Nordic Journal of Botany

Three new species of Centella series Montanae

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Schubert, M. T. R. & Van Wyk, B.-E. 1999. Three new species of *Centella* series *Montanae*. – Nord. J. Bot. 19: 427-434. Copenhagen. ISSN 0107-055X

Three new species of *Centella* are described: *C. cryptocarpa*, *C. gymnocarpa* and *C. longifolia*. These species are similar to *C. montana* and in order to clarify species limits, the latter is also described and illustrated. The concept of the series *Montanae* is broadened to include all species with transversely oblong fruit of which the commissure is narrower than the rest of the fruit.

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Introduction

In this paper the delimitation of the series *Montanae* Adamson (1951) is broadened to include all the species with transversely oblong fruit (i.e., with a length-width ratio of one or less) and with a narrow commissure (Fig. 1). In Schubert & Van Wyk (1997) the importance of a bulging commissure of the fruit is discussed. Transverse sections of the fruit of all the species of *Centella* revealed that the commissure of some species is narrower than the rest of the fruit. This constricted commissure is here considered an important diagnostic character to delimit the series *Montanae*. Three new species of *Centella* are reported in this paper: *C. cryptocarpa* and *C. gymnocarpa* are described for the first time, while *C. montana* var. *longifolia* is elevated to species status. This taxon was previously considered to be a variety of *C. montana* (Adamson 1951). Typical *C. montana* is also described and included in the illustrations, to allow comparisons with the other three species. The shape in commissural view and the narrow commissure of the fruit of the new species show that the sectional limits of series *Montanae* will have to be revised.

Fruit morphology

A study of transverse sections of the fruits of all the species of *Centella* revealed an interesting modification of the commissure, in addition to the commissural bulging reported in Schubert & Van Wyk (1998): in transverse view the commissural area is much constricted and thus considerably narrower than the rest of the fruit (Fig. 1). This constricted commissure of some species of *Centella* is an important diagnostic character and is associated with *C. montana* and related species. Although all four of the species discussed in this paper may superficially seem unrelated, they all exhibit the above-mentioned fruit character. It is furthermore interesting to note that the length-width ratio of the fruit of *Centella* species with a constricted commissure is lower than that of other species. These two correlated fruit characters could provide further supporting evidence for the delimitation of the series *Montanae*. As it has become evident that the series is not monophyletic, we propose the use of fruit characters to devise a more satisfactory classification system. All four of the species described exhibit the presence of irregular ridges or ribs but these are not as distinct as those present in the series *Glabratae* or *Virgatae*.

Accepted 28-1-1998

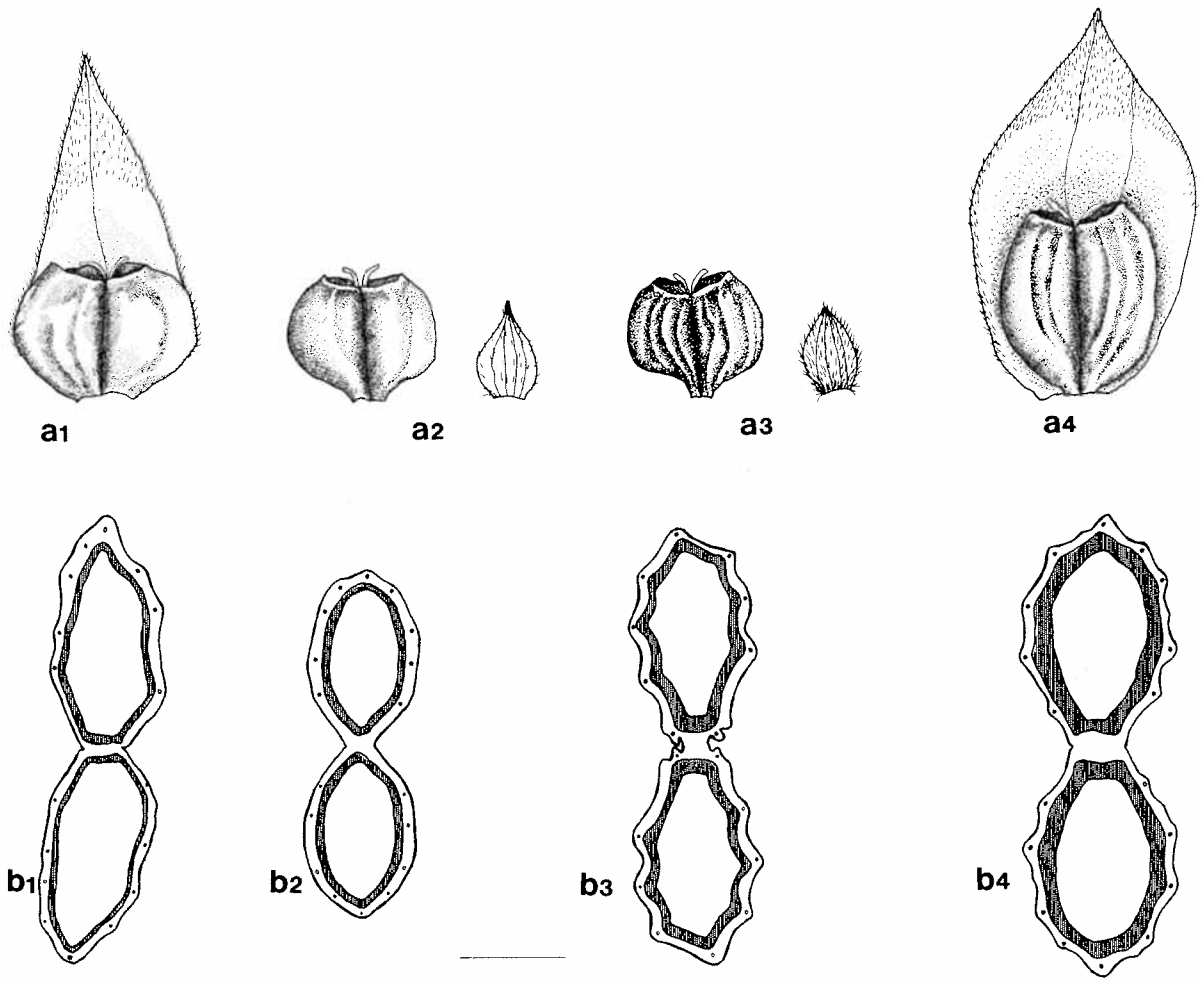

Fig. 1. Summary of fruit characters of *Centella montana*, *C. longifolia*, *C. gymnocarpa* and *C. cryptocarpa*. – a, comparison of fruit as seen in commissural view. a1, C. montana: slightly ribbed fruit with commissural constriction, bracts longer than the fruit; a2, *C. longifolia*: very slightly ribbed fruit with commissural constriction, bracts shorter than the fruit; a3, *C. gymnocarpa*: ribbed fruit with commissural constriction, bracts shorter than the fruit; a4, *C. cryptocarpa*: ribbed fruit with commissural constriction, bracts longer and wider than the fruit. b, comparison of transverse sections. b1, *C. montana*: slightly ribbed fruit with commissural constriction; b2, *C. longifolia*: very slightly ribbed fruit with commissural constriction; b3, *C. gymnocarpa*: ribbed fruit with commissural constriction; b4, *C. cryptocarpa*: ribbed fruit with commissural constriction. – (a1 & b1 from Esterhuysen 18262, a2 & b2 from Schubert & Van Wyk 5, a3 & b3 from Rourke 523, a4 & b4 from Schubert & Van Wyk 94). (scale bars: a = 5 mm, b = 1mm).

Leaves

Although the leaves of *Centella montana* as well as those of two of the new species (*C. longifolia* and *C. cryptocarpa*) may rarely be dentate, they are usually entire (Fig. 2). The leaves of the third new species (*C. gymnocarpa*) are mostly dentate. The co-occurrence of both dentate and entire leaves in one species once again confirms that Adamson's (1951) distinction between series *Montanae* and *Glabratae* is artificial. The four species discussed in this paper indicate how deceptive leaf characters can be: *C. gymnocarpa* is superficially different from the other three species and almost identical to *C. calcaria* (Schub. & Van Wyk) of the series *Capenses* (Adamson). The leaves of both *C. gymnocarpa* and *C. calcaria* are petiolate, obovate, grey-green and sericeous. The fruit and inflorescence structure however, reveal that they are unrelated and only superficially similar.

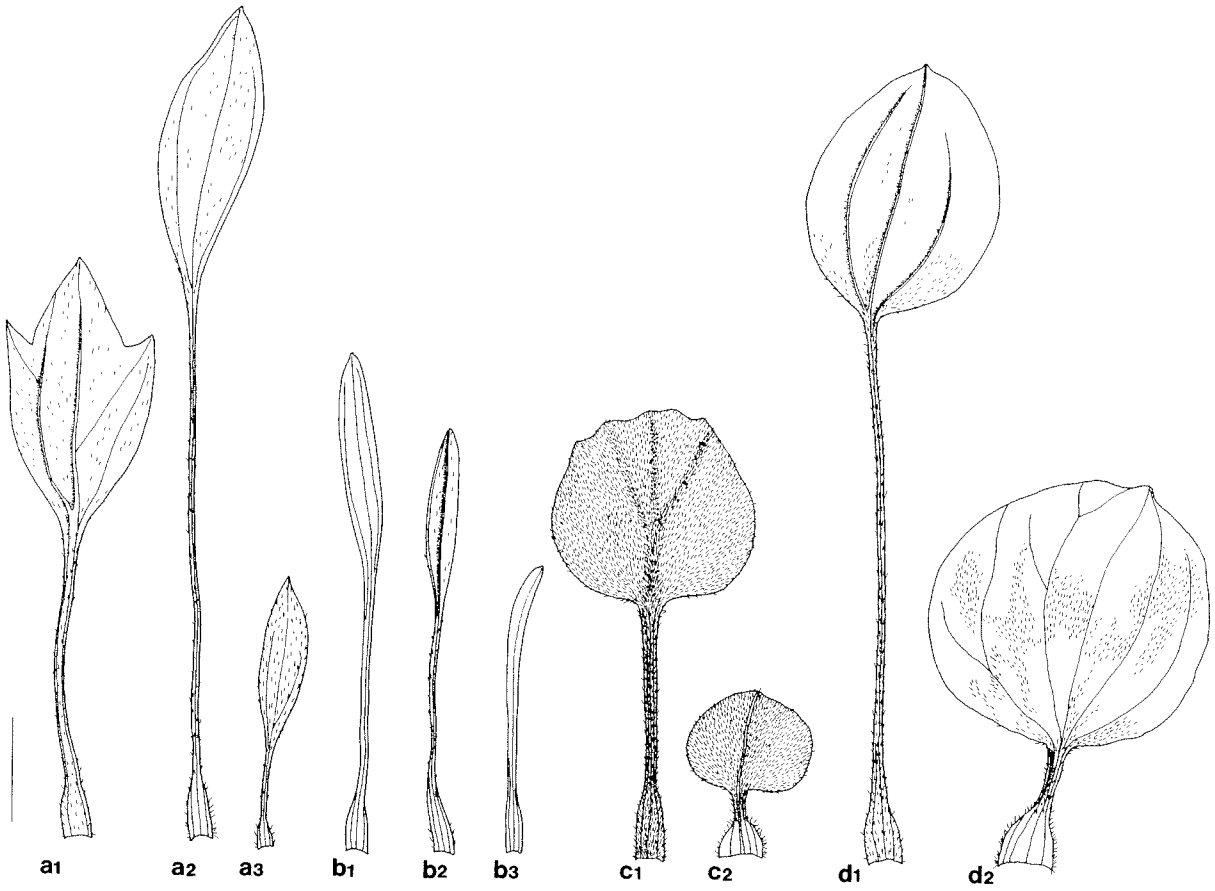

Fig. 2. Leaves of *Centella montana* (a), *C. longifolia* (b), *C. gymnocarpa* (c) and *C. cryptocarpa* (d). – a1, basal leaf, abaxial view; a2, basal leaf, adaxial view; a3, upper leaf, adaxial view; b1, basal leaf, adaxial view; b2, basal leaf, abaxial view; b3, upper leaf, adaxial view; c1, basal leaf, adaxial view; c2, upper leaf, abaxial view; d1, basal leaf, abaxial view; d2, upper leaf, adaxial view. – (a1 from Schlechter 2013, a2 from McDonald 1173, a3 from Esterhuysen 17327, b1-3 from Schubert & Van Wyk 5, c1-2 from Rourke 523, d1-2 from Schubert & Van Wyk 94). (scale bar: 10 mm).

Inflorescence

Plants of *Centella cryptocarpa* are either functionally male or bisexual while the other three species are all andromonoecious (Fig. 3). The male umbels of *C. cryptocarpa* have one, three or five flowers, those of *C. montana* have three flowers and in *C. longifolia* the male umbellules are invariably single-flowered.

Bracts

It is interesting to note that both *Centella cryptocarpa* and *C. montana* can be distinguished from other related species by the length of the bract of the bisexual umbellules (Fig. 1). In *C. montana* (Fig. 1, a1) and *C. cryptocarpa* (Fig. 1, a4) the paired bracts are distinctly longer than the fruit while those of other species are shorter, as long as the fruit or sometimes slightly longer than the fruit. The bracts of *C. montana* (Fig. 1, a1), are clearly not as wide as the fruit while they are wider than the fruit in *C. cryptocarpa* and thus are a unique feature of this species.

Habit

Centella longifolia is a perennial which forms a single tuft of congested nodes, rarely with one or two additional tufts connected to the central tuft by a single internode (Fig. 4b). The extremely short internodes in *C. longifolia* create the impression of a halo of shorter bi-

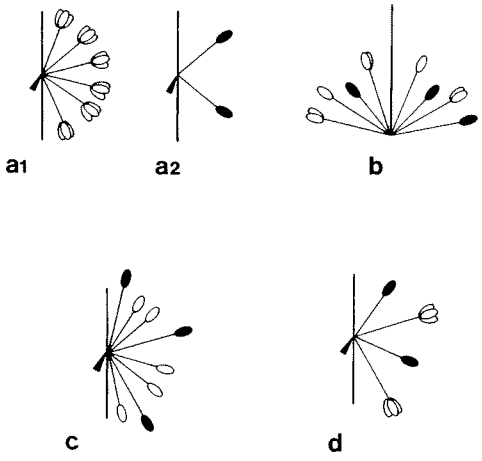

Fig. 3. Schematic overview of inflorescences of *Centella montana* (a), *C. longifolia* (b), *C. gymnocarpa* (c) and *C. cryptocarpa* (d). – a1, three- to five-flowered male umbellules from male plant; a2, single-flowered bisexual umbellules from functionally bisexual plant; b, single- to two-flowered male umbellules and single-flowered bisexual umbellules from bisexual plant, originating from base of the plant; c, single-flowered male umbellules and single-flowered bisexual umbellules from bisexual plant; d, three- to five-flowered male umbellules and single-flowered bisexual umbellules from bisexual plant.

sexual umbellules and longer functionally male umbellules arising from the base of the tufted plant. Figure 4 shows a clear difference between the congested habit of *C. longifolia* and the more spreading habit of *C. montana*, *C. gymnocarpa* and *C. cryptocarpa*, which all three have a central tuft with long trailing branches spreading from it. The leaves and umbellules of the three latter species are borne on separate nodes although some nodes may also be somewhat congested.

Geographical distribution

All four of the species are localized fynbos endemics and appear to be rare (Fig. 5). *Centella cryptocarpa* is only known from a single collection, *C. gymnocarpa* from three localities, while *C. longifolia* and *C. montana* are somewhat more widely distributed.

Centella montana (Cham. & Schlechtd.) Domin.

Bot. Jahrb. 41: 162 (1908), Adamson in J. S. Afr. Bot. (17): 16 (1951); Eichler in Feddes Repert. 98: 20 (1987); Burtt in Edinb. J. Bot. 48: 197 (1991). = *Hydrocotyle montana* Cham. & Schlechtd. in Linnaea 1: 374 (1826); De Candolle, Prodr. 4: 69 (1830). – Type: South Africa, Western Cape, Langekloof Mountains [3320CD/DC], Mund & Maire s.n. (BOL!).

Tufted, prostrate, monoecious perennial, up to 0.2 m wide. Leaves crowded, slightly dimorphic, distinctly petiolate; petiole pubescent along entire length; lamina elliptic to lanceolate, the base attenuate, main veins abaxially raised and adaxially slightly sunken, surface on both sides pilose, red-brown to green, concolorous. Basal leaves with petiole (4-) 15-25 (-55) mm long; lamina (12-) 15-23 (-30) mm long, (3-) 7-9 (-15) mm wide; the margin entire or rarely dentate in upper half and entire lower down, one to three teeth per leaf, apex acuminate. Upper leaves with petiole (2-) 7-10 (-15) mm long; lamina (4-) 10-17 (-22) mm long, (2-) (5-6) (-10) mm wide; the margin entire. Inflorescence with one to two bisexual umbellules and one to two male umbellules. Male umbellules, 4-5 mm long, with three sessile flower each. Bisexual umbellule 2-3 mm long, reduced to a single flower each; borne on nodes of plants; bracts of male umbelulles, paired, up to 1.5 mm long, abaxially pilose, adaxially glabrous; bracts of the functionally bisexual umbellule, paired, 5-6 mm long, 3-4 mm wide, not foliaceous, lanceolate, abaxially pilose, adaxially glabrous; cauline bracts (those below the inflorescence) inconspicuous or absent. Flowers with cream-coloured petals, glabrous. Fruit widely depressed ovate, 2-3 mm long, 3-4 mm wide in commissural view, commissure constricted, ribs not distinct, the surface between ribs not wrinkled, glabrous, stylopodium not prominent.

Material examined. 3320 (Montagu): Langeberge, Zuurbraak (DC), Schlechter 2103 (BOL); Grootvadersbosch State Forest (DD), McDonald & Marley 1083a (NBG), Esterhuysen 18262 (BOL, NBG); Lemoenshoekberg (DD), Esterhuysen 10442 (BOL), Walgate 938 (BOL, PRE, SAM). 3321 (Ladismith): Garcias Forest Station (CC), Esterhuysen 17327 (BOL, NBG). 3323 (Willowmore): Helpmekaar Mountain (DC), Compton 5192 (BOL). 3419 (Caledon): Riviersondereind Peak (BB), Esterhuysen 18753 (BOL).

Fig. 4. Photographic plates of herbarium specimens, showing habit. a, *Centella montana*; b, *C. longifolia*; c, *C. gymnocarpa*; d, *C. cryptocarpa*.


UNIVERSITY OF CAPE TOWN

a


TYPE
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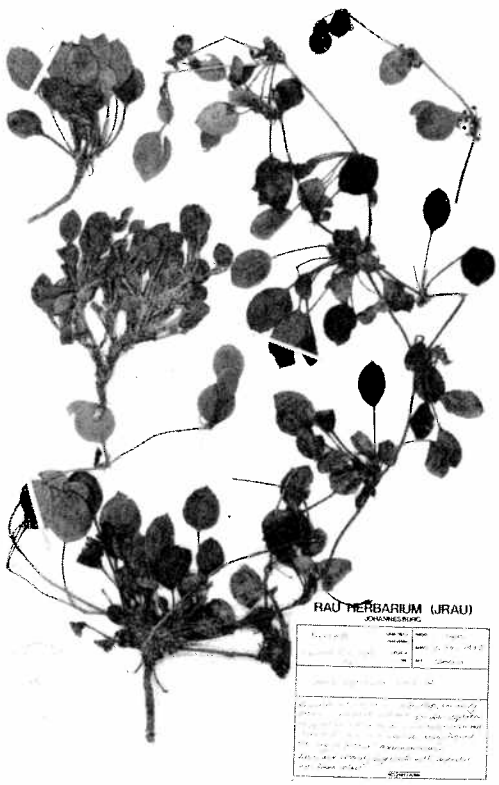
b


NATIONAL BOTANIC GARDENS OF
SOUTH AFRICA

c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d

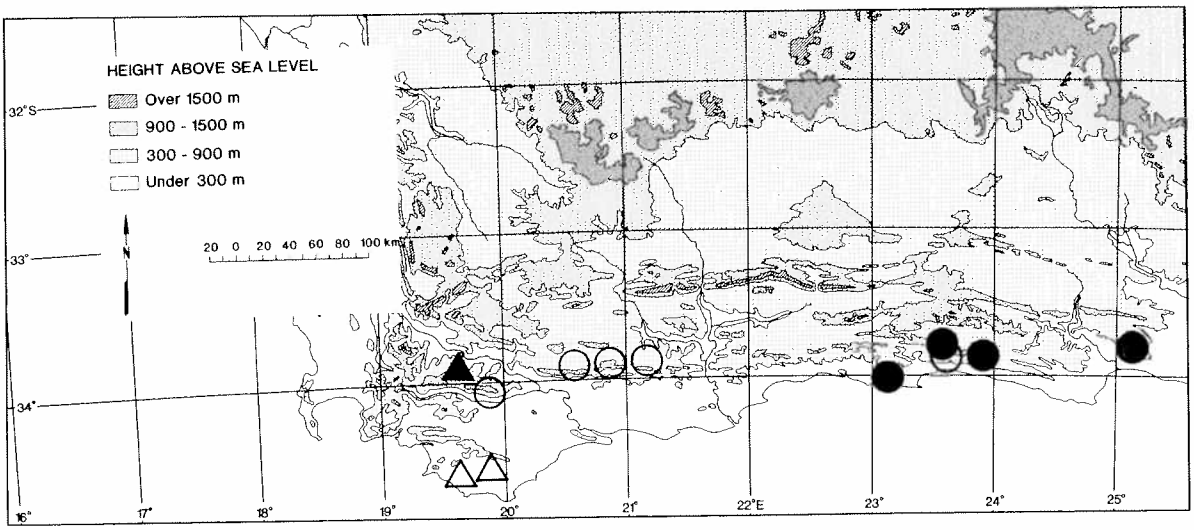

Fig. 5. The known geographical distribution of *Centella montana* (○). *C. longifolia* (●), *C. gymnocarpa* (△) and *C. cryptocarpa* (▲).

Centella longifolia (Adamson) M. Schub. & B.-E. van Wyk stat. nov.

= *C. montana* var. *longifolia* Adamson in J. S. Afr. Bot. (17): 17 (1951); Eichler in Feddes Repert. 98: 20 (1987); Burtt in Edinb. J. Bot. 48: 197 (1991). – Type: South Africa, Western Cape Province, Willowmore district, Tsitsikamma Mountains, near Joubertina [3323DD], Esterhuysen 16767 (BOL!, holotype).

Tufted, monoecious perennial, up to 0.3 m wide. Leaves crowded, distinctly petiolate; petiole (20-) 25-50 (-85) mm long, pubescent along entire length; lamina linear-oblong, (13-) 18-27 (-45) mm long, (3-) 4-6 (-9) mm wide, the base attenuate, main veins abaxially raised and adaxially slightly sunken, surface on both sides glabrous to pubescent red-brown to green, concolorous, the margin entire, apex acuminate. Inflorescence structure with three to six male umbellules and one to two bisexual umbellules. Male umbellules 10-22 mm long, reduced to a single sessile flower each. Bisexual umbellules, 8-15 mm long, reduced to a single flower each; borne at base of plant; bracts of male umbellules, paired, up to 1.5 mm long, abaxially pubescent, adaxially glabrous; bracts of the functionally bisexual umbellules paired, 2--3 mm long, 1-2 mm wide, not foliaceous, lanceolate, abaxially pubescent, adaxially glabrous; cauline bracts (those below the inflorescence) inconspicuous or absent. Flowers with cream-coloured petals, glabrous. Fruit widely depressed ovate, 1-2 mm long, 2-3 mm wide in commissural view, commissure constricted, ribs not distinct, surface between ribs smooth, glabrous, stylopodium not prominent.

Centella longifolia was previously considered to be a variety of *C. montana*. However there is sufficient evidence showing it to be a distinct species. *C. longifolia* is a tufted perennial with compressed internodes (rarely forming shoots). The linear-lanceolate, petiolate leaves originate from a central tuft (Fig. 4b). *C. montana* frequently forms shoots bearing elliptical, entire or sometimes dentate leaves on nodes separated by distinct internodes (Fig. 4a). Both species are pilose with a distinct red-brown colour also found in *C. cryptocarpa*. The extreme compression of nodes in *C. longifolia* creates the impression of a halo of shorter bisexual umbellules and longer functionally male umbellules arising from the base of the tufted plant. The umbellules of *C. montana* are borne on separate nodes but some degree of compression may occur.

Material examined. 3323 (Willowmore): Tsitsikamma Mountains, Die Hoek Valley (DC), Esterhuysen 16371 (BOL, NBG, PRE); Tsitsikamma Mountains, near Joubertina (DD), Esterhuysen 16767 (BOL), 16839 (BOL, NBG), 16844 (BOL). 3325 (Port Elizabeth): Loerie, Longmore State Forest (CC), Vlok 1390 (PRE, NBG). 3423 (Knysna): Farleigh Plantation (AA), Dickson 53 (BOL).

Uncharacteristic specimen: 3320 (Montagu): Langeberg, Grootvadersbosch State Forest (DD), McDonald 1173 (NBG).

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

C. montanae similis sed habitu caespitosiori et foliis uniformibus, late ovatis, sericeis, griseo-viridibus distinguitur (folia *C. montanae* subbiformia, elliptica vel lanceolata, pilosa, rubrobrunnea vel viridia colore). *C. gymnocarpa*, sicut *C. calcaria* seriei Capensium, endemica est super saxum calcareum. Leviter similis est illi, sed forma inflorescentiae et fructus differt.

Typus. South Africa, Western Cape Province, Caledon district, Hagelkraal, above limestone hills [3419DA], Rourke 523 (NBG, sheet 1, holotype, sheet 2, isotype).

Tufted, prostrate monoecious perennial, up to 0.5 m wide. Leaves crowded, distinctly petiolate; petiole (5-) 10-40 (-60) mm long, pubescent along entire length; lamina widely ovate to very widely ovate, (6-) 10-15 (-20) mm long, (8-) 12-15 (-20) mm wide, the base truncate to attenuate, main veins abaxially raised and adaxially sunken, surface on both sides sericeous, grey-green, concolorous, the margin entire or mostly dentate in upper half and entire in lower half, three to nine teeth per leaf, apex acuminate. Inflorescence with one to three bisexual umbellules and five to nine functionally male umbellules. Male umbellules (4-) 10 (-15) mm long, reduced to a single sessile flower each. Functionally bisexual umbellules (5-) 10-20 (-25) mm long, reduced to a single flower each; borne on tufts of congested nodes separated by long internodes; bracts of male umbellules paired, up to 1.5 mm long, abaxially sericeous, adaxially glabrous; bracts of the functionally bisexual umbellule paired, 1-2 mm long, 1 mm wide, not foliaceous, lanceolate, abaxially sericeous, adaxially glabrous; cauline bracts (those below the inflorescence) inconspicuous or absent. Flowers with cream-coloured petals, abaxially densely villous. Fruit widely depressed ovate, 2-2.5 mm long, 2-3.5 mm wide in commissural view, commissure constricted, ribs distinct, surface between ribs smooth, glabrous, stylopodium not prominent.

Centella gymnocarpa is similar to *C. montana* but can be distinguished by its crowded habit and its monomorphic, widely ovate, sericeous, grey-green leaves (the leaves of *C. montana* are slightly dimorphic, elliptic to lanceolate, pilose and red-brown to green in colour). *C. gymnocarpa* is similar to *C. cryptocarpa* in that both species have congested nodes in the central part of the plant, with long trailing branches spreading from a central point. The attenuate and petiolate leaves of both species are usually covered with a dense indumentum. However the leaves of *C. gymnocarpa* are usually dentate and grey-green in colour while those of *C. cryptocarpa* are occasionally dentate and distinctly red-brown in colour. In *C. gymnocarpa* the male umbellules are mostly reduced to a single sessile flower, while in *C. cryptocarpa* they are made up of one to five sessile flowers each. *C. gymnocarpa* is a highly localized limestone endemic. It is superficially similar to another limestone endemic with sericeous grey-green leaves, *C. calcaria* (series *Capenses*) but the species differ significantly in the structure of the inflorescence and fruit. *C. gymnocarpa* appears to be very rare and occurs from Hagelkraal to Soetanysberg.

Material examined. 3419 (Caledon): Hagelkraal (DA), Rourke 523 (NBG); Koks River (DA), Boucher 3795 (PRE, NBG); Soetanysberg (DB), Boucher 2166 (NBG).

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

C. gymnocarpae similis sed colore rubrobrunneo proprio (*C. gymnocarpa* laete grisea est), bracteis magnis foliaceis, usque ad 12 mm longis, plantarum bisexualium fructum ellipsoideum omnino includentibus (bracteae *C. gymnocarpae* breviores fructibus), et plantis discretis masculis aut bisexualibus (*C. gymnocarpa* monoecia est), differt. Etiam umbelli masculi *C. gymnocarpae* semper uniflores sunt.

Typus. South Africa, Western Cape Province, Caledon district, Riviersondereind Mountains, Schilpadkop, on sand patches on firebreak [3319DC], Schubert & Van Wyk 94 (PRE, holotype; BOL, E, GRA, JRAU, KMG, MO, NBG, S, WIND, isotypes).

Tufted, prostrate andromonoecious perennial, up to 0.5 m wide, with flowering branches spreading horizontally. Leaves crowded, distinctly petiolate; petiole (2-) 20-40 (-60) mm long, pubescent along entire length; lamina ovate to very widely ovate (Fig. 4d), (10-) 20-25 (-45) mm long, (5-) 15-20 (-35) mm wide, the base attenuate, main veins abaxially raised and adaxially sunken, surface on both sides pubescent, green-brown, concolorous, the margin entire or rarely dentate in upper half and entire in lower half, one to three teeth per leaf, apex acuminate. Inflorescence of bisexual plants with one to three bisexual umbellules and inflorescence of male plants with three to nine umbellules. Male umbellules (5-) 7 (-10) mm long, reduced to one to five sessile male flowers each. Bisexual umbellules (2-) 7 (-11) mm long, reduced to a single flower each; borne in axils of flowering shoots; bracts of male umbellules one or two pairs, 1-1.5 mm long, abaxially pubescent, adaxially glabrous; paired bracts enclosing single male

flowers larger than other male umbels; bracts of the bisexual umbellule paired, (5-) 7 (-10) mm long, (3-) 5 (-6) mm wide, foliaceous, red-brown, abaxially sericeous, adaxially glabrous except along upper margin; cauline bracts (those below the inflorescences) sessile, narrowly triangular to acuminate. Flowers bisexual or male; petals abaxially villous. Fruit widely elliptic, 5 mm long, 3 mm wide in commissural view, commissure constricted, ribs not distinct, surface between ribs wrinkled, glabrous; stylopodium not prominent.

Centella cryptocarpa is similar to *C. gymnocarpa* but can be distinguished by its distinct red-brown colour (*C. gymnocarpa* is grey-white in colour) and by the large foliaceous bracts (up to 12 mm long) of the bisexual plants which enclose the fruit entirely and which are a unique character of the species (the bracts are shorter than fruit in *C. gymnocarpa*). There are separate male and functionally bisexual plants in *C. cryptocarpa* while *C. gymnocarpa* is invariably monoecious. The male umbels have one, three or five sessile flowers while those of *C. gymnocarpa* are always single-flowered. *C. cryptocarpa* is an endemic of the Riviersondereind mountains. We collected this species for the first time in 1995 and, as far as we could ascertain, it is not present in any other herbarium records.

Material examined. 3319 (Caledon): Schilpadkop (DC), Schubert & Van Wyk 94 (BOL, E, GRA, JRAU, KMG, MO, NBG, PRE, S, WIND).

Acknowledgements – We thank the directors and staff of the listed herbaria for allowing us to study their material. Thank you very much to Dr H. F. Glen for translating the diagnoses. Financial support from the Rand Afrikaans University and the Foundation for Research Development is acknowledged.

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