The South African Species of *Commiphora* *

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**ABSTRACT**

A revision of the South African species of *Commiphora* (Burseraceae) is presented in which 2 keys are provided to the 18 species recognized. A comprehensive morphological study, including an anatomical study of the stems and leaves, was regarded as essential for an accurate delimitation of the different species. Maps, sketches and photographs serve for illustration.

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**INTRODUCTION**

Berg (1862) was apparently the first author to publish a classification of *Commiphora* under the name *Balsamodendrum* Kunth. He divided the 13 species into two sections, using the type of inflorescence and the structure of the calyx as criteria. These two sections were divided into various subsections, mainly based on leaf characteristics. Berg did not assign names to these sections or subsections.

Engler (1883) extended the classification of Berg, recognizing 35 *Commiphora* species, which he divided into 18 subsections. This classification of Engler was primarily based on leaf characteristics and again no names were assigned to the subsections.

In 1896 Engler revised his classification of 1883 and recognized 63 species. The classification of 1896 was once more extended by Engler in 1913. In this much more elaborate classification, 129 species were divided into 43 sections which he published validly with names and diagnoses. The classifications of Engler published in 1915 and 1931 were principally repetitions of the 1913 classification with a few modifications and additions. Although Engler based the ultimate division of the 43 sections mainly on leaf characteristics such as the type of leaf, hairiness of the leaves, number, colour, shape and margins of the leaflets, he already realized the taxonomic importance of the pseudaril. The variable structure of the pseudaril was used as a criterion for distinguishing between two of the sections.

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Sonnerat (1860), Harvey (1862), Hiern (1896), Burtt Davy (1932), Verdoorn (1951), Codd (1951), Von Breitenbach (1965) and de Winter (1968) were the main contributors to the knowledge of the South African species of Commiphora. In the past, descriptions of the species were mainly based on external morphological features, but due to insufficient available material, the knowledge of these features was also incomplete. South African botanists, such as Verdoorn and de Winter, who are particularly interested in this genus, realize that it is essential to obtain mature flowers and ripe fruit for diagnostic descriptions and for the investigation of the relationships of the different species.

This investigation was conducted on 18 species of Commiphora, so far the only representatives of the Burseraceae recorded in South Africa. The majority of species is widely distributed in the central and northern parts of Transvaal, but they are particularly common in the dry bushveld of the northern and north-eastern Transvaal. In the Transvaal, north of the Tropic of Capricorn, 11 species occur and large areas north of the Soutpansberg can be designated as Commiphora-void. Twelve species are recorded from the Kruger National Park, while the genus is also well represented in Zululand. A few mesophytic species occur along the east and south coast, extending as far south as East London. So far two species from the northern Cape, and four from the north-western Cape, have been recorded. The species occurring in the north-western Cape represent the most xerophytic species studied.

The aim of this investigation was primarily to make a contribution to the knowledge of the South African flora by an accurate delimitation of the indigenous species of Commiphora. The morphological investigation was conducted on fresh material collected for each of the species. A comprehensive organographic study of the stems, leaves, flowers and ripe fruit, as well as an anatomical study of the leaves and stems, was regarded as essential for the accurate delimitation of the different species. For a comparative anatomical study of the leaves, it was decided to study the terminal leaflets of all the species, and the transverse sections were made a third of the distance from the base of the leaflets. The anatomy of the petioles has also been studied from transverse sections made through the distal part of the petioles. The anatomical study of the stems included a study of the young stems and stems with a diameter of 2.5 cm of each species.

The type specimens of all the species including those of the synonyms, have been studied and, where applicable, lectotypes have been indicated. All gatherings cited are represented in the National Herbarium, Pretoria (PRE), unless otherwise indicated by the herbarium abbreviation shown after the collector's number.

ACKNOWLEDGEMENTS

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COMMIHPHORA

Commiphora Jacq., Hort. Schoenbr. 2: 66, t. 249 (1797); Engl. in A.D.C., Monogr. Phan. 4: 7 (1883); Bot Jahrb. 15: 94 (1893); in Pflanzenfam. 3,4: 251 (1896); Bot. Jahrb. 26: 368 (1899); Bot. Jahrb. 34: 303 (1905); Guillaumin in Ann. Sc. Nat. 9: 197 (1909); Engl. in Bot. Jahrb. 44: 144 (1910); Bot. Jahrb. 46: 289 (1912); Bot. Jahrb. 48: 449 (1913); Pflanzenw. Afr. 3: 1: 786 (1915); Bot. Jahrb. 54: 292 (1917); Hutch. & Dalz., Fl. W. Trop. Afr. 1: 488 (1928); Engl. in Pflanzenfam. ed. 2,19a: 429 (1931); Chiov., Fl. Somalia 2: 53 (1932); Burtt in Kew Bull. 1935: 101 (1935); Webber in Lilloa 6: 443 (1941); Perr. Bathie in Fl. Madag. 5: 5 (1946); Exell & Mendonca in Conspl. Fl. Angol. 1: 298 (1951); Miller in J. S. Afr. Bot. 18: 38 (1952); Wild in Bol. Soc. Prot. 2,33: 76 (1959); Dale & Greenway, Kenya Trees: 76 (1961); Capuron in Adansonia 2: 270 (1962); White, For Fl. N. Rhod.: 173 (1962); Wild in Fl. Zam. 2: 263 (1963); Von Breitenbach, Ind. Trees S. Afr. 3: 2: 429 (1965); De Wint in Trees S. Afr. 20,1: 3 (1968); Merxm., Prod. Fl. S.W. Afr. 23: 1 (1968). Type species: C. madagascariensis Jacq., Hort. Schoenbr. 2: 66, t. 249 (1797).

Amyris sensu Linn., Mant.: 65 (1767).

Balsamia Gled. in Berl. Ges. Naturf. Fr. Schr. 3: 127 (1782); Engl., Bot. Jahrb. 1: 41 (1881).

Balessan Bruce, Trav.: 5: t. 25 (1790).

Balsamodendrum Kunth in Ann. Sc. Nat. 1,2: 348 (1824); D.C., Prod. 2: 76 (1825); Sond. in Fl. Cap. 1: 526 (1860); O. Berg in Bot. Ztg. 21: 161 (1862); Marchand in Adansonia 8: 34, 67 (1867); Oliv. in Fl. Trop. Afr. 1: 324 (1868).

Hempichia Ehrenb. in Linnaea 4: 396 (1829); Marchand in Adansonia 8: 69 (1867).

Heudeletia A. Rich. in Guill., Perr. & A. Rich., Fl. Sen. 1: 150, t. 39 (1832).

Protium sensu Wight & Arn. in Prod. Fl. Ind.: 176 (1834); Harv. in Fl. Cap. 2: 592 (1862).

Protonoposin Blume in Mus. Bot. Lugd.-Bat. 1: 229 (1850) nom. nud.

Hirzeria Klotzsch in Peters, Reise Mossamb. Bot. 1: 89 (1861).

Balsamophloeos O. Berg in Bot. Ztg. 20: 163 (1862).

Dioecious or polygamous but rarely monoeocious many-stemmed shrubs or shrubs with the trunk branching repeatedly above soil level or trees with a single main stem of variable height; bark often peeling or flaking in papery pieces or strips; resin ducts secreting an odoriferous resin occurring in the phloem; wood relatively light and consisting mainly of septated fibres; branchlets often spine-tipped, glabrous, pinnate or tomentose. Leaves petiolate but rarely sessile or
subsessile, alternate, usually grouped at the ends of the branches, simple, trifoliolate or impari-pinnate, margins or leaflets usually crenate, serrate or lobed but seldom entire, glabrous, pilose or tomentose, leaflets dorsiventral or isobilateral; petioles of a few species with medullary vascular bundles. Flowers unisexual rarely bisexual, perigynous or hypogynous, male flowers usually larger than female flowers, appearing before or with the leaves and occasionally after the leaves in axillary simple or compound dichasial cymes, in paniculate cymes or singly in clusters. Pedicels of variable length, glabrous or pilose to tomentose. Calyx infundibuliform, campanulate or broadly campanulate with 4 valvate persistent lobes, usually yellowish-green or reddish-green, glabrous, glandular or pilose to tomentose, in perigynous flowers continuous with hypanthium, in hypogynous flowers inserted on receptacle. Petals 4, usually yellow to green, apex incurved, glabrous or occasionally pilose on outside. Disk in perigynous flowers adnate to hypanthium, cylindrical, rarely fleshy, sometimes lobed in hypogynous flowers adnate to calyx or corolla, intrastaminal, cylindrical, usually with 4 large lobes but in some species with 4 large and 4 small lobes, lobes bident or not bident; disk in male flowers usually more fleshy than in female flowers, glabrous or occasionally pilose. Stamens 4 or in a few species 2, obdiplostemonous, 4 antisealous stamens longer than other 4; filaments female flowers, glabrous or occasionally pilose. petals 4 large and 4 small lobes, lobes bifid or not bifid; ovary ovoid, 2-locular with 2 valves in a few species outside our area; endocarp tissue with resin ducts; exocarp and mesocarp exocarp relatively thin, glabrous but occasionally obscurely 2-4 lobed. Fruit an ovoid, ellipsoid or subglobose drupe, usually asymmetrically flattened; exocarp relatively thin, glabrous but occasionally pilose; mesocarp usually fleshy, consisting of spongy tissue with resin ducts; exocarp and mesocarp splitting in ripe fruit into 2 longitudinal valves (4 valves in a few species outside our area); endocarp forming a crustaceous or bony putamen and usually also a pseudaril; putamen ellipsoid or subglobose, irregularly flattened, smooth or rugose, usually enclosing one fertile loculus and a much smaller abortive loculus; seed with a straight embryo, cotyledons much folded; pseudaril clasping putamen, usually red or yellowish, usually fleshy but in a few species thin or membranous or absent, cupular with short lobes or arms or with 2-4 relatively long arms or covering almost whole putamen without distinct arms.

Commiphora is represented in Arabia and western India by only eight species, all the other species occurring on the continent of Africa or on islands along the east coast of Africa. The genus is well represented in Madagascar and the Mascarenes where 25 species occur.

According to Jacquin (1779) the type species, C. madagascariensis Jacq., is a plant from Madagascar and Mauritius although the specimen from which the plant was described was a cultivated plant. C. madagascariensis has apparently never been re-collected in either Madagascar or Mauritius. There is evidence that species of Commiphora have been much in demand for their resin from the earliest times and it may be that the type species was widely cultivated in the past (Wild, 1959a). According to Wild it could easily have been in cultivation in Madagascar or Mauritius before 1797 when Jacquin described it.

Engler (1931) and Wild (1959a&b, 1963) regarded the leaves of C. glandulosa, C. pyracanthoides and C. merkeri as unifoliolate. According to them, representatives of the genus with pinnate leaves are primitive, and the unifoliolate leaves are developed by way of reduction. Sinia (1938) and Leenhouts (1959) rejected this theory and stated that the pinnate condition is advanced. The phylogeny of Commiphora species needs further investigation, but observations made during this study, support the view of Sinia and Leenhouts. Since no articulation exists in the petioles of C. glandulosa, C. pyracanthoides and C. merkeri, I prefer to designate the leaves as simple rather than unifoliolate.

Key to the Species Based on Vegetative Characteristics

**Branchlets spine-tipped:**

| Leaves simple or trifoliolate with 2 much smaller lateral leaflets: | 3. C. merkeri |
|--------------------|------------------------------------------|
| Bark grey with large black lenticels and peeling off around the stems in yellowish paper strips, branchlets smooth and purplish, leaves glaucous, small trees with a single stem: | 15. C. nanaensis |
| Bark yellow to green and flaking in yellowish paper pieces, branchlets greyish, leaves green, trees with a single main stem or many-stemmed shrubs: | 6. C. neglecta |
| Many-stemmed shrubs up to 3 m tall, terminal leaflet up to 4 x 2 cm, leaflet-margins finely crenate-serrate or entire: | 2. C. pyracanthoides |
| Trees with a single main stem up to 8 m tall, terminal leaflet up to 6 x 3 cm, leaflet-margins finely crenate-serrate, rarely entire: | 1. C. glandulosa |
| Leaves trifoliolate with the lateral leaflets at least half the size of terminal leaflet: | 5. C. africana |
| Branchlets and leaves pilose to tomentose: | 4. C. schimperi |
| Branchlets and leaves glabrous or with a few scattered short hairs: | 6. C. neglecta |
| Branchlets and leaves glabrous, leaflets elliptic to broadly elliptic, margins coarsely crenate-serrate especially in upper half, terminal leaflet dorsiventral: | 4. C. schimperi |
| Branchlets and leaves with a few scattered short hairs, leaflets elliptic to ovate to broadly ovate, margins entire or upper half finely crenate-serrate, terminal leaflet isobilateral: | 6. C. neglecta |
| Branchlets not spine-tipped: | 7. C. mollis |
| Leaves simple: | 15. C. nanaensis |
| Leaves trifoliolate or impari-pinnate: | 7. C. mollis |
| Branchlets and leaves pilose to tomentose: | 6. C. neglecta |
| Leaflets often distinctly paler below, margins entire, bark peeling in thick discs, trunk often irregularly fluted: | 7. C. mollis |
Leaflets not distinctly paler below, margins not entire (or entire as usually the case with *C. edulis*), bark flaking or peeling in thin papery pieces, trunk not fluted:
Leaves trifoliolate or impari-pinnate, lateral leaflets up to 2 × 1.2 cm, branchlets not obtuse, terminal leaflets isobilateral and with hesperidin crystals, petiole without medullary vascular bundles:

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C. angolensis

Leaves only impari-pinnate, lateral leaflets larger than 2 × 1.2 cm, branchlets obtuse, terminal leaflets isobilateral and with hesperidin crystals, petiole with medullary vascular bundles:
Bark peeling in large yellowish papery pieces, tree with a single main stem, stems not entwined, leaves dark green, leaves obovate to broadly elliptic, margins crenate-serrate to finely lobed

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C. marlothii

Bark flaking in small yellowish papery pieces, many-stemmed shrub or small tree, stems usually entwined, leaves greyish-green, leaflets narrowly elliptic to narrowly ovate, margins usually entire, rarely finely crenate-serrate:

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Branchlets and leaves glabrous (or with a few scattered short hairs in the case of *C. harveyi*):

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Leaves impari-pinnate or trifoliolate with relatively large leaflets and the petiole usually much longer than 2 cm, trees with a single long trunk or many-stemmed:
Branchlets and leaves with a few scattered short hairs, bark usually peeling in large brown papery pieces:

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C. harveyi

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Branchlets and leaves glabrous, bark not peeling or peeling in white papery pieces:
Leaves trifoliolate or impari-pinnate, petiole slender, terminal leaflet isobilateral and with hesperidin crystals, bark usually peeling in large white papery pieces to expose a glaucous underlayer:

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C. tenuipetiolata

Leaves only impari-pinnate, petiole not slender, terminal leaflet dorsivenetral and without hesperidin crystals:

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Branchlets and leaves with a few scattered short hairs, leaflet-margins entire or upper half finely rugose:

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C. woodii

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Leaves trifoliolate with relatively small leaflets and the petiole not longer than 2 cm, shrubs with a short trunk branching repeatedly above soil level:
Leaves cordate, orbicular or obovate but without irregular lobes, apex usually emarginate but sometimes obtuse, margins finely lobed:

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C. capensis

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Leaves linear or ovate and usually with irregular lobes, apex acute to obtuse, margins entire or coarsely denticate-serrate:

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C. gracilifrondosa

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Leaves up to 8 cm long, leaflets linear to ovate, margins coarsely denticate-serrate, petiole slender:

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C. pyracanthoides

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Key to the Species Based on all Characteristics

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Leaves simple or trifoliolate with 2 much smaller lateral leaflets:

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C. glandulosa

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Calyx glandular, flowers usually bisexual or female but male flowers rare, fruit subglobose

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C. pyracanthoides

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Leaves impari-pinnate or trifoliolate with the 2 lateral leaflets at least half the size of terminal leaflet:

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C. africana

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Branchlets spine-tipped, leaves trifoliolate, flowers hypogynous:
Branchlets and leaves pilose to tomentose, leaflet-margins isobilateral and without hesperidin crystals:
Bark grey with large black lenticels and peeling off around the stem in yellowish papery strips, small tree with a single main stem, disk in flowers not fluted, petiole yellow and without a sclerenchymatous pericycle

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C. schimperi

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Branchlets and leaves with a few scattered short hairs, leaflet-margins entire or upper half finely crenate-serrate, flowers bisexual or unisexual, fruit subglobose, petiole red and with 4 distinct arms, stems with a sclerenchymatous pericycle

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C. pyracanthoides

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C. mollis

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C. neglecta

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C. edidis

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C. zanzibarica

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C. diander

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C. angolensis

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C. marlothii

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C. harveyi
Leaflets not distinctly paler below and margins crenate-serrate. Flowers perigynous, petals glabrous or outside sparsely pilose, disk reduced and adnate to hypanthium, pseudaril cupular with 2 lobes, many-stemmed shrub ........................................ 14. C. angolensis

Leaves impari-pinnate, lateral leaflets usually much larger than 3.5 × 2 cm, veins on lower surface of leaflets conspicuous raised, petiole with medullary vascular bundles, fruit more than 1.5 cm in diameter: Bark peeling in large yellowish papery pieces, leaves dark green, leaflets obovate to broad elliptic, flowers hypogynous; disk fleshy, pilose, not adnate to calyx or corolla; pseudaril yellow, with 2 long and 2 short arms .................................................. 9. C. marlothii

Bark flaking in small yellowish papery pieces, leaves grayish-green, leaflets narrowly ovate, flowers perigynous; disk much reduced, glabrous, adnate to hypanthium; pseudaril red, cupular with 4 short lobes ................................ 10. C. edulis

Branchlets and leaves glabrous (or with a few scattered short hairs in the case of C. harveyi):

Leaves impari-pinnate or trifoliate with relatively large leaflets and the petiole usually much longer than 2 cm, inforescences relatively long paniculate dichasia cymes or dichasia cymes, trees with a long trunk or many-stemmed trees:

Branchlets and leaves with a few scattered short hairs, bark usually peeling in large brown papery pieces, inforescences with large leaf-like bracts, flowers hypogynous, disk not adnate to calyx or corolla; pseudaril with 4 arms ........................................ 8. C. harveyi

Branchlets and leaves glabrous, bark not peeling or peeling in white papery pieces, inforescences with relatively small bracts, flowers perigynous, disk adnate to hypanthium, pseudaril cupular with 0-2 short lobes:

Leaves trifoliolate or impari-pinnate, petiole slender, bark usually peeling in large white papery pieces to expose a glaucous underlayer, inforescences simple or compound dichasia cymes, pseudaril cupular with 2 lobes of varying length .................. 13. C. tenpeiitala

Leaves only impari-pinnate, petiole not slender, bark not peeling, inforescences paniculate dichasia cymes or paniculate cymes without lobes or with one cyme cupular:

Leaflets oblanceolate to narrowly elliptic, margins entire to finely serrate, petiole with medullary vascular bundles, inforescences very long, pedicels relatively long (4-6 mm); pseudaril cupular, covering the lower 1/3 of putamen, without lobes, margin coarsely crenate ........ 12. C. anazibarica

Leaflets narrowly elliptic to elliptic, margins crenate-serrate, petiole without medullary vascular bundles, inforescences long, pedicels relatively short (less than 1 mm); pseudaril cupular, covering the lower 1/3 of putamen, with 1 short lobe, margin finely crenate 11. C. woodii

Leaves trifoliolate with relatively small leaflets and the petiole not longer than 2 cm, flowers borne singly or in short simple dichasia cymes, shrubs with a short trunk branching repeatedly above soil level:

Leaves up to 8 cm long, flowers with only 4 stamens/staminodes, fruit subglobose to ellipsoid, pseudaril fleshy, cupular with 2 arms ........................................... 16. C. gracilifronsosa

Leaves up to 8 cm long, flowers with 8 stamens/staminodes, fruit ellipsoid and flattened, pseudaril absent:

Leaflets cordate, orbicular or obovate, without irregular lobes, apex usually emarginate but sometimes obtuse, margins finely lobed.... 17. C. capensis

Leaflets cultivate, irregularly lobed, margins entire irrespective of lobes ...................... 18. C. cervifolia

1. Commiphora glandulosa Schinz in Bull. Herb. Boiss. 2,8: 633 (1906); Codd. Mem. Bot. Surv. S. Afr. 26: 86 (1951); Exell & Mendonca in Consup. Fl. Angol. 1,2: 298 (1951); Miller in J. S. Afr. Bot. 18: 38 (1952); Brenen in Kew Bull. 1953: 106 (1953). Syntypes: S.W.A., Ombandja, Schinz 767 (Z!); Ondangau, Schinz s.n. (not seen). Lectotype: Schinz 767 (Z).

Commiphora lagardeae N.E. Br. in Kew Bull. 1909: 99 (1909); Miller in J. S. Afr. Bot. 18: 38 (1952). Type: Botswana, Kwebe Hills, Lagerda 23 (K, holo.). C. seieri Engl. in Bot. Jahrb. 44: 145 (1910); Bot. Jahrb. 48: 480 (1913); Pflanzenfam. 2,19a: 437 (1931). Type: Zamb. Sibenzake, Seiwer 57 (B, holo., K, photo, BM, sketch). C. berberidifolia Engl. in Bot. Jahrb. 48: 480 (1913); Pflanzenfam. ed. 2,19a: 437 (1931). Type: S.W.A., Okahandja, Walda, Unter 385 (B, holo.). K. fragment

C. pyracanthoides subsp. glandulosa (Schinz) Wild in Bol. Soc. Brot. 23: 43 (1959); Fl. Zamb. 2,1: 268 (1963). Von Breitenbach, Ind. Trees S. Afr. 3,2: 433 (1965); Pflanzenfam. ed. 2,19a: 437 (1931). Type: S.W.A., Okahandja, Waldau, photo!; BM, sketch). C. capensis

Polygamous or dioecious tree up to 8 m tall with a single main stem; bark purple-grey to green, flaking in yellowish papery pieces to expose a green underlayer; branchlets spine-tipped. Leaves simple or trifoliolate, up to 6.3 cm long, with long glandular hairs especially at base of laminae; petiole up to 3 mm long, with long glandular hairs at distal end; petiololes less than 1 mm long; terminal leaflet up to 3 cm, narrowly obovate to broadly obovate, rarely elliptic, apex acute or obtuse, base cuneate, margins finely crenate-serrate, rarely entire; lateral leaflets up to 1.5 × 0.8 cm, elliptic: Flowers subsessile, bisexual or unisexual but male flowers rare, hypogynous, appearing before the leaves in axillary clusters on side shoots or spines, in some cases reduced dichasia cymes up to 1.5 cm long; bisexual and male flowers, 6-8 mm, larger than female flowers, 4.5-5.5 mm. Bracteoles up to 1 mm long, lanceolate, with numerous glandular hairs. Pedicels usually less than 1 mm long, with numerous glandular hairs. Calyx campanulate, green to red. 2-3.5 mm long, with numerous long glandular hairs, lobes less than 1 mm long, apex acute. Petals yellowish green to red, 4-6 mm long, without glandular hairs. Disk fleshy, not adnate to calyx or corolla, cylindrical with 4 prominent lobes, indentations between lobes shallow, lobes bifid. Stamens 8, 4 long stamens up to 4.5 mm long, inserted high up on the outside of disk lobes, 4 short stamens up to 3 mm long, inserted on the outside of disk between lobes; filaments subterete, lower part flattened and broadened; staminodes in female flowers. Gynoeceum rudimentary in male flowers; ovary superior; style variable in length; stigma obscurely 4-lobed. Fruit 1.1 × 1 cm, subglobose, slightly flattened, asymmetrical; exocarp glabrous; mesocarp fleshy; putamen 7 × 5 mm, ellipsoidal, asymmetrical with one face more convex than the other, rugose; pseudaril red, fleshy, with 4
arms of equal length reaching almost to apex of putamen, margins of arms irregular, arm on more convex face of putamen slightly broader than arm on the other face. Fig 1–7.

Fig. 1.—Commiphora glandulosa near Waterpoort, northern Transvaal (height ±4 m).

Fig. 2.—Close-up view of the trunk of Commiphora glandulosa illustrating the bark flaking off in small papery pieces.

Fig. 3.—Commiphora glandulosa: A, branchlet with flowers and young fruits; B—E, leaves; F, branchlet with leaves and mature fruits.

Fig. 4.—Flowers of Commiphora glandulosa: A, bisexual flower; B, bisexual flower with calyx and corolla partly removed; C, diagrammatic representation of two disc lobes illustrating the insertion of the filaments; D, female flower; E, female flower with the calyx and corolla partly removed.
Distinctive anatomical features of the stems and leaves

Young stems with a few glandular hairs especially near apex. Stems of 2.5 cm diameter: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 1-2 layers of cells with slightly thickened walls. Leaves with relatively long glandular hairs; petiole semi-circular as seen in transverse section, sclerenchymatous pericycle absent, vascular bundles triangularly distributed as seen in transverse section; terminal leaflet typically dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy parenchyma, bulliform cells confined to adaxial epidermis; stomata mainly abaxial.
Diagnostic features

Polygamous or dioecious tree with a single main stem; bark purple-grey to green, flaking in yellowish papery pieces to expose a green underlayer; branchlets spine-tipped. Leaves simple or trifoliate with 2 small lateral leaflets, with long glandular hairs at base of laminae and distal end of petiole, terminal leaflet typically dorsiventral. Flowers subsessile; hypogynous; bisexual or unisexual but male flowers rare; calyx with numerous long glandular hairs; disc lobes 4, bilid. Fruit subglobose; putamen rugose; pseudaril red with 4 arms of equal length reaching almost to apex of putamen.

Widely distributed in northern Zululand, northern, far-northern and north-eastern Transvaal, but is particularly common north of the Soutpansberg. Also collected in the northern Cape. Usually grows in sandy, well-drained soil in areas with a relatively low annual rainfall, and occurs in savanna-woodland or in broken mopaneveld.

Also recorded from South West Africa. Botswana, Rhodesia, Zambia, Mozambique and Angola.

Transvaal.—2229(Waterpoort): Dongola (—BC), Pole-Evans 4450; Verdoorn 2297; 2325; Soutpans (—CD), Obermeyer, Schweickerd & Verdoorn 159; near Mopane (—DB), Strey 3501; 8 km E. of Waterpoort (—DC), Van der Walt 20; Willies-poort (—DD), Story 1857. 2230(Messina): near Messina (—CC), Häfström & Aneeck 1882; Rogers, 18475; Tshibise (—CA), Van der Schiiff 5238 (PRU); Van der Walt 3; 29 km E. of Tshibise (—CB), Van der Schiiff 5239. 2231(Pafuri): 7 km N.E. of Punda Milia (—CA), Codd & Dyer 4569. 2327(Ellisras): 16 km S.S.E. of Ellisras (—DD), Van der Walt 108. 2329(Baltimore); 32 km N.W. of Melkrivier (—CD), Van der Walt 47; near Sterkwater (—DD), Van der Walt 51. 2329(Piersburg): near Vico (—AB), Strey 3518. 2331(Phalaborwa): Shingwidzi Rest Camp (—BA), Codd 4652; Gorge Rest Camp (—DD), Van der Schiiff 839. 2427(Thabazimba): 50 km S. of Ellisras, (—BA), Van der Walt 54; 40 km N.N.W. of Vaalwater (—BB) Smuts 532; 22 km S.E. of Bulge River (—BB), Van der Walt 52; W. of Kranzberg (—CB), Codd 4422; Galpin 13377; 35 km N.W. of Northam (—CC), Van der Walt 74. 2429(Zedebiela): 13 km S.S.E. of Roedtan (—CA), Meeuse 9497. 2431(Acornhoek); near Olifants Rest Camp (—BA), Codd 4290; near Satara Rest Camp (—BD), Van der Schiiff 3497. 2527(Rustenburg): S. of Pilanesberg (—AC), Codd 1107; at confluence of Crocodile and Pienaars Rivers (—BA), Codd 9839. 2529(Witbank; Loskop-dam Nature Reserve (—AD), Codd 10365; Van der Walt 14.

Natal.—2632(Bela Vista): Nduvo Game Reserve (—CC), Gerstner 3148; Tinley 577; Van der Walt 99; 102. 2831(Eshowe): Umfolozi Game Reserve (—BD), Feely 55; Ward 4061 (NH).

Cape.—2724(Taung): River Valley at Tierkloof (—BA), Brueckner.

Wild (1959b) considers this taxon as a subspecies of C. pyracanthoides Engl. This taxonomic change by Wild is based mainly on observations made by Merxmüller in South West Africa where C. glandulosa occurs in tree and shrub form. However, the flower, and fruit structure of these two taxa differ to such an extent that they should be considered as different species.

This species is easily grown from pole cuttings which are often planted as fencing poles.

Common names: Corkwood ("Kurkhout") and "Kannedood".

2. Commiphora pyracanthoides Engl. in Bot. Jahrb. 26: 368 (1899); Bot. Jahrb. 48: 481 (1913); Pflanzenfam. ed. 2,19a: 437 (1931); Burtt Davy, Fl. Transv. 2: 485 (1932); Miller in J.S. Afr. Bot. 18: 38 (1952); Brenan in Kew Bull. 1953: 104 (1953); Wild in Bot. Soc. Brot. 2,33: 43, 82 (1959); White, For. Fl. N. Rhod.: 176, t. 34A (1962); Wild in Fl. Zam. 2,1: 268 (1963); Von Breitenbach, Ind. Trees S. Afr. 3,2: 432 (1965); De Wint in Trees S. Afr. 20,1: 16 (1968); Merxm., Prod. Fl. S.W. Afr. 23: 8 (1968). Type: S.W.A., Ojtjimbingwe, Fischer 8 (holo: K; ?); Neotype: S.W.A., Little Karas Mountains, Holoog, Pearson 9747 (K!).

Diocious or polygamous many-stemmed shrub up to 3 m tall; bark yellow to green, flaking in yellowish papery pieces to expose a green underlayer; branchlets spine-tipped. Leaves simple or trifoliate up to 4,5 cm long, with long glandular hairs especially at base of laminae; petiole up to 3 mm long, with long glandular hairs at distal end; petiologies less than 1 mm long; terminal leaflet up to 4x2 cm, narrowly obovate to broadly obovate, rarely elliptic, apex acute to obtuse, base cuneate, margins finely crenate-serrate, in some cases entire; lateral leaflets 2x1 cm, elliptic. Flowers subsessile, predominantly unisexual, rarely bisexual, hypogynous, appearing before the leaves in axillary clusters on side shoots or spines, in some cases in reduced dichasial cymes up to 1,5 cm long; male and bisexual flowers, 8-10 mm, larger than female flowers, 3,5-5 mm. Bracteoles up to 2 mm long, lanceolate, with a few glandular hairs. Pedicels up to 1,5 mm long, without glandular hairs. Calyx campanulate, green to red, 2-4 mm long, without glandular hairs, lobes up to 1 mm long, apex acute. Petals yellowish green to red, 3-7 mm long, without glandular hairs. Disk fleshy, cylindrical, not adnate to calyx or corolla, folded to form 4 large lobes towards the outside, indentations between lobes shallow, lobes not bید, inside of lobes deeply grooved; disk of female and bisexual flowers smaller and less fleshy than those of male flowers but the lobes in some cases bifid. Stamens 8, 4 long stamens up to 4 mm long, inserted high up on the outside of lobes, 4 short stamens up to 3 mm long, filaments suberete, lower part flattened and broadened; staminodes in female flowers. Gynoeicum: rudimentary in male flowers; ovary superior; style relatively long; stigma 4-lobed. Fruit 1,2x0,8 cm, ellipsoid, irregularly flattened, asymmetrical, apiculate; exocarp glabrous; mesocarp relatively thin; putamen 8x6 mm, ellipsoid, asymmetrical with one face more convex than the other, rugose; pseudaril red, not very fleshy, with 4 arms and isolated fragments on putamen, arms of equal length reaching almost to apex of putamen, margins of arms irregular, arm on more convex face of putamen broader than arm on the other face. FIG. 8-13.
Fig. 8.—*Commiphora pyracanthoides* near Waterpoort, northern Transvaal (height ± 1.5 m).

Fig. 9.—Close-up view of a branch of *Commiphora pyracanthoides* illustrating the bark flaking in small papery pieces.

Fig. 10.—*Commiphora pyracanthoides*: A, branchlet with flowers; B, C, leaves; D, branchlet with leaves and mature fruits.

Fig. 11.—Geographical distribution of *Commiphora pyracanthoides* in South Africa.
Distinctive anatomical features of the stems and leaves

Young stems with a few glandular hairs especially near apex. Stems of 2.5 cm diameter: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 1–2 layers of cells with slightly thickened walls. Leaves with relatively long glandular hairs; petiole semi-circular as seen in transverse section, sclerenchymatous pericycle present or absent, vascular bundles triangularly distributed as seen in transverse section; terminal leaflet dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy or palisade-like cells, bulliform cells confined to adaxial epidermis, stomata mainly abaxial.

Diagnostic features

Dioecious or polygamous many stemmed shrub; bark yellow to green, flaking in yellowish papery pieces to expose a green underlayer; branchlets spine-tipped. Leaves simple or trifoliolate with 2 small lateral leaflets, with long glandular hairs at base of laminae and distal end of petiole, terminal leaflet dorsiventral. Flowers sub sessile; hypogynous; predominantly unisexual, rarely bisexual; calyx glabrous; disk folded to form 4 large lobes towards the outside, lobes in male flowers not bifid but in female and bisexual flowers bifid. Fruit ellipsoid; apiculate; putamen rugose; pseudaril red, with 4 arms of equal length reaching almost to apex of putamen. Widely distributed in northern Zululand, north-western, northern, far-northern and north-eastern Transvaal, but is particularly common north of the Soutpansberg. Also collected in northern Cape. Usually grows in sandy, well-drained soil in areas with a relatively low annual rainfall, and occurs in savanna-woodland, broken mopaniveld and shrub-thornveld. Also recorded from Swaziland, South West Africa, Botswana, Rhodesia and Mozambique.

Transvaal—2229(Waterpoort): Dongola (-BC), Dyer 4314; 4300; Verdoorn 2336; 16 km N.E. of Alladays (-CA), Van der Walt 63; Soutpan (-CD), Obermeyer, Schlecker & Verdoorn 48; 8 km E. of Waterpoort (-DC), Van der Walt 10, 2230 (Messaia): near Messina (-AC), Dyer 4324; 48 km N.E. of Tsipise (-BC), Van der Schijff 5241; Tsipise (-CA), Van der Schijff 5217. 2231(Pafuri): near Klipperfontein (-AC), Van der Schijff 1861; 21 km N.E. of Punda Milia Rest Camp (-CA), Codd & Dyer 4578. 2327(Ellisras): 8 km N.E. of Ellisras (-DB), Van der Walt 57; 10 km S.E. of Ellisras (-DD), Van der Walt 119; 120. 2328(Baltimore): 16 km S. of Marmitz (-AC), Van der Walt 58. 2329(Pietersburg): 5 km S. of Bandelierkop (-BD), Gerstner 5576; 3 km N.E. of Kalkbank (-CB), Story 1562. 23214(Phalaborwa): 5 km S. of Shingwitzi Rest Camp (-AB), Van der Walt 76, 2428(Mochudi): 5 km S.E. of Rooibokkraal (-BB), Leister 3167. 2427(Thabazimbi): 13 km E.N.E. of Rooibokkraal (-AA), Van der Walt 26, 2428(Nylstroom): 5 km N. of Tuinplaats (-DD), Strey 1373. 2429(Zebediela): near Immerman (-CB), Meese 4948; 9 km N.W. of Marble Hall (-CD), Codd 10537, 2430(Pilgrim's Rest): 2 km N. of Oristad (-DA). Codd 6733. 2531(Arocks): 11 km N.W. of Candover (-BD), Arocks 13128; Ward 3697 (NH). 2831(Eshowe): Umfolozi Game Reserve (-BD), Leibnitz, Fakude & Runcov 10; Van der Walt 88.

Cape—2725(Bloemhof): near Schweizer-Reneke (-AB) Van Wyk 14.
Brenan (1953) stated that the type specimen (Fischer 8) could not be traced. Pearson 9747 was chosen by him as the neotype because this specimen was sent to Berlin in 1929 where it was compared with material which Engler himself designated as C. pyracanthoides.

3. Commiphora merkeri Engl. in Bot. Jahrb. 44: 144 (1910); Bot. Jahrb. 48: 480 (1913); Pflanzenfam. ed. 2,19a: 437 (1931); Burtt in Kew Bull. 1935: 110 (1935); Wild in Bol. Soc. Brot. 2,33: 82 (1959); Dale & Greenway, Kenya Trees 89 (1961); Wild in Fl. Zamb. 2,1: 269 (1963); Von Breitenbach, Ind. Trees S. Afr. 3,2: 431 (1965); De Wint. in Trees S. Afr. 20,1: 12 (1968). Type: Tanzania, Nguruka, Merker 565 (B. holo.; K, fragment!).

Commiphora viminea Burtt Davy, Fl. Transv. 2: 485 (1932); Codd, Mem. Bot. Surv. S. Afr. 26: 88 (1951); Brenan in Kew Bull. 1953: 104 (1953). Type: Transvaal, Messina, Moss & Rogers 184b (K, holo.).

Dioecious small tree up to 5 m tall; bark grey with large black lenticels, peeling off around the stems in yellowish papery strips; branchlets spine-tipped. Leaves simple or trifoliolate, glaucous, up to 5 cm long, with long glandular hairs especially at base of laminae; petiole up to 5 mm long, with long glandular hairs at distal end; petiolules less than 1 mm long; terminal leaflet up to 4.5x2.5 cm, narrowly obovate to obovate or elliptic, apex acute to obtuse, base cuneate, margins crenate-serrate especially near apex; lateral leaflets up to 7x5 mm, elliptic. Flowers unisexual, hypogynous, appearing before the leaves or with the young leaves in axillary clusters on side shoots or spines; male flowers, 10–12 mm, usually much larger than female flowers, 5–6 mm. Bracteoles up to 1 mm long, ± triangular, with a few long glandular hairs. Pedicels 2–7 mm long, without glandular hairs. Calyx campanulate, yellowish green to brown, 2–3 mm long, without glandular hairs, lobes usually less than 1 mm long, apex acute. Petals yellowish green 3–5.5 mm long, without glandular hairs. Disk cylindrical, not adnate to calyx or corolla; in male flowers very fleshy with 4 prominent lobes, indentation between lobes shallow, lobes not bifid, outside of lobes deeply grooved and inside shallowly grooved; disk in female flowers smaller. Stamens 8, 4 long stamens up to 5 mm long, inserted halfway up on the outside of lobes; 4 short stamens up to 3.5 mm long, inserted on the outside of disk between lobes; filaments subterete, lower part flattened and broadened, lower part of 4 long filaments placed in grooves of lobes; staminodes in female flowers. Gynoecium: rudimentary in male flowers; ovary superior; style long causing stigma to protrude above petals; stigma obscurely 4-lobed. Fruit 1.3x0.7 cm, ellipsoid, slightly flattened, asymmetrical, very apiculate; exocarp glabrous; mesocarp relatively thin; putamen 8x5 mm, ellipsoid, asymmetrically and irregularly flattened, rugose; pseudaril yellow, covering the whole putamen except the apex, forming a prominent ridge on small face of putamen. Fig. 14–19.

Fig. 14.—Commiphora merkeri near Waterpoort, northern Transvaal (height ±2.5 m).
Fig. 15.—Close-up view of a branch of Commiphora merkeri illustrating the large lenticels and bark peeling off around the stem in papery strips.

Fig. 16.—Commiphora merkeri: A, branchlet with leaves and flowers; B & C, leaves; D, branchlet with leaves and a mature fruit.

Fig. 17.—Flowers of Commiphora merkeri: A, male flower; B, longitudinal section of male flower; C, diagrammatic representation of two disc lobes illustrating the insertion of the filaments; D, female flower; E, female flower with the calyx and corolla partly removed.

Fig. 18.—Fruit of Commiphora merkeri: A, side-view of the fruit; B, view of the less convex face of putamen with pseudaril; C, view of the more convex face of putamen and pseudaril as seen from above.
The stems often exude large quantities of gum-resin. Common name: Zebra Tree.

4. Commiphora schimperi (O. Berg) Engl. in A.D.C., Monogr. Phan. 4: 14 (1883); Schweinf. in Bull. Herb. Boiss. 7, 2: 288 (1899); Engl. in Bot. Jahrb. 48: 477, t.2N (1913); Pflanzenfam. ed. 2,19a: 435, t.204 C–D (1931); Burtt in Kew Bull 1935: 110 (1935); Wild in Bot. Soc. Brot. 2,33: 88 (1959); Dale & Greenway, Kenya Trees 80 (1961); Wild in Fl. Zamb. 2,1: 277 (1963); Von Breitenbach, Ind. Trees S. Afr. 3,2: 437 (1965); De Wint in Trees S. Afr. 20,1: 16 (1968). Synotypes: Ethiopia. Takazze. Schimper 1564 (B+; W!; G!); Schimper 624 (B+; K1); Schoata, Schimper 1139 (B+; W!; G!). Lectotype: Schimper 624 (K).

Balsamendrum schimperi O. Berg in Bot. Ztg. 20: 162 (1862) B. africanum sensu Oliv., Fl. Trop. Afr. 1: 325 (1868), pro parte quoad specim. Schimper.

Balsamea schimperi(O. Berg) Engl. in Bot. Jahrb. 1: 41 (1881).

Commiphora betschuanica Engl. in Bot. Jahrb. 44: 149 (1910); Bot. Jahrb. 48: 478 (1913); Pflanzenfam. ed. 2,19a: 435 (1931); Burtt Davy, Fl. Transv. 2: 484 (1932); Codd. Mem. Bot. Surv. Afr. 26: 85 (1951); Miller in J.S. Afr. Bot. 18: 38 (1952). Type: Botswana. Mugunne, Seiner 64 (B, holo+; K, fragment!; BM, sketch!).

Shrub or small tree 2–6 m tall; bark peeling in black discs or flaking in small yellowish papery pieces to expose a green underlayer; branchlets spine-tipped, glabrous. Leaves trifoliolate, glabrous; petiole up to 2,5 cm long; petioles up to 2,8 cm long; petiolules 1–2 mm long; leaflet up to 5x3,5 cm; lateral leaflets 1–2,5x2,2 cm. Flowers hypogynous; unisexual: calyx glabrous; disk lobes less than 0,5 mm long, apex acute or obtuse. Pedicels 1–2 mm long, with a few glandular hairs. Calyx campanulate, green to red. 3–4 mm long, glabrous, lobes less than 0,5 mm long, apex acute or obtuse. Petals yellow to pink, 6–7 mm long, glabrous. Disk fleshy, not adnate to calyx or corolla, cylindrical with 4 lobes, indentation between lobes shallow, lobes in some cases bifid. Stamens 4, 4 long stamens up to 4,5 mm, inserted on the outside of disk lobes; filaments slightly flattened, lower part broadened. Gynoecium: ovary superior; style relatively long; stigma 4-lobed. Fruit 1,7×1 cm, ellipsoid, asymmetrically and irregularly flattened, very apiculate, apex curved; exocarp rugose and glabrous; mesocarp fleshy; putamen 1,1×0,7 cm, ellipsoid, asymmetrically and irregularly flattened, very rugose, slimy; pseudaril red, membranous, covering almost the whole putamen. Fig. 20–26.
Fig. 20—Commiphora schimperi near Ellisras, northern Transvaal (height ±5 m).

Fig. 21, Fig. 22.—Close-up view of different branches of Commiphora schimperi illustrating the bark flaking in papery pieces (Fig. 21) and peeling in thicker discs (Fig. 22).
Distinctive anatomical features of the stems and leaves

Young stems with a few glandular hairs especially near apex. Stems of 2.5 cm diameter: sclerenchymatous pericycle consisting of separate fibre strands but stone cells absent, epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. Leaves with a few glandular hairs; petiole heart-shaped as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± triangularly distributed as seen in transverse section, vascular bundles on adaxial side smaller than bundles on abaxial side; terminal leaflet dorsiventral with a single layer of palisade...
cells adaxially, remaining mesophyll consisting of spongy or palisade-like cells, abaxial epidermis consisting mainly of large bulliform cells but smaller bulliform cells occur in abaxial epidermis, stomata confined to abaxial epidermis.

Diagnostic features

Shrub or small tree; bark peeling in black discs or flaking in small yellowish papery pieces to expose a green underlayer; branchlets spine-tipped. Leaves trifoliolate, glabrous, all leaflets elliptic to broad elliptic, margins coarsely crenate-serrate, terminal leaflet dorsiventral. Flowers hypogynous, only bisexual. Fruit ellipsoid, very apiculate and apex curved; putamen rugose, slimy; pseudaril red, membranous, without distinct arms, covering almost the whole putamen. Widely distributed in central Transvaal, northern Transvaal and Zululand, and occurs in savannah-woodland. Grows in well-drained, sandy soil, usually in areas with a relatively low annual rainfall. Also recorded from Botswana, Rhodesia, Mozambique, Tanzania, Kenya and Ethiopia.

Diagnostic features

Shrub or small tree; bark peeling in black discs or flaking in small yellowish papery pieces to expose a green underlayer; branchlets spine-tipped. Leaves trifoliolate, glabrous, all leaflets elliptic to broad elliptic, margins coarsely crenate-serrate, terminal leaflet dorsiventral. Flowers hypogynous, only bisexual. Fruit ellipsoid, very apiculate and apex curved; putamen rugose, slimy; pseudaril red, membranous, without distinct arms, covering almost the whole putamen. Widely distributed in central Transvaal, northern Transvaal and Zululand, and occurs in savannah-woodland. Grows in well-drained, sandy soil, usually in areas with a relatively low annual rainfall. Also recorded from Botswana, Rhodesia, Mozambique, Tanzania, Kenya and Ethiopia.
fleshy; putamen 1.0 × 0.8 cm, subglobose to ellipsoid, asymmetrically and irregularly flattened, very rugose; pseudaril red, fleshy, with 4 arms of variable size and form and often also isolated fragments, 2 arms on seam of putamen reaching almost to apex, 2 arms on flattened faces of putamen of variable length, in some cases arms not distinct and pseudaril covering almost whole putamen. Fig. 27–32.

Fig. 27.—Commiphora africana near Dendron, northern Transvaal (height ± 1 m).

Fig. 28.—Close-up view of a branch of Commiphora africana illustrating the bark flaking in small papery pieces.

Fig. 29.—Commiphora africana: A, branchlet with flowers; B, C, branchlets with leaves; D, branchlet with leaves and mature fruits.
Distinctive anatomical features of the stems and leaves

Young stems with a variable number of multicellular non-glandular and glandular hairs. Stems of 2.5 cm diameter: sclerenchymatous pericycle consisting of separate fibre strands but stone cells absent, epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. Leaves with a variable number of multicellular non-glandular and glandular hairs; petiole ± triangular as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy or palisade-like cells, bulliform cells confined to adaxial epidermis, stomata mainly abaxial.

Diagnostic features

Dioecious shrub or small tree; bark grey to green, flaking in small yellowish papery pieces to expose a green underlayer; branchlets spine-tipped, pilose to tomentose. Leaves trifoliolate, pilose to tomentose; all leaflets obovate, seldom elliptic, margins coarsely crenate-serrate or finely lobed, terminal leaflet dorsiventral. Flowers hypogynous, unisexual. Fruit subglobose; putamen rugose; pseudaril red, fleshy, with 4 arms of variable size and form and often also isolated fragments. Distributed in northern Zululand, north-western, far-northern, north-eastern and eastern Transvaal, but is particularly common north of the Soutpansberg. Usually grows in sandy, well-drained soil in areas with a relatively low annual rainfall. Occurs in shrub-thornveld, savanna-woodland or in broken mopaneveld. Also recorded from Swaziland, the northern and central parts of South West Africa, Botswana, Rhodesia, Mozambique, Zambia, Malawi, Angola, Tanzania, Kenya, Ethiopia, Uganda, Sudan, Gambia, Senegal, Nigeria, Mauritania, Mali, Ghana, Togo, Niger, Zaire and Rwanda.

Transvaal.—2228(Maasstroom): 15 km S.W. of Swartwater (-CC), Meeuse 1057; 2229(Waterpoort): Dongola (-BB), Verdoorn 2239; N. of Soutpan (-CC), Obermeyer, Schweckardt & Verdoorn 180. 2230(Messina): 30 km N.E. of Tshipise (-AD), Van der Schijff 3237; Tshipise (-CA), Van der Schijff
Richard (1832) described Heudelotia africana as the type species of this genus. In his description it is mentioned that the flowers are bisexual. An illustration of Dale & Greenway (1961) also indicates that the flower of Commiphora africana is bisexual. The staminodes of the female flowers investigated, although relatively long, are always sterile.

Wild (1963) distinguishes the var. africana and var. rubriflora (Engl.) Wild. The calyx and pedicels of the var. rubriflora are hairy, while those of the var. africana are glabrous. As far as could be determined, only var. africana occurs in South Africa.

Wild (1963) mentions that the pseudaril of Commiphora africana is apparently absent. However, all the fruits of this species studied possess a fleshy pseudaril. According to Irvine (1961) the gumresin is used by the natives for perfuming and fumigating huts. He also mentions that it has several medicinal uses, and it is also used as a varnish. The species is easily grown from pole cuttings which are often planted as fencing poles. Common name: African bdellium.

6. Commiphora neglecta Verdoorn in Bothalia 6,1: 214 (1951); Codd, Mem. Bot. Surv. S. Afr. 26: 88 (1951); Wild in Bol. Soc. Brot. 23,3: 86 (1959);

Wild in Fl. Zamb. 2,1: 271 (1963); Von Breitenbach, Ind. Trees S. Afr. 3,2: 438 (1965); Moll. For. Trees Natal 80 (1967): De Wint in Trees S. Afr. 20,1: 16 (1968). Type: Transvaal, Skukuza, Codd & Verdoorn 5498 (PRE, holo.).

Polygamous or dioecious many-stemmed shrub or small tree with a single main stem up to 8 m tall; bark grey to green, smooth or flaking in small yellowish papery pieces; branchlets spine-tipped and with a few short hairs. Leaves trifoliolate, with a few short hairs; lamina up to 7 cm long; petiole up to 4.5 cm long; petiolules usually less than 1 mm long; leaflets elliptic or ovate to broadly ovate, apex acute, base cuneate, margins entire or upper half finely crenate-serrate; terminal leaflet up to 4.4 x 2.8 cm, lateral leaflets up to 3 x 2.2 cm. Flowers bisexual or unisexual but male flowers rare, hypogynous, appearing before or with the leaves in axillary dichasial cymes up to 1.2 cm long or in clusters, usually on spines; peduncles usually with a few short hairs; bisexual and male flowers, 7-8 mm, usually slightly larger than female flowers, 6-7 mm. Bracteoles up to 3.5 mm long, lanceolate, with variable number of short hairs. Pedicels 2-5 mm long, often with a few short hairs. Calyx campanulate, yellow to green, 2-3 mm long, often with a few short hairs, lobes up to 1 mm long, apex acute to obtuse. Petals yellow to green, 3-5 mm long, glabrous. Disk fleshy, not adnate to calyx or corolla, cylindrical with 4 lobes, indentation between lobes shallow, lobes of bisexual and male flowers not bifid but in female flowers bifid. Stamens 8, 4 long stamens up to 4 mm long, inserted high up on the outside of disk lobes, 4 short stamens up to 2.8 mm long, inserted on the outside of disk between lobes; filaments subterete, lower part flattened and broadened; staminodes in female flowers. Gynoecium: rudimentary in male flowers; ovary superior; style relatively short; stigma obscurely 4-lobed. Fruit 1.5 x 1.4 cm, subglobose, slightly

Fig. 33.—Commiphora neglecta in the Umfolozi Game Reserve, Zululand (height 3 m).
flattened and asymmetrical; exocarp glabrous; mesocarp fleshy; putamen $8 \times 7$ mm, ellipsoid, asymmetrically and irregularly flattened, smooth; pseudaril red, very fleshy, with 4 arms. 2 arms on seam of putamen reaching almost to apex, 2 arms on flattened faces of putamen shorter and of equal length, but arm on more convex face usually broader than arm on other face. Fig. 33–38.

Fig. 34.—Close-up view of a branch of Commiphora neglecta illustrating the bark flaking in papery pieces.

Fig. 35.—Commiphora neglecta: A, branchlet with young leaves and flowers; B, branchlet with leaves; C, branchlet with leaves and mature fruits.

Fig. 36.—Flowers of Commiphora neglecta: A, bisexual flower B, bisexual flower with the calyx and corolla partly removed; C, diagrammatic representation of two disc lobes illustrating the insertion of the filaments; D, female flower; E, female flower with the calyx and corolla partly removed.

Fig. 37.—Fruit of Commiphora neglecta: A, side-view of the fruit; B, view of the less convex face of putamen with pseudaril; C, view of the more convex face of putamen with pseudaril; D, putamen and pseudaril as seen from above.
Distinctive anatomical features of the stems and leaves

Young stems with a few short non-glandular hairs (mostly unicellular) and glandular hairs. Stems of 2.5 cm diameter: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 1 layer of cells with slightly thickened walls.

Diagnostic features

Polygamous or dioecious many-stemmed shrub or small tree; bark grey to green, smooth or flaking in stems of 10 cm diameter; sclerenchymatous pericycle-pre­sent, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet isobilateral with a single layer of long palisade cells adaxially and a single layer of shorter palisade cells abaxially, remaining mesophyll consisting of spongy or palisade-like cells, adaxial epidermis consisting mainly of large bulliform cells but smaller bulliform cells occur in adaxial epidermis, stomata mainly abaxial.

As Verdoorn (1951) mentions, this species differs in the particular combination of characters rather than in any outstanding characteristics. This is probably the reason why it was described in 1951 for the first time. Although plants in the veld only develop trifoliotate leaves, it has been observed that leaves of pole cuttings can be impari-pinnate with two pairs of lateral leaflets.
Lectotype: Böhm 281 (K, fragment). *C. ndemfi* Engl. in Bot. Jahrb. 54: 293 (1917); Pflanzenfam. ed. 2,19a: 435 (1931). Type: Tanzania, Urambo, Stolz 1678 (B, holo.; K!; Z!; P.!). Lectotype: Stolz 1678 (K).

Dioecious tree with a rounded spreading crown up to 8 m tall, trunk often irregularly fluted or with large knobbly outgrowths; bark brown to greyish-green, peeling in discs with an average diameter of 2.5 cm; branchlets pilose to pubescent. *Leaves* impari-pinnate but in some cases trifoliolate: grey to green, pilose to tomentose, often distinctly paler and tomentose below; lamina up to 10 cm long; petiolule up to 2.5 cm; petiolules up to 3 mm long; leaflets 1–6-jugate, oblong-elliptic to elliptic or obovate, apex acute to obtuse rarely emarginate, base cuneate to broadly cuneate, margins entire; terminal leaflet up to 5.2 × 3.6 cm; lateral leaflets up to 3.2 × 1.7 cm. *Flowers* unisexual, hypogynous, appearing before or with the leaves, male inflorescences usually axillary compound dichasial cymes up to 4 cm long, female inflorescences usually axillary simple dichasial cymes up to 2 cm long, branches of inflorescences pilose to pubescent; male flowers, 8–12 mm, usually larger than female flowers, 4–7 mm. *Bracteoles* up to 5 mm long, linear, pilose to pubescent. *Pedicels* 3–8 mm long, pilose to pubescent. *Calyx* campanulate, green to red, 2–3 mm long, pilose to pubescent, lobes 1–2 mm long, apex acute. *Petals* green to red, 3–6 mm long, pilose to pubescent on outside. *Disk* fleshy, not adnate to calyx or corolla, cylindrical with 4 prominent lobes, lobes bifid, indentation between lobes deep; disk in female flowers smaller than in male flowers. *Stamens* 8, 4 long stamens up to 5 mm long, inserted high up on outside of disk lobes, 4 short stamens up to 2.5 mm long, inserted on outside of disk between lobes; filaments subterete, lower part flattened and broadened; staminodes in female flowers. *Gynoecium* rudimentary in male flowers; ovary superior; style relatively short; stigma obscurely 4-lobed. *Fruit* 1.3 × 1.2 cm, subglobose, slightly flattened, asymmetrical; exocarp pilose to pubescent; mesocarp fleshy; putamen 1.0 × 0.8 cm, ellipsoid, asymmetrically and irregularly flattened, smooth; pseudaril bright red, fleshy, with 4 winged arms, 2 arms on seam of putamen reaching almost to apex, 2 arms on flattened faces shorter than arms on seam, arm on more convex face of putamen longer than arm on other face. Fig. 39–44.
Fig. 40.—Close-up view of the trunk of *Commiphora mollis* illustrating the knobly outgrowths and the bark peeling in thick discs.

Fig. 42.—Flowers of *Commiphora mollis*: A, male flower; B, longitudinal section of male flower; C, diagrammatic representation of two disc lobes illustrating the insertion of the filaments; D, female flower; E, female flower with the calyx and corolla partly removed.

Fig. 41.—*Commiphora mollis*: A, branchlet with young leaves and flowers; B—D, leaves; E, branchlet with leaves and mature fruits.

Fig. 43.—Fruit of *Commiphora mollis*: A, side-view of the fruit; B, view of the less convex face of putamen with pseudaril; C, view of the more convex face of putamen with pseudaril; D, putamen and pseudaril as seen from above.
Messina (- AC), Gerstner 5713; Tshipise (- CA), Van der Schaff 5202; Van der Walt 7; 2231(Pafuri); Punda Maria Rest Camp (- CA), Codd & Dyer 4612; Van der Walt 77; 19 km S.E. of Punda Maria Rest Camp (- CC), Codd & Dyer 4589; 2328 (Baltimore); Marnitz (- AA), Van der Walt 59; N. of Blaauwberg (- BB); Obermeyer, Schweickhardt & Verdoorn 93; 32 km N/W of Melkrivier (- CD), Van der Walt 45; near Sterkwater (- DD), Codd 6571; Van der Walt 30. 2229(Pietersburg); 13 km S.E. of Dendron (- AB), Van der Walt 18; 5 km S. of Bandeleroep (- BD), Obermeyer, Gerstner & Verdoorn 5575. 2320(Tranceen); Modderpoort Reserve (- DA), Krige 7. 2427(Thabazimbi; Sentrum (- AD), Vahnriuweiler 1370; 30 km S. of Ellisras (- BA), Van der Walt 53; 32 km N.E. of Thabazimbi (- BC), Codd 3726. 2429(Zebesieda); Chernopsoort (- AD), De Winter 2228. 2430(Pilgrim’s Rest); 27 km S.E. of Gravelotte (- BB), Codd & de Winter 3710; Abel Erasmus Pass (- BD), Strey 3636; 8 km S. of Buffelsvlei (- DD), Codd 6677. 2431(Acornhoek); Skukuza Rest Camp (- DC), Letty 58; Van der Schaff 745; 6 km S. of Skukuza Rest Camp, Van der Schaff 867. 2528(Pretoria); 1 km N. of Pienaarsrivier (- AB), Codd 3709A. 2513(Komatipoort); Numbi (- AA), Van der Schaff 3439; Krocodilepoort near Baberton (- CB), Gaplin 1077.

The variation in hairiness of the young stems and leaves, as well as the variation in the form and size of the leaflets, can account for the many synonyms. This species is easily grown from pole cuttings which are often planted as fencing poles. The young branches are grazed by cattle and game.

Common name: “Ghor-Ghor”.

8. Commiphora harveyi (Engl.) Engl. in A. DC., Monogr. Phan. 4: 25 (1883); Bot. Jahrb. 48: 476, t. 2J (1913); Pflanzenfam. ed. 2,19a: 435 (1931); Burtt Davy, Fl. Transv. 2: 484 (1932); Henkel, Woody Pl. Natal 213 (1934); Wild in Bot. Soc. Brot. 2,33: 85 (1959); Von Breitenbach, Ind. Trees S. Afr. 3,2; 442 (1965); Moll, For. Trees Natal 79 (1967); De Wint. in Trees S. Afr. 20,1: 12 (1968). Type: Natal Durban, Gerrard & McKen 689 (TCD, holo. !; K!).

Protium africanum Harv. in Fl. Cap. 2: 982 (1862); Swart, Monog. Protium 393 (1942).

Balsamea harveyi Engl. in Bot. Jahrb. 1: 42 (1881).

Diococious tree from 4 m up to 18 m tall; bark peeling in large brown papery pieces or in thick, crusted discs; branchlets fluted and with a few short hairs. Leaves impari-pinnate, or occasionally trifoliolate, with a few short hairs; lamina up to 15 cm long; petiole up to 6 cm long; petiolules up to 1,5 cm long; leaflets 1–3-jugate, lanceolate to elliptic or ovate, apex acute, base cuneate, margins crenate-serrate to coarsely crenate-serrate; terminal leaflet up to 8 × 2,5 cm; lateral leaflets up to 6 × 2,5 cm. Flowers unisexual, hypogynous, appearing after the leaves in axillary paniculate cymes up to 10 cm long, male inflorescences usually longer than female inflorescences, peduncles with a few short hairs and conspicuous leaf-like bracts up to 6 mm; male flowers, 5–7 mm, usually larger than female flowers, 4–5,5 mm. Bracteoles linear, up to 3 mm long, with a few short hairs. Pedicels 2–3 mm long, usually with a few short hairs. Calyx campanulate, yellowish green, 2–3 mm long, sometimes with a few short hairs, lobes 1–1,8 mm long, apex acute. Petals yellowish green, 2,5–4 mm long, without hairs. Disk fleshy, not adnate to calyx and corolla, cylindrical, with 4 lobes, indentation between lobes not very deep, lobes in male flowers not bifid but in female flowers bifid. Stamens 8, 4 long stamens up to 4 mm long, inserted high up on outside of disk lobes, 4 short stamens up to 2,5 mm long, inserted on outside of disk between lobes; filaments slightly flattened, lower part broadened; staminodes in female flowers.

Distinctive features of the stems and leaves

Young stems with a variable number but usually many multicellular non-glandular and glandular hairs, hypodermis consisting mainly of secretory cells. Stems of 2.5 cm diameter: sclerenchymatous pericycle consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 1 layer of cells with slightly thickened walls. Leaves with a variable number but usually many multicellular non-glandular and glandular hairs; petiole ± triangular as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy or palisade-like cells, bulliform cells confined to adaxial epidermis, stomata mainly abaxial.

Diagnostic features

Diococious tree, trunk often irregularly fluted; bark brown to greyish-green, peeling in discs with an average diameter of 2.5 cm; branchlets pubescent to pilose. Leaves impari-pinnate but sometimes trifoliolate, pilose to tomentose, leaflets 1–6-jugate, often distinctly paler and tomentose below, margins entire, terminal leaflet dorsiventral. Flowers red, hypogynous, unisexual; pedicels, calyx and corolla pilose to pubescent. Young stems with a variable number but usually many multicellular non-glandular and glandular hairs, hypodermis consisting mainly of secretory cells. Stems of 2.5 cm diameter: sclerenchymatous pericycle consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 1 layer of cells with slightly thickened walls. Leaves with a variable number but usually many multicellular non-glandular and glandular hairs; petiole ± triangular as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy or palisade-like cells, bulliform cells confined to adaxial epidermis, stomata mainly abaxial.

Diagnostic features

Diococious tree, trunk often irregularly fluted; bark brown to greyish-green, peeling in discs with an average diameter of 2.5 cm; branchlets pubescent to pilose. Leaves impari-pinnate but sometimes trifoliolate, pilose to tomentose, leaflets 1–6-jugate, often distinctly paler and tomentose below, margins entire, terminal leaflet dorsiventral. Flowers red, hypogynous, unisexual; pedicels, calyx and corolla pilose to pubescent. Young stems with a variable number but usually many multicellular non-glandular and glandular hairs, hypodermis consisting mainly of secretory cells. Stems of 2.5 cm diameter: sclerenchymatous pericycle consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 1 layer of cells with slightly thickened walls. Leaves with a variable number but usually many multicellular non-glandular and glandular hairs; petiole ± triangular as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy or palisade-like cells, bulliform cells confined to adaxial epidermis, stomata mainly abaxial.
Gynoecium: rudimentary in male flowers; ovary superior; style relatively long; stigma 2-lobed. Fruit 1.4×1.2 cm, subglobose, slightly flattened, asymmetrical; exocarp glabrous; mesocarp fleshy; putamen 0.9×0.7 cm, ellipsoid to obovate, asymmetrically and irregularly flattened, smooth; pseudaril light red, very fleshy, with 4 arms, 2 arms on seam of putamen reaching almost to apex, 2 arms on flattened faces of putamen variable in length and breadth but shorter than arms on seam, arm on more convex face of putamen usually shorter but broader than arm on other face. Fig. 45-50.

Fig. 45.—Commiphora harveyi near Malelane in the Kruger National Park (height ±6 m).

Fig. 46.—Close-up view of a stem of Commiphora harveyi illustrating the bark peeling off in thick pieces.

Fig. 47.—Commiphora harveyi: A, branchlet with a leaf and flowers; B, branchlet with a leaf and mature fruits.

Fig. 48.—Flowers of Commiphora harveyi: A, male flowers; B, longitudinal section of male flower; C, diagrammatic representation of two disc lobes illustrating the insertion of the filaments; D, female flower; E, female flower with the calyx and corolla partly removed.
THE SOUTH AFRICAN SPECIES OF COMMIPHORA

Distinctive anatomical features of the stems and leaves

Young stems with a few short non-glandular hairs (mostly unicellular) and glandular hairs; sclerenchymatous pericycle-cylinder fluted. Stems of 2.5 cm diameter: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells but in some stems already cut off by the development of periderm; epithelium cells of resin ducts in xylem rays surrounded by 1-2 layers of spheroids. Leaves with a few short non-glandular hairs (mostly unicellular) and glandular hairs; petiole ± ovate as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy parenchyma, bulbiform cells confined to adaxial epidermis, stomata mainly abaxial.

Diagnostic features

 Dioecious tree, bark peeling in large brown papery pieces or in thicker discs; branchlets fluted, with a few short hairs. Leaves impari-pinnate or occasionally trifoliolate, with a few short hairs, leaflets 1-3-jugate, margins crenate-serrate to coarsely crenate-serrate, terminal leaflet typically dorsiventral. Flowers hypogynous, unisexual, peduncles with large bracts. Fruit subglobose; exocarp glabrous; putamen smooth; pseudaril light red, very fleshy, with 4 arms, 2 arms on seam of putamen reaching almost to apex, 2 arms on flattened faces of putamen shorter.

Occurs in north-eastern Transvaal, eastern Transvaal, the Transkei and eastern Cape as far south as East London, but is widely distributed in Natal and Zululand.

Usually grows on the slopes of mountains or in kloofs as part of the coastal forests. Occurs in areas with a rainfall up to 1,000 mm or more per annum.

Also recorded from Swaziland and Mozambique.

Transvaal.—2430 (Pilgrim's Rest): 6 km N. of Branddraai (-DA), Codd & de Winter 1259; Mariepskop (-DB), Van der Schijff 6095 (PRU) 2531 (Komatoipoort); near Malelane Rest Camp (-AD), Codd 5263; Van der Walt 22; 14 km S.E. of Pretoriuskop Rest Camp (-AD), Codd & de Winter 5156; Van der Walt 70.

Natal.—2829 (Harrismith): Tugela Valley near Colenso (-DB), Edwards 2467; 6 km N.E. of Estcourt (-DD), Cheadle 611, 2830 (Dundee): near Muden (-CD), Edwards 2772, 2831 (Eshowe): Hlabisa (-BB), Gerstner 715; 49 km S.E. of Nongoma (-BB), Van der Walt 107; 32 km E. of Melmoth (-DA), Van der Walt 95; Ntontama forest at Ntontama (-DA), Venter 4222; Umhlatuzana (-DD), Venter 3824; Umhlatuzi Valley at Ntontama (-DD), Van der Walt 27, 2832 (Mtubatuba): Hluhluwe Game Reserve (-AA), Bayer 1455; Ward 2907 (NH), 2930 (Pietermaritzburg): Richmond (-CC), Moll & Morris 663; Camperdown (-DA), Morris 593; Isipingo (-DD), Ward 848, 2931 (Stanger): Mapumulo (-AA), Moll 1628; New Guelderland (-AD), Stewart 121 (NH); Burman Bush in Durban (-CC), Ross & Moll 1723 (NH). 3030 (Port Shepstone): Ramsgate (-CD), Nicholson 136 (NH).

Cape.—3227 (Stutterheim): Komga (-DB), Schlechter 1403, 3228 (Butterworth): near Kentani (-CA), Pegler 2136, 3227 (Peddie): Keiskama Valley between Peddie and East London (-AB), Dyer 4539; Elizabeth Island in East London (-BB), Galpin?.

This species is easily grown from pole cuttings which are often planted as fencing poles.

Common name: Paper Tree.

9. Commiphora marlothii Engl. in Bot. Jahrb. 44: 155 (1910); Bot. Jahrb. 48: 485 (1913); Pflanzenfam. ed. 2, 19a: 438 (1931); Miller in J. S. Afr. Bot. 18: 38 (1952); Palgrave, Trees Cent. Afr. 55, t. & photo (1956); Wild in Fl. Zamb. 2.1: 281 (1963); Von Breitenbach, Ind. Trees S. Afr. 3.2: 440 (1965); De Winter in Trees S. Afr. 20.1: 12 (1968); Lisowski, Malaire & Symons in Bull. Jard. Bot. Nat. Belg. 40: 360 (1970). Synotypes: Rhodesia, Matopos, Marloth 3397 (Bf); K. fragment!; PRE!); 3402 (Bf). Lectotype: Marloth 3397 (PRE).

Dioecious tree with a rounded crown up to 9 m tall; bark peeling in large yellowish papery pieces to expose a green underlayer; branchlets obtuse, densely
pilose to pubescent. Leaves impari-pinnate, dark green, pubescent to tomentose; lamina up to 26 cm long; petiole up to 9.5 cm long; petiolules up to 2 mm long; leaflets 3–5-jugate, obovate to broadly elliptic, apex obtuse to acute, base cuneate or rounded; margins crenate-serrate to finely lobed; terminal leaflet up to 8 × 4 cm; lateral leaflets up to 5.8 × 3.2 cm. Flowers unisexual, hypogynous, appearing with the leaves in axillary paniculate simple or compound dichasial cymes up to 10 cm long, peduncles densely pilose to pubescent, male inflorescences usually longer than female inflorescences; male flowers, 6–7 mm, usually larger than female flowers, 4.5–5.5 mm. Bracteoles up to 6 mm long, linear, pubescent. Pedicels usually less than 1 mm, clustered, pubescent. Calyx campanulate, yellowish green, up to 3 mm long, pubescent, lobes up to 1 mm long, apex acute. Petals yellowish green, 3–4 mm long, pilose outside. Disk fleshy, pilose, not adnate to calyx and corolla, cylindrical, with 4 prominent lobes, indentation between lobes rather shallow, lobes not bifid in male flowers but bifid in female flowers. Stamens 8, 4 long stamens up to 3.5 mm long, inserted on top of disk lobes, 4 short stamens up to 2.5 mm long, inserted on top of disk between lobes; filaments slightly flattened, lower part broadened; staminodes in female flowers. Gynoecium: rudimentary in male flowers; ovary superior, sparsely pilose; style relatively short, sparsely pilose; stigma obscurely 4-lobed. Fruit 1.9 × 1.7 cm, subglobose, slightly flattened, asymmetrical; exocarp pilose; mesocarp very fleshy; putamen 1 × 0.8 cm, ellipsoid, asymmetrically and irregularly flattened, slightly rugose; pseudaril yellow, fleshy, with 4 arms, 2 arms on seam of putamen reaching almost to apex, 2 arms on flattened faces of putamen shorter than arms on seam, arm on more convex face of putamen shorter than arm on other face. Fig. 51–56.
Distinctive anatomical features of the stems and leaves

Young stems with numerous multicellular non-glandular and glandular hairs; sclerenchymatous pericycle-cylinder fluted. Stems of 2.5 cm diameter; sclerenchymatous pericycle-cylinder consisting of fibres and stone cells; epithelium cells of resin ducts in xylem rays surrounded by 1-2 layers of cells with slightly thickened walls. Leaves with numerous multicellular non-glandular and glandular hairs; petiole ± triangular to ovate as seen in transverse section, sclerenchymatous pericycle present, vascular bundles circularly distributed as seen in transverse section but 3-8 medullary bundles also present; terminal leaflet dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy or palisade-like cells, bulliform cells relatively small and confined to adaxial epidermis, stomata mainly abaxial.

Diagnostic features

Diocious tree, bark peeling in large yellowish papery pieces to expose a green underlayer; branchlets obtuse, densely pilose to pubescent. Leaves imparipinnate, densely pilose to pubescent, leaflets 3-5-jugate, margins crenate-serrate to finely lobed, terminal leaflet dorsiventral, petiole with 3-8 medullary vascular bundles. Flowers hypogynous, unisexual; pedicels, calyx, corolla, disk and gynoecium pilose to pubescent. Fruit subglobose; exocarp pilose; putamen slightly rugose; pseudaril yellow, fleshy, with 4 arms, 2 arms on seam of putamen reaching almost to apex, 2 arms on flattened faces of putamen shorter.

Widely distributed in central and northern Transvaal. Usually grows on arid mountain slopes or on granite koppies.

Also recorded from Botswana, Rhodesia and Zambia.

Transvaal.—2229(Waterpoort): near Soutpan (−CD), Obermeyer, Schweikerdt & Verdoorn 121; 165; Wylliespoort (−DD), Pole-Evans 3763; Masekwaspoot (−DD), Vahrmeijer 151, 2230(Messina): Tshipise (−CA), Van der Walt 8, Nshelele (−CC), Van der Schijff 5275. 2231(Pafuri): 50 km N.E. of
Punda Milia (AC), Codd & de Winter 5534; near Pafuri (AC), Van der Schijff & Marais 3711; 2327(Ellisras): 74 km N.W. of Vaalwater (DC), Meeitse 10434.

It is recorded that the papery bark is used by natives as writing paper.

Common name: Paper Tree.

10. Commiphora edulis (Klotzsch) Engl. in A.DC., Monogr. Phan. 4: 22 (1883); Bot. Jahrb. 48: 474, t. 15 (1913); Pflanzenfam. ed. 2,19a: 435 (1931); Burtt Davy, Fl. Transv. 2: 484 (1932); Burtt in Kew Bull. 1935: 108 (1935); Codd, Mem. Bot. Surv. S. Afr. 26: 86 (1951); Miller in J. S. Afr. Bot. 18: 38 (1952); Wild in Bot. Soc. Brot. 2,33: 91 (1959); White, For. Fl. N. Rhod. 176, t. 34E (1962); Wild in Fl. Zamb. 2.1 279 (1963); Von Breitenbach, Ind. Trees S. Afr. 3,2 435 (1965); De Wint. in Trees S. Afr. 20: 12 (1968). Type: Mozambique, Sena, Peters s.n. (B, holo.†; K! ).

Hitzeria edulis Klotzsch in Peters, Reise Mossamb. Bot. 1: 89 (1861).

Commiphora chlorocarpa Engl. in Bot Jahrb. 28: 414, t. 1N (1901); Pflanzenfam. 2,19a: 435 (1931). Type: Tanzania, Ruaha River, Goetze 452 (B, holo.†).

Dioecious many-stemmed shrub or small tree up to 6 m tall, stems usually entwined; bark light grey, flaking in small yellowish papery pieces; branchlets obtuse, densely pubescent. Leaves impari-pinnate, greyish green, pubescent; lamina up to 25 cm long; petiole up to 8 cm long; petiolules up to 1 cm long; leaflets 2-6-jugate narrowly elliptic to narrowly ovate, apex acute or rounded, base obtuse, margins usually entire but in some cases finely crenate-serrate; terminal leaflet up to 6,5×3 cm; lateral leaflets up to 5×2,7 cm. Flowers unisexual, perigynous, appearing with the leaves in axillary paniculate simple or compound dichasial cymes up to 15 cm long, branches of inflorescences pubescent, male inflorescences usually longer than female inflorescences; male flowers, 6-7 mm, usually larger than female flowers, 5-6 mm. Bracteoles up to 3 mm long, linear, pubescent. Pedicels 1-1,5 mm long, clustered, pubescent. Calyx yellow to green, continuous with hypanthium, pubescent, lobes 2-3 mm long, apex acute. Petals yellowish green, 3-4,5 mm long, inserted on hypanthium, glabrous. Disk much reduced, cylindrical, adnate to hypanthium. Stamens 8, inserted on top of disk, 4 long stamens up to 3 mm long, 4 short stamens up to 2 mm long; filaments subterete, lower part flattened and broadened; staminodes in female flowers. Gynoecium; rudimentary in male flowers; ovary half inferior, pilose; style relatively short, pilose; stigma obscurely 4-lobed. Fruit 2,4×2,3 cm, subglobose, slightly flattened asymmetrical; exocarp pilose; mesocarp very fleshy; putamen 1,5×0,9 cm, ellipsoid, much flattened, slightly asymmetrical smooth; pseudaril red, very fleshy, cupular with 4 short lobes, covering the lower 3 of putamen, lobe on less convex face of putamen longer than other 3 lobes. Fig. 57-62.
Fig. 58.—Close-up view of a branch of Commiphora edulis illustrating the bark flaking off in small, papery pieces.

Fig. 59.—Commiphora edulis: A, branchlet with young leaves and flowers; B, branchlet with leaves and mature fruits.

Fig. 60.—Flowers of Commiphora edulis: A, male flower; B, longitudinal section of male flower; C, female flower; D, female flower with the calyx and corolla partly removed.

Fig. 61.—Fruit of Commiphora edulis: A, side-view of the fruit; B, view of the less convex face of putamen and pseudaril; C, view of the more convex face of putamen with pseudaril; D, putamen and pseudaril as seen from above.
Distinctive anatomical features of the stems and leaves

Young stems with numerous multicellular non-glandular and glandular hairs; sclerenchymatous pericycle-cylinder fluted. **Stems of 2.5 cm diameter:** sclerenchymatous pericycle-cylinder consisting of fibres and stone cells; epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. **Leaves** with numerous multicellular non-glandular and glandular hairs; petiole ± triangular as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section but 3-8 medullary bundles also present; terminal leaflet typically dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy parenchyma, bulliform cells confined to adaxial epidermis, stomata mainly abaxial.

Diagnostic features

Dioecious many-stemmed shrub or small tree; bark light grey, flaking in small yellowish papery pieces, stems usually entwined; branchlets obtuse, densely pubescent. **Leaves** impari-pinnate, pubescent, leaflets 2-6-jugate, margins usually entire, terminal leaflet typically dorsiventral, petiole with 3-8 medullary vascular bundles. **Flowers** perigynous, unisexual, pedicels and calyx pilose to pubescent. **Fruit** sub-globose; exocarp pilose; putamen smooth; pseudaril red, very fleshy, cupular with 4 short lobes.

This species is recorded from the far-northern and north-eastern Transvaal. These areas are warm and dry and the annual rainfall is less than 400 mm. It usually occurs in the vicinity of the Limpopo River, but is particularly common in the Messina area.

It grows in savanna-woodland or broken mopani-veld in well-drained, sandy soil.

Also recorded from Botswana, Rhodesia, Zambia, Tanzania, Mozambique and Malawi.

**C. edulis** is one of the first *Commiphora* species of northern Transvaal to shed its leaves, the plants being leafless as early as March.

The fruits are eaten by birds, rodents and baboons.

11. *Commiphora woodii* Engl. in Bot. Jahrb. 15: 97 (1893); Bot. Jahrb. 26: 371 (1899); Bot. Jahrb. 44: 154 (1910); Bot. Jahrb. 48: 476, t. 2E (1913); Pflanzenfam. ed. 2, 19a: 435 (1913); Wild in Bol. Soc. Brot. 2, 33: 91 (1959); Von Breitenbach, Ind. Trees S. Afr. 3, 2: 422 (1965); Moll, For. Trees Natal 80 (1967); De Wint. in Trees S. Afr. 20, 1: 18 (1968). Syntypes: Natal, Durban, Wood sub NH 861 (Bt?; BM!); Pinetown, Rehmann s.n. (Bt?); Inanda, Rehmann s.n. (Bt?). Lectotype: Wood s.n. (BM).

*Commiphora caryaeolia* Oliv. in Hook. Icon. Pl. 23: t. 2287 (1894); Engl. in Pflanzenfam. ed. 2, 19a: 435 (1931). Henkel, Woody Pl. Natal 213 (1934). Syntypes: Natal, Durban; Wood 4085 (BOL); NH!; Inanda, Wood 1046 (NH!); Wood 1409 (not seen); Flanagan 1107 (Z!).

Dioecious tree up to 12 m tall; bark grey, not peeling; branchlets glabrous, shallowly fluted, obtuse. **Leaves** impari-pinnate, glabrous; lamina up to 32 cm long; petiole up to 9 cm long; petiolules up to 5 mm long; leaflets 3-5-jugate, narrowly elliptic to elliptic,
apex acute, base cuneate to rounded, margins crenate-serrate to coarsely crenate-serrate; terminal leaflet up to 12 × 5 cm; lateral leaflets up to 13 × 5 cm. **Flowers** unisexual, subsessile, perigynous, appearing before the leaves in axillary paniculate simple or compound dichasial cymes up to 10 cm long, male inflorescences usually longer than female inflorescences; male and female flowers ± of equal size, 4-5 mm long, relatively broad. **Bracteoles** up to 2 mm long, lanceolate. **Pedicels** usually less than 1 mm long. **Calyx** yellowish green, glabrous, continuous with hypanthium, lobes 2.5-3 mm long, apex acute. **Petals** yellowish green, 3-4 mm long, inserted on hypanthium. **Disk** fleshy or very fleshy in female flowers, adnate to hypanthium, cylindrical, with 4 lobes. **Stamens** 8, inserted on top of disk, 4 long stamens up to 2 mm long, 4 short stamens up to 1,5 mm long; filaments flattened and lower part broadened; staminodes in female flowers. **Gynoecium**: rudimentary in male flowers; ovary half inferior; style relatively short; stigma obscurely 4-lobed. **Fruit** 2 × 1.9 cm, subglobose, slightly flattened, asymmetrical; exocarp glabrous; mesocarp very fleshy; putamen 1 × 0.8 cm, ellipsoid, asymmetrically and irregularly flattened, smooth; pseudaril red, very fleshy, cupular, covering lower ½ of putamen, with 1 very short lobe on the less convex face of putamen, margin finely crenate. **Fig. 63-68.**

**Distinctive anatomical features of the stems and leaves**

**Young stems** with a few glandular hairs especially near apex; sclerenchymatous pericycle-cylinder fluted. **Stems of 2.5 cm diameter**: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells; epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. **Leaves** with a few glandular hairs; petiole ± oval to ovate as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet typically dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy parenchyma, bulliform cells confined to adaxial epidermis, stomata exclusively abaxial.

**Fig. 64.—Close-up view of a branch of Commiphora woodii.**

**Fig. 65.—Commiphora woodii:** A, branchlet with a leaf and flowers; B, branchlet with a leaf and mature fruits.

**Fig. 66.—Flowers of Commiphora woodii:** A, male flower; B, longitudinal section of male flower; C, female flower; D, female flower with the calyx and corolla partly removed.
Fig. 67.—Fruit of Commiphora woodii: A, side-view of the fruit; B, view of the less convex face of putamen with pseudaril; C, view of the more convex face of putamen with pseudaril; D, putamen and pseudaril as seen from above.

Fig. 68.—Geographical distribution of Commiphora woodii in South Africa.

Diagnostic features

Dioecious tree; bark grey, not peeling; branchlets shallowly fluted, obtuse, glabrous. \( C. \) woodii and \( C. \) zanzibarica, two closely related species, can be distinguished on features of the inflorescences, flowers and fruit. The inflorescences and flowers of \( C. \) zanzibarica are relatively long. Medullary vascular bundles occur in the petals of \( C. \) zanzibarica but are absent in those of \( C. \) woodii. The leaves of \( C. \) woodii and \( C. \) harveyi are sometimes also confused. Short hairs occur on the leaves of \( C. \) harveyi while those of \( C. \) woodii are glabrous.

Also recorded from Mozambique.

Natal.—2732(Ubombo): near Ingwavuma (−AA), Dutton & Tinker 6; 29 km S. of Jozini (−CA), de Winter & Vahrenger 8481. 2830(Dundee): S.W. of Weenen (−CC), Pentz 545; 2831(Eshowe): Umhlatuzi Valley at Ntumana (−DD), Van der Walt 28; Ubisana Valley near Kwa-Dlangezwa (−DD), Van der Walt 83; 2832(Mtabatuba): near Hluhluwe (−AA), Wells 2130; Hluhluwe Game Reserve (−AA), Ward 2982 (NH). 2930(Peitermaritzburg): near Richmond (−CB), Moll & Morris 663; Camperdown at Shongweni Dam (−DC), Marais 3030(Port Shepstone): Port Shepstone (−CB), Nicholson 247 (NH).

Cape.—3226(Fort Beaufort): Victoria East at Pefferskop (−DD), Acocks 11900; 3227(Stutterheim): 18 km S.W. of King William's Town (−DD), Acocks 11879; Kei Road (−DA); Ranger ?. 3228(Butterworth): Kentani (−AD), Pegler 1137.

None of the three syntypes mentioned by Engler (1893) could be traced and it is suspected that they were destroyed in Berlin. A specimen from the British Museum with a label of the Natal Herbarium, collected by Wood in Berea, Durban, was seen. Since no number appears on the label, it is uncertain whether this specimen is an isotype.

\( C. \) woodii and \( C. \) zanzibarica, two closely related species, can be distinguished on features of the inflorescences, flowers and fruit. The inflorescences and flowers of \( C. \) zanzibarica are relatively long. Medullary vascular bundles occur in the petals of \( C. \) zanzibarica but are absent in those of \( C. \) woodii. The leaves of \( C. \) woodii and \( C. \) harveyi are sometimes also confused. Short hairs occur on the leaves of \( C. \) harveyi while those of \( C. \) woodii are glabrous.

\( C. \) woodii grows easily from pole cuttings which are often planted as fencing poles. Natives prepare gum from the bark.

12. \textit{Commiphora zanzibarica} (Baill.)Engl. in A.D.C., Monogr. Phan. 4: 28 (1883); Bot. Jahrb. 48: 468, t. 1A (1913); Pflanzenfam. ed. 2,19a: 433 (1931); Butitt in Kew Bull. 1935: 111 (1935); Wild in Bot. Soc. Bro. 2,33: 91 (1955); Dale & Greenway, Kenya Trees 93 (1961); Wild in Fl. Zamb. 2,1: 279 (1963). Type: Tanzania, Zanzibar, Jablonksi s.n. (P, holo! ).

\textit{Balsamena zanzibarica} Baill. in Adonsonia 11: 180 (1874); Engl. in Bot. Jahrb. 1: 42 (1881).

\textit{Commiphora spondioides} Engl. in Bot. Jahrb. 26: 371 (1899); Bot. Jahrb. 48: 448 (1913); Pflanzenfam. ed. 2,19a: 433 (1931). Type: Mozambique, Lourenco Marques, Schlechter 11559 (B, holo! ; K1).

Dioecious tree, often many-stemmed, up to 7 m tall; bark grey, not peeling; branchlets glabrous, shallowly fluted. \textit{Leaves} impari-pinnate, glabrous; lamina up to 20 cm long; petiole up to 6 cm long; petiolules up to 5 mm long; leaflets 3-5-jugate, margins crenate-serrate to coarsely crenate-serrate, terminal leaflet typically dorsiventral, petiole without medullary vascular bundles. \textit{Flowers} perigynous, unisexual, glabrous. Fruit subglobose; exocarp glabrous; putamen smooth; pseudaril red, very fleshy, cupular with 1 very short lobe.

This species occurs near the coast, from Zululand southwards to East London. It usually grows on the slopes of mountains or in kloofs as part of the coastal forests with a rainfall of 1 000 mm and more per annum.
rudimentary in male flowers; ovary half inferior; style relatively short; stigma obscurely 4-lobed. 

Fruit 1.8 × 1.5 cm, subglobose, slightly flattened, asymmetrical; exocarp glabrous; mesocarp very fleshy; putamen 1.8 × 0.8 cm, ellipsoid asymmetrically and irregularly flattened, smooth; pseudaril red, very fleshy, cupular, covering the lower \( \frac{1}{2} \) of putamen, margin coarsely crenate. Fig. 69-74.

**Fig. 69.**—*Commiphora zanzibarica* near Makanies-Pont, northern Zululand (height ±7 m).

**Fig. 70.**—Close-up view of a branch of *Commiphora zanzibarica*. The white patches on the bark are lichens.

**Fig. 71.**—*Commiphora zanzibarica*: A, branchlet with a leaf and flowers; B, branchlet with a leaf and mature fruits.

Distinctive anatomical features of the stems and leaves

*Young stems* with a few peltate glandular hairs especially near apex; sclerenchymatous pericycle-cylinder fluted. *Stems of 2.5 cm diameter*: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. *Leaves* with a few peltate glandular hairs; petiole ± triangular as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section but 4-14 medullary bundles also present; terminal leaflet typically dorsiventral with a single layer of palisade cells adaxially, remaining mesophyll consisting of spongy parenchyma bulliform cells confined to adaxial epidermis, stomata mainly adaxial.
Fig. 72.—Flowers of Commiphora zanzibarica: A, male flower; B, longitudinal section of the male flower; C, female flower; D, female flower with the calyx and corolla partly removed.

Fig. 73.—Fruit of Commiphora zanzibarica: A, side-view of the fruit; B, view of the less convex face of putamen with pseudaril; C, view of the more convex face of putamen with pseudaril; D, putamen and pseudaril as seen from above.

Fig. 74.—Geographical distribution of Commiphora zanzibarica in South Africa.

Diagnostic features

Dioecious tree, often many-stemmed; bark grey, not peeling; branchlets shallowly fluted, glabrous. Leaves impari-pinnate, glabrous, leaflets 3–5–jugate, margins entire of finely serrate, terminal leaflet typically dorsiventral, petiole with 4–14 medullary vascular bundles. Flowers perigynous, unisexual, glabrous, inflorescences relatively long (up to 30 cm). Fruit subglobose; exocarp glabrous; putamen smooth; pseudaril red, very fleshy, cupular without lobes.

So far this species has only been collected near the Kumane Dam in the Kruger National Park and on the Makatini Flats in northern Zululand where it grows in deep sandy soil in savanna-woodland. The annual rainfall in these areas lies between 400–550 mm.

Also recorded from Mozambique, Rhodesia, Zanzibar, Tanzania and Kenya.

Transvaal.—2431(Acornhoek): at Kumane Dam (-DB), Van Wyk 4917.

Natal.—2732(Ubombo): 8 km S.E. of Makanies Pont (-AB), Van der Walt 89.

Dale & Greenway (1961) and also Wild (1963) mention that the bark of this species peels off in papery pieces. This is not the case with the plants from which the material for this study was collected.

13. Commiphora tenuipetiolata Engl. in Bot. Jahrb. 48: 483, 3L (1913); Pflanzenfam. ed. 2,19a: 438 (1931); Burtt Davy, Fl. Transv. 2: 485, t. 52 (1932); Wild in Bol. Soc. Brot. 2,33: 93 (1959); Wild in Fl. S. Afr. 2: 32: 434 (1965); De Wint. in Trees S. Afr. 20,1: 16 (1968); Merxm., Prod. Fl. S.W. Afr. 23: 9 (1968). Syntypes: S.W.A., Otjiwarongo, Sesfontein, Dinter 1721 (B); K, fragment!; BM, sketch!; S.W.A., Bulspoort, Dinter 2109 (B); K, fragment!).

Dioecious tree with a single main stem up to 7 m tall; bark grey to white, usually peeling in large whitish papery pieces to expose a glaucous underlayer; branchlets glabrous. Leaves trilobulate or impari-pinnate, glabrous; lamina up to 8 cm long; petiole relatively long and slender, up to 5 cm long.
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glabrous; petiolules up to 1 mm long; leaflets 1-3-jugulate, obovate to broadly elliptic or elliptic; apex acute but more often obtuse, base cuneate, margins entire or crenate-serrate in the upper half; terminal leaflet up to 3 x 2 cm; lateral leaflet 3 x 1.8 cm. Flowers unisexual, perigynous, appearing after the leaves in axillary simple or compound dichasial cymes up to 5.5 cm long; male flowers 1.2-1.4 cm, usually larger than female flowers, 1-2.2 cm. Bracteoles linear, up to 5 mm long. Pedicels usually relatively long, 6-10 mm. Calyx yellowish green, glabrous, continuous with hypanthium, lobes 1.2-1.5 mm long, apex acute. Petals yellowish green, 2-3 mm long, inserted on hypanthium, glabrous. Disk reduced, not fleshy, adnate to hypanthium, cylindrical, with 4 inconspicuous lobes. Stamens 8, inserted on disk, 4 long stamens up to 2 mm long, 4 short stamens up to 1.5 mm long; filaments subterete, lower part flattened and much broadened; staminodes in female flowers. Gynoecium: rudimentary in male flowers, ovary half inferior; style relatively short; stigma 2-lobed. Fruit 1.5 x 1.3 cm, subglobose, slightly flattened and asymmetrical, very much flattened, smooth; pseudaril red, fleshy, cupular with 2 lobes of variable length and shape on flattened faces of putamen, covering lower 1/4 of putamen, lobe on less convex face of putamen usually longer and more acute than lobe on other face. Fig. 75-81.

Fig. 76, Fig. 77.—Close-up views of different branches of Commiphora tenuipetiolata.

Distinctive anatomical features of the stems and leaves
Young stems with a few glandular hairs especially near apex; dendritic crystals (hesperidin or Diosmin) occurring in some epidermal and hypodermal cells. Stems of 2.5 cm diameter: sclerenchymatous pericycle consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 1 layer of sclereids. Leaves with a few glandular hairs, dendritic crystals (hesperidin or Diosmin) occurring in some epidermal and hypodermal cells of the petioles and leaflets; petiole ± circular as seen in transverse section, sclerenchymatous pericycle present, vascular bundles ± circularly distributed as seen in transverse section; terminal leaflet isobilateral with a single layer of long palisade cells adaxially and a single layer of shorter palisade cells abaxially, remaining mesophyll consisting of spongy or palisade-like cells, adaxial epidermis consisting mainly of large bulliform cells but smaller bulliform cells occur in abaxial epidermis, stomata mainly abaxial.
Diagnostic features

Dioecious tree with a single main stem; bark grey to white, usually peeling in large whitish papery pieces to expose a glaucous underlayer; branchlets glabrous. Leaves trifoliolate or impari-pinnate, glabrous, leaflets 1–3-jugate, margins entire or crenate-serrate in the upper half, terminal leaflet isobilateral, dendritic crystals (hesperidin or diosmin) occurring in some epidermal and hypodermal cells of petioles and leaflets, petioles relatively long and slender (up to 5 cm). Flowers perigynous, unisexual, glabrous. Fruit subglobose; exocarp glabrous, putamen very much flattened, smooth; pseudaril red, fleshy, cupular with 2 lobes on flattened faces of putamen.
This species occurs in the far-northern and north-eastern Transvaal, but is particularly common north of the Soutpansberg. Grows in well-drained, sandy soil in warm areas with a relatively low annual rainfall.

Also recorded from South West Africa, Botswana and Rhodesia.

Transvaal. — 2228 (Maastricht): near Koperspruit (–CB), Van der Walt 61. 2229 (Waterpoort): Dongola (–BC), Codd 4140; Gerstner 5460; 19 km W. of Messina (–BD), Gerstner 5460; 8 km E. of Waterpoort (–DC), Van der Walt 31. 2230 (Messina): near Messina (–AC), Rogers 20763; 40 km N.E. of Tshipise in Nwanedzi River valley (–AD), Gerstner 6039; Tshipise (–CA), Van der Schijff 5197 (PRU); Van der Walt 4; Van Wyk & Pienaar 4696. 2231 (Pafuri): Mzimbiti Kloof near Punda Milia Resi Camp (–CA), Van Wyk & Pienaar 4696. 2328 (Baltimore): 32 km N.E. of Melkrivier (–CD), Van der Walt 46.

On the basis of the size, form and margin of the terminal leaflet, Burtt Davy (1932) distinguishes the var. tenuipes and var. rogersii Burtt Davy. The supposed existence of the two varieties is not supported since these variations of the terminal leaflet occur on the same plant.

It has been recorded that C. tenuipes also occurs in shrub form in South West Africa.

14. Commiphora angolensis Engl. in A.D.C., Monogr. Phan. 4: 24 (1883); Bot. Jahrb. 48: 486 (1913); Pflanzenfam. ed. 2,19a: 438 (1931); Exell & Mendonca in Bot. Afri. 7: 440 (1965); De Wint. in Trees S. Afr. 20:1, 8 (1968); Merxm., Prod. Fl. S.W. Afr. 23: 5 (1968). Syntypes: Angola, Luanda, Welwitsch 4485; sine loc. 4488 (G, only photo seen; LISU!). Lectotype: Welwitsch 4485 (LISU).

Balsamea angolensis (Engl.) Hiern, Cat. Welw. Pl 1, 1: 24 (1896). Commiphora oliveri Engl. in A.D.C., Monogr. Phan. 4: 24 (1883); Bot. Jahrb. 48: 483, t. 3K (1913); Pflanzenfam. ed. 2,19a: 438 (1931). Type: Botswana, Baines s.n. (K, holo.). C. rhemannii Engl. in A.D.C., Monogr. Phan. 4: 15 (1883); Bot. Jahrb. 48: 483 (1913); Burtt Davy, Fl. Transv. 2: 485 (1932). Type: Transvaal, Rehmann s.n. (K, holo.; BM, sketch of holo.). Kliplaan, Rehmann 5324 (Z). Lectotype: Rehmann 5324 (Z). C. longibracteata Engl. in A.D.C., Monogr. Phan. 4: 19 (1883); Bot. Jahrb. 48: 486 (1913); Pflanzenfam. ed. 2,19a: 438 (1931). Type: Angola, Welwitsch 4494 (G, holo., only photo seen; LISU!). C. kwabensis N.E. Br. in Kew Bull. 1909: 98 (1909); Miller in J.S. Afr. Bot. 18: 38 (1952). Syntypes: Botswana, Kwewe Hills, Lugarud 34 (KJ); Lugarud 86 (K). Lectotype: Lugarud 86 (K). C. gossweileri Engl. in Bot. Jahrb. 44: 147 (1910). Type: Angola, Luanda, Gossweiler 442 (B, holo.; BM, sketch.). Lectotype: Gossweiler 442 (K). C. nigrescens Engl. in Bot. Jahrb. 44: 148 (1910); Bot. Jahrb. 48: 484 (1913); Pflanzenfam. ed. 2,19a: 438 (1931). Syntypes: S.W.A., Grootfontein, Dinter 727 (B; K, fragment!). Dinter 727a (B; BM, sketch.). Lectotype: Dinter 727 (BM).

Dioecious many-stemmed shrub up to 3 m tall; bark yellowish green to chestnut-brown, peeling in yellowish pieces to expose a green underlayer; branchlets pilose to densely pubescent. Leaves tri-foliate or impari-pinnate, sparsely pilose to densely pubescent; lamina up to 9 cm long; petiole up to 2.2 cm long; petiolules up to 4 mm long; leaflets 1–3-jugate, terminal leaflet up to 3.5 × 2 cm, elliptic to obovate; lateral leaflets up to 2 × 1.2 cm, elliptic; apex of all leaflets acute to obtuse, base cuneate, margins crenate-serrate. Flowers unisexual, perigynous, appearing after the leaves in axillary dichasial cymes, male inflorescences usually compound dichasial cymes up to 5 cm long, female inflorescences usually simple dichasial cymes up to 3 cm long; male flowers, 8–11 mm, usually larger than female flowers, 6–8 mm. Bracteoles linear, up to 6 mm long, sparsely pilose to densely pubescent. Pedicels 4–5 mm long, sparsely pilose to densely pubescent. Calyx yellow to green, sparsely pilose to densely pubescent, continuous with hypanthium, lobes 2–3 mm, apex acute. Petals yellow to green, 2–3 mm long, usually glabrous but in some cases sparsely pilose on outside. Disk reduced, not fleshy, adnate to hypanthium, cylindrical, with 4 inconspicuous lobes. Stamens 8, inserted on disk, 4 long stamens up to 4 mm long, 4 short stamens up to 3 mm long; filaments suberiate, lower part much flattened and broadened; staminodes in female flowers. Gynoecium: rudimentary in male flowers; ovary half inferior; style relatively short; stigma obscurely 4-lobed. Fruit 1.1 × 0.9 cm, subglobose to ellipsoid, asymmetrically flattened; exocarp fleshy; putamen 9 × 7 mm ellipsoid, slightly asymmetrical, much flattened, smooth; pseudaril red, fleshy, cupular with 2 lobes of variable length and shape on flattened faces of putamen, covering lower ⅓ of putamen, lobe on convex face of putamen usually longer than lobe on other face. Fig. 82–87.
Fig. 83.—Close-up view of a branch of Commiphora angolensis illustrating the bark peeling in papery pieces.

Fig. 84.—Commiphora angolensis: A, branchlet with leaves and flowers; B-D, leaves; E, branchlet with leaves and mature fruits.

Fig. 85.—Flowers of Commiphora angolensis: A, male flower; B, longitudinal section of male flower; C, female flower; D, female flower with calyx and corolla partly removed.

Fig. 86.—Fruit of Commiphora angolensis: A, side-view of the fruit; B, view of the less convex face of putamen with pseudaril; C, view of the more convex face of putamen with pseudaril; D, putamen and pseudaril as seen from above.
Distinctive anatomical features of the stems and leaves

Young stems with a variable number of multicellular non-glandular and glandular hairs; dendritic crystals (hesperidin or diosmin) occurring in some epidermal and hypodermal cells. 

Stems of 2.5 cm diameter: sclerenchymatous pericycle consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by 2–3 layers of sclereids.

Leaves with a variable number of multicellular non-glandular and glandular hairs; dendritic crystals (hesperidin or diosmin) occurring in some epidermal and hypodermal cells of the petioles and leaflets; petiole ± triangular as seen in transverse section, terminal leaflet isobilateral with a single layer of long palisade cells adaxially and a single layer of shorter palisade cells abaxially, remaining mesophyll consisting of spongy or palisade-like cells, adaxial epidermis consisting mainly of large bulliform cells but smaller bulliform cells occur in abaxial epidermis, stomata mainly abaxial.

Diagnostic features

Diocious many-stemmed shrub; bark yellowish green to chestnut-brown, peeling in yellowish pieces to expose a green underlayer; branchlets pilose to densely pubescent. Leaves trifoliolate or impari-pinnate, sparsely pilose to densely pubescent, leaflets 1–3-jugate, margins crenate-serrate, terminal leaflet isobilateral, dendritic crystals (hesperidin or diosmin) occurring in some epidermal and hypodermal cells of petioles and leaflets, petioles up to 2.2 cm long. 

Flowers perigynous, unisexual, pedicels and calyx pilose to pubescent, corolla in some cases sparsely pilose on outside. 

Fruit subglobose to ellipsoid; exocarp pilose; putamen much flattened, smooth; pseudaril red, fleshy, cupular with 2 lobes on flattened faces of putamen.

In South Africa this species is confined to a few localities in the arid bushveld of north-western and northern Transvaal north of the Soutpansberg. It grows in deep sandy soil presumably derived from the Kalahari.

Also recorded from Botswana, South West Africa, Rhodesia, Zambia and Angola.

Transvaal. — 2229 (Waterpoort): 10 km N.E. of Vivo (-CD), Van der Walt 1969; near Mopane (-DB), Codd 6603; 2317 (Ellisras): 3 km W. of Monte Christo (-BC), Codd 6603; Van der Walt 110. 121; 8 km N. of Steenbokpan (-CB), Van der Walt 122. 2329 (Pietersburg): 3 km N.E. of Vivo (-AB), Strey 3516; 2427 (Thabazimbi): 13 km E.N.E. of Rooibokkraal (-AA), Theron & Marsh 298 (PRU); Van der Walt 25.

As far as it could be determined, this species occurs only in shrub form in South Africa. In South West Africa it usually develops into a tree with a single main stem.

15. Commiphora namaensis Schinz in Bull. Herb. Boiss. 2:8: 633 (1908); Wild in Bol. Soc. Brot. 2:33: 92 (1959); Metxim., Prod. Fl. S.W. Afr. 23: 7 (1968). Type: S.W.A., Inachab, Dinter 958 (Z, holo.).

Commiphora rotundifolia Dinter & Engl. in Bot. Jahrb. 46: 289 (1912); Engl. in Bot. Jahrb. 48: 482, t. 3G (1913); Pflanzenfam. ed. 2:20a: 438 (1931). Type: S.W.A., Seeheim, Dinter 1203 (B, holo.; K, fragment!).

Fig. 87.—Geographical distribution of Commiphora angolensis in South Africa.

Fig. 88.—Commiphora namaensis near Vioolsdrif, north-western Cape (height ±1 m).
Dioecious shrub less than 1 m up to 3 m tall; trunk branching repeatedly above soil level, forming many relatively thin side branches; bark light grey, not peeling; branchlets glabrous. Leaves simple, glabrous, lamina up to 1,2 × 1 cm, orbicular or slightly oblong, apex obtuse, base cuneate, margin dentate to coarsely dentate, petiole up to 7 mm long. Flowers subsessile, unisexual, perigynous, appearing before the leaves in axillary clusters; male flowers, 4–5 mm, larger than female flowers, 3–4 mm. Bracteoles up to 0,2 mm long, ± triangular, glandular. Pedicels less than 0,2 mm long. Calyx green to brown, continuous with hypanthium, lobes 0,5–1 mm long, apex acute. Petals yellow to brown, 2,5–4 mm long, inserted on hypanthium. Disk adnate to hypanthium, cylindrical with 4 fleshy lobes, lobes in male flowers not bifid but in female flowers bifid. Stamens 8, 4 long stamens up to 4 mm long, inserted on top of disk lobes, 4 short stamens up to 2,5 mm long, inserted on top of disk between lobes; filaments subterete, lower part flattened and broadened; staminodes in female flowers. Gynoecium: rudimentary in male flowers; ovary half inferior, glandular; style relatively long, glandular; stigma obscurely lobed. Fruit 1 × 0,8 cm, subglobose to ellipsoid, slightly flattened, asymmetrical; exocarp glabrous; mesocarp not very fleshy; putamen 8 × 6 mm, ellipsoid, asymmetrically and irregularly flattened, slightly rugose; pseudaril red, fleshy, cupular with 2 arms on seam of putamen, covering the lower ⅔ of the more convex face of putamen and the lower ⅔ of the other face.

**Fig. 89.—Close-up view of a branch of Commiphora namaensis.**

**Distinctive anatomical features of the stems and leaves**

Young stems with numerous peltate glandular hairs at apex. Stems of 2,5 cm diameter; sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells, resin ducts in primary phloem very conspicuous (up to 2 mm in diameter). Leaves with a few peltate glandular hairs; petiole ± semi-circular as seen in transverse section, sclerenchymatous pericycle present or absent, vascular bundles mainly abaxial and distributed in the form of an arc as seen in transverse section, in some cases 1–2 much smaller bundles adaxially, with a large number of stomata; terminal leaflet typically isobilateral with 1–3 layers of palisade cells ad- and abaxially, central mesophyll consisting of ± colourless cells, ad- and abaxial epidermis consisting mainly of large bulliform cells, with a large number of evenly distributed stomata in the ad- and abaxial epidermis.

**Fig. 90.—Commiphora namaensis: A, branchlet with flowers; B, branchlet with leaves and flowers; C-E, leaves; F, branchlet with leaves and mature fruits.**

**Fig. 91.—Flowers of Commiphora namaensis: A, male flower; B, longitudinal section of male flower; C, female flower; D, female flower with the calyx and corolla partly removed.**
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Fig. 93.—Geographical distribution of *Commiphora namaensis* in South Africa.

Fig. 92.—Fruit of *Commiphora namaensis*: A, side-view of the fruit; B, view of the less convex face of putamen with pseudaril; C, view of the more convex face of putamen with pseudaril; D, putamen and pseudaril as seen from above.

**Diagnostic features**

Dioecious shrub, trunk branching repeatedly above soil level, forming many relatively thin side branches; bark light grey, not peeling; stems with very large resin ducts in primary phloem; branchlets with numerous peltate glandular hairs at apex but otherwise glabrous. Leaves simple, glabrous, lamina orbicular or slightly oblong, margin dentate to coarsely dentate, typically isobilateral. Flowers subsessile, perigynous, unisexual. Fruit subglobose to ellipsoid; exocarp glabrous; putamen slightly rugose; pseudaril red, fleshy, cupular with 2 arms on seam of putamen.

In South Africa this species is confined to the semi-desert areas of the north-western Cape. It occurs in the mountains near the Orange River from Goodhouse westwards. These areas are extremely dry and hot with a rainfall of less than 80 mm per annum.

Also recorded from South West Africa.

Fig. 94.—*Commiphora gracilifrondosa* near Pella, north-western Cape (height 1.5 m).
All the plants seen in the veld have simple leaves. Plants cultivated in a glass house at Stellenbosch developed trifoliolate leaves in addition.

16. Commiphora gracilifrondosa Dinter ex Van der Walt in J.S. Afr. Bot. 37,3: 190 (1971); Dinter in Fedde, Rep. Beih. 53: 48 (1928), nom. subnud. Type: Dinter 5124 (BOL, holo. !; S! ; B|).

Dioecious shrub up to 3 m tall; trunk branching repeatedly above soil level, stamens appearing succose; bark reddish brown with dark patches, not peeling; branchlets slender, glabrous. Leaves trifoliolate but terminal leaflet often 3-lobed, glabrous; lamina up to 6 cm long; petiole up to 2 cm long; petiolules up to 3 mm long; leaflets variable in size and form, linear to cultrate, margins irregularly and rather coarsely dentate-serrate, apex obtuse to acute, base cuneate; terminal leaflet up to 4,3×0,2 cm, lateral leaflets up to 3,5×0,2 cm. Flowers unisexual, perigynous, appearing before or with the leaves in axillary dichasial cymes or occasionally solitary, male inflorescences up to 5 cm long, female inflorescences up to 1 cm long; male flowers 6-7 mm, usually larger than female flowers, 4-5 mm. Bracteoles up to 4 mm long, linear, sparsely glandular. Calyx yellow to green, continuous with hypanthium, sparsely glandular, lobes up to 1 mm long, apex acute. Petals yellow to green, 2,5-3,5 mm long, inserted on hypanthium. Disk adnate to hypanthium, cylindrical with 4 fleshy lobes. Stamens only 4, up to 2,5 mm long, inserted on top of disk lobes; filaments slender, subterete, lower part flattened and broadened; staminodes in female flowers. Gynoecium: rudimentary in male flowers; ovary half inferior, sparsely glandular; style relatively long, sparsely glandular; stigma obscurely lobed. Fruit 1×0,8 cm, subglobose to ellipsoid, asymmetrical, slightly flattened; exocarp glabrous; mesocarp not very fleshy; putamen 8×5 mm, ellipsoid, asymmetrically flattened, smooth; pseudaril red, not very fleshy, cupular with 2 arms on seam of putamen, covering the lower 1 of more convex face of putamen and 1 of the other face. Fig. 94-99.
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Distinctive anatomical features of the stems and leaves

**Young stems** with numerous peltate glandular hairs at apex. **Stems of 2.5 cm diameter**: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. **Leaves** with a few peltate glandular hairs; petiole ± circular as seen in transverse section, sclerenchymatous pericycle present or absent, vascular bundles mainly abaxial and distributed in the form of an arc as seen in transverse section, in some cases 1–2 much smaller bundles adaxially, with a large number of stomata; terminal leaflet typically isobilateral, mesophyll consisting mainly of palisade cells with a few colourless cells centrally, ad- and abaxial epidermis consisting mainly of large bulliform cells, with a large number of evenly distributed stomata in the ad- and abaxial epidermis.

**Diagnostic features**

Dioecious shrub, trunk branching repeatedly above soil level, stems appearing succose; bark reddish brown with dark patches, not peeling; branchlets slender, with numerous peltate glandular hairs at apex but otherwise glabrous. **Leaves** trifoliolate but terminal leaflet often 3-lobed, glabrous, leaflets linear to cuneate, margins irregularly and rather coarsely dentate-serrate, terminal leaflet typically isobilateral. **Flowers** perigynous, unisexual, only 4 stamens/staminodes. **Fruit** subglobose to ellipsoid; exocarp glabrous; putamen smooth; pseudaril red, not very fleshy, cupular with 2 arms on seam of putamen.

This species occurs in the north-western Cape from Kenhardt in the east to Goodhouse in the west. It grows on the arid mountains and kopjes in the vicinity of the Orange River in areas with an annual rainfall up to 160 mm.

Also recorded from the southern part of South West Africa.

**Cape.**—2818 (Warmbad): 5 km E. of Goodhouse (−CD), Van der Walt 214; 27 km W. of Pella (−DD), Van der Walt 119. 2819 (Nieuwoudtville): 8 km N. of Pella (−CC), Van der Walt 116. 2820 (Kakamas): near Augrabies (−CB), Pearson 3567 (BOL); near Kakamas (−DC), Fuller 24 (BOL). 2919 (Pofadder): 6 km N.E. of Pofadder (−AB), Acocks 21795. 2921 (Kenhardt): S. of Kenhardt (−AC), Hutchinson 952 (BOL).

This species is closely related to *C. oblanceolata* Schinz. The type specimen (*Dinter* 1497) of the latter species has been studied. Like *C. gracilifrondosa*, *C. oblanceolata* has also only 4 stamens. De Winter, who studied the material of these two taxa in Kew, also concluded that they should be considered as different species.

It was observed that goats and game graze on the young branches. The local name of “Suikerkan” is probably derived from the sweet taste of the wood.

17. **Commiphora capensis** (Sond.) Engl in A.DC., Monogr. Phan. 4: 18 (1883); Bot. Jahrb. 48: 470 (1913); Pflanzenfam. ed. 2,19a: 433 (1931); Wild in Bol. Soc. Broit. 2,33: 89 (1959); Von Breitbenach, Ind. Trees S. Afr. 3,2: 436 (1965); de Witt in Trees S. Afr. 20,1: 10 (1968); Merxm., Prod. Fl. S.W. Afr. 23: 5 (1958). Type: North-western Cape, Natvoice, Drège 6809 (ex parte) (S, holo.; MEL, fragment!).

**Balsamodendrum capense** Sond. in Fl. Cap. 1: 526 (1860). **Balsamea capensis** (Sond.) Eng. in Bot. Jahrb. 1: 42 (1881). **Commiphora rangeana** Engl. in Bot. Jahrb. 44: 149 (1910); Bot. Jahrb. 48: 482, t. 3F (1913); Pflanzenfam. ed. 2,19a: 438 (1931). Type: S.W.A., Kovies Mountains, Range 172 (B, holo.; BOL).

Dioecious shrub up to 4 m tall; trunk branching repeatedly above soil level, stems appearing succose; bark brown to green with blackish patches, peeling locally in small white papery pieces; branchlets glabrous. **Leaves** trifoliolate, glabrous; lamina up to 2,3 cm long; petiole up to 1,5 cm long; petiolules up to 1,5 mm long; leaflets usually cordate but in some cases orbicular or obovate, apex usually emarginate but in some cases obtuse, base cuneate to obtuse, margins finely lobed; terminal leaflet up to 1,8×1,4
cm; lateral leaflets up to 1.3 x 1 cm. Flowers unisexual, perigynous, appearing with the leaves in axillary simple dichasial cymes or solitary; male flowers, 5-6 mm, usually larger than female flowers, 4-5 mm. Bracteoles up to 1 mm long, triangular, glandular. Pedicels 0.5-1 mm long, glandular. Calyx yellow to green, fleshy, continuous with fleshy hypanthium, glandular, lobes 1.5-2 mm long, apex acute. Petals yellow to green, 2-3 mm long, glandular, inserted on hypanthium. Disk adnate to hypanthium, cylindrical with 4 fleshy lobes. Stamens 8, 4 long stamens up to 2.5 mm, inserted on top of disk lobes, 4 short stamens up to 2 mm long, inserted on top of disk between lobes; filaments flattened and lower part broadened; staminodes in female flowers. Gynoecium: rudimentary in male flowers; ovary half inferior, glandular; style relatively long, glandular; stigma 2-lobed. Fruit 1.2 x 1 cm, ellipsoid, asymmetrical, very much flattened; exocarp glabrous; mesocarp very thin; putamen 1.1 x 0.9 cm, ellipsoid, asymmetrical, very much flattened, smooth; pseudaril lacking. Fig. 100-105.

Fig. 100.—Commiphora capensis in Klein Helskloof near Vioolsdrif, north-western Cape (height ± 1 m).

Fig. 101.—Close-up view of a branch of Commiphora capensis.

Fig. 102.—Commiphora capensis: A, branchlet with flowers; B—D, leaves; E, branchlet with leaves and mature fruits.
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**Fig. 105.**—Geographical distribution of *Commiphora capensis* in South Africa.

Diagnostic features

Dioecious shrub, trunk branching repeatedly above soil level, stems appearing succose; bark brown to green with blackish patches, peeling locally in small white papery pieces; branchlets with numerous glandular hairs at apex but otherwise glabrous. *Leaves* trifoliolate, glabrous, leaflets usually cordate but in some cases orbicular or obovate, margins finely lobed, terminal leaflet typically isobilateral. *Flowers* perigynous, unisexual, calyx fleshy. *Fruit* ellipsoid, very much flattened; exocarp glabrous; mesocarp very thin; putamen smooth; pseudaril lacking.

This species is confined to the semi-desert areas of the north-western Cape and south-western parts of South West Africa. It grows in the mountains and koppies in the vicinity of the Orange River from Goodhouse westwards to the Richtersveld. These areas are extremely dry and hot with a rainfall of less than 80 mm per annum.

Cape.—2816(Oranjemund); S.E. of Sendlingsdrift (-BB), Pillans 5001 (BOL). 2817(Vioolsdrif): 37 km W.S.W. of Vioolsdrif in Klein Helskloof (-CD), Van der Walt 111; 112. 2818(Warmbad): 5 km E. of Goodhouse (-CD), Van der Walt 126; 127.

*C. capensis* and *C. cervifolia* are closely related species and the two have many characteristics in common, especially as far as growth form, external features of the stems and fruits are concerned. Although both species have trifoliolate leaves, the form of the leaflets differs considerably.

Distinctive anatomical features of the stems and leaves

*Young stems* with numerous glandular hairs at apex. *Stems of 2,5 cm diameter:* sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. *Leaves* with a few glandular hairs; petiole ± heart-shaped as seen in transverse section, sclerenchymatous pericycle present or absent, vascular bundles mainly abaxial and distributed in the form of an arc as seen in transverse section, in some cases 1–2 much smaller bundles (usually only phloem strands) adaxially, with a large number of stomata; terminal leaflet typically isobilateral with 1–3 layers of palisade cells ad- and abaxially, central mesophyll consisting of ± colourless cells, ad- and abaxial epidermis consisting mainly of bulliform cells, with a large number of evenly distributed stomata in the ad- and abaxial epidermis.

*Fig. 103.*—Flowers of *Commiphora capensis*: A, male flower; B, longitudinal section of male flower; C, female flower; D, female flower with the calyx and corolla partly removed.

*Fig. 104.*—Fruit of *Commiphora capensis*: A, side-view of the fruit; B, view of the less convex face of putamen; C, view of the more convex face of the putamen; D, putamen as seen from above.

*Fig. 105.*—Geographical distribution of *Commiphora capensis* in South Africa.
As in the case of *C. cervifolia*, but to a lesser extent, the living shoots, on being touched, exude an aromatic secretion in such quantities that the stems become wet.

The fruits are eaten by animals.

18. *Commiphora cervifolia* Van der Walt in J.S. Afr. Bot. 37,3: 189 (1971). Type: North-western Cape, 8 km S. of Vioolsdrift, Van der Walt 128 (PRE, holo.; PRU).

Dioecious shrub up to 2 m tall; trunk branching repeatedly above soil level, stems appearing succose; bark greyish green to yellowish brown with dark patches, not peeling; branchlets short and stout, glabrous. *Leaves* trifoliolate, glabrous; lamina up to 1,5 cm long; petiole up to 5 mm long; leaflets small, cultrate, usually irregularly lobed, apex acute to obtuse, base cuneate, margins entire irrespective of lobes; terminal leaflet up to 1×0,2 cm; lateral leaflets up to 0,8×0,2 cm. *Flowers* unisexual, perigynous, appearing before the leaves in axillary dichasial cymes up to 2 cm long or solitary; male flowers, 6–7 mm, usually larger than female flowers, 5–6 mm. *Bracteoles* up to 0,5 mm long, lanceolate, sparsely glandular. *Pedicels* 1–1,5 mm long, sparsely glandular. *Calyx* yellowish green to brown, fleshy, continuous with fleshy hypanthium, sparsely glandular, lobes up to 2 mm long, apex acute. *Petals* yellowish green to brown, 2–3 mm long, inserted on hypanthium. *Disk* adnate to hypanthium, cylindrical with 4 fleshy lobes. *Stamens* 8, 4 long stamens up to 3 mm long, inserted on top of disk lobes; 4 short stamens up to 2,2 mm long, inserted on top of disk between lobes; filaments slender, subterete, lower part flattened and broadened; staminodes in female flowers. *Carpel* rudimentary in male flowers; ovary half inferior, sparsely glandular; style relatively short, sparsely glandular; stigma obscurely 4-lobed. *Fruit* 1,1×1 cm, ellipsoid, asymmetrically flattened; exocarp glabrous; mesocarp very thin; putamen 9×8 mm, ellipsoid, asymmetrically flattened; pseudaril lacking. Fig. 106–111.
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Distinctive anatomical features of the stems and leaves

Young stems with numerous glandular hairs at apex. Stems of 2.5 cm diameter: sclerenchymatous pericycle-cylinder consisting of fibres and stone cells, epithelium cells of resin ducts in xylem rays surrounded by thin-walled cells. Leaves with a few glandular hairs; petiole ± heart-shaped as seen in transverse section, sclerenchymatous pericycle usually absent, 1–3 but usually only 1 vascular bundle abaxially and in some cases 1–2 phloem strands adaxially, with a large number of stomata; terminal leaflet typically isolateral, mesophyll consisting mainly of palisade cells with a few ± colourless cells centrally, ad- and abaxial epidermis consisting mainly of large bulliform cells, with a large number of evenly distributed stomata in the ad- and abaxial epidermis.

Diagnostic features

Dioecious shrub, trunk branching repeatedly above soil level, stems appearing succose; bark greyish green to yellowish brown with dark patches, not peeling; branchlets short and stout, with numerous glandular hairs at apex but otherwise glabrous. Leaves trifoliolate, glabrous, leaflets small, cultrate, usually irregularly lobed, margins entire irrespective of lobes, terminal leaflet typically isobilateral. Flowers perigynous, unisexual, calyx fleshy. Fruit ellipsoid; exocarp glabrous; mesocarp very thin, putamen smooth; pseudaril lacking.
1. This species is apparently confined to the semi-desert areas of the north-western Cape from Goodhouse in the east to Vioolsdrif in the west. It occurs on the arid mountains or kopjes in the vicinity of the Orange River in areas with an annual rainfall of less than 80 mm.

2. **DISCUSSION OF THE RELATIONSHIPS OF THE SPECIES**

   The South African species of *Commiphora* can be divided on the basis of characteristics of the flower, inflorescence, fruit and leaf as follows:

   1. *C. glandulosa*, *C. pyracanthoides*, *C. merkeri*, *C. schimperi*, *C. africana*, *C. neglecta*, *C. mollis*, *C. harveyi* and *C. marlothii* have hypogynous flowers. The disk of the flowers is adnate to the hypanthium and in most cases not fleshy. The pseudaril covers only the lower part of the putamen or is completely absent.

   2. The pseudaril of *C. edulis*, *C. woodii* and *C. zanzibarica* is cupular without long arms or lobes, the leaves are impari-pinnate and the flowers are borne in long paniculate cymes.

   3. The pseudaril of *C. angolensis* and *C. tenuipetiolata* is cupular with two lobes on the flattened faces of the putamen, the leaves are trilobate or impari-pinnate and the flowers are borne in simple or compound dichasial cymes.

   4. *C. capensis* and *C. cervifolia* have no pseudaril, the flowers are borne singly or in short dichasial cymes and the leaves are trilobate.

   In the revised classification of Wild (1959a) the genus is divided into the subgenera *Commiphora* and *Opobalsamum*. According to this division all the South African species belong to the subgenus *Commiphora*, characterized by the fruit splitting into two valves at maturity, four stamens which are distinctly shorter than the remaining four and the presence of four or eight disk lobes. It should be noted, however, that the flowers of *C. ob lanceolata* Schinz (not mentioned by Wild) and *C. gr acilifrondosa* have only four stamens.

   In the division of the subgenus into sections, Wild did not make use of the fact that some species possess hypogynous and other perigynous flowers. However, all the South African species of his sections *Commiphora* and *Africanae* have hypogynous flowers, while those of the sections *Coriaceae* and *Spondioideae* are perigynous.

   The distinction between the sections *Commiphora* and *Africanae* by Wild is mainly based on the structure of the pseudaril. Representatives of the section *Commiphora* have a pseudaril forming four arms, while representatives of the section *Africanae* have no pseudaril. Wild, however, maintained that the pseudaril is only apparently absent in the latter section because it is probably united too intimately with the putamen to be visible. A remarkable similarity exists between the South African species belonging to the section *Africanae* (*C. africana* and *C. schimperi*) and the species of the subsection *Pyracanthoides* (*C. glandulosa*, *C. pyracanthoides* and *C. merkeri*). The putamen of all these species is fleshy; the fruit of *C. pyracanthoides*, *C. merkeri* and *C. schimperi* is apiculate; the length and shape of the four arms of the pseudaril of *C. africana*, *C. glandulosa* and *C. pyracanthoides* are alike, while the pseudaril of *C. merkeri* and *C. schimperi* (although

   ![Fig. 111. Geographical distribution of Commiphora cervifolia in South Africa.](image-url)
thin and membranous and only visible in fresh fruits) covers almost the whole putamen. Furthermore, C. glandulosa, C. pyracanthoides and C. schimperi can have bisexual flowers. In addition all these species have spine-tipped branchlets, flaking or peeling bark and petioles which show marked anatomical similarities. A reasonable deduction can be made that a closer affinity exists between these species than Wild realized.

C. marlothii is the only South African representative of the section Commiphora where the filaments are not adnate to the outside of the disk, but inserted on top of the disk. This feature, as well as the presence of long, paniculate cymes, impari-pinnate leaves and medullary vascular bundles in the petiole, suggests an affinity with the subsection Cupulares of the section Spondioideae.

In agreement with the classification of Wild, a cupular pseudaril is found in all the indigenous representatives of the section Spondioideae. Species of the subsection Cupulares (C. edulis, C. woodii and C. zanzibarica) have large pinnate leaves, perigynous flowers and a pseudaril without long lobes or arms. These three species show marked similarities in stem and leaf anatomy, although medullary vascular bundles are absent from the petiole of C. woodii. The short lobes of the pseudaril of C. edulis suggest a probable affinity with the section Commiphora.

The two closely related species, C. angolensis and C. tenuepetiolarata of the subsection Glaucidulae, have a pseudaril with two lobes on the flattened faces of the putamen. The hypanthium of both species is relatively long. The external morphological similarities of the leaves of the two species are reflected anatomically; it is also of particular interest that the dendritic crystals of hesperidin or diosmin only occur in these two species.

The new species C. gracilifrondosa should be placed in Wild’s subsection Pruinosae. As in C. namaensis (subsection Pruinosae), the pseudaril of C. gracilifrondosa is cupular with two arms on the seam of the putamen.

The absence of a pseudaril is the outstanding feature of representatives of the section Coriaceae, and the new species C. cervifolia should be placed in this section. Wild’s division of the Coriaceae into the subsections Rangeanae and Teretifoliolatae is partly based on the structure of the calyx. He described the calyx of Rangeanae (includes C. capensis) as campanulate and the calyx of Teretifoliolatae as broadly campanulate. This criterion for the subdivision is now unsatisfactory because the calyx of C. cervifolia is broadly campanulate, but this species is undoubtedly closely related to C. capensis.

**OPSOMMING**

Hierdie ondersoek behels ’n taksonomies-morfologiese studie van die 18 Commiphora-spesies wat tot dusver in Suid-Afrika versamel is. Die belangrikste oogmerk met die studie was om die verschillende spesies duidelik te onderskei. Om dit te kon bereik is ’n volledige anatoniem studie van die singels en blare, asook ’n organografiestude van die singels, blare, blomme en spulp vragte gemaak. Die organografiestude van hierdie organe is met behulp van sketse en foto’s geïllustreer.

’n Volledige uiteensetting van die taksonomiese literatuur en geografiese verspreiding in Suid-Afrika, van elke spesie gegee. Die tipe-eksemplare van al die spesies en hulle sinonie is beskryf, en in toepasselijke gevalle is lektotipes aangewys. Die onderliggende geografiese verspreiding in Suid-Afrika, van die spesies word bespreek. Die moontlike verwantskappe van elke spesie, word gegee.

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