbels, rays short and thick or long and slender, terminal umbel compound; lateral umbels compound, smaller or ± equal to terminal umbel; involucral bracts 4 to 6, lanceolate; rays (3) 6 to 25; involucel bracts 4–6, lanceolate; raylets (6) 10 to 25. *Flowers* hermaphroditic, pentamerous, 1.5–5 mm long; *sepals* prominent, triangular; *petals* yellow, sometimes flushed with red, acuminate with tips inflexed, septum present on inner face. *Stamens* with anthers inflexed. *Stylopodium* broadly conical, with lobed margin; styles relatively short (less than half as long as stylopodium); *Fruit* broadly oblong, obovate–oblong or ± elliptic–oblong; mericarps isodiametric or dorsally compressed, homomorphic; median and lateral ribs mostly distinct, marginal ribs distinct to very narrowly winged; commissural vittae 2; vallecular vittae 4, rarely slightly branched; druse crystals present, scattered throughout the mericarp. $2n = 22$ (reported by Constance et al., 1976).

A genus of three species, endemic to the Fynbos Biome. Occurring in fynbos and renosterveld vegetation, from the Cederberg southwards to the Cape Peninsula and eastwards as far as the Swellendam district. Closely related to *Anginon* (tribe Heteromorpheae) and distinguished primarily by the geophytic habit, annual or short-lived and mostly unbranched stems with ± basal, puberulous foliage.

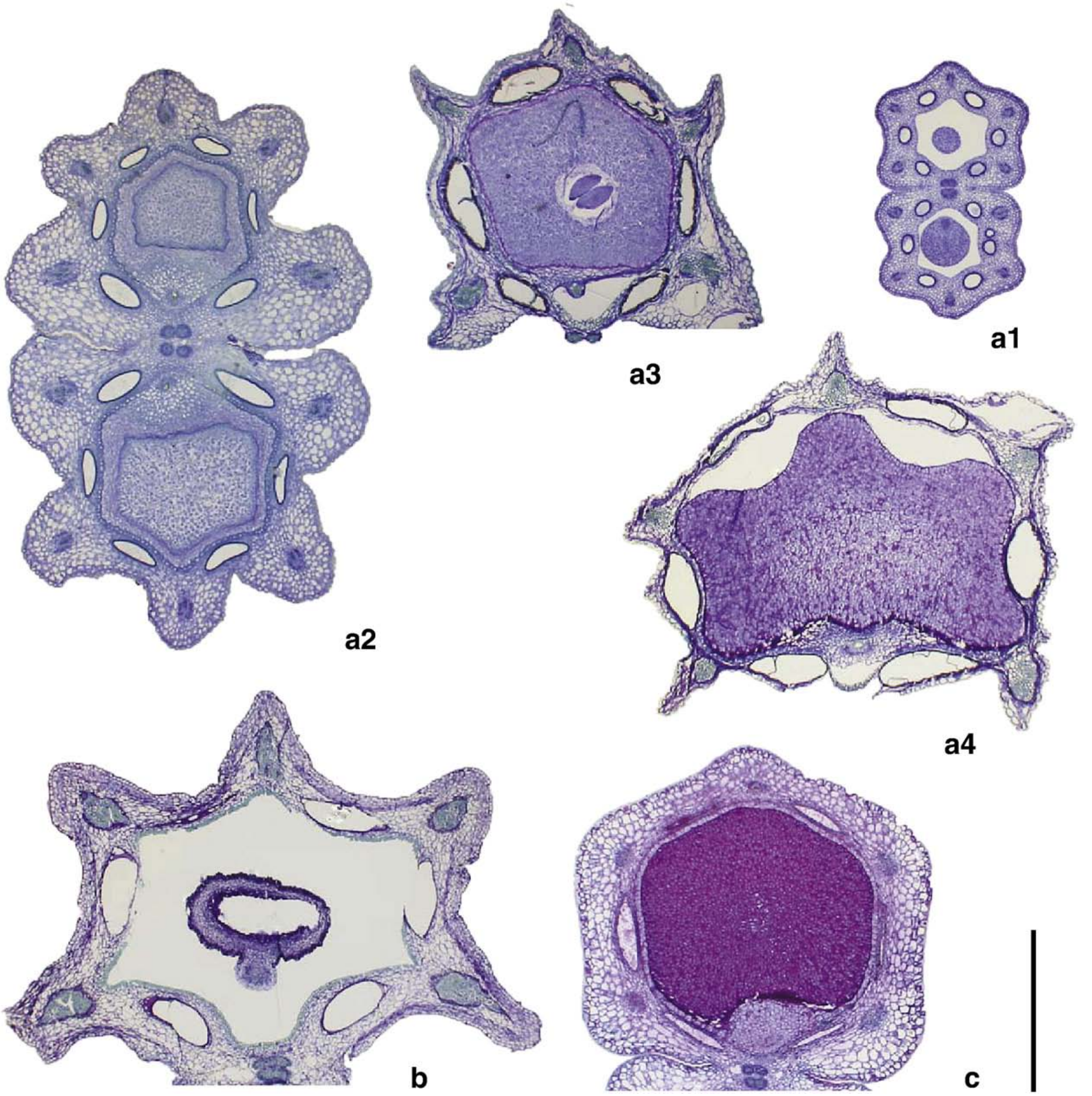

Fig. 8. Fruits of *Glia* species in transverse section to show the differences between *G. prolifera* (a), *G. decidua* (b) and *G. pilulosa* (c). (a1) Ovary from a flower of *G. prolifera* (from FAA; note the pair of vittae on the lower right); (a2) near-ripe fruit of *G. prolifera* (from FAA; note the larger marginal ribs); (a3, a4) ripe, dried mericarps of *G. prolifera* (note the prominent ribs); (b) ripe, dried mericarp of *G. decidua* (note the dorsally compressed shape, thick ribs and lignified endocarp); (c) near-ripe fruit of *G. pilulosa* (from FAA; note the indistinct ribs). Voucher specimens: (a1, a2) *Winter 77*; (a3) *Bond 200*; (a4) *Marloth 7313*; (b) *Van Wyk 4360*; (c) *Van Wyk & Albrecht s.n.* Scale bar = 1 mm.

3.3.2. Key to the species

1. Plants evergreen or partially so (the lower leaves may wither); cauline leaves usually present for some distance along the lower part of the flowering stem; mericarps ± isodiametric and 5-ribbed ……………………… *G. prolifera*

1. Plants summer-deciduous; cauline leaves usually absent or weakly developed; mericarps either dorsally compressed (flattened) or isodiametric but then with obscure ribs ….. ……………………………………………………… **3**

2. Leaves and petioles sparsely scabridulous; mericarps large (± 8 × 4 mm), dorsally compressed with distinct ribs ………………………………*G. decidua*

2. Leaves and petioles pilulose; mericarps small (± 4.5 × 3.5 mm), isodiametric (not dorsally compressed), without distinct ribs ……. *G. pilulosa*

1. *Glia prolifera* (Burm.f.) B.L.Burtt in Edinb. J. Bot. 48: 208–211 (1991); Goldblatt and Manning, Cape Plants 276 (2000). Type: South Africa, Cape, without precise locality or

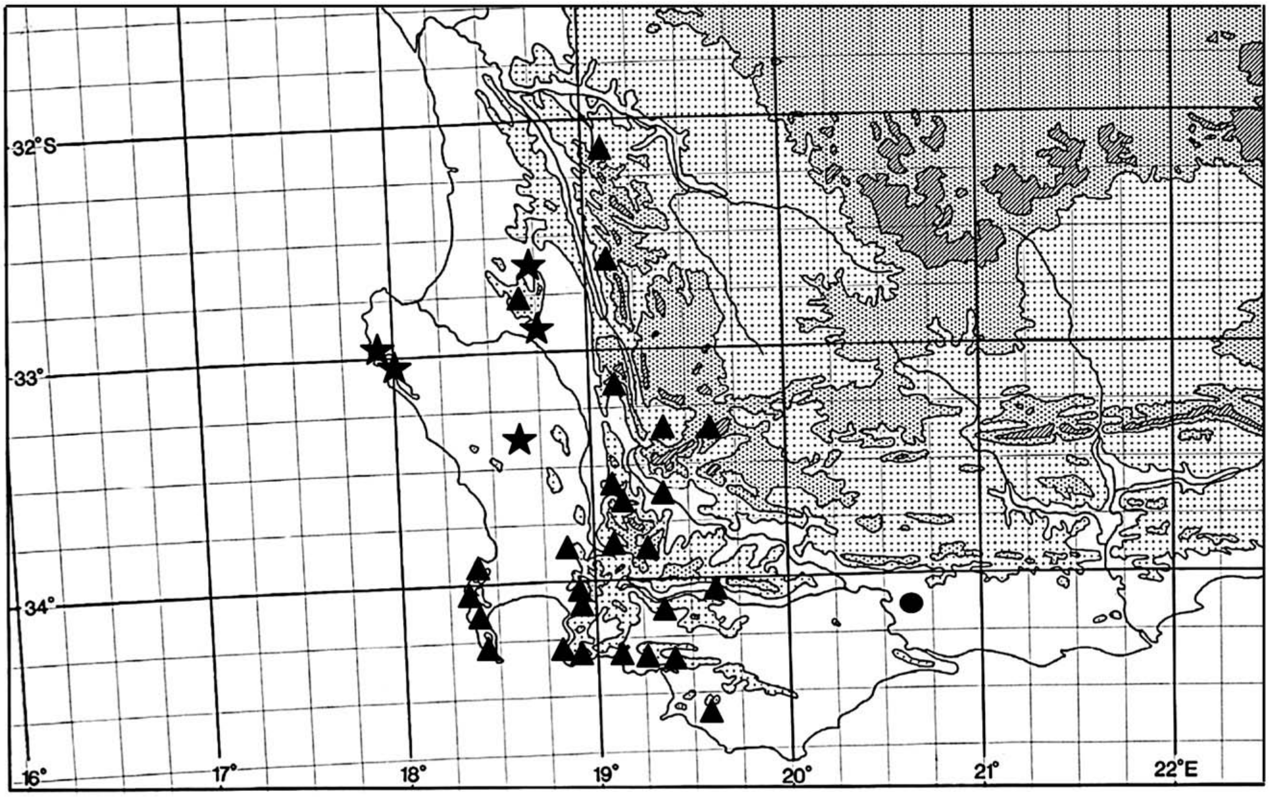

Fig. 9. The known geographical distribution of *Glia prolifera* (triangles), *G. decidua* (stars) and *G. pilulosa* (circle).

date, *Anon. s.n. sub Herb. Burmann* (G, holo.; photo! in Burtt, 1991). ≡ *Bubon proliferum* Burm.f., Fl. Cap. Prodr. 7 (1768).

= *Oenanthe capensis* Houtt., Nat. Hist. 2(8): t. 45, f.2 (1780) ≡ *Glia capensis* (Houtt.) B. L. Burtt in Notes Roy. Bot. Gard. Edinb. 45: 198 (1989). Type: [South Africa, without locality or date] *Anon. s.n. sub Herb. Houttuyn* (G, holo; photo! in Burtt, 1991).

= *Oenanthe inebrians* Thunb., Prodr. Pl. Cap. 49 (1794). ≡ *Lichtensteinia inebrians* (Thunb.) Eckl. & Zeyh., Enum. 349 (1837). ≡ *Anesorrhiza inebrians* (Thunb.) Wijnands, Bot. Commelins 199 (1983). Type: South Africa, [Western Cape], Table Mountain, without date, *Thunberg* s.n. UPS-THUNB 7095 [UPS-THUNB, lecto., designated by Burtt: 208 (1991)]).

Oenanthe tenuifolium Thunb., Prodr. Pl. Cap. 49 (1794). Type: South Africa, Cape, *Thunberg* s.n. UPS-THUNB 7103 (UPS-THUNB, lecto.!, here designated). [Note: Sheet 7103 is identical to 7104 but shows several umbels and some near-mature fruits.]

Peucedanum caledonicum Eckl. & Zeyh., Enum. 349 (1837). Type: South Africa, Caledon, Zwarteberg, *Ecklon & Zeyher 2233* (S, holo.!, K, iso.!). *Peucedanum abbreviatum* E.Mey ex Meisn. in Hook., Lond. J. Bot. 2: 535 (1843), non Sond. (1862). Type: South Africa, [Western Cape, summit of Table Mountain] “in summitate montis Tafelberg (III. A. e)”, March 1840, *Krauss 1179* (NY, lecto., designated by Burtt: 208 (1991), K, photo!).

Glia gummifera sensu Sond. in Fl. Cap. 2: 548 (1862), excl. basionym. [Note: the basionym and type apply to *Bubon gummiferum* L., the correct name for which is now *Notobubon gummiferum* (L.) Magee. When Sonder (1862) described the monotypic genus *Glia*, he misapplied the type of *Bubon gummifera* L. (Commelin’s plate 58 in *Horti Medici Amstelodamensis Rariorum Plantarum* of 1701). See also Magee et al. (2008)].

Ruthea gummifera sensu Drude in Engl. and Prantl, Nat. Pflanzenfam. 3(8): 179 (1898), excl. basionym.

Annesorhia gummifera sensu Hiroe, Umbell. World. 675 (1979), excl. basionym.

Perennial pyrophyte with slender, unbranched stems arising from short, persistent woody caudex at ground level; root single, up to 30 mm diam., parsnip-like, fleshy, with yellowish resin. *Leaves* 1- to 4-pinnate, variable, dimorphic, up to 240 mm long, scabridulous, bright green, yellowish green or rarely glaucous; basal leaves large, foliaceous, with broad segments; upper ones sparse, smaller, with linear segments. *Inflorescence* usually branched, with conspicuous bracts along peduncle; lateral branches with terminal umbel and up to 5 lateral umbels; lateral umbels smaller than terminal umbel, usually extending above terminal umbel; rays (3-)6-20, thick, 10–35 mm long; raylets 10–25, 2–5 mm long. *Flowers* 3–4 mm long; petals yellow. *Fruit* obovate-oblong to broadly oblong or broadly elliptic, ± 6 × 4 mm, mericarps isodiametric to slightly dorsally compressed, median and lateral ribs distinct, marginal ribs very narrowly winged. $2n = 22$.

Glia prolifera is a common species distributed from Pakhuis Pass in the Cederberg southwards along the mountains to the Cape Peninsula and eastwards to the Caledon and Pearly Beach districts west of Agulhas.

Glia prolifera is easily recognised by the broad and foliaceous basal leaves that gradually become smaller and narrower along the lower part of the flowering stems. These cauline leaves are persistent and usually yellowish green in colour (very rarely glaucous). The mericarps are almost isodiametric, with five prominent ribs that are narrowly winged. The species is often confused with the superficially similar *Notobubon ferulaceum* (Thunb.) Magee, especially when the basal leaves have withered, but can be distinguished by the untidy, irregular ultimate leaflets of the cauline leaves (regularly divided in *N. ferulaceum*), the ± isodiametric fruit with only very narrow marginal wings (dorsally compressed with broad marginal wings in *N. ferulaceaum*) and the larger, prominent sepals (minute in *N. ferulaceum*).

3.3.3. Additional specimens examined

–3218 (Clanwilliam): Piketberg, Bo-berg, Bergskeer Farm, Versveld Pass, New Caledonia Road (–DC), 29 January 2004, *Botha 4051* (NBG).

–3219 (Wuppertal): Between Clanwilliam and Pakhuis Pass (–AA), no date, *Rogers 16829* (BOL); Pakhuis Pass (–AA), November 1929, *Thode A2118* (PRE, 2 sheets); Pakhuis Pass, 200 m west of Leipoldt's grave (–AA), 13 October 1993, *Van Wyk 3516* (JRAU); Middelberg Pass (–CA), 26 November 2005, *Van Wyk et al. 4188* (JRAU).

–3318 (Cape Town): Cape Peninsula, Bishop's Court (–CD), 8 December 1951, *Salter 9417* (BM); Camps Bay (–CD), December 1846, *Alexander Prior s.n.* (K); Cape Town (–CD), January 1907, *Rogers 2420* (GRA); Devil's Peak (–CD), no date, *Bolus 3276* (BOL), no date (1875–1880), *Rehmann 1105* (BM), no date, *Stewart 246* (LE), January 1898, *Thode 6234, 6241* (NBG); Kasteelspoort (–CD), January 1916, *Marloth 7313b* (PRE); Kirstenbosch (–CD), January 1920, *Garside 1445* (K), February 1928, *Norman 272* (BM), December 1914, *Pearson s.n.* (BOL), 8 July 1993, *Winter 86* (JRAU); below Kirstenbosch (–CD), 19 December 1927, *Young 27350* (PRE); Kirstenbosch, Contour Path (–CD), 7 December 1939, *Compton 8086* (NBG), February 1928, *Norman 284* (NBG); Kirstenbosch, above Lübbert's Gift (–CD), 17 December 1992, *Winter 77* (JRAU); Kirstenbosch Ridge (–CD), February 1932, *Pillans* s.n. sub BOL 20063 (BM, BOL, K); Kirstenbosch, Silver Trees (–CD), 9 February 1935, *Esterhuysen 25* (BOL); Kirstenbosch, upper slopes north of Window Stream (–CD), 14 April 1956, *Esterhuysen 25651* (BOL); Kirstenbosch, clearing north of Window Stream (–CD), 7 February 1940, *Bond 200* (NBG); Table Mountain (–CD?), no date, *Bowie s.n.* (BM), September to December, *Ecklon s.n.* (K), December, *Ecklon & Zeyher s.n. sub SAM 37198* (SAM), 1891, *Guthrie 868* (BOL); Table Mountain, Orange Kloof and Disa Gorge (–CD), December 1915, *L. Bolus s.n.* (BOL, PRE); Table Mountain, Pipe Track (–CD), 25 October 1972, *McKinnon s.n.* (NBG); December, *Anon. (Ecklon?) sub Herb. Fischer 563* (LE), Cape Peninsula, Orange Kloof (–CD), 17 January 1956, *Lewis s.n. sub SAM 68494* (PRE, SAM, 2 sheets); Rondebosch, University grounds (–CD), September 1972, *Esterhuysen s.n.* (BOL, NBG, PRE); University grounds (–CD), 5 December 1932, *Levyns s.n.* (BOL); Wynberg (–CD), 19 December 1842, *Wallich 397* (BM); Wynberg Hill (–CD), 1921, *Pillans 4322* (K); Jonkershoek (–DD), 21 January 1964, *Taylor 5671* (NBG); Jonkershoek, Biesievlei (–DD), 13 November 1941, *Levyns 8487* (BOL); Jonkershoek, Jakkalsvlei (–DD), 17 December 1963, *Taylor 5607* (PRE), 21 January 1964, *Taylor 5671* (PRE); Jonkershoek, Langrivier Catchment (–DD), 30 May 1975, *Haynes 1042* (PRE); 31 October 1975, *Haynes 1111* (NBG, PRE), June 1967, *Kerfoot 5826* (PRE); Jonkershoek State Forest Valley (–DD), 27 November 1975, *Kruger 76* (NBG, PRE 2 sheets).

–3319 (Worcester): Mostert's Hoek [Winterhoek] (–AA), 22 October 1773, *Thunberg s.n. sub THUNB-UPS 7094* (UPS); Mitchell's Pass, Ceres (–AD), 9 November 1946, *Adamson 3720* (BOL); Hex River Valley (–BC), January 1881, *Tyson 792* (BOL, SAM); Bain's Kloof (–CA), December 1921, *Rogers 2928* (GRA); Du Toit's Kloof (–CA), January 1882, *Tyson s.n. sub SAM 37197* (SAM); Du Toit's Kloof Pass, 12 km from Paarl to Worcester (–CA), 28 January 2006, *Van Wyk, Magee and Liu* 4209 (JRAU); Du Toit's Kloof Pass, at the top (–CA), 21 January 2009, *Van Wyk, Tilney and Magee* 4329 (JRAU); Head of Du Toit's Kloof, Paarl (–CA), November 1937, *Pillans 8471* (BOL); Worcester district, kloof NW of Chavonnesberg (–CB), 18 December 1921, *Andreae 850* (NBG); Paarl Division, Haalsneeuwkop [Haalhoeksneeukop] (–CC), December 1944, *Stokoe s.n. sub SAM 58665* (SAM, 2 sheets); Elandskloof near Villiersdorp (–CD), 16 December 1933, *Galpin 12331* (PRE).

–3418 (Simonstown): Cape Peninsula (–AB?), 1886, *Thode 9382* (NBG); Chapmans Peak (–AB), 7 December 1943, *Wasserfall 712* (BOL, NBG), 7 December 1943, *Compton 15448* (NBG); Constantia (–AB), December 1896, *MacOwan sub Herb. Austr. Afr. 1617* (BM, BOL, GRA 2 sheets, K, SAM 2 sheets), December 1909, *Marloth 7313* (PRE); Hout Bay, Ruyterplaats (–AB), 22 December 1981, *Ellis 116* (NBG); Kalk Bay Mountains (–AB), January 1894, *Guthrie 1371* (BOL); Noordhoek (–AB), 1 December 1895, *Wolley Dod 453* (BM); Simon's Bay (–AB), November 1846, *Alexander Prior s.n.* (K); Cape Peninsula, Vlaggenberg (–AB), 28 December 1938, *Adamson 2382* (BM); Cape of Good Hope Nature Reserve, Paulsberg summit (–AD), 23 November 1966, *Taylor 7014* (NBG); Near Smitswinkel (–AD), 3 April 1928, *Salter 273/18* (BM); Sir Lowrey's Pass (–BB), 18 January 1896, *Schlechter 7287* (BM, GRA, K, PRE); Sir Lowrey's Pass Road (–BB), 17 February 1919, *Garside 1221* (K); Hottentot's Holland mountains (–BB), October, *Fischer s.n.* (LE); Western slopes of the Hottentot's Holland mountains below Sir Lowrey's Pass (–BB), December 1877, *Bolus 4138* (BOL); Southern slopes of Hangklip (–BD), 26 January 1936, *Pillans 8212* (BOL); Betty's Bay (–BD), Dec/Jan 1970/1971, *Van der Schijff 7458* (PRE); Betty's Bay, southern slopes of Elephant Rock Mountain above Sunny Seas (–BD), 29 March 1971, *Boucher 1470* (NBG).

–3419 (Caledon): Caledon district, 14 km NW of Caledon, just east of Florishoogte Pass, on De Vleytjes 261 (–AB), 4 September 2001, *Helme 2112* (NBG); Kleinmond, mountain slopes (–AC), 29 January 1947, *De Vos 537* (NBG); Voëlklip, Hermanus (–AD), 1934, *Bruyn 191* (PRE); Vogelgat, Little Gulley (–AD), 22 January 1983, *Williams 3413* (NBG); Vogelgat Private Nature Reserve (–AD), 15 October 1986, *Stirton 11171* (NBG, PRE); Happy Valley, southern foot of the Riviersonderend Mountains, near Greyton (–BA), 1 January 1953, *Esterhuysen 21078* (BOL); Mountains at Genadendal (–BA), December, *Ecklon & Zeyher s.n. sub SAM 37198* (SAM); Groot Hagelkraal near Pearly Beach (–DA), 16 March 1983, *Van Wyk 1149* (NBG); Hagelkraal River, limestone hills (–DA), 27 December 1946, *Leighton 2550* (BOL) [not typical, exceptionally glaucous].

Without precise locality: *Burchell 469, 8470* (K), *Drége s.n.* (K, LE, several sheets), *Ecklon 2250* (K, LE, SAM 2 sheets), *Harvey 637* (K); *Miller s.n. sub Herb. Hook.* (K), *Pappe s.n. sub Herb. Hook.* (K), *Sieber sub Fl. Cap. 211* (K, LE, several sheets), *Thunberg s.n. sub THUNB-UPS 7103*, *7104* (UPS), *Wallich s.n. sub Herb. Hook.* (K), 1909, *Worsdell s.n.* (K).

2. *Glia decidua* B.-E. van Wyk sp. nov. *G. proliferae similis sed foliis plerumque radicalibus et deciduis (in G. prolifera caulinis et persistentibus) et mericarpiis compressis (in G. prolifera quasi isodiametris) differt.* Type: South Africa, Western Cape, Malmesbury, S end of Hout Street, renosterveld [3318BC], 11 December 2008, *B-E. & M. van Wyk 4274* (NBG, holo.; K, NBG, PRE, JRAU, iso.).

Perennial geophyte with slender, unbranched stems arising from short, persistent woody caudex at ground level; root single, large, ±200 × 80 mm, fleshy. *Leaves* pinnate to bipinnate, very variable, up to 280 mm long, foliaceous, with broad segments, minutely scabrous, bright green or glaucous; cauline leaves absent or few, with linear segments. *Inflorescence* usually branched, with conspicuous bracts along peduncle; lateral branches usually with solitary terminal umbel and no lateral umbels; lateral umbels smaller than terminal umbel, usually extending above terminal umbel; rays (3–) 5 or 6 (7), thick, 35–50 (–110) mm long; raylets 6–20, 2–3 mm long. *Flowers* 4–5 mm long; p*etals* yellow or flushed with red. *Fruit* ovate-oblong to broadly oblong in dorsal and lateral view, large, 8–10 × 4–5 mm, mericarps markedly dorsally compressed, median and lateral ribs thick and distinct, marginal wings distinct but not winged.

The species has a relatively localized distribution in the western coastal region of the Western Cape Province (an area known as the Swartland), where it occurs on heavy soils (derived from shale or limestone) in renosterveld and strandveld vegetation at low elevations. It appears to be an ecological (edaphic) vicariant of *G. prolifera*; the latter typically grows in acid, sandy soils at higher elevations. Most of the Swartland is now under wheat cultivation. The new species is known from only a few localities (Piquetberg, Malmesbury and Saldanha) and its conservation status deserves attention.

Glia decidua can easily be distinguished by the radical leaves, all or most of which occur as basal rosettes, with at best a few highly reduced cauline leaves The plants are summer-deciduous and become leafless during the fruiting period in January and February. *Glia prolifera* is an evergreen species with well developed cauline leaves on the lower parts of the stem, these at least persisting for more than one season although the basal leaves may wither during the summer months. The leaves of *D. decidua* are more prominently scabrous than those of most specimens of *G. prolifera and* the fruits (when fully developed) are larger, with the mericarps dorsally compressed and not ± isodiametric as in other species. As a result, the mericarps are broader in dorsal view than in lateral view (but the schizocarps are of similar width in dorsal and lateral view). The fruit ribs are thick and blunt vs. narrowly winged in *G. prolifera* (Fig. 7). The range of variation in the shape and size of the tuberous roots is poorly known but *G. decidua* appears to have longer and thicker tubers (Fig. 5) of at least 200 mm long and about 80 mm diam. (the tuberous roots of *G. prolifera* are shorter and appear to be thinner, up to 30 mm diam.). The yellow flowers may be flushed with red, while they appear to be uniformly yellow in the other species. Confusion with *G. pilulosa,* the only other deciduous species, is unlikely as this plant has minutely but distinctly pilose leaves (Fig. 3) and smaller, isodiametric mericarps, so that the schizocarps are much narrower in dorsal view than in lateral view (visible in Fig. 6d).

3.3.4. Additional specimens examined

–3217 (Vredenburg): West Coast, Langebaan Peninsula, Jacobsbaai (–DD), 20 April 2009, *Magee*, *Boatwright* and *Claassens 144* (NBG); 30 October 2008, *Merunkova KM52/09* (STEU).

–3218 (Clanwilliam): East base of Piquetberg near its N end (–DB), 23 October 1938, *Pillans 8646* (BOL); SE end of Piketberg Mt not far above road, above cement factory (–DC/DD), 28 May 1952, *Esterhuysen 20168* (BOL).

–3318 (Cape Town): Saldanha Bay, granitic hills (–AA?), 18 July 1921, *Marloth 10177a* (leaf, PRE); plant from Saldanha, cultivated in Cape Town, December 1923, *Marloth 10177b* (fruits, PRE, 2 sheets); Malmesbury, S end of Hout Street, (–BC), 11 September 2007, *Magee & Boatwright 123* (JRAU); 20 January 2009 (ripe fruits collected and added to the type specimens), *B-E. van Wyk 4360* (JRAU).

3. *Glia pilulosa* B-E van Wyk sp. nov.; *Species insignis*, *ceteris cognitis speciebus vestimento piluloso foliorum et fructibus minoribus valde distincta.* Type: South Africa, Western Cape, Swellendam, near Bontebokskloof (3420BA), 4 November 2008, *Van Wyk, Magee and Boatwright 4223* (NBG, holo.; PRE, iso.).

Perennial geophyte with slender, erect, basally branched stems arising from short, persistent woody caudex at ground level; root single, fleshy (size unknown). *Leaves* pinnate to bipinnate, large, up to 280 mm long, foliaceous, with broad segments, distinctly pilulose with widely but evenly spaced, short, thin spreading hairs, bright green to greyish green; cauline leaves few, much reduced in size, with linear segments. *Inflorescence* much branched, with small bracts along peduncle; lateral branches with terminal umbel and up to 3 lateral umbels; lateral umbels ± equal to terminal umbel, usually extending above terminal umbel; rays (4–) 6 or 7, slender, (5–)10–26 mm long; raylets 4–18, 1–2 mm long. *Flowers* small, 1.5–2 mm long; *petals* yellow. *Fruit* obovate in lateral view, small, ±4.5 × 3.5 mm, oblong in dorsal view, ±4.5 × 2 mm, mericarps isodiametric; median, lateral and marginal ribs indistinct.

The species is known from a single population of ±14 plants, growing in sandy clay soil in a small patch of renosterveld vegetation at Bontebokskloof near Swellendam. It appears to have been collected for the first time in November 2008. The species seems to be critically endangered but collectors are requested to keep a lookout for additional populations in the remaining renosterveld patches of the Swellendam and Bredasdorp region.

Glia pilulosa is distinguished by the pilulose vestiture of the leaf margins, veins and petioles (Fig. 2c1, c2) as well as the small flowers and small fruits borne in extensive panicles. The lateral branches of the inflorescence almost invariably have the terminal umbel plus three lateral umbels in a racemose arrangement and not single as is often the case in *G. prolifera* and mostly (always?) in *G. decidua* (and some species of *Anginon*). The mericarps are isodiametric, resulting in a schizocarp that appears to be laterally compressed (as seen in Figs. 6d and 7c).

3.3.5. Additional specimens examined

–3420 (Bredasdorp): Swellendam, near Bontebokskloof (–BA), 19 January 2009, *Van Wyk, Tilney and Magee 4359* (JRAU), 19 February 2009, *Van Wyk and Albrecht s.n.* (fruit samples only, added to type collection).

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