

## A revision of *Centella* series *Capenses* (Apiaceae)

Mahalia T. R. Schubert and Ben-Erik van Wyk

Schubert, M.T.R. & Van Wyk, B.-E. 1997. A revision of *Centella* series *Capenses* (Apiaceae). – Nord. J. Bot. 17: 301-314. Copenhagen. ISBN 0107-055X.

*Centella capensis* (L.) Domin and related species form a distinct but poorly known group within the genus. The most conspicuous diagnostic feature is the unique inflorescence structure. Each umbel comprises a central umbellule reduced to a single, sessile, functionally female flower and four lateral, functionally male, pedicellate umbellules each reduced to a single flower. The umbel is surrounded by four large, foliaceous bracts. Another unusual character is the habit. Most of the species are annuals or short-lived perennials, while all other species of the genus are perennial shrublets. A taxonomic revision of the four species and three varieties recognized, is presented.

M. T. R. Schubert & B.-E. van Wyk, Department of Botany, Rand Afrikaans University, P. O. Box 524, Auckland Park 2006, Johannesburg, Republic of South Africa.

### Introduction

Adamson (1951) already recognized the *Centella capensis* group as a unit but did not realize the importance of inflorescence structure in relation to the delimitation of the group and of the species within the group. Three of the four species are annuals or short-lived perennials and, since all other species of the genus are invariably perennial, the annual habit in the *C. capensis* group is an interesting specialization. The four species included in this group are likely to be monophyletic as they all exhibit an unique inflorescence structure. The inflorescence and habit may be an indication of a highly advanced development within the genus. The species and varieties are distinguished from each other by differences in habit, leaf morphology, inflorescence and bract morphology, and in the development of the stylopodium and fruit. Four species are recognized here: *C. capensis* (L.) Domin, *C. tridentata* (L.f.) Domin and two new species, *C. annua* M. Schub. & B.-E. van Wyk and *C. calcaria* M. Schub. & B.-E. van Wyk (see below). *C. tridentata* is an exceptionally variable species complex,

and we have divided it into four more or less allopatric varieties: var. *tridentata*, var. *litoralis* (Eckl. & Zeyh.) M. Schub. & B.-E. van Wyk, var. *hermanniifolia* (Eckl. & Zeyh.) M. Schub. & B.-E. van Wyk, and var. *dregeana* (Sond.) M. Schub. & B.-E. van Wyk.

### Morphology

#### Habit

The *Centella capensis* group is unique in the genus as it contains the only three annual or short-lived perennial species of *Centella*: *C. tridentata* and two new species, *C. annua* and *C. calcaria*. The internodes in *C. calcaria* are compressed and the inflorescences are borne directly on the main stem. In the other species a group of very short internodes is followed by an elongate one. This gives the leaves a clustered appearance, and although they are alternate rather than opposite, this is difficult to determine. The inflorescences are dispersed along the lateral branches or borne on short shoots in the axils of

Accepted 15-9-1996

© NORDIC JOURNAL OF BOTANY

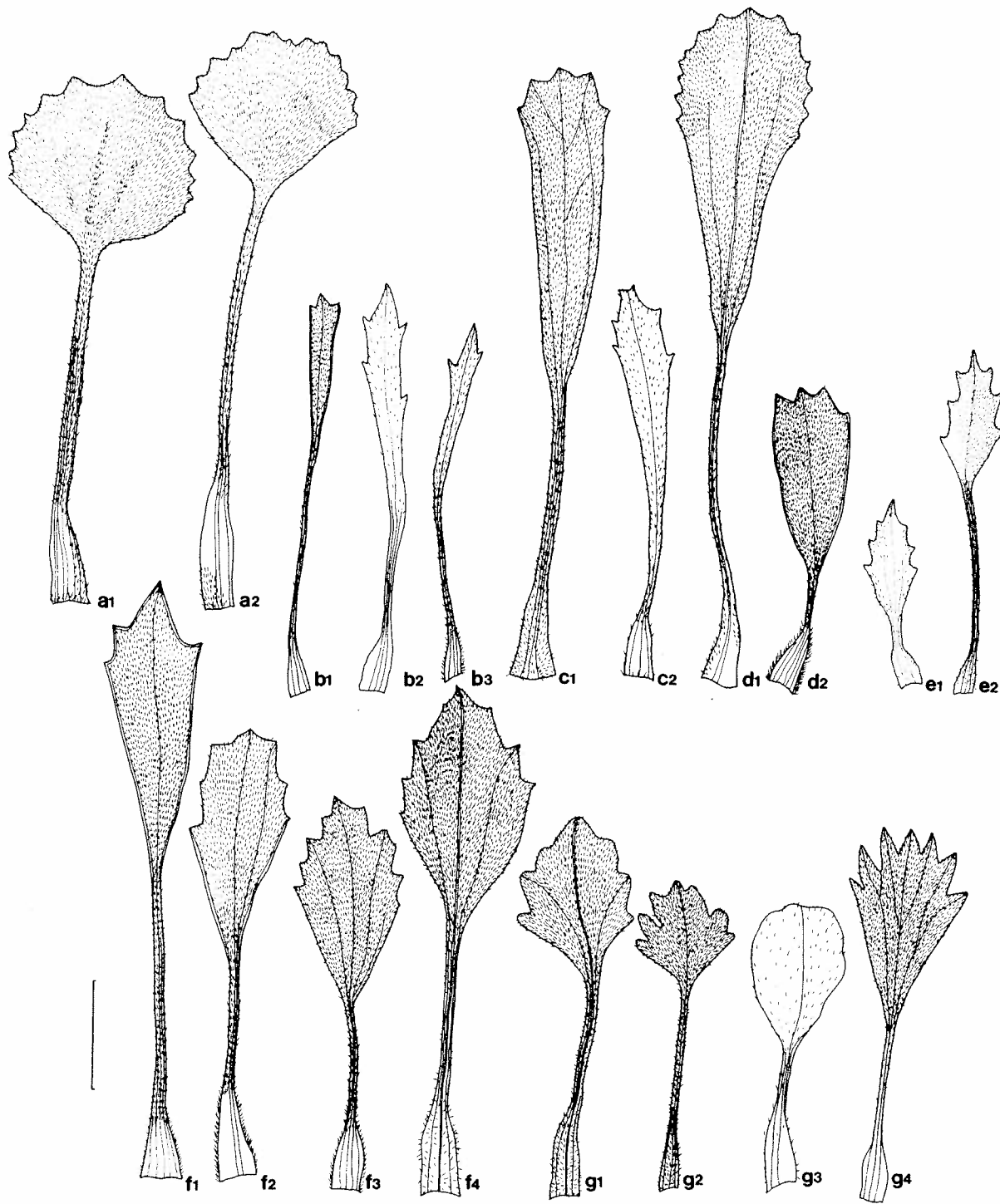
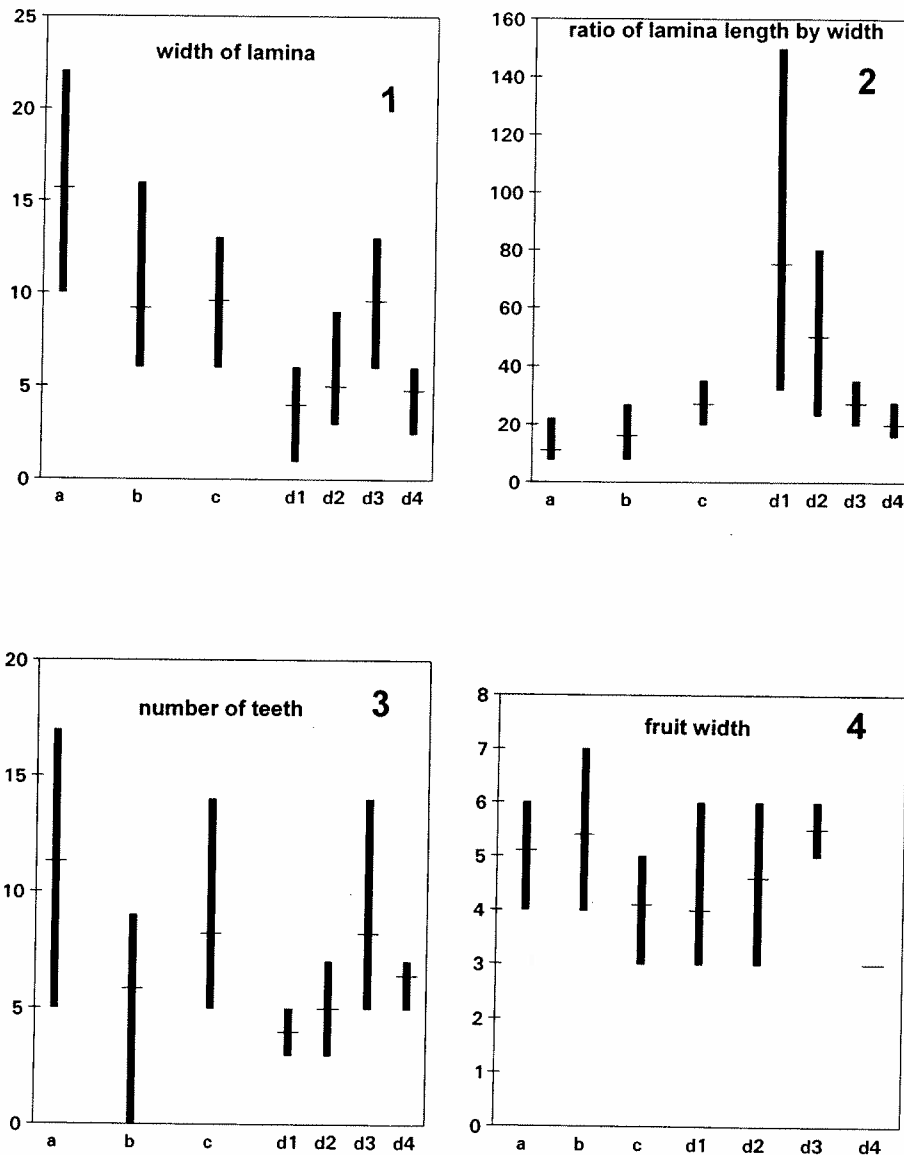


Fig. 1. Leaves, showing variation in the length of the petiole, lamina shape and size and indumentum of *Centella calcaria* (a1-2); *C. tridentata* var. *tridentata* (b1-3); *C. tridentata* var. *litoralis* (c1-2); *C. tridentata* var. *hermanniifolia* (d1-2); *C. tridentata* var. *dregeana* (e1-2); *C. annua* (f1-4) and *C. capensis* (g1-4). (a1-2 from Burgers 3072, b1 from Purcell 333, b2-3 from Van Wyk et al. 3482, c1 from Schubert 70, c2 from Vlok 2217, d1 from Hutchinson 1477, d2 from Cruden 327, e1-e2 from Drège s.n., f1-f2 from Taylor 4272, f3 from Esterhuysen 17850, f4 from Story 4383, g2 from Schubert & Van Wyk 47, g3 from anon. s.n. sub PRE, g4 from Barker 7530). – Scale 5 mm.

Fig. 2. Graphs of relevant statistical data (range and mean value) of leaves and fruit of all the species and varieties included in the *Centella capensis* group: 1, lamina width (scale in mm); 2, leaf shape, as established from the length/width ratio of the lamina; 3, number of teeth along the leaf lamina; 4, fruit width (scale in mm). (a = *C. calcaria*, n = 10; b = *C. capensis*, n = 50; c = *C. annua*, n = 30; d = *C. tridentata*; d1 = var. *tridentata*, n = 10; d2 = var. *litoralis*, n = 60; d3 = var. *hermannifolia*, n = 10; d4 = var. *dregeana*, n = 3).



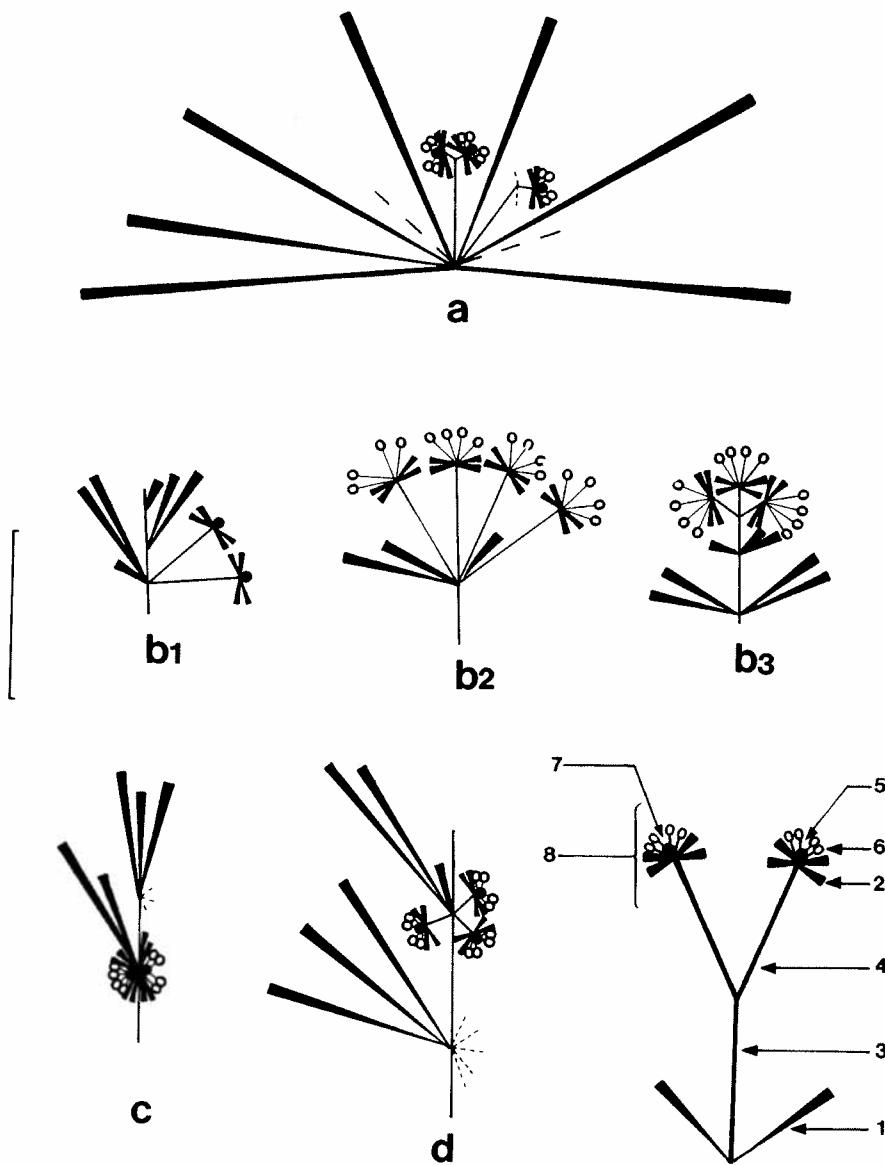
the vegetative leaves. The above-ground stems of *C. capensis* are invariably much-branched, while those of *C. tridentata* are sparsely and laxly branched. *C. capensis*, the only perennial in the group, forms subterranean, branched stems which are frequently confused with roots. This character is particularly valuable in distinguishing *C. capensis* from the superficially similar *C. annua*.

## Leaves

*Centella calcaria* can clearly be distinguished from all other species in the group by the broadly ovate leaves

which have a widely truncate base. Furthermore, the leaves are densely white tomentose and the petioles are relatively long (Fig. 1a). The leaves of *C. annua* (Fig. 1f) are very similar in shape to those of *C. capensis* (Fig. 1g) but both the lamina and the petiole are longer and in *C. capensis* the leaves are regularly lobed. The leaves of *C. tridentata* have cuneate leaf bases and bear teeth in the upper half (Fig. 1b-e). Figure 2 shows the variation in the width of the leaves, their shape (expressed by the ratio of length to width) and the number of teeth on the leaf margin. Note the large differences between taxa, particularly between the varieties of *C. tridentata*, where the leaf shape and dentation are diagnostically different.

Fig. 3. Schematic representation of the inflorescence structure and position on the plant of *Centella calcaria* (a); *C. capensis* (b1-3); *C. tridentata* (c) and *C. annua* (d). (Leaves congested, often appearing to be opposite but actually alternate). (1 = leaf, 2 = foliaceous bract, 3 = peduncle, 4 = ray, 5 = pedicel, 6 = male flower, 7 = bisexual flower, 8 = inflorescence unit). – Scale 40 mm.



### Inflorescence and bracts

All four species in the group are characterized by a unique inflorescence unit: a central sessile bisexual (functionally female) flower and four lateral male flowers; the entire inflorescence is enclosed by four foliaceous bracts (Fig. 3). What appears to be a single functionally female flower and four male flowers may represent umbellules that have been reduced to single flowers. *Centella difformis* (Eckl. & Zeyh.) Adamson is superficially similar as its inflorescence also has a central, functionally female umbellule and many lateral male umbellules composed of one male flower. Howev-

er the structure is unlikely to be homologous as each of the umbellules is associated with two bracts and the male umbellules are not invariably four in number and not all necessarily reduced to a single flower as in the *C. capensis* group. The basic inflorescence unit (Fig. 3) may be almost sessile, occurring in groups of one to five as in *C. tridentata* (Fig. 3c) or with distinct rays, as in *C. calcaria*, *C. capensis* and *C. annua* (Fig. 3a, b, d respectively). Furthermore, a peduncle may be present as in *C. calcaria* (Fig. 3a) and sometimes in *C. capensis* (Fig. 3b3), or the rays may be borne directly on the nodes as in *C. annua* (Fig. 3d) and mostly in *C. capensis* (Fig. 3b1 & b3). The five cream-coloured or white

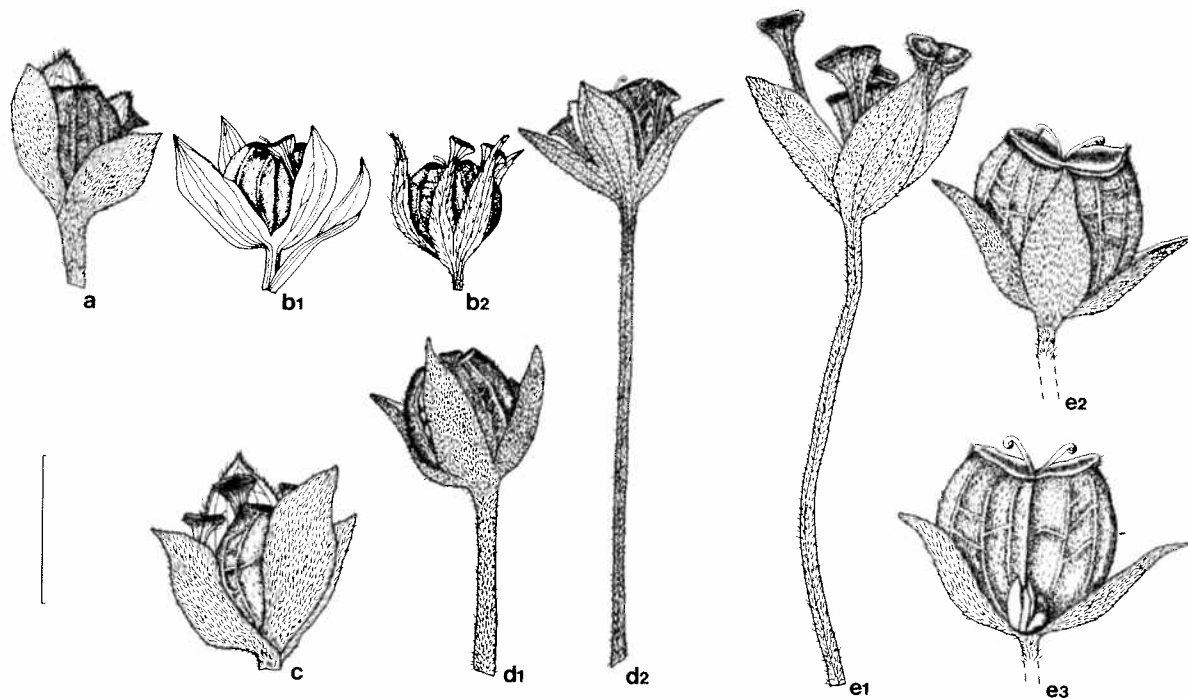


Fig. 4. Inflorescences of species included in the *Centella capensis* group. *C. calcaria*, bisexual inflorescence (a); *C. tridentata* var. *tridentata*, bisexual inflorescence showing differences in indumentum (b1-2); *C. tridentata* var. *hermannifolia*, bisexual inflorescence (c); *C. annua*, bisexual inflorescence (d1-2); *C. capensis* (e1-3): e1 male inflorescence; e2, female inflorescence; e3, female inflorescence, with bract removed to show sessile male flower in commissural position. (a from Burgers 3072, b1 from Ecklon & Zeyher s.n., b2 from Van Wyk et al. 3482, c from Hutchinson 1477, d1 from Taylor 4272, d2 from Esterhuysen 17850, e1 from Zeyher s.n., e2-3 from Schubert & Van Wyk 47). - Scale 10 mm.

petals of *C. capensis* and *C. annua* are glabrous while those of *C. calcaria* are abaxially densely tomentose and the petals of *C. tridentata* are abaxially sparsely to densely villous.

An interesting discovery was that *Centella capensis* differs from all the other species in the group by the male and functionally female inflorescences being borne on different plants (Fig. 4). Field observations have confirmed that the plants are either functionally female or functionally male (i.e. androdioecious, and not andromonoecious as all the other species of the group). The bisexual (functionally female) inflorescence (Fig. 4e2) is characterized by a large fruit in which the stylopodium has become prominent both in size and colour (red-brown). The lateral umbellules are each reduced to a single, sessile, abortive flower. One or rarely two of these occur in the axil of each involucre bract (Fig. 4e3). The rare occurrence of more than one flower in each bract axil supports the assumption that the lateral structures are reduced umbellules rather than individual flowers. The male inflorescence (Fig. 4e1) is characterized by an abortive ovary with four very well developed lateral, single-flowered male umbellules. Each of the

umbellules is longer than the enclosing bracts (Fig. 4e1) and the species can easily be identified by this character and also by the exceptionally large stylopodium of the male flowers (Figs 4e1, 5e, 6.4). The stylopodium becomes conspicuous already in the flowering stage and its prominence in the post-flowering stage is a very distinct feature of this species. All the other species in the group are functionally bisexual (andromonoecious) with bisexual and male flowers in each inflorescence (Fig. 4a-d). The taxonomic importance of the length of the pedicel of the male flowers in relation to the bract length can be seen in Figure 6. *C. capensis* is the only taxon in the group in which the length of the pedicel exceeds that of the bracts. Although relatively long in *C. tridentata* var. *hermannifolia* (Figs 5c, 6.1), it is invariably shorter than the bracts as in all other species. The pedicel of the male flowers of *C. calcaria* is densely sericeous, especially so towards the stylopodium, but in all of the other species this structure is glabrescent (Fig. 5).

The bracts of all the species are abaxially densely villous to pubescent and adaxially glabrous except in the vicinity of the margin, where a thin line of vesti-

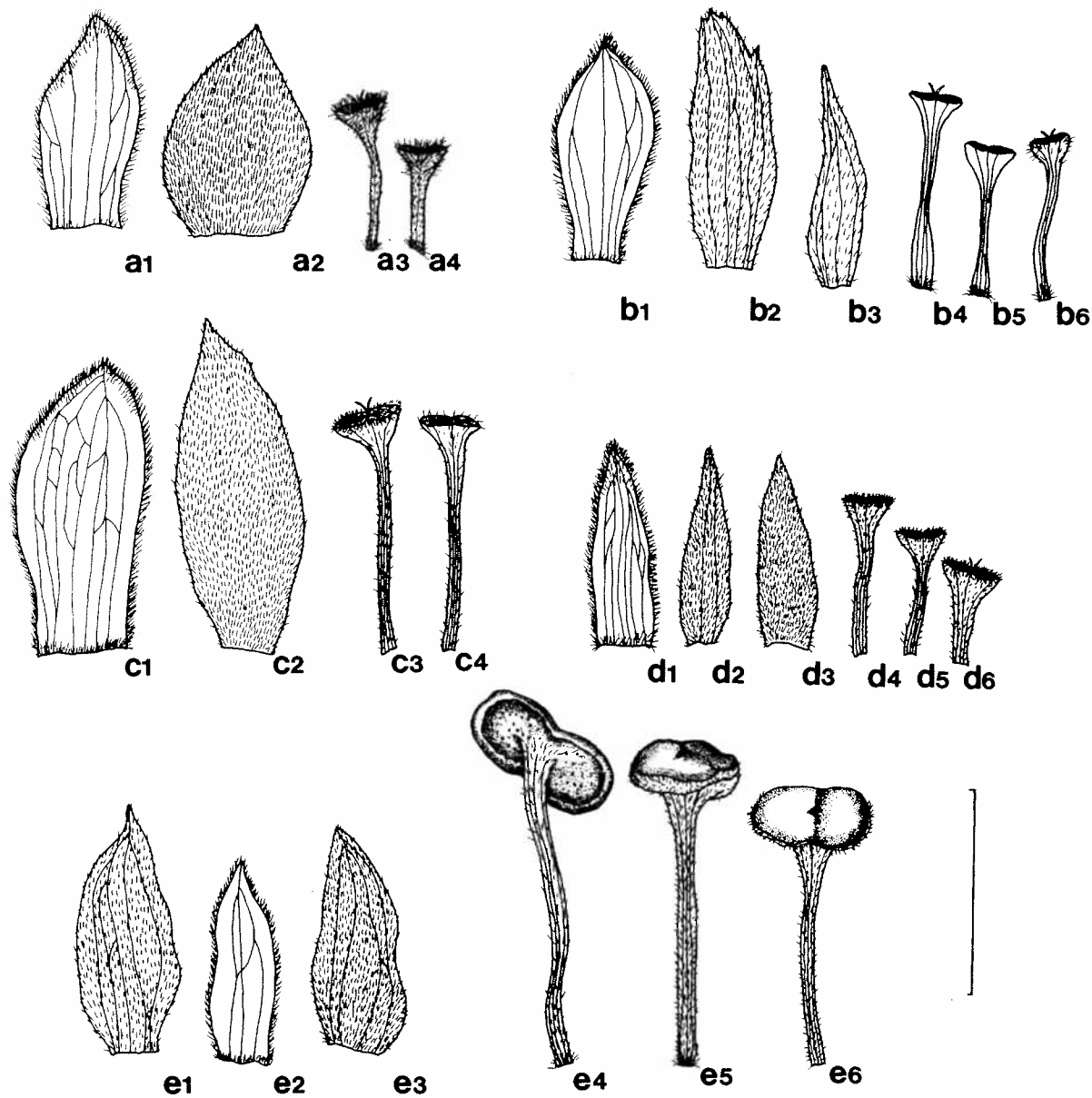
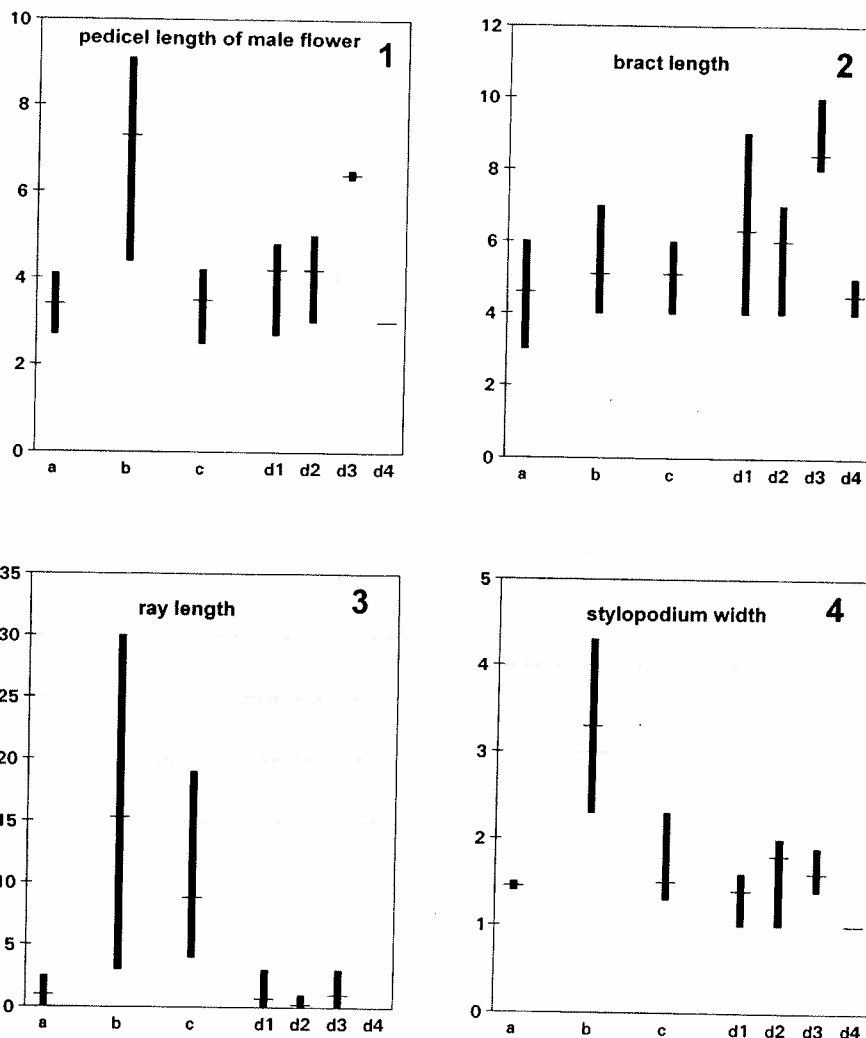


Fig. 6. Bracts and male flowers. *Centella calcaria* (a): a1 adaxial view; a2, adaxial view; a3-4, male flowers; *C. tridentata* var. *tridentata* (b): b1, adaxial view; b2, abaxial view; b3-6, male umbellules; *C. tridentata* var. *hermannifolia* (c): c1, adaxial view; c2, abaxial view; c3-4, male flowers; *C. annua* (d): d1, adaxial view; d2, adaxial view; d3-6, male flowers; *C. capensis* (e): e1-2, abaxial view; e3, adaxial view of bract; e4-6, male flowers. (a1-4 from Esterhuysen 19543, b1 from Purcell 333, b2-3 from Esterhuysen 32342, b4 from Purcell 333, b5-6 from Esterhuysen 32342, c1-4 from Hutchinson 1477, d1-6 from Taylor 4272, e1 from Bolus 4283, e2 from Penfold s.n., e3-4 from Bolus 4283, e5-6 from Mac Owan 129. - Scale 5mm.

ture occurs; this line becomes slightly wider near the bract apex (Fig. 5). The adaxial side of the bracts has distinct dark brown veins. The bracts of *Centella calcaria* (Fig. 5a1) are wider than those of the other species and although some overlap of the extreme meas-

urements occurs, *C. tridentata* var. *hermannifolia* can be distinguished from the other three varieties by its particularly long bracts (Figs 5c, 6.2).

Fig. 5. Graphs of relevant statistical data (range and mean value) of the inflorescences of all species and varieties included in the *Centella capensis* group. 1, length of the pedicel of the male flowers; 2, bract length; 3, ray length; 4, stylopodium width. (a = *C. calcararia*, n = 10; b = *C. capensis*, n = 46; c = *C. annua*, n = 30; d = *C. tridentata*, d1 = var. *tridentata*, n = 10; d2 = var. *litoralis*, n = 56; d3 = var. *hermannifolia*, n = 7; d4 = var. *dregeana*, n = 3). -- All scales in mm.



### Fruit structure

The surface of the fruit of all the species in the *Centella capensis* group is pubescent, slightly wrinkled and with somewhat prominent ridges. The fruit of other *Centella* species is mostly glabrous but pubescent fruits do occur in the *C. glabrata* group and elsewhere. Transverse sections through the fruits of all four species revealed that the ectocarp, mesocarp and lignified endocarp are equally well developed. The commissure is invariably narrow and there is no proliferation of tissue, as found in *C. glabrata*, for example. No anatomical difference between the species of the group could be found. The fruit of *C. capensis* is particularly large when compared to the fruits of the other species, as shown in Fig. 2.4.

### Geographical distribution

All of the species in this group are endemic to the fynbos and are concentrated in the Western Cape Province (Fig. 7). Note that most of the taxa are sympatric, but that the four varieties of *Centella tridentata* are more or less allopatric. *C. calcararia* occurs only on limestone between De Hoop and the Gouritz River mouth.

### Key to the species of the *Centella capensis* group

1. Inflorescence with one to three bisexual flowers surrounded by two to four small bracts; male flowers (if present) sessile, on separate umbellules, with two to four small bracts ..... other *Centella* species

1. Inflorescence with one central bisexual flower and four pedicellate male flowers, all of which are surrounded by four foliaceous bracts ..... 2 (*C. capensis* group)
2. Inflorescence units with distinct rays, the rays more than 3 mm long ..... 3
2. Inflorescence units without rays, the rays up to 3 mm long ..... 4
3. Annual or short-lived perennial with short, erect to prostrate stems; bracts longer than the umbellules; male flower with inconspicuous stylopodium, the latter 2-4 × 1-2 mm ..... *C. annua*
3. Perennial with long, slender, branching, subterranean stems; bracts shorter than the umbellules; male flower with exceptionally large stylopodium, the latter 4-9 × 2-4 mm ..... *C. capensis*
4. Leaves obovate, densely white tomentose; inflorescence units distinctly pedunculate; petals abaxially densely tomentose ..... *C. calcaria*
4. Leaves cuneate, sericeous or pubescent; inflorescence units without peduncles; petals abaxially sparsely to densely villous ..... *C. tridentata*

## Taxonomy

### *Centella capensis* (L.) Domin

in Bot. Jahrb. 41: 161 (1908); Adamson & Salter in Fl. Cape Penins.: 613 (1950); Adamson in J. S. Afr. Bot. 17: 13 (1951) pro parte; Eichler in Feddes Repert. 98: 15 (1987); Burtt in Edinb. J. Bot. 48: 192-193 (1991). – Type: sine loc., Solander s.n. (LINN 332a.1!), neotype, designated here). [Note: the only specimen of *C. capensis* in LINN was annotated by Linnaeus himself “*Solandra septemdentata*” and the epithet formed part of the protologue in Sp. Pl. ed. 2. The specimen probably post-dates Syst. Nat. ed. 10 in 1759, since there is no mention of “*capensis*” in its annotation and the word “*septemdentata*” does not appear until 1763, in the species description of *S. capensis* in Sp. Pl. ed. 2. (Nick Turland, pers. comm.). If hard evidence comes to light demonstrating that Linnaeus did indeed change his mind about the name before publishing Syst. Nat. ed. 10, then our neotypification would be correctable to lectotypification under Art. 9.8 of the Code].

≡ *Solandra capensis* L., Sp. Pl. ed. 2: 1407 (1763). – Type as above.

≡ *Hydrocotyle capensis* (L.) Kuntze, Rev. Gen. 1: 268 (1891). – Type as above.

≡ *H. solandra* L. f., Suppl.: 176 (1782) nom. illeg.; DC., Prodr. 4: 69 (1830); Lam., Encycl. 3: 155 (1789);

Eckl. & Zeyh., Enum.: 332 (1837); Sond. in Harv. & Sond., Fl. Cap. 2: 529 (1862). – Type as above.

≡ *Centella Solandra* (L.f.) Drude in Pflanzenfam. 3(8): 120 (1898) nom. illeg. – Type as above.

= *H. tomentosa* Thunb., Diss. Hydroc.: 416 (1798) nom. illeg., pro parte, excluding *H. hermanniaefolia*. – Type: South Africa, Western Cape, “Habitat ad Cap. bonae spei”, Thunberg s.n. sub THUNB - UPS 6718 (UPS!, lectotype).

≡ *C. capensis* (L.) Domin var. *capensis* L. – Type as for *Solandra capensis*.

= *H. solandra* L. f. var. *communis* DC., Prodr. 4: 69 (1830). – Type: sine loc., Sieber 140 (G, to be chosen as lectotype; S!); Lam. Ill. t. 188, f. 5, syntype.

= *H. solandra* L. f. var. *longifolia* DC., Prodr. 4: 69 (1830). – Type: South Africa, Western Cape, Burchell (G-DC.).

= *H. solandra* L. f. var. *longipes* DC., Prodr. 4: 69 (1830). – Type: sine loc. and coll., ex Mus. Bot. Berol. (G-DC.).

= *H. solandra* L. f. var. *glauca* Eckl. & Zeyh., Enum.: 332 (1837). – Type: South Africa, Western Cape, Tulbagh [3318AA], Ecklon & Zeyher 2163b (SAM!, lectotype; S!, isolectotype).

[Note: We have not seen all the type specimens of some varieties, but from the description it is clear that they only differ in minor morphological details which are not of taxonomic importance].

Loosely tufted, functionally dioecious perennial, up to 1 m wide; underground stems slender, branched. Leaves crowded; petiole (8-) 16-22 (-27) mm long, mostly pubescent along the entire length, base 2-4 mm wide, adaxially glabrous; lamina cuneate, ovate or spatulate (Fig. 1g), (8-) 12-16 (-24) mm long, (6-) 7-10 (-16) mm wide, the base cuneate, main veins abaxially slightly raised and adaxially slightly sunken; surface on both sides pubescent, grey-green to green-brown, concolourous, mostly obtusely lobed in upper half of leaf and entire in lower half, rarely entire, (0-) 5-7 (-9) lobes per leaf; apex acute, sometimes shorter than the lobes. Inflorescence with central bisexual flower (abortive ovary in functionally male plants) and with four lateral pedicellate male flowers (abortive and sessile in functionally female plants) (Fig. 4) borne along the shoots; ray (3-) 13-17 (-30) mm long, peduncle absent or rarely present, 16-30 mm long; bracts shorter than the male flowers, 4-7 mm long, 1-4 mm wide, lanceolate, abaxially pubescent, adaxially glabrous except along upper margin, with prominent dark veins. Flowers with glabrous petals; pedicel of male flower 4-8 mm long, pubescent along entire length. Fruit widely ovate in commissural view, 3-7 mm long, 4-7 mm wide; surface wrinkled, thinly pubescent, ribs prominent, no commissural proliferation; stylopodium 4-9 × 2-4 mm, red-brown.



*Distribution.* *Centella capensis* is widely distributed in the Western Cape (Fig. 7) and is particularly common in the south-western coastal areas.

*Material examined.* 3219 (Wupperthal): mountains near Olifant's River and Brakfontein (-AD), Ecklon & Zeyher 2163a (S, SAM). 3317 (Saldanha): Saldanha Bay (-BB), Gamble 22071 (K). 3318 (Cape Town): Kasteelberg (-BD), Zeyher 4732 (GRA, SAM); Groenkloof (-CB), Bolus 4283 (BOL, K); Melkbosch Strand road (-CB), Bond 511 (NBG), Compton 13435 (PRE), Humbert 9466 (PRE); Kloof Nek (-CD), Acocks 886 (S), Froembling s.n. (SAM); Lions Head (-CD), Adamson 3755 (K), Bolus 9320 (BOL), Ecklon 408 (K), Garside 1753 (K), Schubert & Van Wyk 47 (JRAU), Thode 6237 (STE), Wolley Dod 1181 (BOL, K); Clifton (-CD), Barker 1539 (NBG); Camps Bay Drive (-CD), Barker 2433 (NBG), 5363 (NBG, STE), MacOwan 129 (K, PRE, SAM, STE); Flats on Koeberg road (-CD/DA), Bodkin s.n. (BOL); Sea Point (-CD), Bolus 3967 (BOL, K), Smith 2909 (PRE); Signal Hill (-CD), Kinges 3510 (PRE), Phillips 23 (SAM); Cape Town (-CD), Marloth 144 (PRE), Worsdell s.n. (K); Table Mountain (-CD), Pappe s.n. (K), Shantz 68 (K), Thode A104 (PRE), 6236 (STE), Young 26517 (PRE); Orangezicht (-CD), Penfold s.n. (NBG); Green Point (-CD), Prior s.n. (PRE, S); Lemoenkloof, Perdeberg (-DB), Hugo 919 (STE); Kanonberg (-DC), Acocks 2496 (S); Botteryberg (-DD), Acocks 2466 (S); Paarl, near Joostenberg (-DD), Esterhuysen 16023 (PRE). 3319 (Worcester): Tulbagh, mountains (-AA), Ecklon & Zeyher s.n. (S, SAM), Schlechter 10 (S); Wellington, on mountains (-CA), collector unknown (PRE, STE); between Worcester and Villiersdorp (-CD), Barker 7530 (NBG); Onklaarberg, top of Baviaans Kloof (-DC), Stokoe s.n. (BOL). 3320 (Montagu): Montagu (-CC), Barnard 442 (NBG, SAM). 3322 (Oudtshoorn): road from Deepwalls to Knysna (-DD), Gillett 1281 (BOL, STE). 3418 (Simonstown): Karbonkelberg (-AB), Compton 6407 (NBG); Llandudno (-AB), Compton 8947 (NBG); Bakoven (-AB), Sandwich s.n. (K); Hout Bay (-AB), Schlechter 1224 (GRA, K, S). Without precise locality: Alexander s.n. (PRE), Burchell 8450 (K), Drège s.n. (K), Ecklon & Zeyher 2165 (PRE), Prior s.n. (K), Sieber 140 (S), Thunberg s.n. (S), Zeyher s.n. (SAM).

### ***Centella annua* M. Schub. & B.-E. van Wyk sp. nov.**

*Centella capensis* similis sed habitu annuo, praesentia inflorescentiarum functionaliter bisexualium, umbellulis masculis bracteis brevioribus, et stylopodiis florum masculorum inconspicuis differt.

Typus: South Africa, Western Cape, at the foot of mountains, Tulbagh Kloof [3319AA], Bolus 13560 (PRE, sheet 1, holotype; PRE, sheet 2, isotype).

= *Centella capensis* (L.) Domin var. *micrantha* Adamson in J. S. Afr. Bot. 17: 13 (1951). – Type: South Africa, Western Cape, Clanwilliam district, Pakhuis Pass [3219AA], Adamson 4260 (BOL!, holotype).

= *C. capensis* var. *capensis* sensu Adamson in J. S. Afr. Bot. 17:13 (1951) pro parte minore.

Tufted andromonoecious annual or short-lived perennial, up to 0.2 m wide. Leaves crowded, petiolate; petiole (-8) 20-30 (-52) mm long, pubescent along entire length, base (3-) 4-5 (-6) mm wide, adaxially glabrous; lamina cuneate, ovate or spatulate (Fig. 1f), (16-) 20-26 (-40) mm long, (11-) 19-22 (-33) mm wide, the base cuneate, main veins abaxially raised and adaxially sunken, surface on both sides pubescent, grey-green to green-brown, concolourous, the margin adaxially raised, obtusely lobed in upper half of leaf and entire in lower half, (5-) 7-9 (-14) lobes per leaf; apex acute. Inflorescence with central bisexual flower and four lateral male flowers (Figs 4 & 5) borne along the shoots; ray (4-) 8-19 (-19) mm long, peduncle absent; bracts longer than the male flowers, lanceolate, 4-6 mm long, 2-3 mm wide, abaxially pubescent, adaxially glabrous except along upper margin, with prominent dark veins. Flowers with glabrous petals; pedicel of male flower 2-5 mm long, pubescent along entire length. Fruit widely ovate in commissural view, 3-4 mm long, 3-5 mm wide; surface wrinkled, thinly pubescent, ribs relatively prominent, no commissural proliferation; stylopodium prominent, 2-4 × 1-2 mm.

*Note.* *Centella annua* is similar to *C. capensis* but differs in the annual habit, the presence of bisexual inflorescences, the male flowers which are shorter than the bracts and the inconspicuous stylopodia of the male flowers. The new species is widely distributed in the interior of the south-western and north-western parts of the Western Cape (Fig. 7).

*Material examined.* 3119 (Calvinia): Lokenburg (-CA), Story 4383 (PRE). 3218 (Clanwilliam): Pakhuis Pass (-AA), Adamson 4260 (BOL), Emdon 120 (STE); Olifantsrivier valley, Keerom (-CC), Esterhuysen 17850 (BOL, PRE). 3319 (Worcester): Tulbagh Kloof (-AA), Bolus 13560 (PRE), Esterhuysen 6069 (BOL), Zeyher s.n. (SAM); Mitchell's Pass, flats (-AC), Guthrie 3378 (NBG). 3420 (Swellendam): Bontebok Park (-AB), Taylor 4272 (K, PRE, STE).

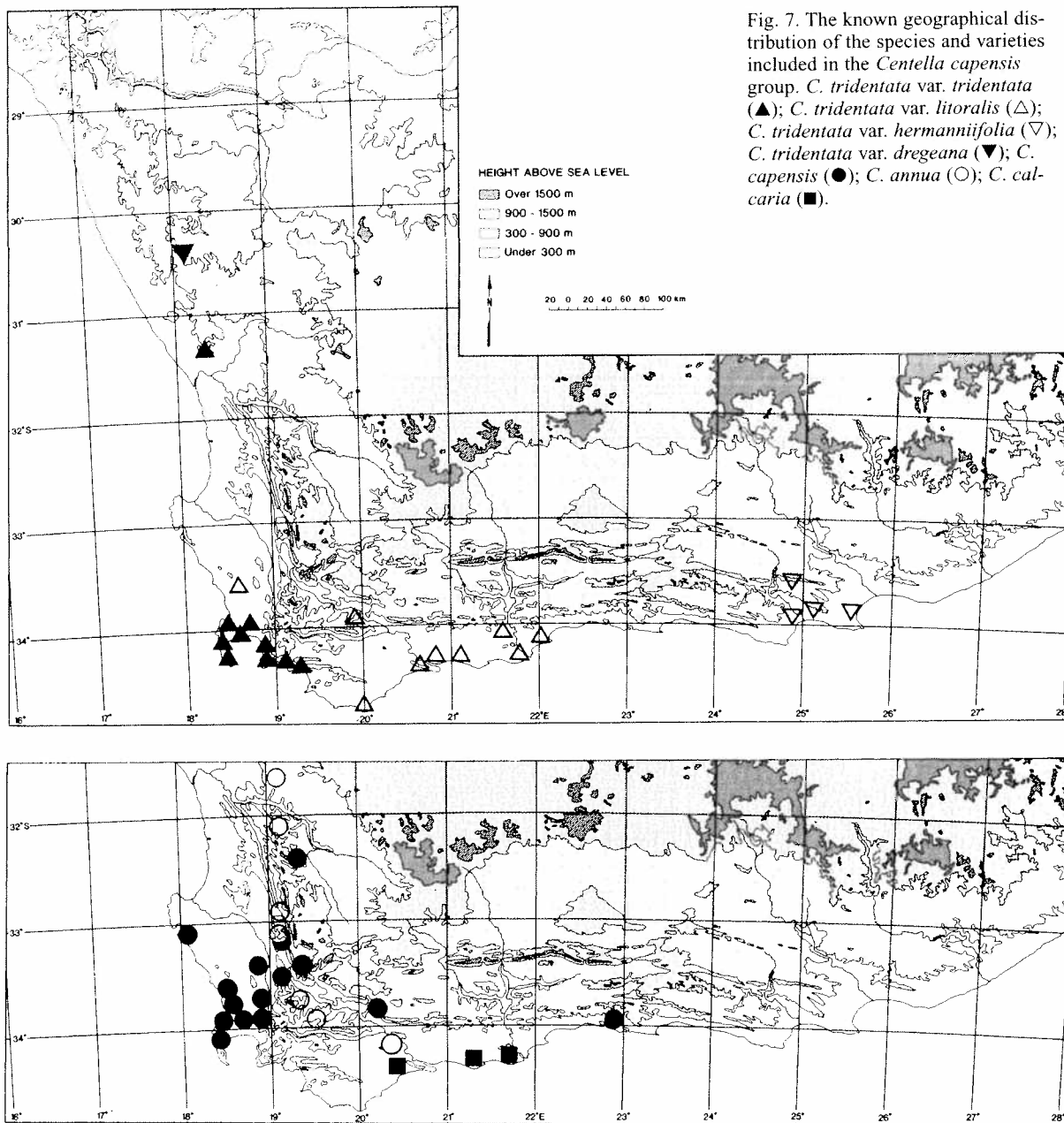


Fig. 7. The known geographical distribution of the species and varieties included in the *Centella capensis* group. *C. tridentata* var. *tridentata* (▲); *C. tridentata* var. *litoralis* (△); *C. tridentata* var. *hermannifolia* (▽); *C. tridentata* var. *dregeana* (▼); *C. capensis* (●); *C. annua* (○); *C. calcaria* (■).

***Centella calcaria* M. Schub. & B.-E. van Wyk  
sp. nov.**

Species distinctissima, a *C. capensi* et speciebus omnibus similibus foliis latis orbicularibus vestituraque dense tomentosa differt. Etiam a speciebus annuis et brevi-viventibus omnibus aliis inflorescentiis pedunculatis differt.

Typus. South Africa, Western Cape, Riversdale District,

limestone hills along road to Still Bay, Esterhuysen 19543 (BOL, holotype).

Tufted andromonoecious annual or short-lived perennial. Leaves crowded, distinctly petiolate; petiole, (-16) 25-35 (-65) mm long, pubescent along entire length, base (3-) 4-5 (-6) mm wide, adaxially glabrous; lamina very widely ovate (Fig. 1a), (12-) 14-18 (-22) mm long, (4-) 4-10 (-24) mm wide, the base truncate to widely cuneate, main veins abaxially raised; surface

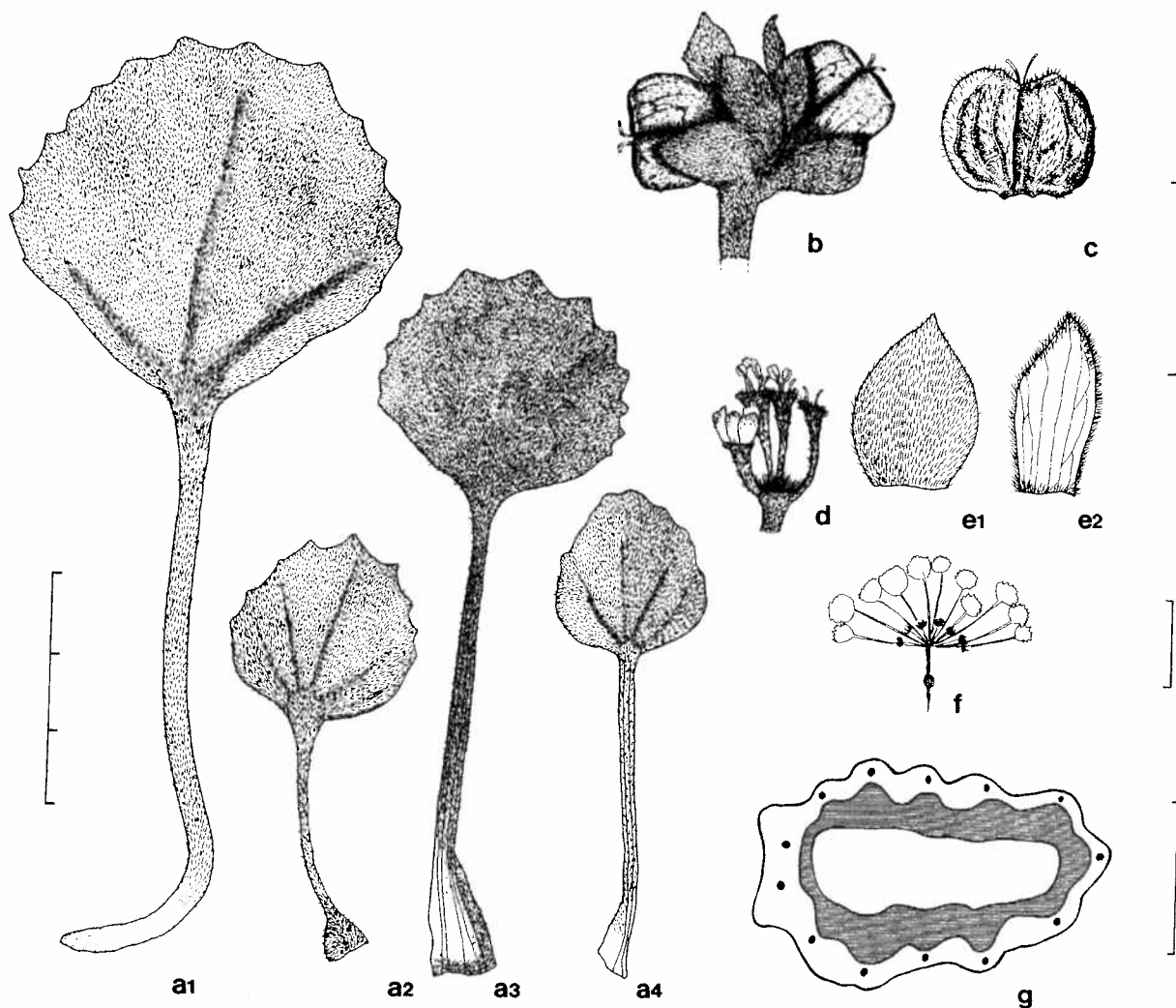


Fig. 8. *Centella calcaria*. a1-4, vegetative leaves showing variation in size and shape; b, ray with pedunculate inflorescences; c, mature fruit with bracts removed; d, inflorescence unit with fruit and bract removed to show the male flowers; e1, abaxial view of bract; e2, adaxial view of bract; f, habit; g, transverse section of fruit. (a3 from Burgers 3072, a1-2, a4, b-g from Esterhuysen 36784). – Scales: a = 15 mm; b-e = 5 mm; f = 30 mm; g = 1mm.

on both sides sericeous, grey-green, concolourous, the margin dentate in upper half of leaf and entire in lower half, (5-) 8-15 (-17) teeth per leaf; apex rounded. Inflorescence with central bisexual flower and four lateral male flowers (Figs 4, 5 & 8), borne at base of plant; ray (5-) 10-18 (-37) mm long; peduncle 0-2.5 mm long; bracts longer than the male flowers, (3-) 4-5 (-6) mm long, (2-) 4-5 (-6) mm wide, lanceolate, abaxially sericeous, adaxially glabrous except along upper margin, with prominent dark veins. Flowers with abaxially densely villous petals; pedicel of male flower (0.27-) 0.32-0.36 (-0.41) mm long, densely pubescent along entire length, with particularly dense hair towards the

stylopodium. Fruit widely depressed ovate in commissural view, 4-5 mm long, 4-6 mm wide; surface wrinkled, thinly tomentose, ribs relatively prominent, no commissural proliferation; stylopodium prominent, 2.7-4.1 × 1.4-1.5 mm.

*Note.* *Centella calcaria* is a distinct species and differs from *C. capensis* and related species in the broad leaves and the densely tomentose vestiture. It also differs from all the other annuals and short-lived perennials in the pedunculate inflorescences. It is endemic to limestone ares of the Western Cape, from Bredasdorp to the Gouritz River mouth (Fig. 7). The species ap-

pears to be rare, and is only known from five collections.

*Material examined.* 3420 (Bredasdorp): De Hoop, limestone hills (-AD), Acocks 23172 (K), Burgers 2414 (PRE, STE), Burgers 3072 (STE). 3421 (Riversdale): Still Bay, limestone hills (-AD), Esterhuysen 19543 (BOL); Hornstrass, between Albertina and Gouritz River Mouth (-BD), Esterhuysen 36784 (BOL).

### **Centella tridentata (L. f.) [Drude ex] Domin**

in Bot. Jahrb. 41: 163 (1908); Adamson & Salter, Fl. Cape Penins.: 613 (1950); Adamson in J. S. Afr. Bot. 17: 15 (1951); Eichler in Feddes Repert. 98: 21 (1987); Burt in Edinb. J. Bot. 48: 199 (1991). – Type: South Africa, “Habitat ad Cap. bonae spei”, Sparrmann s.n. (LINN 332a.2!, lectotype, designated here).

[Note: there is only one specimen of *C. tridentata* in LINN and this specimen was determined by the elder Linnaeus as “*Solandra tridentata*”].

≡ *Hydrocotyle tridentata* L. f., Suppl.: 176 (1782); Thunb., Diss. Hydroc.: 415 - 416 (1798); Lam., Encycl. 3: 156 (1789); Sond. in Harv. & Sond., Fl. Cap. 2: 531 (1862). – Type as above.

≡ *H. dregeana* Sond. in Harv. & Sond., Fl. Cap. 2: 530 (1862). – Type: South Africa, Northern Cape, “near Ezelfontein and on the Roodeberg” [3018AA], Drège 7612 (S!).

= *Centella dregeana* (Sond.) Domin in Bot. Jahrb. 41: 162 (1908); Adamson in J. S. Afr. Bot. 17: 13 (1951); Eichler in Feddes Repert. 98: 16 (1987); Burt in Edinb. J. Bot. 48: 199 (1991). – Type as above.

≡ *H. hermanniaefolia* Eckl. & Zeyh., Enum.: 333 (1837); Sond. in Harv. & Sond., Fl. Cap. 2: 530 (1862). – Type: South Africa, Eastern Cape, between Krakamma and Vanstadensrivier mountains [3324DB], Ecklon & Zeyher 2164 (S!, SAM!).

= *C. hermanniaefolia* (Eckl. & Zeyh.) Domin in Bot. Jahrb. 41: 161 (1908) [as *C. “hermanniifolia”*]; Adamson in J. S. Afr. Bot. 17: 13 (1951); Eichler in Feddes Repert. 98: 19 (1987); Burt in Edinb. J. Bot. 48: 196 (1991) *synon. nov.* – Type as above.

≡ *H. hermanniaefolia* Eckl. & Zeyh. in S.A. Quart. J.: 375 (1830) *nom. nud.* [Note: for the purpose of priority, the name *C. hermanniaefolia* dates back to Enum.: 333 (1837)].

= *H. litoralis* Eckl. & Zeyh., Enum.: 334 (1837). – Type: South Africa, Western Cape, Cape Agulhas [3420CC], Mund (K!), Mund s.n. sub Ecklon & Zeyher 2168 (S!, SAM!).

Complete synonymies and lectotypifications are given under each of the varieties.

Laxly branching decumbent annual or short-lived perennial. Leaves mostly crowded; petiole 3-37 mm long, densely hairy to glabrescent along entire length, base 3-6 mm wide, adaxially glabrous; lamina cuneate (Fig. 1), 4-31 mm long, 1-13 mm wide, the base cuneate, main veins abaxially slightly raised and adaxially slightly sunken, margin sometimes adaxially upturned, surface on both sides pubescent to glabrescent, grey-green to brown-green, concolourous, toothed in upper half of leaf and entire in lower half, with 1-14 acuminate teeth per leaf; apex acute, obtuse or rounded. Inflorescence with central bisexual flower and with four lateral male flowers (Figs 4 & 5) borne along the shoots; ray absent; peduncle mostly absent, 0-3 mm long; bracts longer than male flowers, 4-10 mm long, 1-4 mm wide, lanceolate, sometimes toothed at apex, abaxially pubescent to glabrescent, adaxially glabrous except along upper margin, with prominent dark veins. Flowers with abaxially villous petals; pedicel of male flower 1-5 mm long; pubescent to glabrescent along entire length. Fruit widely ovate in commissural view, 3-6 mm long, 3-7 mm wide; surface wrinkled, thinly pubescent to glabrescent, ribs relatively prominent, no commissural proliferation; stylopodium prominent, 2-6.5 × 1.2-1.9 mm.

### **Key to the varieties of *Centella tridentata***

1. Leaves narrowly cuneate, with three apical teeth .....  
..... var. *tridentata*
1. Leaves broadly cuneate to obovate, with more than three teeth ..... 2
2. Leaves cuneate, usually densely white sericeous; with 3-5 teeth restricted to the upper half of the lamina; bracts 4-9 mm long; widespread in the southern and western coastal areas of the Western Cape .....  
..... var. *litoralis*
2. Leaves usually broadly obovate, densely ferruginous; with 5-14 teeth restricted to the upper half of the lamina; bracts 8-10 mm long; restricted to the western part of the Eastern Cape .....  
..... var. *hermanniifolia*
2. Leaves elliptic, pubescent; with 5-7 teeth distributed along the entire length of the lamina; bracts 4-5 mm long; restricted to one locality in the Northern Cape (Kamiesberg) ..... var. *dregeana*

### **var. *tridentata***

= *C. hermanniaefolia* var. *schlechteriana* Domin in Bot. Jahrb. 41: 161 (1908). – Type: South Africa, Western Cape, Caledon, Hawston, in dunes [3419AC], Schlechter 9463 (K!, holotype; BOL!, GRA!, isotypes).

Leaf lamina narrowly cuneate, the apex acute, with mostly three acuminate teeth; villous to glabrescent; bracts narrow, 4-7 mm long, 1-4 mm wide. The known distribution of var. *tridentata* is partially sympatric with var. *litoralis*, with a relatively wide distribution in the Western Cape (Fig. 7).

*Material examined.* 3118 (Vanrhynsdorp): Namaqualand, Hendriksvlei (-AC), Taylor 5508 (STE). 3318 (Cape Town): Kenilworth Race Course (-CD), Esterhuysen 32342 (BOL); Rondebosch, flats (-CD), Wolley Dod 907 (BOL); Kuilsrivier (-CD), Lamb 1073 (SAM), Zeyher s.n. (SAM); Vygeskraal (-DC), Wolley Dod 1477 (K). 3319 (Worcester): McGregor (-DD), Van Wyk et al. 3482 (JRAU). [This specimen is atypical as it is particularly narrow-leaved, the teeth are laterally positioned and the apex is acute instead of tridentate]. 3418 (Simonstown): Simonstown (-AB), Adamson 1339 (PRE), Bolus 4682 (BOL, K), Purcell 333 (SAM), Salter 1832 (K), 2900 (BOL, K), Taylor 2569 (STE), 6056 (K, STE), Zeyher s.n. (SAM); Retreat station (-AB), Dummer 12168 (STE), Schlechter 1250 (GRA, K); Kalk Bay (-AB), Esterhuysen 20113 (BOL, PRE); Tygerberg (-AB), collector unknown (SAM); Hoek van Bobbejaan (-AD), Esterhuysen 34073 (BOL); Cape Point Nature Reserve (-AD), Levyns 1913 (SAM), Pilsans 4582 (BOL); Ronde Vlei (-BA), Compton 9842 (NBG); Steenbras River mouth (-BB), Bond 685 (NBG); Palmiet River, sand flats (-BD), Boucher 1042, 3195 (STE), Esterhuysen 13691 (BOL); Pringle Bay (-BD), Compton 6123 (NBG); Rooi Els (-BD), Parker 4461 (BOL, K). 3419 (Caledon): Hermanus (-AC), Purcell s.n. (SAM); Hawston, in dunes (-AC), Schlechter 9463 (BOL, GRA, K); Kleinmond Nature Reserve (-AD), Schubert & Van Wyk 19 (JRAU), Williams s.n. (NBG). Without precise locality: Levyns s.n. (BOL), name not legible 620, ex Herb. Harvey (K).

**var. *litoralis* (Eckl. & Zeyh.) M. Schub. & B.-E. van Wyk, comb. nov.**

= *H. litoralis* Eckl. & Zeyh., Enum.: 334 (1837). - Type: South Africa, Western Cape, Cape Agulhas [3420CC], Mund (K!), Mund s.n. sub Ecklon & Zeyher 2168 (SAM!), lectotype, designated here, S!, isolectotype).

= *H. hermanniaefolia* Eckl. & Zeyh. var. *litoralis* (Eckl. & Zeyh.) Sond. in Fl. Cap. 2: 530 [as var. "*litoralis*"].

= *C. hermanniaefolia* (Eckl. & Zeyh.) Domin var. *litoralis* (Eckl. & Zeyh.) Domin in Bot. Jahrb. 41: 161. (1908); Eichler in Feddes Repert. 98: 11-23 (1987); Burt in Edinb. J. Bot. 48: 199 (1991) [as *C. "hermanniaefolia"* var. *litoralis*]; Adamson in J. S. Afr. Bot. 17: 15 (1951) [as *C. hermanniaefolia* var. "*litoralis*"]. - Type as above.

Leaf lamina narrowly to broadly cuneate, the apex acute, with three to five acute teeth; densely white villous. Bracts relatively narrow, 4-9 mm long, 1-4 mm wide. The variety is widely distributed in the southwestern regions of the Western Cape (Fig. 7), most commonly found on sand dunes near the sea.

*Material examined.* 3318 (Cape Town): Malmesbury (-DA), Boucher 4447 (PRE, STE), Boucher & Shepherd 4618 (STE). 3420 (Riversdale): De Hoop (-AD), Burgers 1011 (PRE), Van Wyk 2078 (STE); Potberg Nature Reserve (-BC), Schubert 86 (JRAU); Witwater (-BD), Van Wyk 1864 (STE); Cape Agulhas (-CC), Mund s.n. (K), Mund s.n. sub Ecklon & Zeyher 2168 (S, SAM). 3421 (Swellendam): Puntjie (-AC), Boucher 3195 (STE), Esterhuysen 28763 (BOL); Albertina (-BA), Esterhuysen 19520 (BOL); Gouritz River mouth (-BD), Schubert 68, 70 (JRAU). 3422 (Oudtshoorn): Great Brak River (-AA), Vlok 2217 (PRE).

**var. *hermanniaefolia* (Eckl. & Zeyh.) M. Schub. & B.-E. van Wyk, comb. nov.**

= *H. hermanniaefolia* Eckl. & Zeyh., Enum.: 333 (1837). - Type: South Africa, Eastern Cape, between Krakamma and Vanstadensrivier mountains [3324DB], Ecklon & Zeyher 2164 (SAM!), branch on lower left corner of herbarium sheet, above Zeyher label, lectotype, designated here; K!, S!, isolectotype).

= *H. hermanniaefolia* Eckl. & Zeyh. in S. A. Quart. J.: 375 (1830), nom. nud. [Note: for the purpose of priority, the name *C. hermanniaefolia* dates back to Enum.: 333 (1837)].

= *C. hermanniaefolia* (Eckl. & Zeyh.) Domin in Bot. Jahrb. 41: 161 (1908) [as *C. "hermanniaefolia"*]; Adamson in J. S. Afr. Bot. 17: 13 (1951); Eichler in Feddes Repert. 98: 19 (1987); Burt in Edinb. J. Bot. 48: 196 (1991). - Type as above.

= *Hydrocotyle hermanniaefolia* Eckl. & Zeyh. var. *brevifolia* Eckl. & Zeyh., Enum.: 333 (1837). - Type: South Africa, Eastern Cape, Uitenhage, Zwartkopsrivier [3324DB], Ecklon & Zeyher 2164b (SAM!), branch on upper right corner of herbarium sheet, lectotype, designated here, S!, isolectotype).

= *C. hermanniaefolia* (Eckl. & Zeyh.) Domin forma *brevifolia* (Eckl. & Zeyh.) Domin in Bot. Jahrb. 41: 161 (1908). - Type as above.

= *C. hermanniaefolia* (Eckl. & Zeyh.) Domin var. & forma *hermanniaefolia* Eichler in Feddes Repert. 98: 19. - Type as for *H. hermanniaefolia*.

Leaf lamina broadly cuneate to obovate, usually with a rounded apex, with five to 14 acute to acuminate teeth; densely ferruginous. Bracts very wide, 8-10 mm long, 3-4 mm wide. Pedicels of male flowers particularly

long, 4-5 mm. This variety is geographically isolated from the other three varieties and is restricted to the Eastern Cape, from Port Elizabeth to Humansdorp (Fig. 7).

*Material examined.* 3324 (Steytlerville): Van Stadens River mountains (-DB), Ecklon & Zeyher 2164 (K, S, SAM); Uitenhage, Zwartkops River mouth (-DD), Ecklon & Zeyher 249 (K, SAM), 2164b (S, SAM), Zeyher 2665 (SAM). 3325 (Port Elizabeth): Top of Gamtoos River Pass (-CC), Borkelmann 55 (NBG), Cruden 327 (GRA), Drège 249 (GRA), 7613 (K), Hutchinson 1477 (BOL, K), Kemsley 192 (GRA), Patterson 2374 (BOL); Walmer (-DC), Paterson 2394 (GRA) [not typical]. 3424 (Port Elizabeth): Humansdorp, Kromme Bay (-BB), Acocks 21452 (PRE) [not typical]. Without precise locality: Burchell 3975 (K).

**var. dregeana (Sond.) M. Schub. & B.-E. van Wyk, comb. et stat. nov.**

= *Hydrocotyle dregeana* Sond. in Harv. & Sond., Fl. Cap. 2: 530 (1862). – Type: South Africa, Northern Cape, “near Ezelfontein and on the Roodeberg” [3018AA], Drège 7612 (S!, lectotype).

= *C. dregeana* (Sond.) Domin in Bot. Jahrb. 41: 162 (1908); Adamson in J. S. Afr. Bot. 17: 13 (1951); Eichler in Feddes Repert. 98: 16 (1987); Burt in Edinb. J. Bot. 48: 194 (1991). – Type as above.

Leaf lamina elliptic with an acute apex, with five to seven acute to acuminate teeth positioned along the entire lateral margin of the lamina; pubescent. Bracts narrow, 4-5 mm long, 1-2 mm wide. This poorly known taxon is geographically isolated from the other three varieties and appears to be restricted to Namaqualand. It is known only from a single herbarium specimen.

*Material examined.* 3018 (Kamieskroon): near Ezelfontein and on the “Roodeberg” (-AA), Drège 7612 (S).

*Acknowledgements* – We thank the directors and staff of the listed herbaria for allowing us to study their material and Nick Turland (BM) for his advice on the typification of *C. capensis*. Dr H. F. Glen kindly translated the diagnoses. Financial support from the Rand Afrikaans University and the Foundation for Research development is acknowledged.

## References

- Adamson, R. S. 1951. A revision of the subgenus *Solandra* of *Centella*. – J. S. Afr. Bot. 17: 1-48.
- & Salter, T. M. 1950. Flora of the Cape Peninsula. 613. – Cape Town, Juta.
- Burt, B. L. 1991. Umbelliferae of Southern Africa: an introduction and annotated check-list. – Edinb. J. Bot. 48 (2): 190-200.
- De Candolle, A. P. 1830. Prodomus systematis naturalis regni vegetabilis 4: 69. – Paris.
- Domin, K. 1908. Monographische uebersicht der Gattung *Centella* L. – Bot. Jahrb. Syst. 41(3): 573-669.
- Drude, O. 1898. Umbelliferae. – In: Engler, A. & Prantl, K. (eds), Die naturerlichen Pflanzenfamilien 3(8): 120. Leipzig, Engelmann.
- Ecklon, C. F. 1830. A list of plants found in the district Uitenhage, between the months of July, 1829, and February, 1830, together with a description of some new species. – S. Afr. Quart. J.: 375.
- & Zeyher, C. L. P. 1837. Enumeratio plantarum africae australis extratropicae 3: 330-338. – Hamburg, Perthes & Besser.
- Eichler, H. 1987. Nomenclatural and bibliographical survey of *Hydrocotyle* (L.) Apiaceae. Part I. – Feddes Repert. 98: 11-23.
- Kuntze, O. 1891. Revisio generum plantarum 1: 267-268. – Leipzig, Arthur Felix.
- Lamarck, J. B. A. P. De. 1789. Encyclopédie méthodique 3: 151-156. – Paris.
- Linnaeus, C. 1763. Species plantarum 2: 1407. – Stockholm.
- Linnaeus, C. von. fil. 1782. Supplementum plantarum. 175-177. – Braunschweig.
- Sonder, O. W. 1862. *Hydrocotyle*. – In: Harvey, W. H. & Sonder, O. W. (eds), Flora Capensis 2: 526-533. Dublin, Hodges & Smith.
- Thunberg, C. P. 1798. Dissertatio botanicade *Hydrocotyle*. 416. – Uppsala, Edman.