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Series of revisions of Apocynaceae
XLIX
Carissa L.

by A.J.M. Leeuwenberg & F.J.H. van Dilst

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Key to Apocynaceae in continental Africa

by A.J.M. Leeuwenberg

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Carissa L.

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Abstract

This paper monographs *Carissa*, a genus counting 7 species of the *Apocynaceae-Plumerioideae-Carisseae-Carissinae* known from Africa, South Asia, Australia and New Caledonia. Four keys to the species are presented, one to all species, one for the species presented to the African continent, one for those of Madagascar and one for the species known from Asia. In the countries not listed here only a single species occurs.

Twenty-one names are considered to be new synonyms. The very well-known name *C. edulis* has to yield to the earlier name *C. spinarum*. Eighteen lectotypes are designated here for various names and synonyms. For *C. macrocarpa* a neotype is selected, as the type very probably has not been preserved.

Introduction

The present paper is a monographic revision of the genus *Carissa*. The taxonomic study is based on herbarium material, while in addition the first author has had the opportunity of observing living plants in the wild of 3 of the 7 species maintained here and of 2 other ones in cultivation.

Geographical distribution

The genus *Carissa* counts 7 Old World species.

The most widespread species is *C. spinarum*, known in Africa from Senegal to Socotra in the North and from Namibia to Natal in the South, from the Comoro Islands and Madagascar, from South Asia from the Arabian Peninsula to Vietnam, from Australia and from New Caledonia. *C. bispinosa* occurs in Southeastern and Southern Africa. *C. tetramera* can be found in East Africa, and *C. macrocarpa* in Southern Africa. *C. boiviniana* and *C. pichoniana* are endemic to Madagascar and *C. carandas* is only found in Southern India and Bangladesh.

As *C. carandas* is frequently cultivated in various Asian countries its original area of distribution is often over-estimated.

Relationship with other genera

Carissa belongs to the subtribe *Carissinae* of the tribe *Carisseae* of the subfamily *Plumerioideae*. It is closely related to the only other genus of this subtribe, *Acokanthera*, from which it can be distinguished as follows:

1. Plants usually spiny; inflorescences terminal and sometimes also axillary; branches repeatedly dichotomously branched; anthers glabrous; sap not poisonous. Widespread in the Old World and often cultivated as ornamental .....**Carissa**
   Plants never spiny; inflorescences axillary; stems sparingly branched; anthers with stiff hairs; sap extremely poisonous. East and South Africa.....**Acokanthera**

The genus *Carissa* is considered to be the most primitive genus of the family of the Apocynaceae as for the flowers and fruits. The aestivation of the corolla is contorted to the left or to the right: to the left in the 3 species confined to continental Africa and to the right for the 4 other species. The stamens are free from the pistil head of which the apex is often situated clearly below it. The anthers are completely fertile, ovate or elliptic and cordate at the base, as in all *Carisseae* and many Old World species of *Tabernaemontana*. The pistil head is composed of a basal stigmatic part subglobose or nearly so and a sometimes absent bilobed stigmoid apex. The latter is clearly figured by Albers & van der Maesen (1994) for *Tabernaemontana pandacaqui*. The fruits are indehiscent syncarpous 2-celled berries, as is the rule in the tribe *Carisseae*. In that tribe only the *Pleiocarpinae* with apocarpous baccaceous fruits constitute an exception. However, the berries can be halfway 2-celled with axile placentation and halfway 1-celled with parietal placentation in other *Carisseae* genera, such as in *Landolphia*. Berries are also similar in *Tabernanthe iboga* of the tribe *Tabernaemontaneae*.

References:

Albers, P. & L.J.G. van der Maesen. 1994. Pollination of Apocynaceae. Wageningen Agric. Univ. Pap. 94,3 : 61-81.

Leeuwenberg, A.J.M. 1994. Taxa of the Apocynaceae above the genus level, Series of revisions of Apocynaceae XXXVIII. Wageningen Agric. Univ. Pap. 94, 3: 45-60.

Carissa L., Mantissa 1: 52 (1767); Syst. Nat. ed. 12, 2: 189 (1770); Pichon in Mém. Inst. Sc. Madag. ser. B, 2: 125–140 (1949); H. Huber, Apocynaceae in Fl. Ceylon 1: 9 (1973); Kupicha in Fl. Zamb. 7, 2: 398–404 (1985); P.T. Li, A.J.M. Leeuwenberg & D. J. Middleton, Apocynaceae in Fl. China 16: 146 (1995), nom. cons. – Type species: *C. carandas* L.

Homotypic synonyms: *Carandas* Rumph., Herb. Amboin. 7: 58, t. 25 (1775); Adanson, Fam. 2: 171 (1763), nom. rej. *Jasminonerium* L. ex Kuntze, Rev. 2: 415 (1891).

Heterotypic synonyms: *Arduina* Mill., Icon. 2: t. 300 (1760); Linnaeus, Mantissa 1: 52 (1767), as *Arduinia*. — Type species: *A. bispinosa* L. (= *C. bispinosa* (L.) Desf. ex Brenan).

Antura Forssk., Fl. Aegypt.-Arab. 63 (1775). No species mentioned. Type species: *C. edulis* Vahl (= *C. spinarum* L.).

Shrubs, climbers or trees, with white latex in all parts, but without latex in bark of big trees. Spines opposite on the forks and usually forming a right angle with the branches, or when the leaves ternate or quaternate, also ternate or quaternate, simple, furcate, bifurcate or, especially in trees, spines absent. *Leaves* opposite or on main stems often ternate or quaternate, but all ternate or quaternate in *C. pichoniana*; blade orbicular to very narrowly elliptic, entire. *Inflorescence* terminal and sometimes also axillary, cymose. *Flowers* pentamerous or only in *C. tetramera* tetramerous, open during the day. *Sepals* usually green, connate at the extreme base, erect, ovate to narrowly oblong. *Corolla* white, sometimes pink or nearly and/or partly or entirely so; tube cylindrical, not twisted; lobes from broadly ovate or orbicular to elliptic, entire, spreading, in bud overlapping to the left or to the right. *Stamens* included, often barely so, mostly inserted in the upper half of the corolla tube; filaments very short; anthers oblong or narrowly ovate, apiculate to retuse at the apex, cordate at the base, usually glabrous. *Pistil* usually glabrous, with apex close to the anthers or below them; ovary 2-celled, with few or many ovules; pistil head of 2 parts, a subglobose or ellipsoid basal stigmatic part and a bilobed stigmoid apical part. *Fruit* a berry, (dark) red to black, edible, globose, ellipsoid or narrowly so, mostly with few seeds. *Seed* medium or dark brown, obliquely ovate to almost orbicular or elliptic, usually convex at one side and flat at the other, the hilar, side; teste rough, hard, minutely

papillose; hilum in the middle of the hilar side. Endosperm mealy, surrounding the embryo. Embryo straight, spathulate, relatively small; cotyledons ovate or elliptic.

7 species from Senegal in the West to New Caledonia in the East and from Saudi Arabia in the North to South Africa and Australia in the South.

Note. The climbers grow in the model of Koriba and the trees usually in the model of Prévost, especially when young.

Uses. *Carissa macrocarpa* produces large edible fruits. In horticultural literature the synonym *C. grandiflora* is used for the non-deciduous flowering shrub, even a cultivar 'Tuttlei' has been named.

The minimum temperature should be 10-13° C, the species are not hardy. In Europe flowering is from spring to summer. Well-drained soil mixtures and semi-shade are preferred, and propagation is by ripe seeds or semi-ripened cuttings during summer. This species is represented in many Botanic Gardens, outside or in greenhouses as the case may be.

Carissa spinarum hitherto mainly known as *C. edulis*, has usually small tasty fruits, that are known to be edible along its range. Selection will certainly yield larger and more tasty fruits, as is the case in a Thai accession (*Wongsatit* 725). Fruits are not sold on markets.

Flowers of nearly all species are very ornamental. Flowering period is reasonably long.

1. Key to the species

1. Corolla lobes overlapping to the left. Africa, exclusive of Madagascar .....see 2 of key 2
   Corolla lobes overlapping to the right. In Africa only *C. spinarum* 2
2. All leaves rounded or retuse at the apex and some of them oblong and at least twice as long as wide, with 4—12 pairs of rather straight or upcurved secondary veins forming an angle of 30—60° with the costa. Southern India and frequently cultivated in other countries .....**2. C. carandas**
   Leaves acuminate to rounded at the apex, orbicular to narrowly

elliptic, with at least one pair of secondary veins conspicuously arcuate towards the margin forming an angle of 30—45° with the costa and often also above them several pairs of rather straight ones forming an angle of 60—80° with the costa.....
.....see 1 of key 3 (Madagascar) or of key 4 (Asia)

2. Key to the species represented in Africa outside Madagascar

1. Corolla lobes overlapping to the right; spines simple, rarely furcate; 1 or several pairs of secondary veins arcuate along the margin and forming a narrower angle with the costa than the upper more or less straight pairs .....**6. C. spinarum**
   Corolla lobes overlapping to the left; spines usually furcate or bifurcate 2
2. At least 12 pairs of secondary veins, often ending with a fork into the marginal vein, not with basal ones forming a much narrower angle with the costa than the upper ones; flowers 4-merous .....**7. C. tetramera**
   Secondary veins in 5—8 (11) pairs; flowers 5-merous 3
3. Corolla tube 4.8—9 mm long; fruit ca 1—2 cm long.....
   .....**1. C. bispinosa**
   Corolla tube (9)10.5—18.5 mm long; fruit 2—3.5 cm long .....**3. C. macrocarpa**

3. Key to the species represented in Madagascar

Carissa is represented in Madagascar by 3 species, which all have corolla lobes overlapping to the right and which are, except for *C. pichoniana*, easily confused. The author had great problems to distinguish the two other species from each other. The flowers have the same characters and are similarly variable in these two species, the well-known *C. spinarum* one of them. The three species could be distinguished as follows:

1. Leaves in whorls of 3—4, 2—7 x as long as wide, 15—37 x 3—8 mm, with one pair of secondary veins from the base curved along the margin; tertiary venation invisible; shrub 2—4 m high; spines absent. Forest understorey.....
   .....**5. C. pichoniana**
   Leaves opposite, mostly less than 3 x as long as wide; tertiary venation visible or not 2
2. Numerous straight secondary veins forming an angle of 40—70° with the costa, reaching the margin and anastomosing with tertiary

venation prominent on both sides or only above in dried leaves; fertile branchlets usually spiny. Forest .....**2. C. boiviniana**
Secondary veins prominent on both sides or not, basal (several) pairs curved along margin, forming and angle of 30—45(60)° with the costa.....**6. C. spinarum**

4. Key to the species represented in tropical Asia

1. All leaves rounded or retuse at the apex and some of them oblong and at least twice as long as wide, with 4—12 pairs of rather straight or upcurved secondary veins forming an angle of 30—60° with the costa. Southern India and frequently cultivated in other countries .....**2. C. carandas**
Leaves acuminate to rounded at the apex, orbicular to narrowly elliptic, with at least one pair of secondary veins conspicuously arcuate towards the margin forming an angle of 30—45° with the costa and often also above them several pairs of rather straight ones forming an angle of 60—80° with the costa. Widespread .....**6. C. spinarum**

Taxonomic treatment of *Carissa* species in alphabetical order

1. Carissa bispinosa (L.) Desf. ex Brenan in Mem. N.Y. Bot. Gard. 8: 502 (1954); Codd in Fl. Southern Africa 26: 255 (1963); Kupicha in Fl. Zamb. 7, 2: 403 (1985). — Type: Miller, Icon. 2: t. 300 (1760), lectotype designated by Codd. Herb. material studied by Linnaeus (LINN 265.1). Fig. 1, p. 9 and 2, p. 10; map 1, p.11

Basionym and homotypic synonyms: *Arduina bispinosa* L., Mant. 1: 52 (1767) as *Arduinia*. *Jasminonerium bispinosum* (L.) Kuntze, Rev. 2: 415 (1891). *Lycium cordatum* Mill., Gard. Dict. ed. 8: *Lycium* 10 (1768). *C. cordata* (Mill.) Fourc. in Trans. Roy. Soc. S. Afr. 21: 82 (1934). *C. arduina* Lam., Encycl. 1: 555 (1785). *Carandas arduina* (Lam.) S. Moore in Journ. Bot. 41: 403 (1903).
Heterotypic synonyms: *Carissa myrtoides* Desf., Cat. Hort. Paris ed. 3: 398 (1829). — Type: Cult. Hort. Bot. Paris s.n. (holotype FI-W, n.v.).
Arduina erythrocarpa Eckl. in S. Afr. Quart. Journ. 4: 372 (1830). *C. erythrocarpa* (Eckl.) A. DC., Prod. 8: 335 (1844). *Jasminonerium erythrocarpum* (Eckl.) Kuntze, Rev. 2: 415 (1891). — Type: S. Africa, E. Cape Province, Uitenhage District, Kraka-

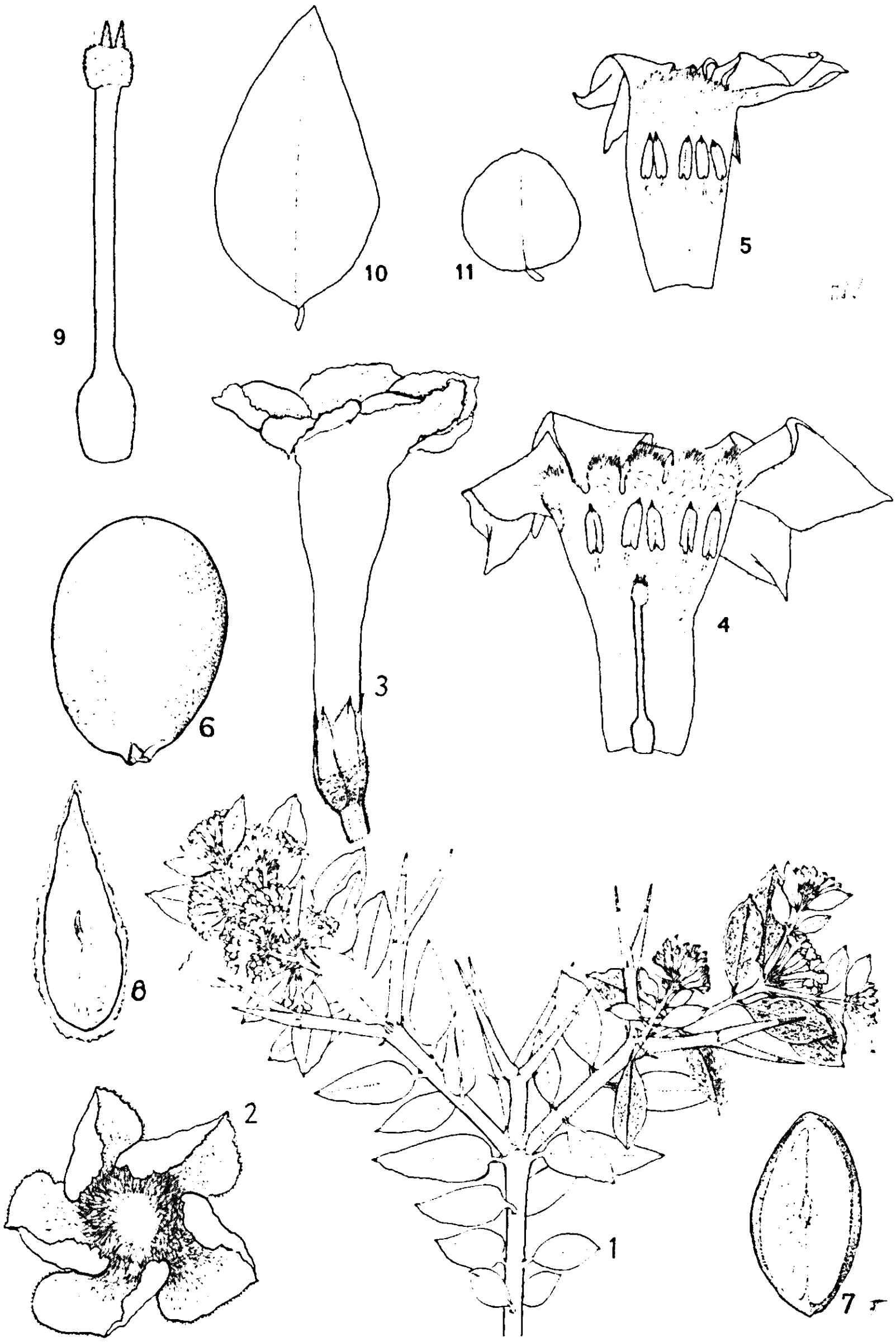


Fig. 1. *Carissa bispinosa*. **1**. habit (x 2/3); **2**. corolla above (x 6); **3**. flower (x 6); **4-5**. opened flowers, (x 4); **6**. fruit (x 2.8); **7**. seed (x 4); **8**. seed with pulp (x 4); **9**. pistil (x 12); **10-11**. leaves (x 2/3). 1-3 and 6-8 from Vlok 511; 4 and 9 from Van der Laan 563; 5 from Kemp 404; 10-11 from Brumbach 6635.

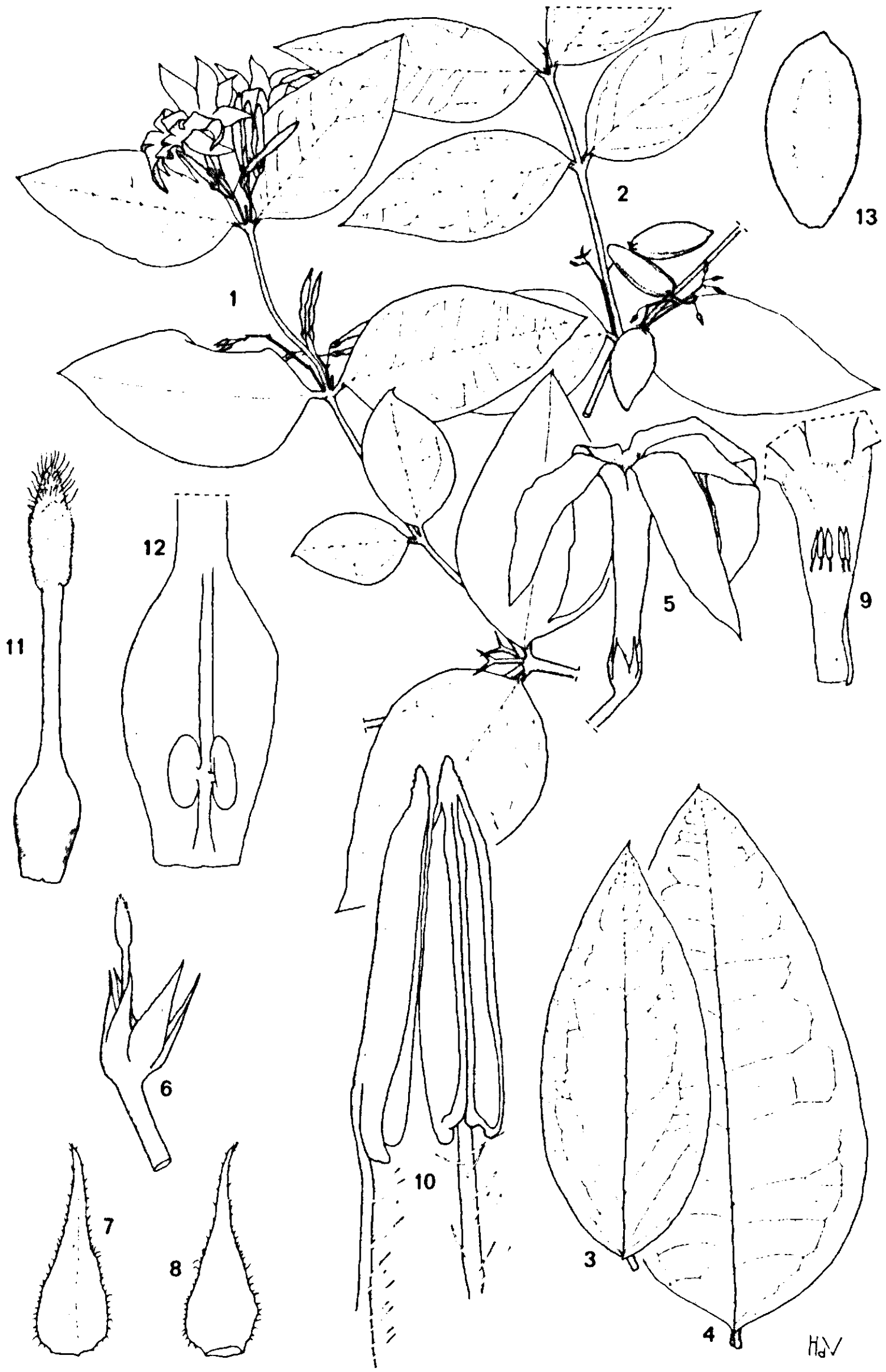
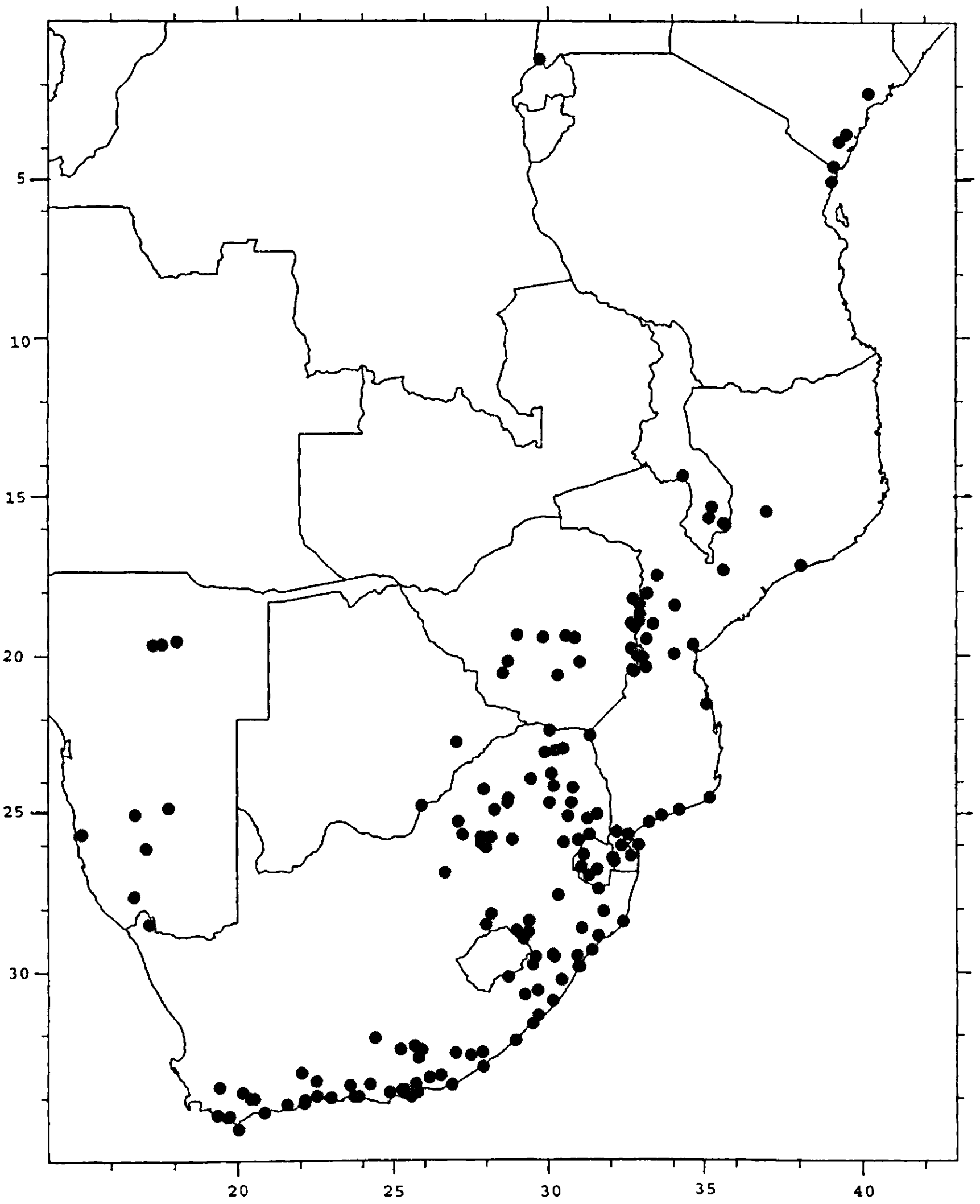


Fig. 2. *Carissa bispinosa*. **1**. habit (x 2/3); **2**. habit fruiting (x 2/3); **3-4**. leaves (x 2/3); **5**. flower (x 2); **6**. calyx with pistil (x 4); **7-8**. sepal out- and inside (x 10); **9**. opened corolla (x 2); **10**. stamens (x 30); **11**. pistil (x 12); **12**. longitudinal section of ovary (x 30); **13**. seed (x 2). 1 and 5-12 from Strey 8852; 2 from Müller & Gordon 1817; 3 from Torre & Paiva 12286; 4 from Wells & Edwards 93; 13 from Macedo & Mackácua 2039.



Map 1. *Carissa bispinosa*.

kamma and Ado, *Zeyher* 308 (lectotype K designated here; isotypes BM, M, TCD).

A. haematocarpa Eckl. in S. Afr. Quart. Journ. 4: 372 (1830). *C. haematocarpa* (Eckl.) A. DC., Prod. 8: 336 (1844); Codd in Fl. Southern Afr. 26: 255 (1963), **syn. nov.** *Jasminonerium haematocarpum* (Eckl.) Kuntze, Rev. 2: 415 (1891). — Type: S. Africa, E. Cape Province, Uitenhage District, between Swartkops and Sunday Rs., *Zeyher* 163 (lectotype G designated here; isotypes BP, W).

A. ferox E. Mey., Comm. 191 (1837). *C. ferox* (E. Mey.) A. DC., Prod. 8: 335 (1844). *Jasminonerium ferox* (E. Mey.) Kuntze, Rev. 2: 415 (1891). — Type: South Africa, E. Cape Province, near Kookhuis (= Cookhouse), near Groot Vischrivier (= Great Fish R.), *Drège* Arduina ferox b (lectotype S designated here; isolectotypes G, K, P, W).

A. acuminata E. Mey., Comm. 191 (1837). *C. acuminata* (E. Mey) A. DC., Prod. 8: 335 (1844). *Jasminonerium acuminatum* (E. Mey.) Kuntze, Rev. 2: 415 (1891). *C. bispinosa* var. *acuminata* (E. Mey.) Codd in Bothalia 7: 451 (1961) and in Fl. Southern Afr. 26: 257 (1963), **syn. nov.** — Type: S. Africa, Natal, between Umzimvubu and Umsikaba Rs., *Drège* Arduina acuminata b (lectotype P designated here; isolectotypes G, HBG, K, S, TCD, W).

C. wyliei N.E. Br., Kew Bull.: 165 (1906); Codd in Fl. S. Africa 26: 258 (1963), **syn. nov.** — Type: South Africa, Natal, Zululand, Ngoya For., *Wylie* in Herb. *Wood* 7898 (holotype K; isotype F; phot. of holotype B, GB, GH, S).

A. megaphylla Gand. in Bull. Soc. Bot. France 65: 59 (1918). — Type: S. Africa, E Cape Province, East London, *Galpin* 3452 (holotype P (?), n.v.).

Carissa dinteri Markgr. in Notizb. Bot. Gart. Berlin 15: 758 (1942). — Type: Namibia, Otavifontein, *Dinter* 5359 (holotype Z; isotypes A, G, GH, K).

C. bispinosa subsp. *zambesiensis* Kupicha in Bol. Soc. Brot. 53, 1: 321 (1980) and in Fl. Zambes. 7, 2: 404 (1985), **syn. nov.** — Type: Zimbabwe, Umtali (= Mutare) District, Nyamakwarara (=Nyamkwarara) Valley, *Mavi* 438 (holotype K; isotypes LISC, PRE, SRGH).

A much branched *shrub*, sometimes scandent, 0.6—6 m high or a

small tree up to 10 m high. Branches longitudinally fissured; branchlets pubescent or glabrous. Spines furcate or bifurcate, mostly robust, sometimes slender and small, simple or absent; axis up to 3.5 cm, forks up to 4.5 cm. *Leaves* opposite; petiole 1-4 mm long, glabrous or pubescent, sometimes colleters present in the axils; blade coriaceous when fresh, (thinly) coriaceous when dried, broadly ovate, orbicular or elliptic, 1.2—2.6 x as long as wide, 1—11 x 0.6—6 cm, acute or mucronate at the apex, sometimes obtuse or rounded, subcordate to almost cuneate at the base, sometimes decurrent into the petiole, glabrous on both sides, margin recurved in dried leaves, with (4)5—8 pairs of secondary veins, arcuate towards the margin; tertiary venation reticulate, inconspicuous on both sides. *Inflorescence* terminal, rather congested few- to many-flowered. Peduncle 1.5—20 mm long, glabrous or pubescent; pedicels 0.2—5 mm long, glabrous or pubescent. *Flowers* fragrant. *Sepals* narrowly ovate or narrowly oblong, 1.6—4 x as long as wide, 1.5—3 x 0.5—1 mm, acute or acuminate at the apex, slightly auriculate at the base, glabrous to pubescent outside, ciliate or ciliolate, glabrous inside. *Corolla* white, glabrous or irregularly pubescent or puberulous outside, with a pubescent belt from 0—4 mm above the base 1.8—8.5 mm wide, pubescent to the mouth or the base of the lobes where hairs longer, ciliolate or not at the lobes; tube usually slightly widened at the base, narrowed at the mouth, 2.5—4.1 x as long as the sepals, 4.8—14 mm long; lobes broadly ovate or orbicular, 0.4—0.7 x as long as the tube, 1.5—2.1 x as long as wide, 3.3—5.9 x 1—3 mm, acute, obtuse or rounded at the apex, auriculate at the right side and thickened in the middle at the base, overlapping to the left in bud. *Stamens* with apex 0.1—1.8 mm below mouth of corolla tube, inserted 0.4—0.6 of the length of the corolla tube, at 2.2—5 mm from the base; filaments 0.3—0.5 x 0.1—0.2 mm, pubescent inside; anthers 1—1.4 x 0.3—0.6 mm, acute at the apex. *Pistil* 2.7—5.4 mm long; ovary cylindrical or (sub)globose, 0.6—1 x 0.3—0.8 mm, acute at the apex, glabrous; style 1.3—4 x 0.1—0.3 mm, glabrous; pistil head 0.6—1.4 x 0.3—0.8 mm, basal part 0.2—0.7 mm long, minutely pubescent, papillose or glabrous, stigmoid apex 0.3—0.7 mm long, pubescent. *Fruit* red, ellipsoid, 10—20 x 4—10 mm, glabrous, 1—2-seeded. *Seeds* plano-convex, obliquely elliptic or ovate, 5.5—12 x 3.5—5 x 1.5—2.7 mm. Embryo 3.6—4.8 mm long, cotyledons 1.8—2.3 x 0.7—1.5 mm, rootlet 1.5—2.8 x 0.6 mm.

Distribution: Kenya to South Africa and Namibia.

Ecology: In karroid scrubs, savannas, forest understorey, even in rather wet forests, mostly on sandy soils, less often on limy soils, or on termitaries. Flowering and fruiting throughout the year. Altitude: 0—2350 m.

Geographical selection of the approximately 460 specimens examined:

Uganda. U2: between Nakalembe and Mashogiri, *Gilbert Rogers & Gardner* 297 (BM).

Kenya. K7: Tana R. District, 2.7 km N of Lango ya Simba, *Robertson & Luke* 5367 (BR, K); km 9 Bamba-Karimani Road, *Luke & Robertson* 2144 (K).; near Samburu, *Kaessner* 486 (BM, K); Gonja F.R., *Luke et al.* 3799B (K).

Tanzania. T3: Amboni, *Holst* 2474a (W).

Malawi. Central: Dedza Mt, *Chapman* 1044 (MAL, SRGH), 2059 (MAL, SRGH). Southern: Zomba Plateau, near Chingwe's Hole, *Chapman & Tawakali* 5984 (BR, K, MAL); Chiradzulu Peak, *Balaka & Kaunda* 802 (MAL, NY); Mt Mulanje, Upper Lukuleza valley, *Chapman* 450 (BM, BR, FHO, K, MAL, PRE); Sombani Basin, *Brummitt* 11276 (K, MAL, UPS).

Mozambique. Zambézia: Guruè, *Torre & Correia* 16871 (LISC); Bajone, between Murroa and Namuera, *Barbosa & Carvalho* 4271 (K); Morrumbala, *Luja* 327 (BR). Sofala: Serra da Gorongosa, Nhandoro Mt, *Torre & Paiva* 12286 (LISC); between Zombué and Caratine, *Macedo* 2039 (WAG); Tsetserra, *Biegel & Pope* 3565 (K, LISC, SRGH); Dondo, *Dawe* 344 (K). Manica: Barué, *Torre* 3002 (LISC); Mt Vumba, near Vila de Manica, *Gomes e Sousa* 4739 (COI, K, M, PRE); Vila Gouveia (= Catandica), *Torre* 6102 (LISC); Garuzo-Chimoio (= Matsinho) Region, *Mendonça* 3860 (LISC); Mavita, *Pereira & Marques* 1083 (BR, LMA, WAG); Haroni R. 1 km above junction with Lusitu R., *Simon & Ngoni* 1287 (K, LISC, SRGH); Chicambué R. valley, *Swynnerton* 1066 (BM, K); Serra Macuta, *T. Müller & T. Gordon* 1817 (K, SRGH); Mussurize (= Algueirão), *Pereira et al.* 1368 (BR, LMA, WAG). Gaza: Chidenguele, *Pedro & Pedrogão* 1811 (LMA, PRE); João Belo (= Xai-Xai), *Balsinhas* 1354 (LISC, WAG); Bilene, *Correia & Marques* 1434 (LMA, WAG). Inhambane: Govuro, *Dawe* 526bis (K); Inharrime, *Barbosa & de Lemos* 8080 (COI, K, LISC). Maputo: Vundiç-Moamba Road, *de Koning et al.* 8520 (BM, K, WAG); Marracuene, *Barbosa & de Lemos* 8659 (COI, K, LISC, PRE, SRGH); Umbelúzi, *de Carvalho* 1322 (PRE); Inhaca Island, *Mogg* 27411 (K, PRE, SRGH); Matutuine, *da Silva et al.* 198 (WAG); Namaacha, *Gomes e Sousa & Balsinhas* 4999 (PRE, WAG); between Goba and Catuane, *Torre* 1885 (LISC).

Zimbabwe. Midlands: 12 km S of Gwelo (= Gweru), *Biegel* 1359 (B, LMA, SRGH), 2289 (SRGH, WAG); Umvuma (= Mvuma), Mtao For., *Brain* 6337 (COI, SRGH); Belingwe, Mt Buhwa, *Pope* 929 (PRE, SRGH). Matabeleland North: Kenilworth Ranch, 90 km N of Byo (= Bulawayo), *Best* 648 (SRGH); Bulawayo, *Rand* 285 (BM). Matabeleland South, *Plowers* 1267 (SRGH). Victoria: Felixburg, *Thompson* 76/51 (SRGH); Kyle (= Mutirikwe) Dam, *Mavi* 1242 (COI, K, PRE, SRGH). Manicaland: ca. 30 km S of Inyanga (=Nyanga), *Fries et al.* 3059 (BM, BR); Nyamingura, R., *Chase* 7405 (K, PRE, SRGH); Nyamakwarara

(= Nyamkwarara) Valley, *Mavi* 427 (BR, K, SRGH, WAG), 438 (K, LISC, PRE, SRGH, type of *C. bispinosa* subsp. *zambesiensis*); Vumba Mts, *Angus* 2442 (FHO, K, LISC, SRGH); ibid., *Chase* 7018 (BR, K, P, PRE, SRGH); Melsetter (= Chimanimani) District, *Sturgeon* SRGH 30782 (K, LISC, NY, PRE, S, SRGH); ibid., Glenco F.R., Mt Pene, *Drummond* 4947 (BR, K, LISC, PRE, SRGH); Chirinda For., *Goldsmith* 103/66 (BR, K, LISC, PRE, SRGH); ibid., *Swynnerton* 69 (BM, K, SRGH, US, Z).

Swaziland. 2 km N of Mbabane, *Kemp* 404 (PRE, WAG); Mankayana, *Compton* 89056 (K); 0.5 km S of Singceni, *Prior* 55 (K); Hlatikulu, *Compton* 28165 (FHO).

South Africa. Transvaal: Punda Milia, *van Wijk* 4725 (G); 22 km W of Sibasa, *Codd* 4517 (K); Soutpansberg, near Entabeni, *Hutchinson & Gillett* 4288 (BM, K); Messina, *Dahlstrand* 923 (GB); ca 12 km E of Louis Trichardt, *Schlieben* 7167 (B, BR, F, G, HBG, K, M, NY, UC, US, WAG), 7334 (B, BR, G, HBG, K, M, NY, US, Z); ca 67 km W of Louis Trichardt, *Schlieben* 7378 (B, BR, F, G, HBG, K, M, NY, UC, US); Westfalia Estate, *Scheepers* 748 (K, M, W); E of Pietersburg, *M.C. Gillett* 307 (BOL, UPS); Warmbath, *Leendertz* 1177 (WAG), 1302 (AMD); ibid., Boschpoort, *Olaphson & Acock* 1102 (S); Mosdene, Naboomspruit, *Galpin* M 209 (L, NSW, US); Nylsvley Nat. Res., *Leeuwenberg* 11013 (WAG); "The Downs", Pieterburg District, *Rogers* 21898 (A, BP, G, Z); Balloon-Makutsi R., *Stalmans* 818 (K); Houtbosch, *Rehmann* 6453 (Z); Belvedere, Pilgrimsrest District, *Davidson & Mogg* 33581 (UPS); Kruger Nat. Park, Pretorius Kop area, *van der Schijff* 491 (K); W of Skukuza, *Dahlstrand* 1693 (GB); Rimer's Creek, Barberton District, *Galpin* 648 (K, Z); Thorncroft Nat. Res., *Edwards* 4119 (AAU, K, PRE); Mt Anderson, W of Sabie, *Humbert* 10920 (K, P, WAG); Farm Goedgelegen, Carolina District, *Balkwill* 8492 (M); Premier mine Dam, Pretoria, *Pont* anno 1939 (U); Pretoria Hills, *Leendertz* 329 (K, L); Hartebeespoort, *Moss* 8023 (BM, G); Rusteburg, *Kaessner* 333 (BR); Pilansberg, *F. Venter* 1109 (K); Klerksdorp, *Nelson* 308 (K); Bryanston, 12 km N of Johannesburg Centre, *Dahlstrand* 410 (GB). Free State: Natal Royal Nat. Park, near Cascades, *Jacobs* 8576 (K, L); Witteberge, Kadziberg, *Rehmann* 3987 (Z). Kwazulu-Natal: Pongola, *Nel* 148 (AMD); Utrecht District, *Devenish* 945 (K); Nduni Hill, *Pooley* 70 (E); Mapelana, *du Toit* 1288 (K); Drakensberg, van Reenenpass, *Rehmann* 7241 (Z); Tugela Valley, *Acock* 1107 (S); Bergville District, Natal Nat. Park, *Wall* 30 Oct. 1938 (S); Cathedral Peak For. Research Station, *Killick* 1216 (K); Nkhandla, *Meebold* 12588 (M); Mtunzini, *Wells & Edwards* 93 (B, BM, G, K, M, W, Z); Ngoya (= Ongoye) For., *Wylie in herb. Wood* 7898 (F, K, type of *C. wyliei*), 8631 (K, NSW, Z), 10350 (F, NSW, P); Loteni R. valley, *Hilliard & Burtt* 15076 (K); Nonoti, *Wood* 11394 (K, M); Lions bush, Lions R. District, *Moll* 814 (BR, K); ca 4 km SW of Ndwedwe, *Balkwill* 4863 (E, M); Goodwill George, *Wall* 2686 (GB); Estcourt Region, *West* 160 (K); Durban, *Gueinzius* 39 (G, GH, K, P, S, W); Berea, *Wood* 7636 (BM, E, F, L, MEL, NSW, US, WAG); Weza State For., *Nicholas* 1816 (K); Dumisa, *Rudatis* 1133 (BM, E, G, GH, K, L, PR, S, W, WAG, Z); Umtamvuna Nat. Res., *Balkwill* 386 (K). Transkei: Nyameni, *Strey* 8852 (K, S); Insizwa For., *Strey* 10744 (K); Intsoban For. *Strey* 8599 (K); between Umzimvubu and Umsikaba Rs., *Drège* Arduina acuminata b (G, HBG, K, P, S, TCD, W, lectotype of *C. acuminata*); Elliotdale District, "The Haven", *Gordon-Gray* 566 (E). E Cape:

Griqualand East, *Jacottet* 29 (G); East London, *Peter* 30264 (B); Komgha, *Flanagan* 71 (L, P); Amabele, *Liebenberg* 3124 (A, K, MEL, P); Victoria East, Hogsback, *Lotsy & Goddijn* 61 (L); Kowie West, *Britten* 743 (M); near Grahamstown, *MacOwan* 760 (BM, BR, E, G, GH, K, P, UPS, Z); Uitenhage, near Boontjes R., *Drège* Arduina bispinosa b, anno 1837 (E, G, HBG, K, L, MEL, P, S, TCD, W); 32 km NW of Bedfort, *Theron* 1811 (K); near Swartskop R., *Drège* Arduina ferox c (P, paratype of *C. ferox*); ibid., *Ecklon* 2.3 (GH, P, S, UPS, W, Z); ibid., *Zeyher* 428 (BM, K, S, TCD), 3414 (K, S), 3414a (BP, K, MEL, P, S, W), 3414b (BP, G, P, W, Z), 3416 (BP, K, MEL, P, W, Z); between Swartkops and Sunday Rs., *Zeyher* 163 (BP, G, M, P, W, lectotype of *C. haematocarpa*); Kat R., *Drège* Arduina bispinosa c (G, P); near Krakakamma, *Ecklon & Zeyher* 3.7 (G, MEL, S, W); Krakakamma & Ado, *Zeyher* 308 (BM, K, M, TCD, lectotype of *C. erythrocarpa*); Ado, *Drège* Arduina bispinosa a (L); between Boschman and Sunday Rs., *Ecklon & Zeyher* 10.9 (G, S, W); Port Elisabeth, *Fries* 3048 (UPS); near Cookhouse, near Great Fish R., *Drège* Arduina ferox b (G, K, P, S, W, lectotype of *C. ferox*); Mortimer, *Lynes* anno 1927 (BM); Buffelshoek, *Acocks* 11963 (K); Humansdorp, *Fourcade* 2266 (K); Graaff Reinet, *Theron* 707 (K); Baviaanskloof, *Vlok* 511 (WAG); Storms R. F.R., *Dahlstrand* 480 (C, GB); Saasveld, *Geldenhuys* 648 (WAG). W Cape: Tsitsikama Nat. Park, *Spitzenberger* 10-16 Jan. 1976 (W); Phantom Pass, near Knysna, *Werdermann & Oberdieck* 972 (A, B, K, US, WAG); Groenkop For., *van der Merwe* 5 (WAG); Klein Brak R., *Taylor* 8338 (K); Oudtshoorn, *Dahlstrand* 2174 (C, GB); Mossel Bay, *Gillett* 23 Feb. 1926 (FHO); near Prince Albert, *Bolus* 11606 (BR); Albertinia, *Wall* 11 Dec. 1937 (S); Infanta, *Blum* 6 Dec. 1948 (E); Buffeljags R., *Penther* 2045 (M, S, W); Kenko R., between Rietkuil and Hemel, *Zeyher* 3415 (G, K, P, W); Bredasdorp, *Wall* 6 Dec. 1938 (S); Grootvadersbosch, *Bos* 690 (AAU, K, M, WAG); Bredasdorp District, "Die Mond", *Van Breda* 1041 (K); Elim, *Schlechter* 9667 (BM, G, K, Z); Worcester, *Leeuwenberg* 10960 (WAG); near Hermanus, *Williams* 1012 (K, WAG). N Cape: 24 km N of Stinkfontein, *Werger* EW 423 (K, U).

Botswana. Chobe Nat. Park, *Mahundu* CNP/154 (SRGH); 5 km N of Radisele, *Leach & Noel* 258 (K, PRE); Gaborone, *Rogers* 6264 (Z); 3 km W of Sherwood, *Hansen* 3484 (C, K, WAG).

Namibia. Grootfontein District, Farm Kumkauas, *Merxmüller & Giess* 30221 (M); SW of Otavi, *Müller-Stoll* Oct. 1944 (M); Otavifontein, *Dinter* 5359 (A, G, GH, K, Z, type of *C. dinteri*); near Kleinfontein, *Rehm* anno 1950 (M); Lüderitz-South District, Farm Spitzkop, *Merxmüller & Giess* 32298 (M); Bethanien District, near Chamis, *Giess et al.* 5521 (M); Farm Witpütz North, *Giess* 13747 (M, WAG); Vahldorn, *Dinter* 31 Jan. 1924 (A, B, K, M, NH, Z).

Cult. U.S.A.: Florida, Fort Meyers, *Brumbach* 6635 (A, UPS). U.K.: London, Chelsea Physick Garden, Herb. *Miller* 1921 (BM). Spain: Canary Islands, Gran Canaria, *Kunkel* May 1966 (G). Netherlands: Wageningen Bot. Garden, *van der Laan* 563 (WAG). Poland: Lauterbach Castel Park, Stabelwitz, *Baenitz* 1617 (A, B, BP, GH, L, M, S, US, Z). Autralia: NSW, Sydney Bot. Garden, *Boorman* Oct. 1904 (NSW).

2. Carissa boiviniana (Baill.) Leeuwenb., **comb. nov.** — Type: Madagascar, Toamasina, Ste. Marie Island, *Boivin* April 1851 (holotype P). Fig. 3, p. 18; map 2, p. 19

Basionym: *Leioclusia boiviniana* Baill., Bull. Mens. Soc. Linn. Paris 1: 224 (1880).

Heterotypic synonyms: *C. sessiliflora* Brong. ex Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 138 (1949), partly, excl. var. *scandens*; Markgraf, Fl. Madag. fam. 169: 16 (1976), **syn. nov.** *C. sessiliflora* var. *septentrionalis* Pichon in Mém. Inst. Sc. Madag. ser. B, 2: 139 (1949). — Type: Cult. Bot. Garden at Paris, *Houllet* April 1844, grown from seeds sent from Madagascar, Antsiranana, Nosy Be and collected by *Perville* (holotype P).

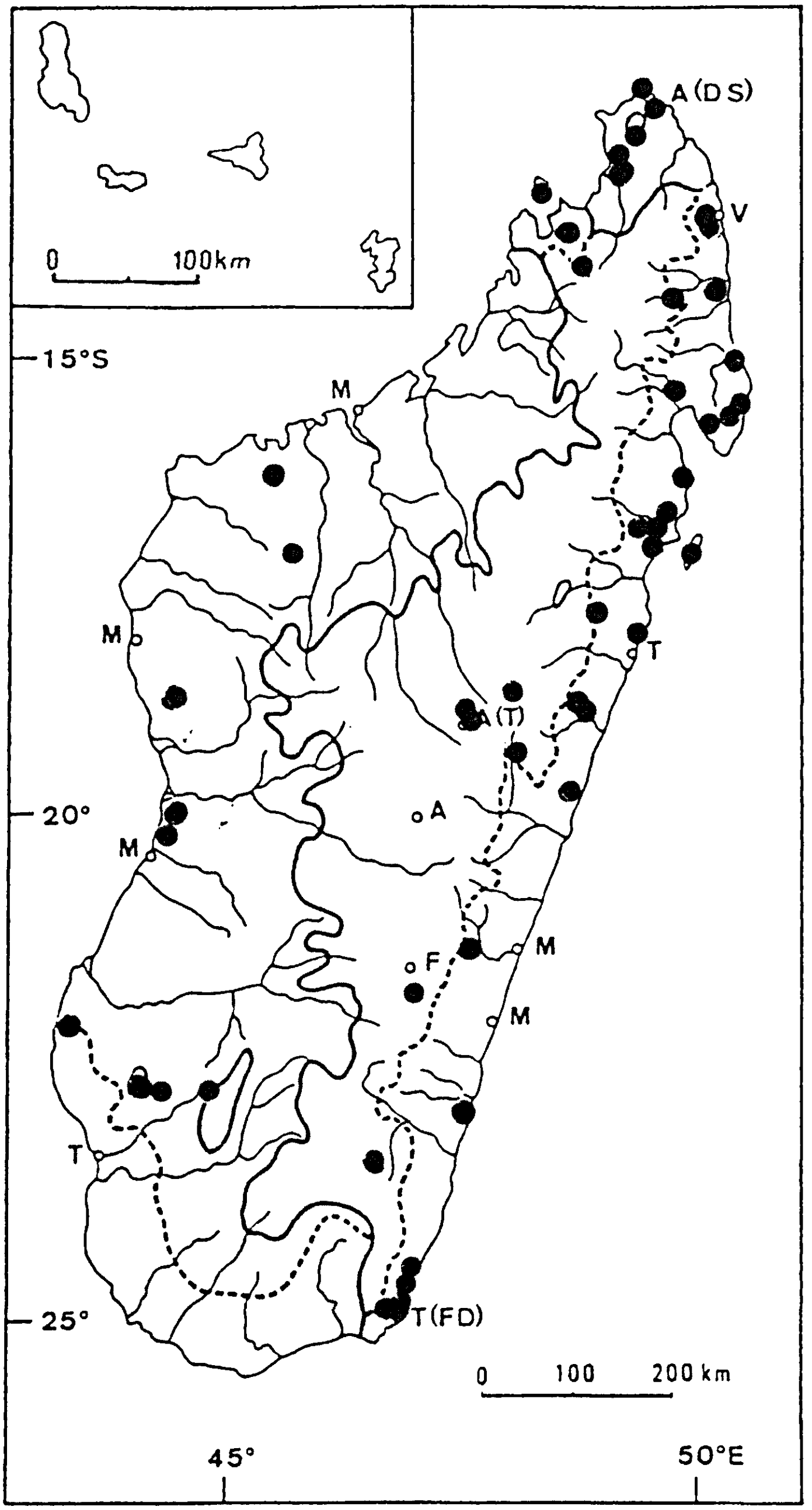
C. sessiliflora var. *meridionalis* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 139 (1949); Markgraf, Fl. Madag. fam. 169: 19 (1976), **syn. nov.** — Type: Madagascar, Toliara, Marofandilia, near Morondava, *Perrier de la Bâthie* 8875 (holotype P).

C. sessiliflora var. *orientalis* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 139 (1949); Markgraf, Fl. Madag. fam 169: 18 (1976), **syn. nov.** — Type: Madagascar, Antsiranana, Antalaha, *Perrier de la Bâthie* 3652 (holotype P).

C. sessiliflora var. *grandiflora* Markgr. in Adansonia sér. 2, 10: 25 (1970) and Fl. Madag. fam. 169: 19 (1976), **syn. nov.** — Type: Madagascar, Antsiranana, Montagne d'Ambre, *Perrier de la Bâthie* 18823 (holotype P).

Shrub or small tree 0.80—6(8) m high, model of Prévost, with white latex in branches, but not in bark of trunk. Trunk up to 4 cm in diameter; bark rather smooth, pale grey-brown, with concolourous lenticels. Branches pale brown, lenticellate, often with bark peeling off; branchlets glabrous. Spines straight, simple, 3—20 (40) mm long, often absent. *Leaves* opposite or on main axis or on sucker shoots often in whorls of 3—4, shortly petiolate; petiole often red, glabrous, 1—3 mm long; blade subcoriaceous when fresh and when dried, elliptic, narrowly elliptic or sometimes ovate, 1.1—4 x as long as wide, 2—12 x 1—7 cm, acuminate at the apex, cuneate or rarely rounded at the base, glabrous on both sides, with numerous secondary veins forming an angle of 40—70° with the costa, strongly anastomosing with the tertiary venation and at least in dried leaves

Fig. 3. *Carissa boiviniana*. **1**. habit (x 2/3); **2**. spiny branchlet (x 2/3); **3**. flowers (x 2); **4**. sepal inside (x 12); **5**. corolla in bud (x 2); **6**. opened corolla with pistil (x 5); **7**. pistil (x 12); **8**. fruit (x 1); **9**. seed (x 2). 1 and 3-7 from Perrier de la Bâthie 8857; 2 and 9 from Morat 2495; 8 from Capuron SF 29154.



Map 2. *Carissa boiviniana*.

prominent on both sides. *Inflorescence* terminal and often at the same time axillary, 1—5-flowered. Peduncle 0—5 mm long, glabrous; pedicels 1—2 mm long, glabrous. Bracts like sepals and about as long as them. *Flowers*: *Sepals* pale green, equal or unequal, ovate or narrowly ovate, (1.5)2—4 x as long as wide, 1.7—4.5 x 1—2 mm, acuminate, acute or less often obtuse or rounded and conchoid, glabrous or less often pubescent outside, ciliolate, glabrous inside, without colleters. *Corolla* white, tube often pink outside, 7—20 mm long in the mature bud and forming a narrowly ovoid head 0.25—0.5 of the bud length, entirely glabrous or sometimes sparsely pubescent outside on the lobes and on the distal part of the tube, with a pilose belt inside from the apex or the base of the lobes, the mouth or the insertion of the stamens to 2—8 mm from the base; tube 1.5—3.8 x as long as the longest sepal, 1.4—3 x as long as the lobes, 5—16 mm long, above the base 0.6—1.5 mm wide, rather gradually widened to the mouth and 1.5—3 mm wide; lobes strap-shaped, 0.3—0.9 x as long as the tube, 2—7 x as long as wide, 2.5—15 x 1—2.5 mm, acuminate or acute, ciliate, not auriculate, overlapping to the right in bud. *Stamens* with apex 1—2 mm below mouth of corolla tube, inserted 0.5—0.9 of the length of the corolla tube, at 3—14 mm from the base; filaments very short, 0.3—0.5 mm long, glabrous; anthers narrowly ovate, 2.5—4 x as long as wide, 1—1.5 x 0.4—0.5 mm, apiculate at the apex, glabrous. *Pistil* glabrous, with apex about halfway along anthers; ovary ovoid, 0.8—2 x 0.6—1.3 mm, gradually narrowed into the rather thin style; pistil head of a globose or ellipsoid stigmatic basal part 0.4—1.2 x 0.4—0.5 mm and a (often absent) stigmoid apex, 0.05—0.2 x 0.05—0.2 mm. Ovules 2—5 in each cell. *Fruit* red or purple, globose or nearly so, 2—4 cm in diameter, 1—6-seeded. *Seed* broadly ellipsoid, laterally compressed, 7—10 x 6—8 x 3—4 mm, smooth. Embryo 6 mm long; cotyledons almost square, 3 x 2.5 mm, truncate at the apex, subcordate at the base; rootlet 3 x 0.7 mm.

Distribution. Endemic to Madagascar.

Ecology. Wet or dry forest or bush. Alt. 0—1600 m.

Geographical selection of the approximately 100 specimens examined:

Madagascar. Mahajanga: near Ambodiriana, E of Antsalova, *Leandri & Saboureau* 2690 (P); Kassige Forest, Kelifely Mts, *Morat* 4682 (P); Andranomavo, Soalala District, *Randriamiera* RN 9715 (G, P, TEF). Antsiranana:

Marovato, Ambanja District, *Sazy* RN 4304 (P); Nosy Be, *Boivin* 2976bis (P); ibid., Lokobe Res., *Perrier de la Bâthie* 18727 (B, K, P); Ankarana Res., *Humbert* 32449 (P); ibid., *Leeuwenberg et al.* 14244 (TAN, WAG); Mt d'Ambre, *Perrier de la Bâthie* 18823 (P, type of *C. s.* var. *grandiflora*); ibid., *Malcomber et al.* 1233 (BR, K, P, TAN, WAG); Orangea, E of Ramena, *van Nek* 1981 (TAN, WAG); Rigny Bay, Diego-Suarez, SF 10008 (P, TEF); SE of Diego-Suarez, *McPherson* 14701 (P); S of Vohemar, *Capuron* SF 24314 (P); near Bezofo, Sambirano, *Perrier de la Bâthie* 8857 (P); Voantsikopiky, Upper Sambirano R., *Perrier de la Bâthie* 15126 (P); Andapa, Antsahaberoka, *Rasoavimbahoaka* 451 (P, WAG); Sambava, *Debray* 1635 (B, P); S of Sambava, *Capuron* SF 27694 (HBG, K, P, TEF, WAG); Antalaha, NE Coast, *Perrier de la Bâthie* 3652 (P, type of *C. s.* var. *orientalis*); Ambohitralana, Antalaha District, *Tsilizy* RN 5288 (P); Ampanavoana, Antalaha, RN 6810 (K, P, TEF, WAG). Toamasina: Maroantsetra, *Mocquerys* 324 (G), 500 (G, Z); Masoala Penisula, near Ambanizana, *van Nek* 2098 (WAG); ibid., *Nicoll et al.* 532 (K); ESE of Maroantsetra, NW coast of Masoala Peninsula, *Lowry et al.* 4016 (P, WAG); near Antanambe, *Morat et al.* 8579 (P); Soanierana-Ivongo, SF 1056 (P, TEF); between Fotsialanana and Ampasiventy, *Jacquemin* 219 (P); Ambodinonoka, Fenerive, SF 14181 (HBG, P, TEF); N of Andilamena, *Perrier de la Bâthie* 15011 (BM, P); Ste. Marie Island, *Boivin* April 1851 (P, type); Zahamena Res., *Malcomber et al.* 2552 (P, TAN, WAG); Sahamany, Anivorano, SF 10759 (K, P); Anpasinfotsy, Mangabe, *Razafindradora* SF 7231 (P, TEF); Perinet, SF 4388 (P, TEF); E of Andapa, Beparasy, *Capuron* SF 29154 (P, TEF, WAG); Tsaravinany Forest, *Rakotozafy* 582 (P). Antananrivo: Mangamila, *Boiteau* 273 (K, P); South slope of Ambohimanga Mts, N of Antananarivo, *Capuron* SF 18370 (K, P, TEF, WAG). Fianarantsoa: Ranomafana Res., Parcelle 3, *Rakoto* 39 (WAG); S of Ambalavao, *Bernardi* 11167 (AAU, E, G, P); km 14 Ambalavao-Ihosy Road, *Leeuwenberg & Rapanarivo* 14606 (P, TAN, WAG); 15 km S of Farafangana, *Bosser* 18678 (P). Toliara: between Manambato and Fitamalama Rs., *Capuron* SF 28695 (K, P, TEF); Enaniliha, Fort-Dauphin District, *Rakotoson* RN 10047 (P, TEF); Andohahela Res., Parcelle 1, *Leeuwenberg et al.* 13957 (P, WAG); ibid., *Phillipson* 2964 (BR, K, P, WAG); Mandena, *McPherson et al.* 14867 (P, WAG); Petriky, *Rabevohitra* 2184 (P); Kalambatitra Mts, *Humbert* 11872 (G, P); Analavelona, SF 12150 (K, P, TEF, WAG); Bona Forest, Ankazoabo Road, *Morat* 2495 (P); Analavelona, SF 15585 (P, TEF); Ambalaroa, SF 12250 (K, P, TEF, WAG); Morondava, *Grevé* 44 (P); Marofandilia, near Morondava, *Perrier de la Bâthie* 8875 (P, type of *C. s.* var. *meridionalis*). Sin. loc., *Baron* 3077 (K, P), 3118 (K), 3326 (K), 5005 (K), 5012 (K), 5259 (K, P), 5924 (BM, K, P); *Commerson* s.n. (P-JU 7202A).

Cult. France: Botanic Garden Paris, collected from Nosy Be by *Pervillé*, Madagascar, *Houllet* anno 1844 (P, type of *C. sessiliflora*).

Note. When checking the references again an obscure synonym was discovered, *Leioclusia boiviniana*, mentioned by Markgraf (1976) under *Carissa sessiliflora* var. *orientalis*. As in the present revision no varieties are maintained the epitheton *boiviniana* (1880) turned out to have considerable priority over *sessiliflora* (1949).

Therefore the new combination *Carissa boiviniana* has to replace *C. sessiliflora*. Unfortunately the discovery of the old synonym was made only after most herbarium material had been returned to the owners already annotated.

Carissa boiviniana is widespread throughout Madagascar and has a great amplitude in ecology. It is especially characterized by the dense venation prominent on both sides of the leaves, which display a continuous variation in shapes and sizes. The flowers also vary much in length of corolla tubes and lobes, and in the shape of the sepals. The sepals are usually acuminate such as in the types of *C. sessiliflora* var. *meridionalis*, var. *sessiliflora* and var. *grandiflora*, but they may also be acute, obtuse or rounded and conchoid. Rounded sepals are known from several specimens, among which the type of *C. sessiliflora* var. *orientalis*. *Capuron* SF 24314 cited as var. *orientalis* by Markgraf has sepals in several shapes, obtuse and conchoid to acuminate. The varieties distinguished by Pichon and Markgraf on the basis of sepal shape are therefore not maintained.

3. Carissa carandas L., Mant. 1: 52 (1797); Haines in Indian Forester 45: 375, f. 1 (1919); Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 34 and 137 (1949); H. Huber in Fl. Ceylon 1: 9 (1973). — Type: Rumphius, herb. Amb. 7: 58, t. 25 (1755), lectotype designated by Huber. Herb. seen by Linnaeus LINN 295.1 (LINN).

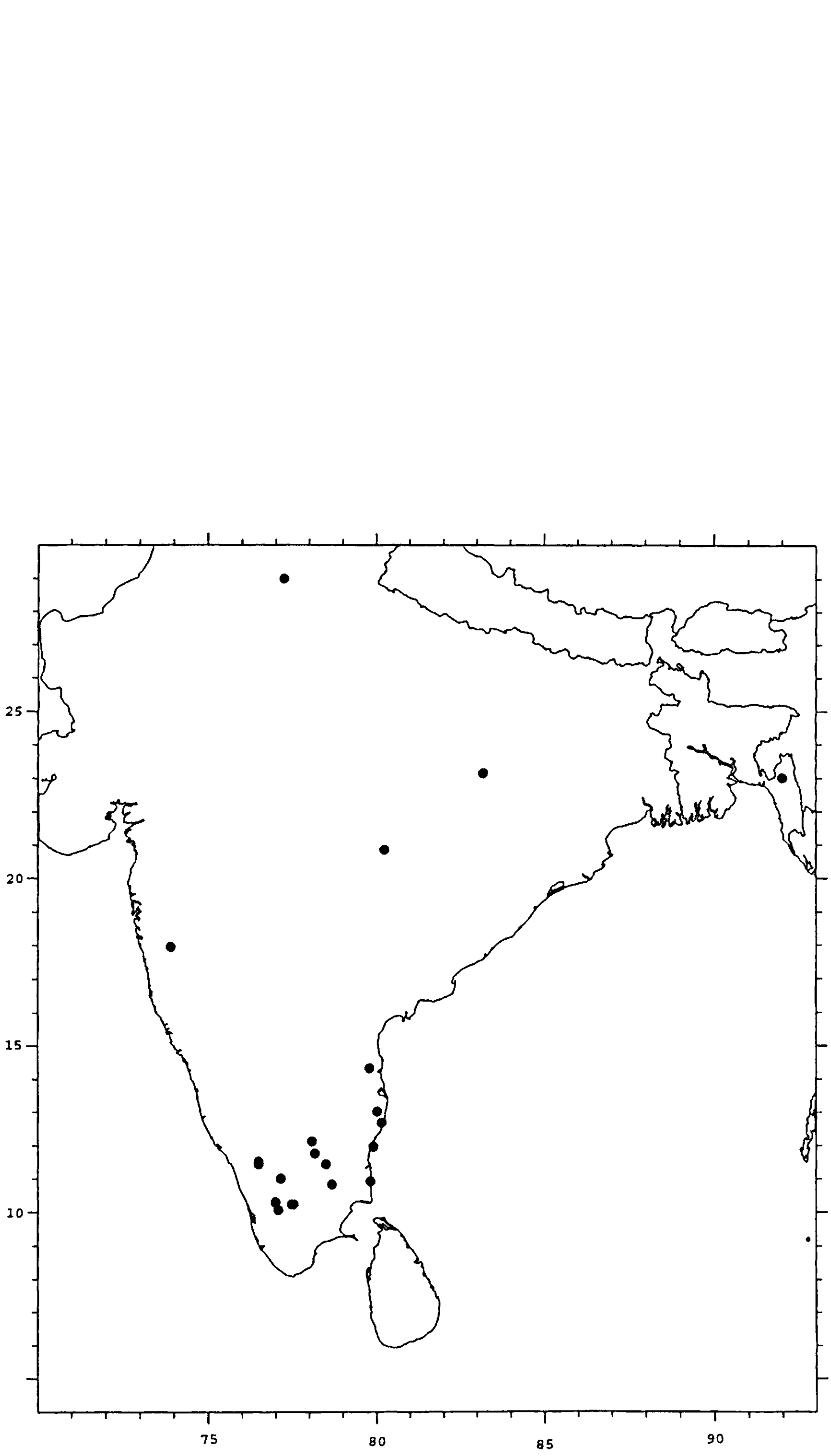
Fig. 4, p. 23; phot.1 and 2, p. 123; map 3, p.24

Homotypic synonyms: *Capparis carandas* (L.) Burm. f., Fl. Ind. 118 (1768). *Arduina carandas* (L.) Baill., Hist. des pl. 10: 170 (1888); K. Schum. in Engler & Prantl, Nat. Pflanzenf. 4, 2: 127 (1895), superfluous combination. *Jasminonerium carandas* (L.) Kuntze, Rev. 2: 415 (1891). *Echites spinosa* Burm. f, Fl. Ind. 69 (1768). Of the last synonym Rumphius' plate cited above is the lectotype designated here.

C. salicina Lam., Enc. 1: 554 (1785). *Jasminonerium salicinum* (Lam.) Kuntze, Rev. 2: 415 (1891).— Type: India, sin. loc., *Sonnerat* s.n. (holotype P-LA; isotype P-JU 7199).

Shrub 2—5 m high or big climber with white latex, model of Koriba or Leeuwenberg. In cultivation branches sometimes are twined around each other producing a trunk as in *Ficus benjamina*.

Fig. 4. *Carissa carandas*. Plate Rumphius, herb. Amb. t. 25 (1755).



Map 3. *Carissa carandas*.

Bark pale brown, rather rough. Branches pale brown, sometimes lenticellate; branchlets terete, glabrous or sometimes minutely puberulous. Spines straight, simple, 7—25 mm long. *Leaves* opposite, shortly petiolate; petiole glabrous, 1—3 mm long; blade coriaceous, even when fresh, orbicular to oblong, less often ovate, 1—4 x as long as wide, in each plant at least some oblong and at least twice as long as wide, 1—10 x 1—5.5 cm, rounded to retuse at the apex and often also mucronate, rounded to cuneate at the base, glabrous on both sides, with 4—12 pairs of rather straight or upcurved secondary veins forming an angle of 30—60° with the costa; tertiary venation reticulate, impressed or prominent above and prominent or not beneath. *Inflorescence* terminal and often also in the axils of the upper leaves, 3.5—4.5 x 4—6 cm, lax, except for the last branchings, 3—12-flowered. Peduncle 5—30 mm long, glabrous; pedicels 1—3 mm long, glabrous or pubescent. Bracts alomost like the sepals and about 0.3 x as long as them, deciduous. *Flowers*: *Sepals* green or wine-red, equal or unequal, ovate, 1.5—2 x as long as wide, 2—3.5 x 1—2 mm, acute or acuminate, pubescent or glabrous outside, ciliate, glabrous inside, without colleters. *Corolla* white or tube pink and limb white, 20—29 mm long in the mature bud and forming a narrowly ovoid head 0.2—0.3 of the bud length, 5—9 x 2—3 mm, acute or obtuse at the apex, pubescent outside for the upper 0.4 of the tube and on the lobes, pubescent in the tube in a belt 5—7 mm wide just below the insertion of the stamens, glabrous or with a few hairs above and pubescent on the lobes; tube 5—8 x as long as the longest sepals, 1.8—2.3 x as long as the lobes, 16—20 mm long, 1—1.3 mm wide at the base, widened around the stamens to 2.5—3 mm wide and again narrowed at the throat to 2—2.5 mm wide; lobes ovate or elliptic, 0.4—0.6 x as long as the tube, 1.8—2.5 x as long as wide, 7—10 x 3.5—5 mm, acute, obtuse or sometimes rounded at the apex, slightly auriculate at the right side of the base, overlapping to the right in bud. *Stamens* with apex 1.8—4 mm below mouth of corolla tube, inserted 0.6—0.7 of the length of the corolla tube, at 10.5—14 mm from the base; filaments very short, 0.3—0.5 mm long, glabrous; anthers oblong or narrowly ovate, 3—4 x as long as wide, 2—3 x 0.6—0.8 mm, apiculate, obtuse or retuse at the apex, glabrous. *Pistil* glabrous, 10—13 mm long, with apex 0.3—4 mm below base of anthers; ovary ovoid or narrowly so, 1.5—2 x 0.5—0.8 mm, gradually narrowed into the rather robust style; pistil head of a subglobose or ellipsoid basal stigmatic part 1—1.2 x

0.6—0.8 mm and a stigmoid apex 0.5—0.7 x 0.3—0.4 mm. Ovules 4 in each cell. *Fruit* cherry-red to black, immature often pink, ellipsoid, 15—23 x 12—17 x 12—17 mm, 4—6-seeded. *Seeds* obliquely ovate or tetrahedral, 6—8 x 5—7 x 2 mm, convex at one side concave and with a thickened margin at the other, the hilar, side; hilum oblong, in the middle. Embryo 6 mm long; cotyledons elliptic, 3 x 1.5 mm, rounded at the apex and at the base; rootlet 3 x 0.5 mm.

Distribution: India and Bangladesh.

Ecology: thickets, in open deciduous forests, scrub jungle.

Cult. in many countries: Seen from Porto Rico, St. Thomas, Martinique, Trinidad, Mauritius, Thailand, W Malaysia, Indonesia (Java, big climber in Bogor Botanic Garden seen), Philippines.

Geographical selection of the approximately 100 specimens examined (material collected in India not seen in extenso):

India. Delhi: near Delhi, *Ernst* 19 (Z). Madhya Pradesh: Ambikapur, *Mooney* 768 (K). Maharashtra: Palandur, *Cooke* XCIV (K); Mahabaleshwar, *Ralph* 155, p.p. (G). Andhra Pradesh: Vadapallo (not localized), *Raju* 133 (E). Tamil Nadu: Coimbatore, Parappalar Dam, *Matthew* RHT 47302 (AAU); Saint Thomas near Madras, *Cleghorn* anno 1856 (E); Seven Pagodas, *Meebold* 2977 (G); Pondicherry, *Perrottet* 423 (G); Dharmapuri, Guthirayan Hills, *Matthew & Venugopal* RHT 23059 (A); Salem, between Yercad and B. Pallipatty, *Matthew* RHT 27777 (L); Hosur Taluk, *Yeshoda* 347 (A, NY); Nilgiri, *Perrottet* 794 (G, K, W); Nilgiri Hills, *Joulkes* 25 (K); Tiruchi, Oosippalam, *Perisnayagam* RHT 27289 (K); Karikal, *Perrottet* anno 1836 (P); Pulney (= Palni) Hills, *Rodriguez* 1934 (A); Kodaikanal, Pachalur, *Matthew* RHT 49347 (K); Anamallago, *Young* 5071 (BM). Kerala: Idukki, Devikolam District, Chinnar, *Matthew* RHT 44505 (AAU). Sin. loc., *Sonnerat* s.n. (P-JU 7199, P-LA, type of *C. salicina*).

Bangladesh. Chittagong Division, Rezu, *Cowan* 16 (E); Kurishkool, Cox's Bazar, *Sinclair* 3971 (E, US).

Cult. U.S.A.: Florida, Coconut Introduction Garden, *Fennell* 1266 (A). Porto Rico: sin. loc., *Eggers* 1069 (W). St. Thomas: Treuchama (?) Bay, *Eggers* 28 June 1876 (C, K). Martinique: Botanic Garden, *Hahn* 1177 (P). Tobago: Botanic Station *Broadway* 2995 (E, K, U). England: Hort. Canterbury, *J.D. Hooker* s.n. (NY). Egypt: Orman Gardens, Giza, *Simpson* 4940 (K), 5251 (K). Mauritius: sin. loc., *Commmerson* anno 1769 (K, P); Barkly Exp. Station, *Vaughan* MAU 10521 (MAU). Pakistan: Punjab, Pathankot, *Stewart* 1768 (A, NY). India: Calcutta, *Haines* 5714 (K); Sans, Gopi Syama, introduced in Roxburgh's time, *Biwas* 9503 (A). Sri Lanka, Peradeniya Bot. Garden, *Petch* 17 May 1922 (A); sin. loc., *Thwaites* CV 1823 (BM, C, K, P, W). Myanmar: Rangoon, *Dickason* 6956 (A, E, L). Thailand: Bangkok, *Groff* 5943 (A, IBSC, K, UC); ibid., Siri Ruckhachai

Garden, *Leeuwenberg* 14789 (WAG). China: Macao, *Callery* 178 (P). Malaysia: Univ. of Malay Campus, Kuala Lumpur, *van Balgooy* 2251 (AAU, L, Z); Malacca Town, *Burkill* 3529 (A, K, L). Singapore: S of Tanjong Punggal, *Sinclair* 5414 (L, US). Indonesia: Sumatra Utara, Medan, *Lörzing* 12961 (B, L, P, Z); Java Barat, Jakarta, *van Harreveld* 14 Aug. 1907 (L); Bogor Bot. Garden, *Hallier* C 50b (G, L); Java Tengha, Yokyakarta, *Leeuwenberg & Rudjiman* 13359 (L, WAG); Timor, sin. loc., *Richard* ex herb. mus. Paris s.n. (B, G, K, L 898.129-415, MEL 278359, NY, P). Phippines: Luzon, Lamao, Bataan Province, *Wester* BS 126 (A).

Sin. Loc., LINN 295.1 (LINN).

4. C. macrocarpa (Eckl.) A.DC., Prodr. 8: 336 (1844); Codd, Fl. Southern Afr. 26: 254 (1963); Kupicha in Fl. Zamb. 7, 2: 401 (1985). - Type: South Africa, Natal, Cult. Uitenhage, *Ecklon* (?), not traced. Neotype: South Africa, Natal, between Umzinto and Durban, *Werdermann & Oberdieck* 1211 (neotype B designated here; isoneotypes A, K, US, WAG).

Fig. 5, p.28; phot. 3, p.124; map 4, p.29

Basionym and homotypic synonym: *Arduina macrocarpa* Ecklon, South Africa Quart. Journ. 1: 372 (1830). *Jasminonerium macrocarpum* (Eckl.) Kuntze, Rev. Gen. Pl. 2: 415 (1891).

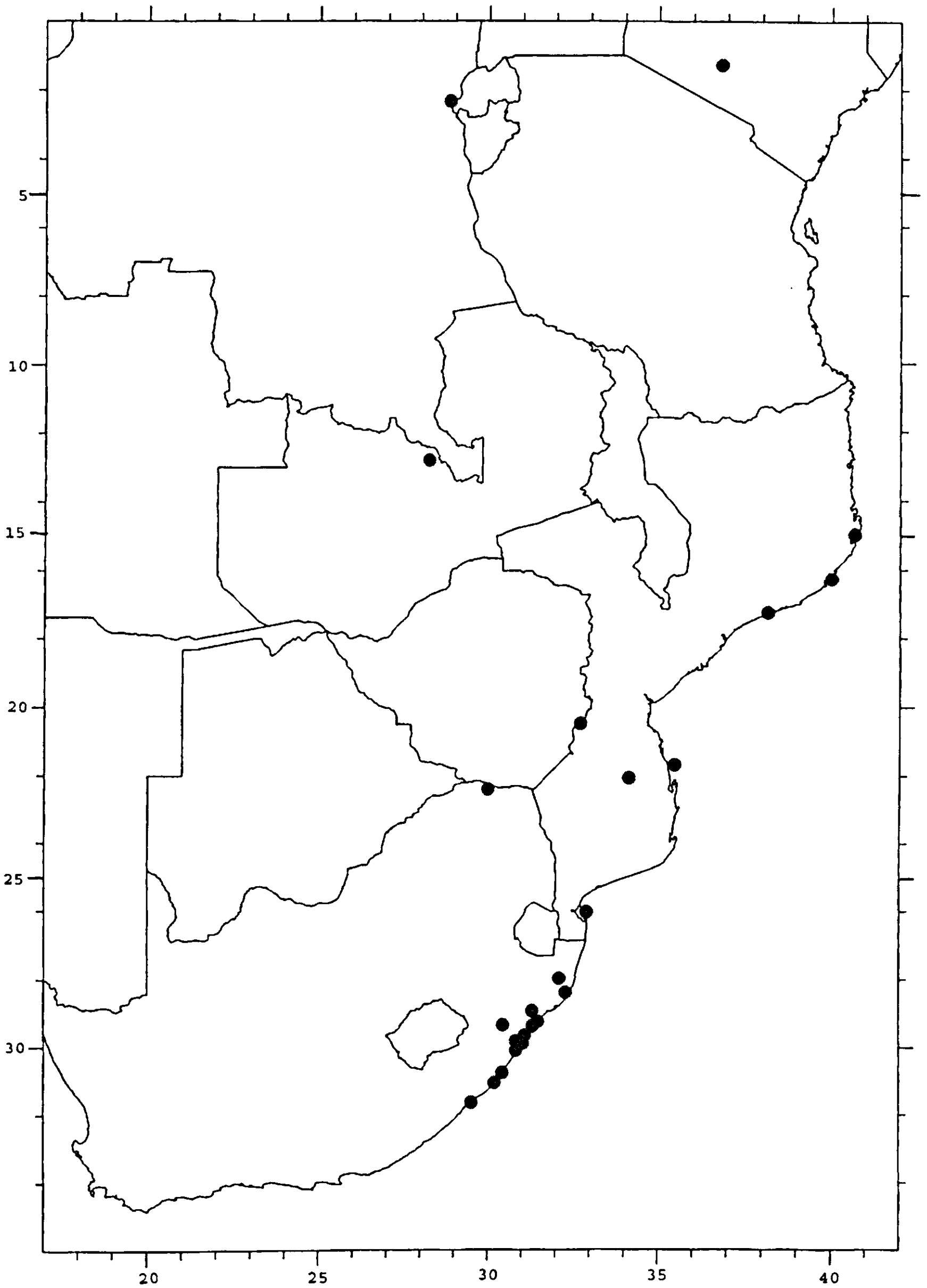
Heterotypic synonyms: *Arduina grandiflora* E. Mey., Comm. 191 (1837); K. Schum. in Engler & Prantl, Nat. Pflanzenf. 4, 2: 126 (1895). *Carissa grandiflora* (E. Mey.) A. DC., Prodr. 8: 332 (1844); Hook.f., Bot Mag. t. 6307 (1877). *Jasminonerium grandiflorum* (E. Mey.) Kuntze, Rev. Gen Pl. 2: 415 (1891). - Type: South Africa, Natal, between Umisikaba and Port Natal (= Durban), *Drège* Arduina grandiflora V, c (lectotype S designated here; isolectotypes G, HBG, K, P, W).

Carissa africana A.DC., Prodr. 8: 332 (1844). *Jasminonerium africanum* (A. DC.) Kuntze, Rev. Gen. Pl. 2: 415 (1891). - Type: Mozambique, Mozambique (= Inhaca) Isl., *Loureiro* s.n. (holotype P-LOUR; phot. A, F).

C. praetermissa Kupicha, Kew Bull. 36: 47 (1981) and in Fl. Zamb. 7, 2: 401, t. 90 (1985), **syn. nov.** - Type: Mozambique, Inhambane, Bazaruto Island, Mogg 28448 (holotype K; isotypes BM, LISC, LMA, SRGH, the last 2 not seen).

A much branched shrub, up to 6 m high. Bark greyish, smooth, longitudinally fissured or outer bark peeling off in flakes. Branches

Fig. 5. *Carissa macrocarpa*. **1.** habit (x 2/3); **2.** leaf (x 2/3); **3.** flower (x 2); **4-6.** sepals inside 4-5 x 10 and 6 x 6); **7.** opened corolla (x 2); **8.** pistil x 6); **9.** fruit (x 1). 1-3 and 6-9 from Leeuwenberg 10882; 4 from Gomes e Sousa 4877; 5 from Nevling 231.



Map 4. *Carissa macrocarpa*.

with longitudinally fissured bark; branchlets greyish green, glabrous. Spines furcate or bifurcate, mostly robust, up to 5.5 cm long. *Leaves* opposite; petiole 1—6 mm long, glabrous, with colleters in the axils; blade shiny above or on both sides, coriaceous when fresh and when dried, ovate, elliptic, oblong or orbicular, 1—2 x as long as wide, 1.3—7.2 x 0.9—5.3 cm, acute or mucronate at the apex, cordate to almost cuneate at the base, sometimes decurrent into the petiole, glabrous on both sides, revolute at the margin, with 4—9(11) pairs of secondary veins, rather conspicuous above or inconspicuous on both sides; tertiary venation reticulate, inconspicuous. *Inflorescence* terminal, rather lax, few(1—4)-flowered. Peduncle ca 4 mm long, glabrous; pedicels 3—4 mm long, glabrous. *Flowers* fragrant. *Sepals* ovate to narrowly oblong, 2—2.6 x as long as wide, 2—4.5(7) x 1—2 mm, acute at the apex, auriculate at the base, glabrous out- and inside, with or without colleters at the base inside, not ciliate. *Corolla* white, glabrous outside, not ciliate at the lobes, with a pubescent belt from 1.2—1.8 mm above the base to ca 1 mm below the mouth; tube usually widened at the base and more or less around the stamens, sometimes narrowed at the mouth, (9)10.5—18.5 mm long, lobes ovate or broadly ovate, 0.5—2.6 x as long as the tube, 4.5—24 x 4—7 mm, obtuse at the apex, auriculate at the base, overlapping to the left in bud. *Stamens* with apex ca 2 mm below mouth of corolla tube, inserted at or near the middle of the corolla tube, at 4.8—9.1 mm from the base; filaments 0.2—0.6 x 0.2—0.4 mm, pubescent inside; anthers 1.2—2.3 x 0.9—1.8 mm, acute at the apex, glabrous. *Pistil*: ovary cylindrical, acute at the apex, 1—3.5 x 0.7—1.6 mm, glabrous; style 1.5—2 x 0.2—0.3 mm, glabrous; pistil head 1.4—2 x 0.6—0.8 mm, glabrous or minutely pubescent; stigmoid apex 0.3—0.4 mm long. *Fruit* red or purple, globose, ovoid or ellipsoid, 2.7—6 x 2—3 cm, many-seeded. *Seeds* obliquely elliptic, ovate or more or less orbicular, 4—6 x 3.5—4.5 x 1.5 mm. Embryo 3.5—4.8 mm long; cotyledons 1.7—2.3 x 1—1.3 mm; rootlet 1.3—1.8—0.6 mm.

Distribution: Kenya to South Africa.

Ecology: Mostly in coastal bushes, often on sand dunes. Flowering and fruiting throughout the year. Altitude: 0-1350 m.

Widely cultivated in tropical and sub-tropical regions all over the world and in many botanical gardens.

Geographical selection of the approximately 100 specimens examined:

Congo K: Kivu: Lushadu, Kivu Lake, *Hendrickx* 7857 (BR).

Kenya. K4: Nairobi District, Mathiga, *Polhill* 225 (K).

Zambia. Copperbelt, Kitwe, *Fanshawe* 27 June 1967 (SRGH).

Zimbabwe. Manicaland: Mt Selinda, *McGregor* 18/39 (FHO).

Mozambique. Nampula: Mossuril, *de Koning et al.* 9707 (K, WAG). Niassa: Antonio Enes (= Angoche), *Gomes e Sousa* 4877 (COI, K, PRE). Zambezia: Pebane, *Torre & Correia* 17101 (LISC). Inhambane: between Mambone and Mabote, *Mendonça* 1974 (LISC); Inhaca Island, Loureiro s.n. (P-LOUR., type of *C. africana*); ibid., *Mogg* 28448 (K, LISC, type of *C. praetermissa*), 31283 (LMA, PRE).

South Africa. Transvaal: Messina, *A Schinz* 75 (Z). Kwazulu-Natal: Hluhluwe District, Makowe Hill, *Wells* 2128 (K); Dukuduku State For., *Nicholas* 1364 (K); Eshowe District., *Edwards* 1568 (K); Tugela R. mouth, *Edwards* 1740 (G, K, M); York, *Cordukes* Feb. 1878 (K); Stanger Beach, *Pentz* 369 (K); Pinetown, *Rogers* 28212 (US, Z); Umdloti Beach, *Schrire* 205 (BM, BR, C, K, M); Durban, *Fries* 3050 (UPS); ibid., Winkel Spruit, *Rudatis* 1494 (E, GH, K, US); Durban, The Bluff, *Lanjouw* 1090 (U); Port Shepstone, *Sidey* 3228 (S, US); Port Edward, *Sidey* 3304 (F, S). Transkei: Port St. Johns, *Howlett* 11 (US). E Cape: Mazeppa Bay, *Helner* 505 (A, US).

Cult. U.S.A.: Hawai'i, Manoa, *Herbst* 545 (L); California, San Marino, Hunt Garden, *Clayton* 227 (A); New York, N.Y. Bot. Garden, *Nee* 43530 (GH), Lousiana, Lafayette, *Solymosy* 6307122 (A); Arizona, Maricopa, *Keil* 6093 (A); Florida, Sanibel Island, *Brumbach* 5982 (A), 6037 (A); Tampa, *Leeuwenberg* 14222 (WAG). El Salvador: near Sta. Tecla, *Shwanitz* 2108 (WAG). Nicaragua: km 14.5 Managua-Masaya Road, *Sandino* 4408 (WAG). Bahamas: N Bimini, *Howard* 10229 (GH). Cuba: Cienfuegas, Soledad, *Salvoza* 523 (A). Jamaica: St. Andrews, Hope, *Powell* 1453 (A).. Puerto Rico: Fajardo, *Wagner* 819 (A). St. Lucia, *Howard et al.* 18950 (A). Dominica: Roseau Bot. Garden, *Hodge* 897 (GH). Venezuela: Caracas Bot. Garden, *Nevling* 231 (A). Netherlands, Wageningen Bot. Garden, *van Nek* 2246 (WAG). Belgium: Gent Bot. Garden, *Boom* 33818 (L). Spain: Gran Canaria, Las Palmas, *Hansen* 1 Jan. 1965 (C). Morocco: Rabat, *Lewalle* 8962 (BR). Nigeria: Ibadan, Moor Plantation, *van Eynatten* 1454 (WAG). Congo K: Eala, Bot. Garden, *Chevalier* 27963 (P). Kenya: Nairobi Arboretum, *Starzenski* 10 (BR). Zambia: Katondwe Mission, Feira District, *Angus* 3361 (C, K, WAG). Zimbabwe: Umtali (= Mutare) District, *Chase* 4677 (K, PRE). Mozambique: Maputo, Vasco da Gama Garden, *Balsinhas* 1830 (K, PRE, SRGH). Malawi: Zomba, *Chapman* 5517 (BR, FHO, K). South Africa: Transvaal, Westfalia Estate, Duivelskloof, *Bos* 1126 (AAU, B, K, M, WAG); Pretoria, Brummeria, *Leeuwenberg* 10882 (WAG). United Arab Emirates: Abu Zabi (= Abu Dhabi), *Western* 1093 (E). Guam: *Thompson* 313 (BM, K). China: Kwantung (= Guandong), Henan Poon Ue, *Lau Shan Yan* 3 (NY). Taiwan: Chiayi Bot. Station, *Ream* 572 (GH, UC). Philippines: Luzon, Rizal Province, Makati, *Steiner* 1858 (L). Australia: Queensland, Brisbane Bot. Garden, *C.T. White* 8707 (A, BRI).

5. Carissa pichoniana Leeuwenb. in Wageningen Agric. Univ. Pap. 97-2 : 101 (1997). — Type: Madagascar, Toamasina, Manampotsy R., SW of Vatomandry, *Perrier de la Bâthie* 14140 (holotype P). Fig. 6, p.33; map 5, p.34

Basionym: *C. verticillata* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 126, 136 (1949); Markgraf, Fl. Madag. fam. 169: 22 (1976), not of Sessé & Mociño (1887) which is a synonym of *Alstonia longifolia* (A. DC.) Pichon.

Shrub 2—4 m high. Branches pale to medium brown, with concolourous lenticels; branchlets reddish-pubescent, with a ring of short thick colleters at each node. Spines absent. *Leaves* in whorls of 3—4, shortly petiolate; petiole 1—2 mm long, pubescent; blade subcoriaceous when dried, narrowly to very narrowly elliptic, 2—7 x as long as wide, 15—37 x 3—8 mm or smaller often at the base of the branchlets, acute or obtuse at the apex, cuneate or rounded at the base, margin often revolute in dried leaves, puberulous on the midrib above, glabrous beneath, with faint venation, with a pair of secondary veins from the base curved along the margin to about halfway the length of the blade and a few often invisble other rather straight secondary veins forming an angle of ca 45° with the costa; tertiary venation invisible. *Flowers* solitary, terminal. Peduncle 2—7 mm long, glabrous or nearly so. Bracts absent. *Sepals* green, equal or unequal, ovate or narrowly ovate, 2—3 x as long as wide, 2—3 x 1—1.5 mm, acuminate, with a partly dark (brown(?)) margin, glabrous on both sides, not ciliate, without colleters. *Corolla* white, with an often yellow throat, 22—30 mm long in the mature bud and forming a narrowly ovoid or ellipsoid head about 0.4 of the bud length with a blunt apex, glabrous outside or on distal part of tube sparsely pubescent, pilose inside in a belt from the base of the lobes, the mouth or the insertion of the stamens to the apex of the pistil or about 1 mm below the pistil head, 3—9 mm wide, otherwise glabrous; tube 3.8—7 x as long as the longest sepal, 0.77—1.5 x as long as the lobes, 12—17 mm long, almost cylindrical, 1.5—2 mm wide at the base, slightly widened around the anthers to 2—3 mm wide and slightly narrowed at the throat or not and 2—3 mm wide; lobes obliquely and narrowly ovate or elliptic, 0.7—1.3 x as long as the tube, 2.4—3.8 x as long as wide, 10—18 x 3—6 mm, acute or acuminate, not ciliate, auriculate at the right side of the base, over-

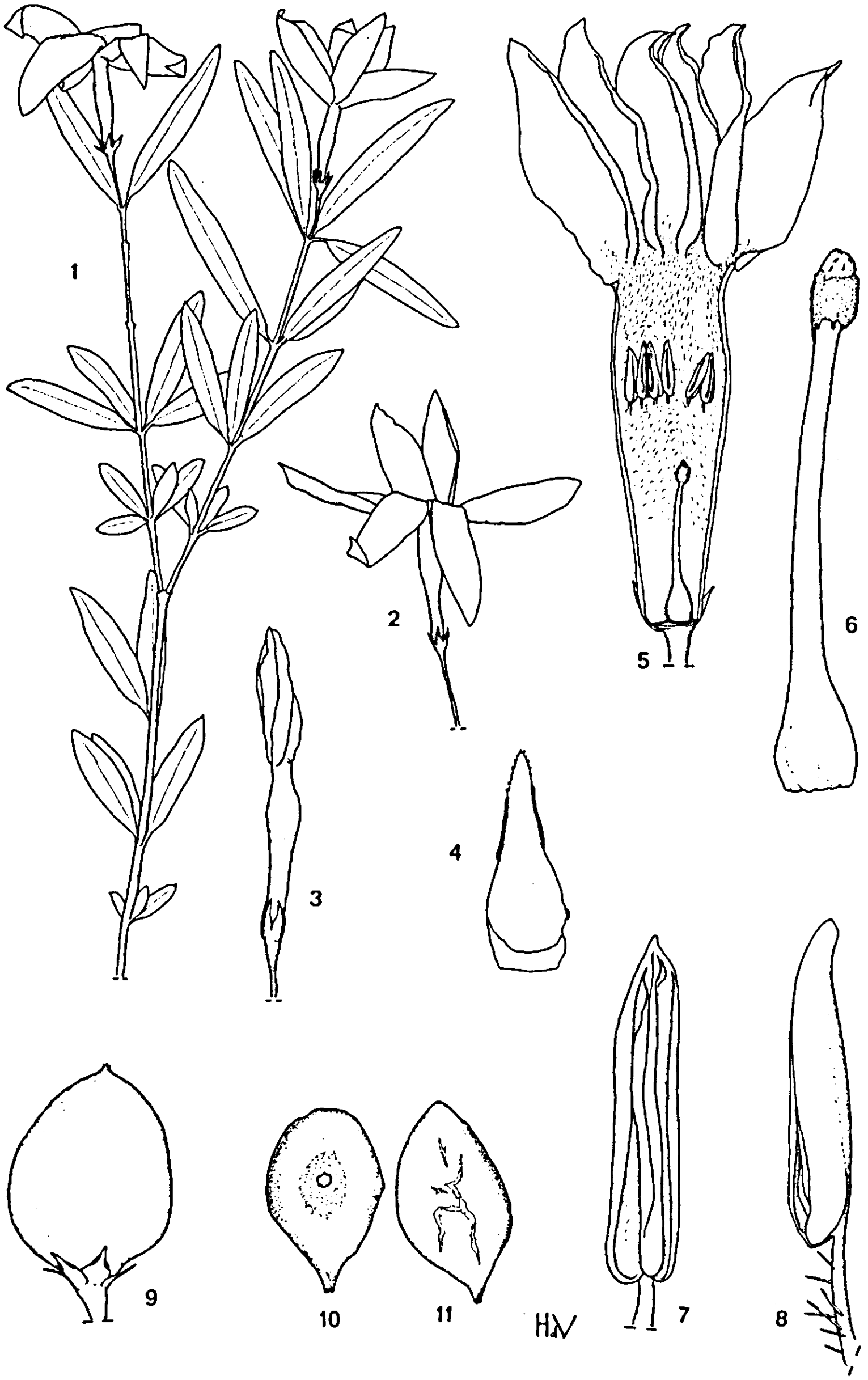
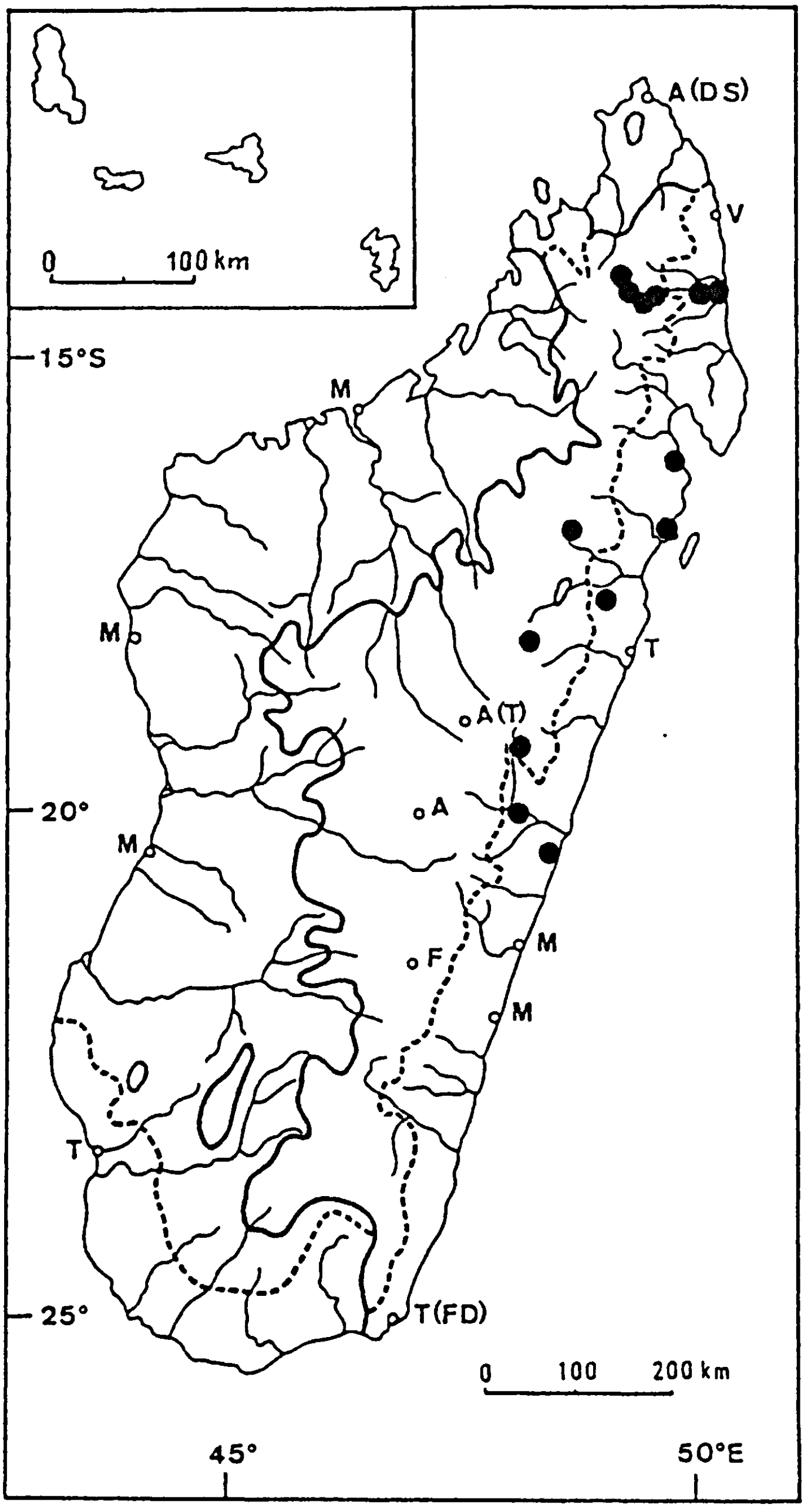


Fig. 6. *Carissa pichoniana*. **1**. habit (x 2/3); **2**. flower (x 1); **3** flower bud (x 2); **4**. sepal (x 12); **5**. opened flower (x 3); **6**. pistil (x 12); **7-8**. stamens (x 18); **9**. fruit (x 3); **10-11**. seeds (x 3). 1-2 from Decary 125; 3-8 from Capuron SF 22826; 9-11 from Guillaumet 2207.



Map 5. *Carissa pichoniana*.

lapping to the right in bud. *Stamens* with apex 3—3.5 mm below mouth of corolla tube, inserted 0.56—0.7 of the length of the corolla tube, at 7.5—11.3 mm from the base; anthers subsessile, narrowly oblong, 3—4 x as long as wide, 1.5—2.5 x 0.5—0.8 mm, with apex apiculate, glabrous. *Pistil* glabrous, 6—7.5 mm long, with apex 4—6 mm below insertion of stamens; ovary ovoid, 1.2—1.5 x 0.7—0.8 mm, gradually narrowed into the rather robust style, 2-celled; pistil head of a subglobose or ellipsoid basal stigmatic part 0.8—1.5 x 0.5—0.8 mm and an often absent stigmoid apex, 0.2 x 0.2 mm. Ovules 7—8 in each cell. *Fruit* red(?), globose or ellipsoid, 11—12 x 6—12 mm, rounded, acute or apiculate, ca 4-seeded. *Seeds* obliquely elliptic, 5—6 x 3.5—4 x 1.5—2 mm, convex at both sides or flat at the hilar side and convex at the other. Embryo 3.2 mm long; cotyledons ovate, 1.5 x 0.8 mm, rounded at the apex and at the base; rootlet 1.7 x 0.3 mm.

Distribution. Endemic to Madagascar.

Ecology. Rain forest understorey, at river or creek banks. Alt. 0—300 m.

Most of the specimens examined:

Madagascar. Antsiranana: Upper Bemarivo de Sambava R. basin, *Perrier de la Bâthie* 8895 (P); Doany, *Christophe* SF 17342 = RN 8412 (K, P, TEF, WAG); Sambava, Adrahanjo, Androranga R., *Rasoavimbahoaka* 400 (P, TAN, WAG); Andalangy R. valley, Bemarivo R. of North-East basin, *Humbert* 24211 (G, HBG, K, P, WAG); near Anketsahely, Ambohimitsinjo, *Jaofetra* SF 26457 (P, TEF); Ambariatelo, *Christophe* SF 17104 = RN 8046 (K, P, TEF); Antalaha, *Naivo* RN 8865bis (P). Toamasina: between Sahasoa and Vahibe, *Capuron* SF 22826 (BR, G, HBG, K, P, TEF, WAG); Ivontaka, *Decary* 125 (K, P); Soanierana-Ambohoabe, *Lam & Meeuse* 5719 (G, K, L, P); Soanierana-Ivongo, SF 2350 (P, TEF); Onibe, *Cours* 1044 (P); Zahamena Res., *Marson et al.* 22 (P); Anonivola, Mangoro R., *Perrier de la Bâthie* 18079 (P); Manampotsy R., Ilaka Est, *Bosser* 16986 (P); SW of Vatomandry, *Perrier de la Bâthie* 14140 (P); Maroleotra, *Tsaratsangana* SF 8007 = SF 9407 (P, TEF); Nosy-Varika, *Guillaumet* 2207 (P).

6. Carissa spinarum L., Mantissa 1: 52 (1767); Syst. Nat. ed. 12, 2: 189 (1770); Haines in Indian Forester 45: 376, f. 2 (1919) and 47: 378 (1921); Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 137 (1949); H. Huber, Apocynaceae in Fl. Ceylon 1: 9 (1973); P.T. Li, A.J.M. Leeuwenberg & D. J. Middleton, Apocynaceae in Fl. China 16: 146

(1995). — Type: India, sin. loc., *Koenig* s.n. (lectotype LINN 295.2 designated by H. Huber; putative isolectotype C).
Fig. 7–10, p.37–40; phot. 4–7, p.124-126; map 6, p. 41 and 7, p. 42

Homotypic synonym: *Jasminonerium carandas* var. *spinarum* (L.) Kuntze, Rev. 2: 415 (1891).

Heterotypic synonyms: *Carissa edulis* Vahl, Symb. Bot. 1: 22 (1790); Pichon in Mém. Inst. Sc. Madag. sér. B, 2. 1: 127 (1949), excl. synonyms *C. abyssinica* R. Br. & *C. africana* A. DC.; Huber in Fl. W. Trop. Afr. 2: 54 (1963); Markgraf, Fl. Madag. fam. 169: 23 (1976); Kupicha in Fl. Zamb. 7. 2: 399 (1985), **syn. nov.** *Antura hadiensis* J.F. Gmel., Syst. ed. 13: 405 (1791). *Arduina edulis* (Vahl) Spreng., Syst. ed. 16. 1: 669 (1825). *Jasminonerium edule* (Vahl) Kuntze, Rev. 2: 415 (1891). *Carandas edulis* (Vahl) Hiern, Cat. Welw. Afr. Pl. 3: 664 (1898). *Antura* Forskal, Fl. Aegyp. 63 (1775), withouth specific epithet. *C. edulis* subsp. *continentalis* Pichon, Mém. Inst. Sc. Madag. sér. B, 2. 1: 129 (1949), partly, excl. syn. *C. abyssinica* R. Br. and *C. africana* A. DC. — Type: Yemen, Mts Hadie, *Forskål* 234 (holotype C-FORSK; isotypes BM, S).

C. inermis Vahl, Symb. Bot. 3: 43 (1794). *Jasminonerium inerme* (Vahl) Kuntze, Rev. 2: 415 (1891). *Arduina inermis* (Vahl) K. Schum. in Engler & Prantl, Nat. Pflanzenf. 4, 2: 127 (1895). — Type: India, sin. loc., *Koenig* s.n. (holotype C).

C. xylopicron Thouars, Obs. Pl. Iles. Afr. Austr. 80, t.2 (1804), **syn. nov.** *Arduina xylopicron* (Thouars) Baill., Hist. des pl.: 10: 170 (1888). *Jasminonerium xylopicron* (Thouars) Kuntze, Rev. 2: 415 (1891). — Type: Réunion, sin. loc., *Du Petit Thouars* s.n. (holotype P).

C. ovata R. Br., Prodr. 468 (1810); P.I. Forster in Aust. Syst. Bot. 5: 586 (1992) and in Fl. Australia 28: 109 (1996). *C. brownii* F. Muell., Fragm. 4: 45 (1863). *Arduina brownii* (F. Muell.) K. Schum. in Engler & Prantl, Nat. Pflanzenf. 4, 2: 127 (1895), p.p. *Jasminonerium ovatum* (R. Br.) Kuntze, Rev. 2: 415 (1891). *C. brownii* var. *ovata* (R. Br.) Maiden & Betche, Census N.S.W. Pl. 173 (1916). — Type: Australia, Queensland, Thirsty Sound, *R. Brown* 2850 (holotype BM; isotypes CANB, E, K).

C. scabra R. Br., Prodr. 468 (1810); P.I. Forster, Aust. Syst. Bot. 5: 589 (1992) and in Fl. Australia 28: 110 (1996). *C. brownii* F.

Fig. 7. *Carissa spinarum*. **1**, **3-5** and **7-13** branchlets (x 2/3); **2** and **6** leaves (x 2/3). 1 from Hubbard 7205; 2 from Lovett 712; 3 from Leeuwenberg 14782; 4-6 from Hubbard 7204; 7 from Leeuwenberg 14781; 8 from MacGillivray 27 Oct. 1849; 9-10 from Leeuwenberg 14719; 11 from E.N.S. Jackson 985; 12 from Schatz 3153; 13 from Clemens 43433.

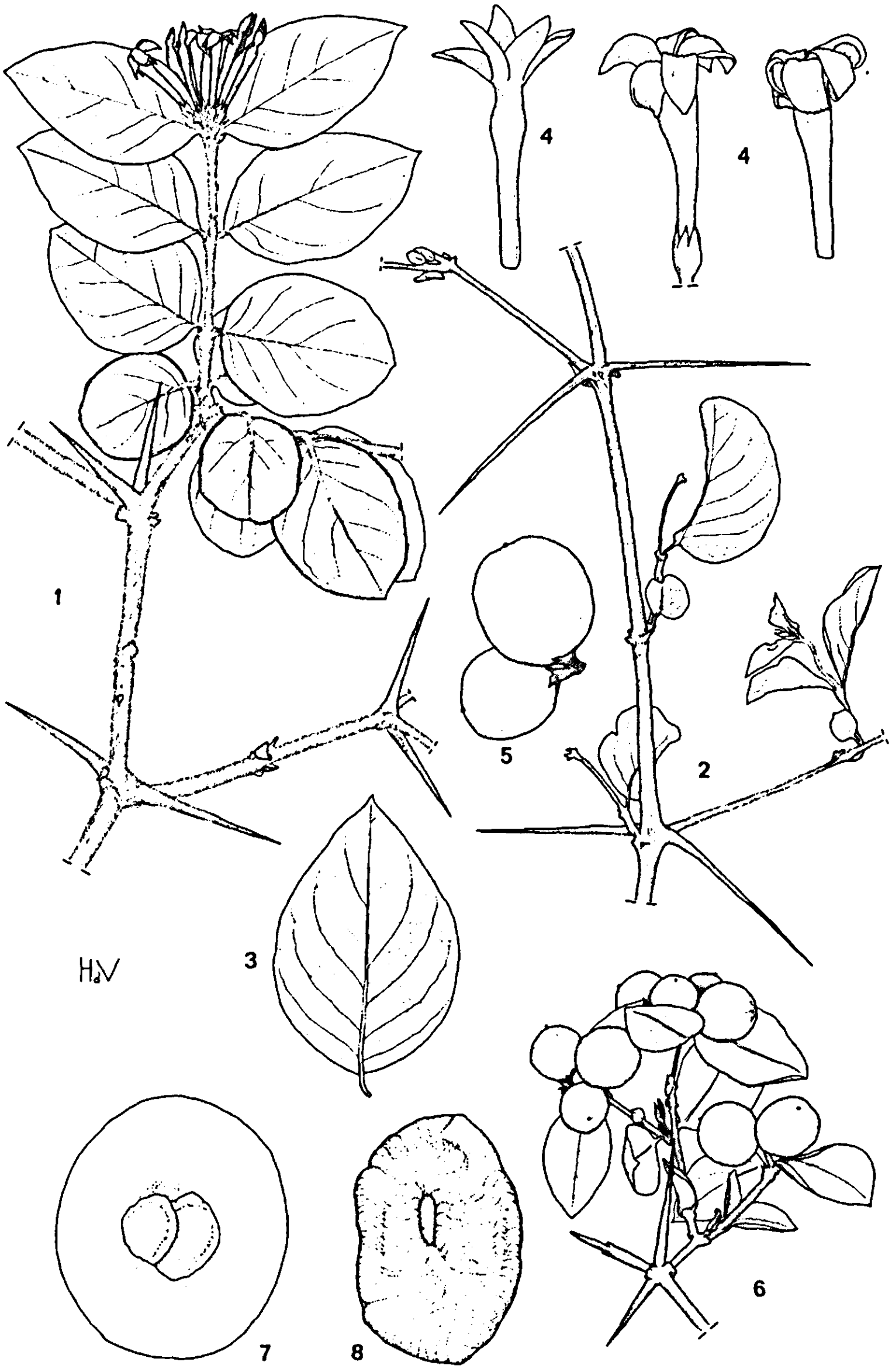


Fig. 8. *Carissa spinarum*. 1. habit (x 2/3); 2. branchlet with spines (x 2/3); 3. leaf (x 2/3); 4. flowers (x 2); 5. fruits (x 1); 6. fruiting branchlet (x 1); 7. section of fruit (x 4/3); 8. seed (x 5). 1 from W. de Wilde 5531; 2-3 from Schmitz 6670; 4 from Leeuwenberg 10787; 5 and 7-8 from Leeuwenberg 10100; 6 from Westphal 416.

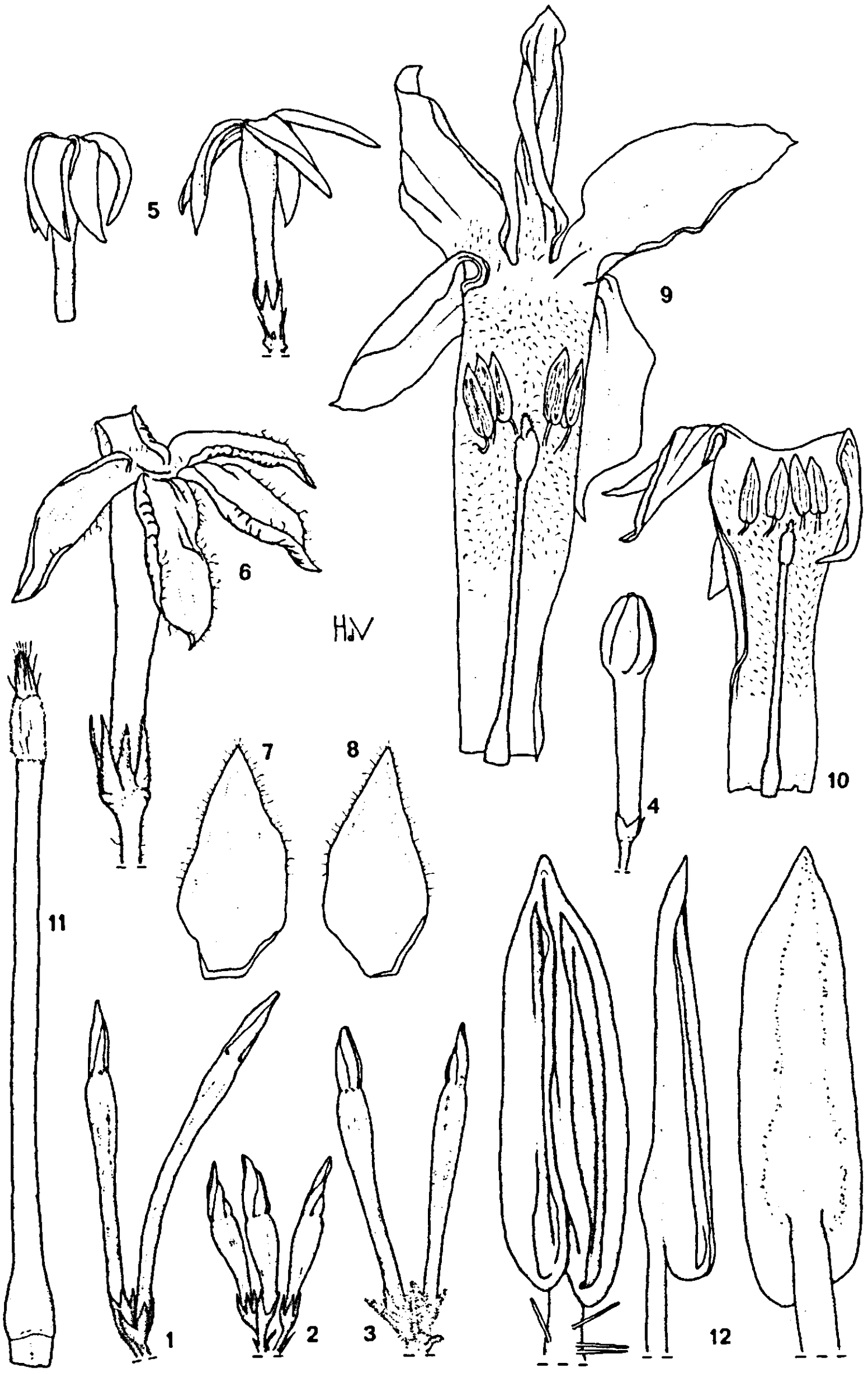
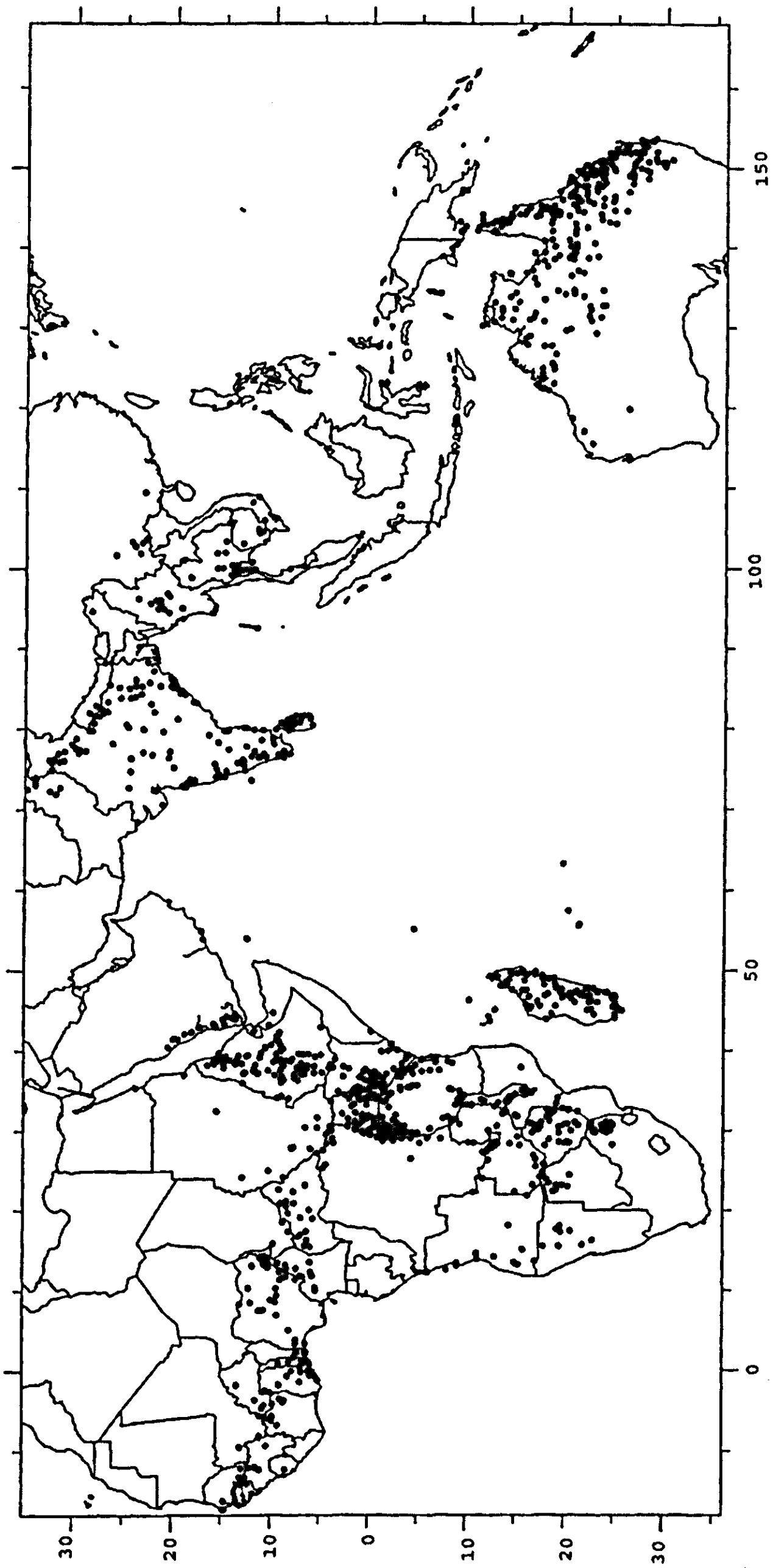
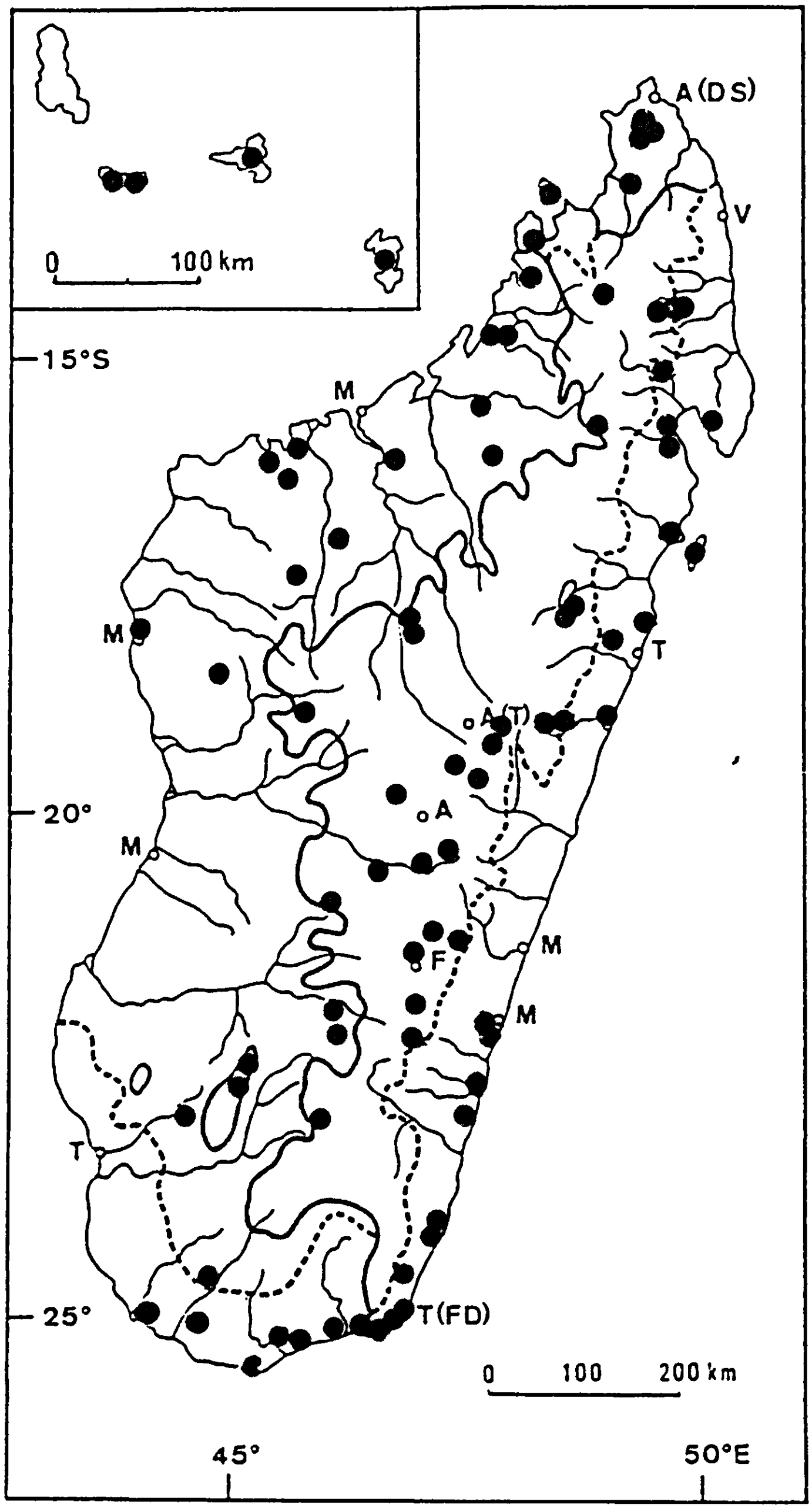


Fig. 9. *Carissa spinarum*. **1-4** buds (x 2); **5.** flower (x 2); **6.** flower (x 4); **7-8.** sepal out- and inside (x 12); **9-10.** opened corollas with pistils (x 4); **11.** pistil (x 8); **12.** stamens (x 30). 1 from Schmitz 6670; 2 from Seegeler 3001; 3 from W. de Wilde 5531; 4 from Capuron SF 18914; 5 from Jansen 5201; 6 from Hagos 6; 7-9 and 11-12 from Hedberg 4798; 10 from Hepper 5968.

Fig. 10. *Carissa spinarum*. **1-3.** habits (x 2/3); **4.** upper part of opened corolla (x 8/3); **5.** pistil (x 6). 1 from Cadet 2606; 2 from Bouton anno 1830; 3 from Coode 4642; 4-5 from Friedmann 2345.



Map 6. *Carissa spinarum*.



Map 7. *Carissa spinarum*.

Muell., Fragm. 4: 45 (1863), p.p. — Type: Autralia, Queensland, Prince of Wales Islands, Good's Island, *R. Brown* 2851 (holotype BM; isotype CANB).

C. lanceolata R. Br., Prodr. 468 (1810); P. I. Forster in Aust. Syst. Bot. 5: 583 (1992) and in Fl Autralia 28: 109 (1996), non Dalz. & Gibs. (1861). *C. brownii* F. Muell., Fragm. 4: 45 (1863), p.p. *C. brownii* var. *lanceolata* (R. Br.) Tate in Horn Sci. Exp. Centr. Austr. 3: 170 (1896). — Type: Australia, Northern Territory, Sir Edward Pellew Group, Morgan's Island, Blue Mud Bay, *R. Brown* 2852 (lectotype BM designated by P.I. Forster; isolectotypes CANB, K, P, P-JU 7201, S).

C. madagascariensis Thouars ex Poir. in Lamarck, Enc. Suppl. 2: 18 (1811); Markgraf, Fl. Mad. fam. 169: 29 (1976), **syn. nov.** *Arduina madagascariensis* (Thouars ex Poir.) Baill., Hist. des pl. 10: 170 (1888). *J. madagascariense* (Thouars ex Poir.) Kuntze, Rev. 2: 415 (1891). *C. edulis* subsp. *madagascariensis* (Thouars ex Poir.) Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 130 (1949). — Type: Madagascar, sin. loc., *Du Petit Thouars* s.n. (holotype P).

C. hirsuta Heyne ex Roth., Nov. Pl. Sp. 128 (1821). *C. spinarum* var. *hirsuta* (Roth.) Hook. f., Fl. Br. Ind. 3: 631 (1882). — Type: Myanmar, Irawaddi R., Kyank Jalong, *Heyne* 560 in *Wallich* 1680.1 (holotype B†; lectotype K-WALL designated here; isotype G-DC).

C. diffusa Roxb., Hort. Beng. 19 (1814), nomem; Fl. Ind. ed. Carey 2: 524 (1824) & 1: 690 (1832); Forman in Kew Bull. 52: 524 (1997). — Type: India, Orissa, near Ganjam, at Ganges R. mouth, *Roxburgh* s.n. (holotype BR; isotypes G-DC, K-WALL 1678B).

? *C. axillaris* Roxb., Fl. Ind. ed. Carey 2: 526 (1824) & 1: 690 (1832). — Type: Indonesia, Moluccas (= Maluku), not traced. Description (opposite leaves, recurved paired spines, axillary inflorescences) may refer to a plant of an other family.

C. villosa Roxb., Hort. Beng. 19 (1814), nomen; Fl. Ind. ed. Carey 2: 527 (1824) & 1: 691 (1832). — Type: Cult. India, Hort. Bot. Calcutta, *Wallich* 1680B (lectotype BM designated here; isotypes K-WALL, L).

C. dulcis Schum. & Thonn., Beskr. Guin. Pl. 146 (1827). *J. dulce* (Schum. & Thonn.) Kuntze, Rev. 2: 415 (1891). — Type: Ghana, Aflaumbe Island (=Aflaha(?), *Thonning* 79 (holotype C; isotypes FI-W, G-DC, MEL, P-JU 7198).

Chapelieria madagascariensis A. Rich. in Mém. Soc. Hist. Nat. Paris 5: 253 (1834), non *Carissa madagascariensis* Thouars. *Carissa edulis* var. *septentrionalis* Pichon in Mém. Inst. Sci. Madag. sér. B. 2: 133 (1949). *C. septentrionalis* (Pichon) Markgr. in Adansonia sér. 2, 10: 26 (1970) and Fl. Madag. fam. 169: 32 (1976), **syn. nov.** — Type: Madagascar, East coast, sin. loc., *Chapelier* s.n. (holotype P).

C. macrophylla Wall. ex G. Don, Gen. Syst. 4: 104 (1837). — Type: India, sin. loc., *Heyne* in *Wallich* 1679 C (holotype K; isotypes E, K-WALL).

C. coriacea Wall. ex G. Don, Gen. Syst. 4: 105 (1837). — Type: Mauritius, sin. loc., *Telfair* 23 June 1827 in *Wallich* 1681 (holotype K; isotypes K-WALL, OXF).

Carissa paucinervia A. DC., Prod. 8: 333 (1844); Wight, Icon. 4: t. 1290 (1848). *C. carandas* var. *paucinervia* (A. DC.) Bedd., Fl. Sylv. Anal. Gen. 156 (1872). — Type: India, Tamil Nadu, Nilgiri Hills, *Leschenault* 203, anno 1823 (holotype G-DC; isotype P).

C. pubescens A. DC., Prodr. 8: 334 (1844). *J. pubescens* (A. DC.) Kuntze, Rev. 2: 415 (1891). *C. edulis* subsp. *continentalis* var. *pubescens* (A. DC.) Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 130 (1949). — Type: Senegal, near Gorea, *Perrottet* 10 April 1829 (holotype G-DC).

C. congesta Wight, Icon. 4: t. 1289 (1848). *C. carandas* var. *congesta* (Wight) Bedd., Fl. Sylv. Anal. Gen. 156 (1872). — Type: India, sin. loc., *Sherpherd* s.n. in herb. *Wight* s.n. (holotype K).

C. tomentosa A. Rich., Tent. Fl. Abyss. 2: 30 (1851). *J. tomentosum* (A. Rich.) Kuntze, Rev. 2: 415 (1891). *Carissa edulis* var. *tomentosa* (A. Rich.) Stapf in Fl. Trop. Afr. 4, 1: 90 (1902). — Type: Ethiopia, Tigray, Mts Tchélikote (= Chelekot), April-May, *Quartin Dillon & Petit* s.n. (lectotype P designated here).

C. richardiana Jaub. & Spach., Ill. Pl. Or. 5: t. 496 (1857). — Type: Ethiopia, Tigray, near Adua (= Adowa), *Schimper* 156 (lectotype P designated here; isolectotypes BM, BP, BR, FT, G-DC, GH, K, L, LG, M, MEL, NY, P, S, UPS, W, WAG, Z).

C. candolleana Jaub. & Spach, Ill. Pl. Or. 5: t. 497 (1857). — Type: Ethiopia, Tigray, near Adua (= Adowa), 1 Dec. 1837, *Schimper* 209 (lectotype P designated here; isolectotypes BM, BP, BR, FT, G-DC, HBG, K, M, MEL, W).

C. cornifolia Jaub. & Spach., Ill. Pl. Or. 5: t. 498 (1857). — Type: Ethiopia, Gonder, Senen, Sanfetch Mt, Nov. 1852, *Schimper* 1068 (lectotype P designated here; isolectotypes BR, G, K, W, WAG).

C. lanceolata Dalz. & Gibs., Bombay Fl. 143 (1861), non R. Br. (1810). *C. dalzellii* Bedd., Fl. Sylv. Anal. Gen. 157 (1872). — Type; India, Maharashtra, Concan, Ramghat, *Dalzell* s.n. (lectotype K designated here). Ibid., *Ritchie* 443, Feb. 1850 (paratype K) and 443, May 1850 (paratypes E, K).

C. laxiflora Benth., Fl. Austr. 4: 305 (1869); P.I. Forster in Blumea 35: 263 (1990), in Aust. Syst. Bot. 5: 588 (1992) and in Fl. Australia 28: 110 (1996), **syn. nov.** *Jasminonerium laxiflorum* (Benth.) Kuntze, Rev. 2: 415 (1891). *Arduina laxiflora* (Benth.) K. Schum. in Engler & Prantl, Nat. Pflanzenf. 4, 2: 127 (1895). — Type: Australia, Queensland, Cook District, Cape York, *MacGillivray* 27 Oct. 1849 (holotype K).

C. sechellensis Baker, Fl. Maurit. Seych. 222 (1877). *J. sechellense* (Bak.) Kuntze, Rev. 2: 415 (1891). *C. edulis* var. *sechellensis* (Bak.) Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 33 (1949). *C. edulis* subsp. *madagascariensis* var. *sechellensis* (Bak.) Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 134 (1949). — Type: Seychelles, Silhouette, La Passe, *Horne* 511 (holotype K).

C. brownii var. *angustifolia* Kempe in Trans. Proc. Roy. Soc. S. Austr. 3: 135 (1880). — Type: Australia, Northern Territory, Finke R., Glen of Palms, 24.05 S, 132.47 E, not mentioned and not traced.

C. suavissima Bedd. ex Hook. f., Fl. Br. Ind. 3: 632 (1882). *Jasminonerium suavissimum* (Bedd. ex Hook. f.) Kuntze, Rev. 2: 415 (1891). — Type: India, Tamil Nadu, Mts of Madurai Distr., *Beddome* 5079 (holotype BM).

C. densiflora Baker, Journ. Linn. Soc. 20: 204 (1883). *J. densiflorum* (Bak.) Kuntze, Rev. 2: 415 (1891). *C. edulis* subsp. *madagascariensis* var. *densiflora* (Bak.) Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 130 (1949). — Type: Central Madagascar, sin. loc., *Baron* 709 (holotype K; isotype P).

C. pilosa Schinz in Verh. Bot. Ver. Prov. Brandenb. 30: 258 (1888). — Type: Namibia, Damaraland, Grootfontein (Upingtonia), *Schinz* 223 (holotype B†; lectotype Z).

C. revoluta Scott Elliot in Journ. Linn. Soc. 29: 33 (1891); Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 135 (1949). *C. edulis* var.

revoluta (Scott Elliot) Markgr. in Adansonia sér. 2, 10: 26 (1970) and Fl. Madag. fam. 169: 24 (1976), **syn. nov.** — Type: Madagascar, Toliara, Fort-Dauphin, *Scott Elliot* 3071 (holotype K; isotypes BM, E, P).

C. ovata var. *stolonifera* Bailey, Bot. Bull. 9: 9 (1894) and Compr. Cat. Queensl. Pl. 317, fig. 295 (1913). *C. stolonifera* (Bailey) Perrot & Vogt, Trav. lab. Mat. Med. l'Ecol. Sup. Pharm. Paris 9: 112 (1912). — Type: Australia, Queensland, Darling Downs District, near Dalby, *T.L. Bancroft* s.n. (holotype BRI n.v.; isotype K).

Arduina campenonii Drake in Bull. Mens. Soc. Linn. Paris 2: 1222 (1896). *Carissa campenonii* (Drake) Palacky, Cat. Pl. Madag. 3: 29 (1907); Pichon in Mém. Mus. natn. Hist. Nat. sér. 2, 24: 133 (1948) and Mém. Inst. Sci. Madag. sér. B. 2: 37 (1949); Markgraf, Fl. Madag. fam. 169: 20 (1976); Leeuwenberg in Wageningen Agric. Univ. Pap. 97-2: 80 (1997), **syn. nov.** — Type: Madagascar, sin. loc., *Campenon* s.n. (holotype P).

C. edulis var. *major* Stapf in Fl. Trop. Afr. 4, 1: 90 (1902). — Type: Malawi, Southern, Maganja Hills, *Meller* Sept.-Nov. 1861 (lectotype K, designated by Kupicha, 1985).

Damnacanthus esquirolii Lév. in Fedde, Repert. 10: 435 (1912). — Type: China, Yunnan, Kouai Tien, *Esquirol* 1508 (holotype E).

C. ovata var. *pubescens* Bailey, Compr. Cat. Queensl. Pl. 317, fig. 296 (1913). — Type: Australia, Queensland, North Kennedy District, Charters Towers, *C.F. Plant* s.n. (holotype BRI).

C. opaca Stapf ex Haines, Indian Forester 47: 378 (1921). *C. paucinervia* var. *opaca* (Stapf ex Haines) Haines, l.c. — Type: India, Uttar Pradesh, Dehra Dun, *Haines* 2159 (lectotype K designated here).

C. gangetica Stapf ex Gamble, Fl. Presid. Madras 5: 805 (1922). — Type: India, Orissa, N Circars, Mahendragiri Hill in Ganjam, *Gamble* 14136 (lectotype K designated here).

C. densiflora var. *microphylla* P. Danguy ex Lecomte, Bois Analamazaotra 134 (1922). *C. edulis* subsp. *madagascariensis* var. *microphylla* (P. Danguy ex Lecomte) Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 132 (1949). *C. edulis* var. *microphylla* Pichon, Markgraf, Fl. Madag. fam. 169: 25 (1976), **syn. nov.** — Type: Madagascar, Toamasina, *Ramanantoavolana* in *Thouvenot* 9 (holotype P; isotypes BM, K).

C. papuana Markgr., Nova Guinea 14 (2): 278 (1927). — Type:

Indonesia, Irian Jaya, near Okaba, *Brandehorst* 64 (holotype U; isotypes K, L).

C. velutina Domin, Biblioth. Bot. 89: 1075 (1928). — Type: Australia, Queensland, Cook District, near Chillagoe, near Walsh R., *Domin* 7811 (lectotype PR, designated by P.I. Forster).

C. cochinchinensis Pierre ex Pitard in Lecomte, Fl. Indoch. 3: 1112 (1933). — Type: Cambodia, near Bati, *Pierre* 4479, May 1874 (lectotype P designated by Yok Lin, published here).

C. laotica Pitard in Lecomte, Fl. Indoch. 3: 1113 (1933). — Type: Laos, Stung-Streng, *Thorel* 2213 (holotype P).

C. laotica var. *ferruginea* Kerr in Bull. Misc. Inf. Kew 1937: 87 (1937). — Type: Thailand, Ayuthia, Saraburi, Muak Lek, *Kerr* 9118 (lectotype BM; isotype K).

Cabucala brachyantha Pichon in Not. Syst. ed. Humbert 13: 205 (1948); Markgraf, Fl. Madag. fam. 169: 73 (1976). — Type: Madagascar, Toamasina, Andrangovalo Mts, SE of Lake Alaotra, Zakamena Res., *Humbert & Cours* 17962 (holotype P).

C. congesta var. *albida* H. Santapau in Kew Bull. 3: 490 (1949), **syn.nov.** — Type: India, Maharashtra, Bombay, Khandala, *Santapau* 8890 (holotype BLAT, n.v.); ibid., *Santapau* 4407 (paratype K).

C. edulis subsp. *madagascariensns* var. *subtrinervia* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 131 (1949). *C. edulis* var. *subtrinervia* Pichon, Markgraf, Fl. Madag. fam. 169: 26 (1976), **syn. nov.** — Type: Madagascar, Fianarantsoa, Vohibasia, *Perrier de la Bâthie* 8865 (holotype P).

C. edulis subsp. *madagascariensis* var. *ambungana* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 131 (1949). *C. edulis* var. *ambungana* Pichon, Markgraf, Fl. Madag. fam. 169: 25 (1976), **syn. nov.** — Type: Madagascar, Mahajanga, Kaleko, near Itampitso, tributary of Mahavavy R., *Perrier de la Bâthie* 8961 (holotype P).

C. edulis subsp. *madagascariensis* var. *nummularis* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 132 (1949). *C. edulis* var. *revoluta* f. *nummularis* (Pichon) Markgr. in Adansonia sér. 2, 10: 26 (1970) and Fl. Madag. fam. 169: 24 (1976), **syn. nov.** — Type: Madagascar, Toamasina, Soanierana-Ivongo, *Decary* 10771 (holotype P).

C. edulis subsp. *madagascariensis* var. *comorensis* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 134 (1949). *C. comorensis* (Pichon) Markgr. in Adansonia sér. 2, 10: 26 (1970) and Fl. Madag. fam.

169: 33 (1976), **syn. nov.** — Type: Comoro Islands, Mayotte, *Boivin* anno 1849 (holotype P).

C. edulis subsp. *madagascariensis* var. *lucubea* Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 134 (1949). — Type: Madagascar, Antsiranana, Nosy Be, *Pervillé* 411 (holotype P).

C. horrida Pichon in Mém. Inst. Sc. Madag. sér. B, 2: 135 (1949). *C. edulis* var. *horrida* (Pichon) Markgr. in Adansonia sér. 2. 10: 26 (1970) and Fl. Madag. fam. 169: 28 (1976), **syn. nov.** — Type: Madagascar, Toliara, Mt Vohitrotsy, Middle Mandrara R., near Anadabolava, *Humbert* 12669 (holotype P).

Strychnos pungens Gagnep. in Not. Syst. ed. Humbert 14: 23 (1950), non Solered. (1892). — Type: Vietnam, Annam, between Phanrang and Tourcham, *Lecomte & Finet* 1425 (holotype P).

Azima pubescens Suesseng., Mitt. Bot. München 1: 334 (1953). — Type: Namibia, Grootfontein District, Farm Otjerukaka, *Walter* 810 (lectotype M designated here).

Carissa obovata Markgr. in Adansonia sér. 2. 10: 25 (1970) and Fl. Madag. fam. 169: 2 (1976), **syn. nov.** — Type: Madagascar, Fianarantsoa, Andringitra Mts, Ambodinavao of Antsalova Forest, *Cours* 2328 (holotype P; isotypes B, WAG).

C. oleoides Markgr. in Adansonia sér. 2, 10: 26 (1970) and Fl. Madag. fam. 169: 29 (1976), **syn. nov.** — Type: Madagascar, Fianarantsoa, Isalo Mts, *Decary* 16361 (holotype P; isotype B).

C. yunnanensis Tsiang & P.T. Li in Acta Phytotax. Sin. 11, 4: 347 (1973). — Type: China, Yunnan, Hokin Domei, Yangtze R., *K.M. Feng* 850 (holotype IBSC; isotype A).

Shrub 0.20—3 m high, often straggling, or climber up to 20 m high, sometimes, especially in Madagascar tree up to 18 (30) m high, with white latex except in bark of tree trunks. Model of Koriba (in Africa and Asia at least) or Prévost (in Madagascar). Trunk 2—50 cm in diameter; bark pale brown or grey-brown, rough or rather rough, shallowly or deeply longitudinally fissured and/or flaking. Branches lenticellate or not; branchlets glabrous or pubescent. Spines straight or sometimes recurved, simple or sometimes furcate, 5—55 mm long, or in trees often absent. *Leaves* shortly petiolate; petiole glabrous or pubescent, 0.5—6(10) mm long, sometimes colleters in the axils; blade subcoriaceous, coriaceous or papery even when fresh, orbicular, elliptic, narrowly elliptic or ovate, very variable in shape and size, 1—3(11) x as long

as wide, (0.5)0.8—8(17) x (0.3)0.5—6 cm, acuminate to rounded at the apex, cuneate or rounded at the base, rarely subcordate, sometimes recurved at the margin, glabrous or (sometimes partly) pubescent on both sides, with 1—8(15) pairs of secondary veins conspicuously arcuate towards the margin and forming an angle of 30—45° with the costa and often also above them several pairs of rather straight secondary veins forming an angle of 60—80° with the costa; tertiary venation mixed scalariform and reticulate, prominent on both sides or above or beneath only or invisible. *Inflorescences* terminal and sometimes also axillary, solitary or paired, lax or congested, subumbellate, few- to many-flowered. Peduncle (0)1—10(20) mm long, glabrous or pubescent; pedicels (0.2)0.5—7 mm long, glabrous or pubescent. Bracts scale-like, like the sepals or very narrowly elliptic, (0.2)0.5—1 x as long as them. *Flowers* sweet-scented. *Sepals* pale or medium green, equal ot unequal, ovate or narrowly so, 1.5—4(6) x as long as wide, (1.2)1.5—4(5) x 0.4—1.7 mm, acuminate or acute, sometimes obtuse, pubescent or glabrous outside, ciliate or rarely not, glabrous or sometimes sparsely pubescent inside, without colleters. *Corolla* white, sometimes pink or with pale green tube, 7—30 mm long in the mature bud and forming a narrowly ovoid head 0.2—0.4 of the bud length, acute or obtuse at the apex, glabrous or pubescent (often only on upper half of tube and on lobes) outside, with a belt pubescent or sparsely so inside from 2—11.5 mm below the insertion of the stamens to 1—2 mm above, less often only up to the insertion itself or to the apices of the lobes; tube 2—7 x as long as the longest sepals, 1.1—4 x as long as the lobes, 5—21.5 mm long, 0.8—1.7 mm wide at the base, widened around the stamens to 1.5—2.5 mm wide and again narrowed at the throat or not and to 1.2—2.5 mm wide; lobes obliquely ovate or elliptic, 0.2—0.9 x as long as the tube, 1.1—4.5 x as long as wide, 1.5—15 x 1—7 mm, obtuse to acuminate, slightly auriculate at the right side of the base, overlapping to the right in bud. *Stamens* with apex 0—4.5 mm below mouth of corolla tube, inserted 0.66—0.8 of the length of the corolla tube, at 3.5—16 mm from the base; filaments very short, 0.2—0.5 mm long, glabrous or pubescent inside; anthers oblong or narrowly ovate, 2—5 x as long as wide, 1—2.5 x 0.3—0.7 mm, apiculate or acute at the apex, glabrous or occasionally with some hairs at the apex. *Pistil* glabrous or sometimes with a few hairs on the ovary, with apex from 3 mm below to halfway along anthers; ovary ovoid or nearly so, 0.5—1.9 x 0.4—1.1 mm, glabrous or less

often pubescent at the apex, more or less gradually narrowed into the rather robust style; pistil head of a suglobose or ellipsoid basal stigmatic part, 0.4—1.1 x 0.3—0.7 mm and a stigmoid apex 0.2—0.7 x 0.1—0.5 mm. Ovules (1)2—4 in each cell when fruits small, less often more. *Fruit* dark red, blue-black or black, globose, or ellipsoid or narrowly so, 5—25(60) x 3—20(60) mm, 1—5(12)-seeded. *Seeds* obliquely and broadly ovate to almost orbicular or elliptic, 4—9(20) x 4.2—6(12) x 2—3 mm, rounded at both ends or acute at one of them, convex at one side, flat or concave and with a thickened margin at the other, the hilar, side; hilum ovate, in the middle. Embryo 3.5—6.5 mm long; cotyledons ovate or broadly so, 1.5—2.5 x 1.3—1.7 mm; rootlet 2—4 x 0.5—0.6 mm.

Distribution. Tropical and southern Africa from Senegal to Socotra in the East and to Namibia and Natal in the South, Seychelles, Madagascar, Arabian Peninsula, Pakistan to Vietnam, Sri Lanka, Aru Islands, New Guinea, Australia (West to Queensland) and New Caledonia.

Ecology. Wet or dry forest, thickets or savannas. Alt. 0—1700 m in Madagascar, up to 2100 m in Kenya and up to 2450 m in Ethiopia and Yemen.

Carissa spinarum clearly avoids the wettest climates, eihter total rainfall and/or distribution of rainfall being important. The species is not found in equatorial rainforest climates, such as in Gabon, Congo for the main part, Malaysia, Indonesia and the Philippines, and the main part of New Guinea.

Geographical selection of the approximately 3000 specimens examined:

Senegal. Dakar: Cap-vert Peninsula, *Perrottet* 490 (BM, P, S, W, WAG), 10 April 1829 (G-DC, type of *C. pubescens*). Thiès: Sangalkam, *Berhaut* 429 (BR, P, Z); Baol, *Leprieur* s.n. (G). Oriental: Siminti, *Adam* 14157 (P); Kanéméré, *Fotius* K 229 (P). Casamance: Anambé, *Boudet* 4747 (P); Abéné, *Van den Berghen* 9062 (BR).

Mali. Bangassi, Cercle de Kita, *Dubois* 152 (P); Ouassada, Ouassoulou R., *Chevalier* 616 (P); Kadiolo, *Diarra* 446 (P); Madina, Diassa, *Audru* 5838 (P).

Guinea Bissau. Nova Lamego-Buruntuma, *Alves Pereira* 3074 (K, MA).

Guinea. Koundara, *Cordonnier* 162 (BR); Pita, *Pobéguin* 2085 (P); Mali area, Mt Lowie, *Lisowski* 51569 (POZG); Téliré, *Malaisse* 2586 (BR, WAG); Labé, *Chevalier* 12405 (BR, K, P); near Koumba, *Lisowski* 20950 (K, POZG).

Sierra Leone. Sin. loc., *Afzelius* 95 (UPS).

Ivory Coast. Souroukou, *Aubréville* 1404 (B, K, P); km 25 Korhogo-Mbingué Road, *Versteegh & den Outer* 454 (U, WAG); ca km 35 Korhogo-Boundiali Road, *Ambe* 121 (BR); Kassere, *Gautier-Beguin et al.* 1384 (G); Bouna Res., Kakpin,

Aké Assi 10268 (UCJ, WAG), 10304 (G, UCJ); W of Gansé, *Geerling & Bokdam* 743 (BR, WAG); 45 km W of Bania, *Geerling & Bokdam* 2233 (BR, WAG); 20 km N of Bavé, *Geerling & Bokdam* 2191 (BR, K, WAG).

Burkina Faso. between Banfora and Tiafora, *Aké Assi* 8624 (UCJ, WAG); Sideradougou, *Toutin* 2383 (P); 53 km S of Houndé, *Roberty* 1286 (P); Tikaré, *Bounounou* 412 (P).

Ghana. Upper: Dorimon, *Kitson* 941 (K); between Wahabu and Turi, *Kitson* 824 (K). Northern: Top of Damango Scarp, *Morton* GC 8729 (K, WAG); Jeji, *Vigne* 3319 (FHO). Ashanti: Krobo plains, *W.H. Johnson* 510 (K). Eastern: Ampoti, *Kitson* 1100 (K); between Anyaboni and Jaketi, *Morton* GC 7260 (K, WAG); Sra Forest, *Moor* 246 (FHO); Aflaumbe Island, *Thonning* 79 (C-THONN, FI-W, G-DC, MEL, P-JU 7198, type of *C. dulcis*); ibid., *Isert* s.n. (C-THONN). Central: Cape Coast, *Brass* s.n. (BM); between Awuti and Cape Coast, *Enti* FE 1856 (WAG); E of Ochreku, near Akora R., *Leeuwenberg* 11055 (WAG). Accra: between Achimota and Legon University, *Leeuwenberg* 11119 (WAG); Dodowa Road junction on Aburi Road, *de Wit & Morton* A 2904 (K, WAG); near Accra, *Jongkind & Noyes* 1250 (WAG); Nsawam Road, *Dalziel* 8289 (E, K, P, US). Volta: Kete Krachi, *Morton* GC 9119 (K); near Dsodje (= Dzodze), *Brent* 403 (K).

Togo. near Lomé, *Warnecke* 266 (BM, BR, E, G, HBG, K, L, M, P, PR); Amakpavé F. R., *Berg* 119 (BR, K, U, US, WAG); Sio Valley, N Agouévé, *Ern et al.* 227 (B, K, P); 7 km S of Bassar, *Hakki et al.* 514 (B); Atikpayi, *Schlechter* 12980 (BR, Z).

Benin. Cotonou, *Chevalier* 4497 (P); 10 km W of Cotonou, *van der Maesen et al.* 6585 (BENIN, WAG); W of Pahou, *Leeuwenberg* 11926 (WAG); near Ouesse, *van der Maesen* 6143 (BENIN, WAG); Covè, *Sinsin* 774 (BRLU); 2 km N of Gbananmè, *van der Maesen et al.* 6359 (BENIN, WAG).

Nigeria. Lagos: Lagos, *Cons. of Forest* 476 (K, P). Ogun: Olokemeji F.R., *Gentry & Pilz* 32645 (K, WAG). Oyo: Ibadan, Herb. *Schwabe* 20 Apr. 1963 (B). Kwara: Ilorin, Omu Aran, *Latilo* FHI 62291 (P, WAG). Niger: Bonu, *Onochie* FHI 18286 (K). Kaduna: km 19 Zaria-Kaduna Road, *Meikle* 1225 (K, P); S of Samaru, *Blum* 2457 (F, NY); Anara N.A. F.R., *Latilo* FHI 37976 (K); Jasai, *Cons. of Forests* 25 (FHO). Kano: Kogin Kano F.R., *Onwudinjoh* FHI 22354 (K). Bauchi: Jos, Assob Hill, *Wit et al.* 1336 in FHI 46845 (K, WAG); Naraguta F.R., *Olorunfemi* FHI 54955 (BR, FHO, K), 54956 (FHO, K, WAG); Mia F.R., Ganjuwa, *Daramola* 289 (F); Katagum District, *Dalziel* 336 (E, K). Borno: Maiduguri District, *Ujor* FHI 21947 (BR, K, P); Lassa, *Royer* 113 (BM). Gongola: Biu, *Wit et al.* 1749 in FHI 65075 (K, WAG); Yola, comm. *Shaw* 87 (K); Lankori Mission, ca 15 km N of Jalingo, *Chapman* 1075 (FHO, K); Gangoro F.R., *Chapman* 1289 (FHO, K); Vogel Peak, *Chapman* 4760 (FHO, K); between Gashaka and Serti, *J.B. Hall* 1590 (K). Plateau: Pankshin District, *Kennedy* FHI 7206 (K).

Cameroun. Ouest: Bafoussam, *Jacques-Félix* 3016 (P); Dschang, Mt Bamboutos, *Saxer* 105 (K). Centre Sud: near Boubala, *Letouzey* 2549 (P); Bouar, *Mildbraed* 9441 (K). Nord: 40 km N of Maroua, *de Wit* 6051 (WAG); Mayo Louti, 10 km N of Mokolo, *Letouzey* 6756 (BR, K, P, WAG); Maroua, *Vaillant* 1014 (K, P); between Maroua and Guider, *Jacques-Félix* 3762 (P); km 5 Mogodé-Mokolo Road, *Leeuwenberg* 7567 (BR, P, WAG); near Bourrah, *van der Zon* 1471 (WAG); 10 km SE of Garoua, *Geerling* 5679 (P, WAG); Poli, N slopes of

Mt Mango, *Jacques-Félix* 8522 (P); Faro Nat. Park, *van der Zon* 2065 (WAG); Tchabal Mbalo Mts, *Satabie* 635 (P, WAG); near Banyo R., 20 km NNE of Banyo, *Letouzey* 8491 (B, BR, HBG, P, WAG); 2 km W of Banyo, *Leeuwenberg* 10100 (BR, K, P, UPS, WAG).

Tchad. Kim, *Fotius* 1515 (P); Koyo, C Koumra, *Gaston* 1683 (P); between Danamadji and Moussafoyo, *Gaston* 2297 (P).

Central African Republic. Nana-Mambéré: Maigalo, *Bille* 1704 (P). Ouham-Pendé: Bocaranga, *Eckendorff* 83 (BM, BR, P); Bozoum, *Tessmann* 2534 (K). Ouham: Boguila Region, *Fay et al.* 5141 (K); ibid., near Furu Creek, *Fay* 5139 (K); near Tambouro Creek, *Fay* 5140 (K). Bribingui: near Fort Crampel, *Koechlin* 4710 (P). Kemo-Gribingui: Guifa, Sibut, *Mazada* 112 (P). Bambari: near Malinji, 18 km SE of Moroubas, *Tisserant* 1035 (BM). Bamingui-Bangoran: Bangoran Nat. Park, *Trochain* 11082 (P); Ndellé, *Chevalier* 7444 (BM, G, P, W, Z); Sangha, *Peeters* 72 (BR); between Ndellé and Mamoun, *Chevalier* 7793 (L, P); 3 km N of Koumbala, *Fay* 4315 (K). Haute-Kotto: Ouadda Region, Yalinga Road, between km 50 and the Kotto R., *Descoings* 11058 (P); Upper Ouandjia R. valley, *Corfield* 15 (P); Yalinga, *Le Testu* 2616 (BM, BR, P).

Congo (K). Bas Congo: Moanda, *Donis* 1780 (BR). Orientale: Gwane, *Lebrun* 2874 (BR, C, K, WAG); Tukpwo, *Gérard* 1208 (BR); Doruma, *De Graer* 277 (BR); Ndelele, Garamba Nat. Park, *de Saeger* 1809 (BR, WAG); Kurukwata, *Gérard* 3013 (BR); between Wilibadi and Gangala, Garamba Nat. Park, *Germain* 656 (BR, P); Dungu, *Troupin* 502 (BR, K, WAG); Nioka, *Deville* 66 (B, BR, K, M); ibid., *Taton* 49 (B, BR, C, K, P); between Kisenyi and Bogoro, *Lisowski* 48251 (BR, POZG, WAG); Kasenyi, *Bredo* 1806 (BR, WAG). Kivu: Albert Nat. Park, near Kombrekebra, *de Witte* 11355 (BR, K); NE of Ishango, *de Witte* 8605 (BR, K); Rwindi, *Lebrun* 7938 (BR, K, P); Masisi, Serke Road, *Devred* 3833 (BR, C, L); Rutshuru R., *Ghesquière* 4264 (B, BR, K, P); Goma, *Stauffer* 584 (BR, K, P, WAG, Z); Bukavu, *Breyne* 1756 (BR); Ruzizi R. plain, Lushima R., *Germain* 6926 (BR, K); Monganga, *de Witte* 1370 (BR); Ubwari, *Ankei* 79/0409 (BR). Katanga: Lambo Kilela, *Schmitz* 6670 (BR); Albertville (= Kalémié), *De Giorgi 2* (BR); Kansimba, *Malaisse* 14006 (BR, C, P, WAG); Mangoa, *Risopoulos* 730 (BR, WAG); Lutshipuka R., *Malaisse* 6050 (BR, K, P, WAG); Kando Plateau, near source of Congo R., *Lisowski* 55180 (BR, K); Lubumbashi, *Quarré* 1945 (BR, WAG); Welgelegen, *Bequaert* 485 (BR); ca 25 km NNE of Tsinsenda, *Symoens* 13310 (BR, K); Kitimbo, *Babault* 12 July 1933 (P).

Rwanda. Baie de Kibuye, Gwanuma Island, *Troupin* 14536 (BR, LG); near Rubona, *Michel* 3937 (BR); km 14 Kigali-Butare Road, *Auquier* 2822 (BR, LG); Kibungu, *Lewalle* 670 (BR); Kibugabuga Hill, *Troupin* 6425 (BR, F, WAG); Lulu Penisula, 10 km S of Gisenyi, *Troupin* 14394 (BR, LG); Biumba, Kakitumba R., *Troupin* 3216 (BR); Kakitumba, *Christiaensen* 496 (BR); km 18 Gabiro-Kakituma, *van der Veken* 10742 (BR, LG); Kagera Nat. Park, *Troupin* 3611 (BR, NY, WAG); Kigali, *Becquet* 374 (BR).

Burundi. Ngozi, *Reekmans* 3077 (BR, LG); Kirundo, *Reekmans* 10435 (B, BR, K, LG, UPS, WAG); Karuzi, *van der Ben* 2190 (BR, K); Kisozi, *Lejeune* 228 (BR, K); Ruygi area, *Declerck* 42 (BR); Mukagoma Hill, *Reekmans* 7625 (BR, K, WAG); Gaterama, *Reekmans* 5686 (BR, K, LG); Kayogoro, *Ndabaneze* 1282 (BR, LG).

Sudan. Eastern Equatoria: Yei R., Jembi Rocks, *Sillitoe* 380 (K, UPS); Seriba

Ghattas, Jur, *Schweinfurth* 1406 (K, MEL, P); E of Ngangala-Mongalla Road, *Jackson* 279 (FHO); Mongalla, *Sandison* 35 (K, P). Western Equatoria: near Mt Duovo, *Andrews* 577 (BM, K); Sue R., *Turner* 115 (K); Yubu, *Turner* 35 (K). El Buheyrat: Yirol-Dirgai Road, *Andrews* 733 (K). Bahr al Ghazal: Bahr al Arab, *Wickens* 3116 (K); headwaters of Boro R., *Hoyle* 512 (BM, FHO); between Rive Pongo and Khor Ramlet, *Broun* 349 (K); Wau District, *Macintosh* 51K (K). S Darfur: Jebel Marra, *W. de Wilde et al.* 5531 (BR, WAG), 5598 (BR, WAG). Kassala: Gallabat, *Schweinfurth* 2445 (G). Khartoum: near Khartoum, von *Württemberg* 1173 (M). Red Sea: Erkowit, *Cook* 239 (K); ibid., *Schweinfurth* 241 (K).

Egypt. Wadi Kansisroh, Jebel Elloa, *Palmer* 17 Jan. 1933 (K).

Eritrea. Sahil Awraja, *Scott Jones* 4 (K); Gheleb, *Schweinfurth* 1087 (M); near Keren, *Beccari* 35 (FT, K, L); ibid., *Schweinfurth* 1010 (G, M); near Filfil, *Fioiri* 575 (FT); Seraè (= Seraye Awraja), Mai Zibo, *Pappi* 82 (FT); Adi Ugri, *Bellini* 167 (FT); near Alibaret (=Alibarate), *Pappi* 2539 (FT); NW of Ghinda (= Ginda), *Schweinfurth* 421 (FT, G); between Asmara and Belesa, *Pappi* 2570 (FT); near Acrur, *Schweinfurth & Riva* 1348 (FT, G, K, P, S, Z); Senafé, *Fiori* 377 (FT).

Ethiopia. Tigray (Tigre): near Adua (= Adowa), *Schimper* 156 (BM, BP, BR, FT, G-DC, GH, K, L, LG, M, MEL, NY, P, S, UPS, W, WAG, Z, type of *C. richardiana*), 209 (BM, BP, BR, FT, G-DC, HBG, K, M, MEL, P, W, type of *C. candolleana*); near Tzellenti, *Chiovenda* 691 (FT); Tembien, *Sollazzo* 251 (FT); Mts Tchélikote (= Chelekot), *Quartin-Dillon & Petit* s.n. (P, lectotype of *C. tomentosa*); Habad, *Hildebrandt* 486 (BM, L, W). Gonder (Begemdir): Mareb, *Buscalioni* 307 (FT); Senen, Saonfeth Mt, *Schimper* 1068 (BR, G, K, P, W, WAG, lectotype of *C. cornifolia*); Tucur Dinghia, Gonder, *Pichi Sermolli* 1222 (FT, K); N of Gonder, *Pichi Sermolli* 1217 (FT, K); Seghido (= Segedo) R., *Corradi* 8005 (FT, WAG); Sciaura Mariam Alefa, *Pichi Sermolli* 1206 (FT); Guguata (= Gwagwat), *Buscalioni* 2294 (FT). Gojjam: W of Zeghie (= Zege), *Pichi Sermolli* 1214 (FT); Abu Kuldzi, *Kotschy* 569 (G, K, L, P, W, Z); near Selcien, Bahir Dar, *Pichi Sermolli* 1199 (FT, P, W); km 15 Debre Markos-Gonder Road, *Seegeler* 3001 (WAG). Wellega: Kassan Mts, Fesoghlu, *Cienkowsky* 61 (W); Ghidami, *Benedetto* 386 (FT); ca km 45 Nekemti-Ghimbi Road, *Jansen* 6356 (WAG); ca 25 km E of Lekemyi = Nekemti, *W. de Wilde et al.* 6272 (B, BR, C, WAG); ca 50 km W of Nekemti, Didessa R., *W. de Wilde et al.* 10719 (WAG); Bori, *Kotschy* 78 (W); Ambo Agric. Farm, *Albers* 61120 (K); ca km 70 Nekemti-Addis Abeba Road, *Jansen* 6203 (WAG); Argio, *Smeds* 1435 (K); ca 6 km SW of Jimma, *W. de Wilde et al.* 9300 (B, BR, C, K, P, WAG). Illubabor: Baro R., 6 km W of Itang, *Friis et al.* 2534 (C, K, UPS). Keffa (Kaffa): Gogeb R., near bridge in Bonga Road, ca 67 km SW of Jimma, *W. de Wilde et al.* 10180 (WAG); ca 3 km NE of Jimma, *Friis et al.* 102 (BR, C, K, WAG); km 9 Jimma-Bonga Road, *Westphal et al.* 3312 (BR, C, WAG); Amu Nada, E of Jimma, *Hedrén* 614 (UPS). Gamo Gofa (Gamu-Gofa): W bank of Mazi R., ca 1 km S of confluence with Omo R., *Gereau* 1306 (K, MO, WAG); km 80 Arba Minch-Soddo Road, *Jansen* 3848 (WAG); Gidole area, Argoba R., *Haugen* 492 (K). Sidamo: Awasa Lake, *Polunin* 11603 (K); S of Neghelle (= Negele), *Friis et al.* 3039 (C, K, UPS); Negele, *Cufodontis* 173 (FT, W); Margherita (= Abaya) Lake, *Vàtova* 1298 (FT); Arba Minch, *Westphal* 2977 (C, WAG); 50 km S of Awasa, N of Wondo,

Bos 9816 (WAG); 4 km W of Dilla, *Jadesse Ebba* 611 (K); Bala, near Hageremariam (= Agere Maryam), *Mooney* 5454 (K); 60 km NW of Neghelli (= Negele), *Burger* 1817 (FT, K); between Negele and Malca Guba (= Melka Guba), *Corradi* 8004 (FT); Banno Mts, Tertale, *Corradi* 7992 (FT); near Hididola, *Brouwer* 69 (WAG); Mega Mt, *Bally* 9201 (G, K, UC). Shoa (Shewa): Burka area, *Aweke* 491 (K); near Guder, *Bos & Jansen* 10166 (WAG); Fiché, *Meyer* 7583 (K, US); Addis Abeba, *Shantz* 27 (FHO, K); ibid., *W. de Wilde et al.* 5886 (BR, C, K, WAG); ca km 45 Addis Abeba-Debre Markos Road, *Ash* 100 (K); Ankober, *von Rohr* 406 (K); Jilli and Hawash R., *Scott* 1-2 Dec. 1926 (K); Awash Nat. park, *Gilbert et al.* 7368 (C, UPS); Asella, Cilalo Mt, *W. de Wilde et al.* 10039 (BR, K, WAG); Mt Zikwala, *Kristoffer et al.* 296 (UPS); NW shore of Lake Zwai, *Gilbert* 1068 (K); Wolisso, *Rankin* anno 1957 (E); ibid., *Hagos* 6 (C); km 79 Kolito-Hosanna Road, *Westphal et al.* 3244 (BR, C, WAG); km 25 Soddo-Shashamane Road, *Westphal et al.* 2888 (BR, C, WAG); between Dalbo and Kambata), *Cockburn* Apr. 1910 (K); between Soddu (=Soddo) and Sassamanne (= Shashemene), *Vàtova* 2118 (FT). Bale Upland: Ordobba, *Mooney* 7212 (FT, K); El Dire (= El Dere), *Corradi* 7989 (FT). Harèrghe (Harar) Upland: near Carsa, Chercher Highlands, *Bos & Jansen* 10014 (WAG); Asba Tafari (= Asbe Teferi), *Logan* 24 (G); Amhar Mts, *Burger* 683 (K); 3 km from Chelenko, *Jansen* 1621 (WAG); near Alemaya, *Westphal* 416 (BR, WAG); between Harar and Dire Dawa, *J.J. de Wilde* 4082 (B, BR, K, WAG); near Bati, *Jansen* 5201 (WAG); Harar, *Gillett* 5003 (FT, K); ca km 36 Harar-Jijiga Road, *J.J. de Wilde* 6339 (BM, M, WAG). Wello (Wollo): Alomata Pass, *Hemming* 1194 (BM, K); S of Dessie, *W. de Wilde et al.* 7363 (B, BR, WAG): Amba Lake, *Schimper* 590 (G, K, P, W), 1615 (P, WAG); Jara, *Rankin* Apr. 1957 (E).

Djibouti. Ourano, *Chedeville* 708 (FT, P).

Somalia. Wobbeh, *Gillett* 4590 (FT, K); Togdheer, *Hansen et al.* 6400 (C, K); Giumbo (= Jumba), *Paoli* 159 (FT); Chisimaio (= Kismayu), *Corini* 213 (FT).

Socotra. near Addehen, *Schweinfurth* 668 (BP, K, P); Hagghiher Mts, *A.R. Smith & Lavranos* 437 (FT, K, P, W, WAG).

Angola. Zaire: Alecto, near Zaire R. mouth, *Welwitsch* 5975 (BM); Ambriz, *Monteiro* Oct. 1872 (K, W); ibid., Quizembo, *Welwitsch* 5974 (BM). Luanda: W of Luanda, *Welwitsch* 5972 (BM, BR, C, G, K, P); Maiango do Povo, *Welwitsch* 5973 (BM, K). Cuanza Sul: Novo Redondo (= Sumbe), *Bamps & Martins* 4329 (BR, C, K, WAG); between Novo Redondo (= Sumbe) and Quicombo, *Teixeira et al.* 11343 (LMA); km 5 Elbo-Condé Road, *Raimundo et al.* 972 (BR). Benguela: km 7 Cuma-Quinjenje Road, *Dechamps et al.* 1068 (BR); Bruco, *Welwitsch* 5971 (BM). Huila: Serra da Chella, *Humbert* 16669 (BM, P); ibid., Lubango, *Humbert* 16222 (BM, K, P, WAG); Serra do Bruco, *Dechamps et al.* 1187 (BR, K, WAG); Lopollo, *Welwitsch* 5969 (BM, G, K, P); between Mulondo and Quiteve, *Henriques* 180 (BM, K). Cunene: Ondjiva, *Rautanen* 318 (Z). Cuando Cubango: Cuatir, *Cardoso de Matos* 128 (BR); near Santa Cruz Mission, on the border of Zambia, *Codd* 7514 (BM, K, PRE)..

Uganda. U1: Karamoja, top of Napak Mts, *Dyson-Hudson* 143 (K, US); Moroto, *Wilson* 2136 (BR, K); Kidepo Nat. Park, *Synott* 976 (K); Ygi, Gulu District, *Hancock* 759 (K); between Kakamogole R. and Kadam Mt, *Dyson-Hudson* 239 (K, US). U2: Rukiga, *Bagshawe* 430 (BM, K); Mbarara-Masaka Road, *Paulo* 680 (K); Ruizi R., *Jarrett* 31 (FHO, K); Kashari County,

Rwaburindore 1225 (US); George Lake, *Brédo* 4638 (BR); Toro Game Reserve, *Dechamps* 11626 (BR); Kagera R., Mulema, *Bagshawe* 204 (BM, K); Hoima District, Hankondo, *Dechamps* 11552 (BR); near Bugungu, *Dümmer* 3173 (BM); Mbarara, *Harker* 210 (K). U3: near Mbale, *Snowden* 190 (BM, K); Kaberamaido, *Bader* 139 (B); Serere, Teso, *Chandler* 357 (K); Paya, *Maitland* 1168 (K). U4: Lake Nabuguta, Masaka, *Chandler* 1395 (K); Madu, Gomba, *Eggeling* 309 (herb. 549) (K); Mubendi, *Snowden* 14 (BM, K); km 22 Kiboga Gombolola-Butemba Road, *Langdale-Brown* 2013 (K); 16 km NW of Nakasongola, *Langdale-Brown* 1504 (K); SE of Kikanda, *Lester & Morrison* 2361 (UPS); near Katonga Channel, *Rose* 10101 (K); Buvumu Island, Victoria Lake, *Bagshawe* 665 (BM).

Kenya. K1: Samburu Game Res., *Strid* 2076 (GB); Lorogi Plateau, *Kerfoot* 1077 (K); Mt Kulal, *Bamps* 6676 (BR); Marsabit Nat. Res., *Jonsell & Moberg* 4589 (FT, UPS); Marsabit-Moyale Road, *Faden* 68/346 (K); Furroli, *Gillett* 13950 (K); Moyale, *Gillett* 12969 (K). K2: Murua Nysigar Peak, *Paulo* 1006 (BR, K, US); Morun R., *Faden* 77/791 (US). K3: Soy, *Vesey-Fitzgerald* 95 (K); near Tot, *Bally* 12336 (G, K); near Kitale, *Brunt* 1379 (FT, K); Marakwet (= Kapsowar), *Lindsay* 7 (K); Katapagat, *Honore* 214 (BM, BR, FHO, K); Laikipia Plateau, *Scoresby Routledge* anno 1908 (K); 30 km N of Thomsons Fall, *Bogdan* 19 (UC); E Mau For. Res., *Maas Geesteranus* 6218 (BR, F, G, GB, K, L, S, UC, WAG, Z); near Eburu, *Humbert* 9060 (K, P, WAG). K4: N of Mt Kenya, *Linsen & Giesen* 15 (G, HBG); near Kisumu, *Tweedie* 1695 (K); Mt Kenya, *Holyoak* 716 (BM, FHO); Amboni R., NE slopes of Aberdare Mts, *Gardner* 383 (FHO); Embu-Siakago Road, *Kokwaro* 11 Aug. 1976 (K); Rongai R., *Fries* 1442 (K, UPS); Forut Station, *Fries* 297a (BR, K, S, UPS); near Thika, *Perdue & Kibuwa* 10199 (BR, K); Nairobi Extra-Prov. District, Ngong Rd. For., *Perdue & Kibuwa* 8106 (K, UPS); Masabubu, *Bally* 2049 (G, K); Kilima Kui (= Kiuu) Hill, *Rendle* 551 (BM), 554 (BM). K4/6: Chyulu Hills, *Bally* 7942 (K). K5: SE Mt Elgon, *Jackson* 324a (K); near Busia Hills, *Makin* 153 (K); Kavirondo, *Davidson* in *Bally* 4408 (K); Tinderet, *Pietro-Davoli* 21 (FT); 30 km W of Kisumu, *Andersen* 421 (S); Gwasi Hills, *Vuyk & Breteler* 89 (WAG); near Luora, *Plaizier* 746 (WAG); E of Ngoina, *Perdue & Kibuwa* 9345 (BR, K); near Ogwedhi, Maasai, *van der Maesen & Ahenda* 6210 (WAG). K6: ca km 11 Narok-Olokurto Road, *Glover et al.* 1320 (BR, K); Mara Masai Res., *Bally* 5290 (C, K); Owor Origenai Gully, Siyabei R., *Glover & Samuel* 3039 (K); Narosura Rest Camp, *Glover et al.* 2432 (BR, K); Ngong, *Pole Evans & Erens* 1139 (BR, E, P); Egerok (= Keekorok), *Bally* 5423 (G, K). K7: Mraru road to Mbolo Hills, *Omino* 73 (WAG); Kaya Kauma, Kilifi District, *Lap* 114 (WAG); 14 km E of Samburu, Manjewa R., *Leeuwenberg* 10787 (K, WAG); 10 km from Taru towards Mackinnon Road, *Faden* 72/90 (BR, FT, K); Mwachi Creek, *Bally* 5785 (K); Mareremi, *Graham* 250 (FHO); Witu, *Thomas (Gebr. Denhardt)* 112 (K); Kitangani, *Bally* 5997 (K); Tana R. Nat. Primate Res., *Luke et al.* TRP 155 (K).

Tanzania. T1: between Kisenji and Mt Ngoma, *Burtt* 3233 (K); Karagwe, *Speke & Grant* 214 (K); Nyakahura, *Tanner* 5622A (BR, K); Ruiga R. F.R., *Ruffo* 423 (BR, K); Minziro For., *Makwilo* 30 (K); Kababwa F.R., *Sangiwa* 93 (K); Ruande Nat. Anth. F.R., *Gane* 48 (K); Victoria Nyanza (=Mwanza), Neuwied, *Conrads* 187 (A, P, Z); Mara R., Musoma District, *Greenway* 10233 (B, BR, K, S); Zanaki, *Tanner* 4383 (BR, K); Ikoma, *Tanner* 4452 (BR, K, NY,

UC); Banagi area, *Tanner* 1702 (B, BR, K, NY, UC, WAG). T2: Endulen, *Raynal* 19389 (BR, HBG, K, P, WAG); Ngorongoro Crater, *Frame* 250 (BR, K); Narjuki (= Nanyuki), *Peter* 58118 (B, WAG); Kilimandjaro, *Schlieben* 5082 (B, BM, BR, G, HBG, M, P, S, Z); Engare Nairobi, *Hughes* 192 (K); Iraku, *Peter* 43751 (B, WAG); Dareda, *Haarer* 97B (K); Ngare Nijuki, *Alluaud* 152 (P); Djalla (= Chala) Crater, *Geilinger* 4160 (K); Rombo, Moshi, *Sanders* 53 (K); Arusha District, road to Meru For., *Richards* 27722 (M, NY); Ngasumet, *Leippert* 5397 (K, M). T3: near Butu, Upare, *Haarer* 795 (K); W of Wudi, *Peter* 58167 (B, WAG); near Suji, *Peter* 58169 (B, WAG); Kwai Valley, *Drummond & Hemsley* 2244 (B, BR, FT, K, S); N of Mgera, *Burtt* 4913 (K); Bushiri Estate, Pangani District, *Faulkner* 754 (BR, K, S); NE of Pangani, *Hedberg* 4798 (UPS); N of Pangani, *Leeuwenberg* 10833 (WAG). T4: Kandaga, *Peter* 38971 (B, WAG); Mwesi, *Kahuranga et al.* 2596 (K); Kakanko, Kibondo District, *Tanner* 6011 (K); Kalambo R., *Vesey-FitzGerald* 4258 (C, K); Tatanda, *Goldblatt et al.* 8148 (GH, WAG); Kijoma, Kassala, *Schlieben* 4276 (BR, G); near Molo, Malonje Plateau, *Richards* 15840 (BR, K). T5: 13 km N of Bereko, along Kondoa-Arusha Road, *Leeuwenberg* 10871 (WAG); Kondoa District, *Ruffo* 1138 (K). T6: Usegguha, between Kanga and Dakawa, *Peter* 58191 (B, WAG); Uluguru Mts, *Greenway* anno 1952 (K); Rufiji, *Musk* 162 (K); Ruvu Railway Station, *Shabani* 921 (K, M); near Pande F.R., *Harris* 4458 (B); near University College, Dar es Salaam, *Mwasumbi* 10104 (BR, K, WAG). T7: Lake Ngwazi Dam, *Lovett & Bidgood* 712 (BR, K, WAG); Mbeya, Mshewe, *Lovett et al.* 4013 (WAG); Livingstone Mts, *Gereau et al.* 5158 (MO, WAG); Kyimbila Station, *Stolz* 392 (BM, C, G, GH, K, L, M, PR, S, US, W, WAG, Z); Chimale R., *Richards* 7484 (K); Iringa, Ludewa Distr., *Kayombo* 487 (WAG); Njombe, *Lynes* DG 120 (K); Ruhudje R., Lupembe area, *Schlieben* 146 (B, BM, BR, G, K, M, MA, P, S, Z); km 64 Iringa-Mbeya Road, *Leeuwenberg* 10861 (BR, WAG). T8: Kingupira, *Vollesen* 2698 (C).

Zambia. Northern: Kawimbe, *Richards* 16850 (BR, K, SRGH); Abercorn (= Mbale), Chinakila, *Kafuli* 179 (SRGH); Makutu Hills, *Lawton* 1258 (FHO). Eastern: 64 km W of Fort Jameson (= Chipata), *Galpin* 15086 (K, PRE); Chadiza, *Robson* 687 (BM, BR, K, LISC, PRE, SRGH). Central: Kasanka Nat. Park, *Harder et al.* 1909 (WAG); Serenje District, near Kanona Rest House, *F. White* 3808 (BR, FHO, K); Chirikutu, near Broken Hill (= Kabwe), *Fries* 313 (UPS, Z); E of Lusaka, *Angus* 3781 (C, FHO, K, P); Chakwenga Headwaters, *Robinson* 5681 (B, K, M, SRGH). Copperbelt: Luano F.R., *Holmes* 461 (FHO, K, SRGH); Ndola West F.R., *R.G. Miller* 278 (FHO); Luanshya District, *Fanshawe* 468 (BR, K). Northwestern: Kaoomba (= Kewunbo) R., *Milne-Redhead* 3778 (BM, BR, K, PRE); near Solwezi, *Milne-Redhead* 1175 (BR, K, PRE). Western: Nkana, *Greenway & Trapnell* 5665 (FHO, K); Kaunga, *Reynolds* B 164 (SRGH); Barotseland, Siluana, *Trapnell* 1291 (BR, K); Sesheke District, *Gardner* 65 (K). Southern: Bombwe, *Martin* 364/32 (FHO); Mulanga, *Martin* 119/31 (FHO); Shimundiwi (= Chimundiwi), *Gilges* 449 (K, LISC, PRE, SRGH); Choma, *Robinson* 2435 (K, M, PRE, SRGH).

Malawi. Northern: Chipita District, 32 km SE of Chisenga, *Pawek* 12215 (K, MAL); Mzuzu, *Balaka & Kaunda* 592 (K, MAL, NSW); ca 6 km SSW of Chikangawa, *Phillips* 4069 (K, MAL, WAG, Z). Central: Kasungu Nat. Park, *Hall-Martin* 1500 (PRE); Lisasadzi, *Jackson* 2035 (BM, BR, FHO, K, MAL);

Lingadzi R., Lilongwe District, *Patel & Kwatha* 2656 (K, MAL, P); Chongoni For., *Banda* 442 (FHO, K, LISC, MAL, SRGH); ibid., *Salubeni* 1712 (K, MAL, SRGH); Dzonze Hill, *Chapman* 1355 (FHO, K, MAL, SRGH). Southern: near Mikalongwi, *Topham* 912 (BM, FHO, MAL); Blantyre, *Buchanan* 150 (BM, G, K, NH, US); Soche Mt F.R., *Chapman & Tawakali* 6397 (BR, FHO, K, MAL); Cholo (= Thyolo) Mt, *Topham* 594 (FHO, MAL); Manganja Hills, *Meller* s.n. (K, type of *C. edulis* var. *major*).

Mozambique: Tete: Fingoè, *Andrada* 1681 (COI, LISC); km 4 Vila Vasco da Gama (= Chiputo)-Fingoè, *Barbosa & Carvalho* 3355 (K, LISC); between Ulongue and Capambadzi R., *Macuácua* 1345 (K, WAG). Zambezia: Alto Ligonha, *Torre & Correia* 16279 (LISC). Manica: Gondola, *Simão* 587 (LISC). Sofala: Vila Macado (= Nhamatanda, *Mendonça* 3957 (LISC).

Zimbabwe. Mashonaland West: Miami (= Mwami), *Rand* 108 (BM); Mangula (= Mhangura), *Jacobsen* 1156 (PRE); Dichwe For., *West* 6345 (SRGH); Sinoia (= Chinhoyi), *Rand* 308 (BM); Great Dyke, *Rutherford-Smith* 306 (SRGH); Matoroshanga, *Leach* 9504 (LISC, SRGH). Mashonaland Central: Mazoe (= Mazowe), *West* 6853 (LMA, SRGH); Umsengesi (= Musengesi) Camp, *Whellan* 903 (PRE, SRGH); Dombashawa, *Rutherford-Smith* 347 (BR, LMA, SRGH). Mashonaland East: near Macheke, *Pitt-Schenkel* 90 (FHO); Mt Arthur, *RJM & RSD* 198 (K). Midlands: Between Umvuma (= Mvuma) and Mtao, *Brain* 6568 (PRE); Gwelo, *Molife* 486 (WAG); Mafungabusi, *Goldsmith* 10/47 (FHO, SRGH); Sengwa Research Stat., *Jacobsen* 3436 (PRE). Matabeleland North: Livingstone Island, *Wall* 13 Oct. 1938 (S); ca 11 km S of Gwelo, *Biegel* 1302 (B, LMA, SRGH); Nymandlora, *Rendle* 319 (BM); Hope Foutain Mission, *Norrgrann* 418 (S, WAG). Matabeleland South: Matopos Research Stat., *Plowes* 1302 (NY, SRGH); Sikanajena Hills, *Davies* 1787 (K, PRE, SRGH). Victoria: Makoholi Exp. Stat., *Senderayi* 63 (K); Zimbabwe Ruins, *Fries et al.* 2073 (G, NY, S, UPS); Nuanetsi, *Mullin* 16/50 (SRGH); Tokwe R. Gorge, *Bingham* 636 (SRGH). Manicaland: Nyamaropa Tribal Trustland, *Chase* 8546 (K, SRGH); Rungwe, *Hornby* 3323 (K, PRE, SRGH); Makoni, *Fries et al.* 2231 (SRGH, US); foot of Christmas Pass, *Gilliland* 1237 (BM, FHO, K, PRE); 10 km S of Umtali (= Mutare), *Methuen* 301 (BR, K, LISC, PRE, S); Odzani R., *Chase* 3234 (BM, BR, COI, NY, SRGH); Melsetter (= Chimanimani) Road, *Swynnerton* 6621 (BM, K, SRGH, US, Z); between Chipinga and Mt Selinda, *Crook* M 232 (NY, PRE, SRGH); near Chirinda, *Swynnerton* 70 (BM, K); Rupembi R., *Mowbray* 32 (PRE, SRGH).

Botswana. Seronga, *Story* 4756 (K, PRE); Okavongo Delta, Beacon Island, *Hiemstra* 268 (BR, K, SRGH); Lake (= Nhabe) R., *Lugard* 16 (K); Boro floodplain, *Biggs* M 624 (SRGH): Okavango swamp island, *P.A. Smith* 1074 (BR, K, SRGH); Namatanga, Linyanti R., *Biegel et al.* 4100 (LISC, PRE, SRGH); Botletle (= Boteti) R., *Erens* 206 (K, PRE); near Serondela, *Robertson & Elffers* 107 (B, BR, K, PRE, SRGH).

Namibia. Auros, *Volk* 814 (M); Ameib, *Volk* 554 (BR): Grootfontein, Farm Heidelberg, *Walter et al.* 346, paratype of *Azima pubescens*); Grootfontein, Farm Otjerukaka, *Walter* 810 (M, lectotype of *A. p.*); Grootfontein (Upingtonia), *Schinz* 223 (Z, type of *C. pilosa*); between Ghaub and Bushmanskloof, *Peter* 58300 (B, WAG); Tsumeb, *Giess* 14793 (M, WAG); near Oshikango, *Loeb & Kock* 491 (UC); between Otavifontein and Auros, *Dinter* 5595 (A, B, G, PRE, Z);

Omupandu, *Wulfhorst* 45 (Z); Caprivi Strip, E of Cuando R., *Curson* 1134 (PRE); Lisikili, *Codd* 7106 (PRE).

South Africa. Transvaal: Soutpansberg, Wylies Poort, *Rogers* 21683 (Z); W of Lake Fundusi, *Gillett* 3071 (K); Punda Maria (= Punda Milia), *Lang* 24 Nov. 1932 (K); Farm Kondowe, *van Jaarsveld* 1229 (K); opposite Metz Mission, *Venter* 1180 (K); Thabina, *Swiestra* 2187 (K, L); km 27 Pietersburg-Tzaneen Road, *van Vuuren* 1291 (K, M); between Bandolier Kop and Louis Trichard, *Legat* 57 (K); Piesang Kop, *Scheepers* 1144 (B, BM, BR, FHO, K, M, NSW, PRE, S, W, WAG); 13.5 km E of Louis Trichard, *Schlieben* 7333 (B, BR, F, G, HBG, K, M, NY, UC, US); Warmbaths Hills, *Dahlstrand* 2215 (C, GB, W); Molepo Res., *Gerstner* 5581 (K, NY); Houtbosch, *Rehmann* 6456 (K, Z): Schelem, *Stalmans* 1050 (K); Shiluvane, *Junod* 620 (G, K, Z); Penge, *Herman* 785 (C, K, US, WAG); Pilgrimsrest, *Young* A 668 (K); Blyde R. Resort, *de Winter* 9401 (K); Blydeberg Res., *Balkwill & Cadman* 3781 (E, K); km 35 Hoedspruit-Bushbuck Ridge Road, *Germishuizen* 3477 (WAG).

Comoro Islands. Moheli: Karthala For., SF 21733 (P, TEF); St. Antoine For., SF 16758 (P, TEF). Anjouan: Col de Patsy, *Schlieben* 11120 (B, BR, HBG, K, M, Z).

Mayotte. Dapani, *Pascal* 336 (WAG).

Madagascar. Mahajanga: near Ambodiria, *Labat & Deroin* 2292 (P, WAG); Maintirano, SF 15735 (P, TEF, WAG); Analatela, Kelifely Mts, *Perrier de la Bâthie* 8960 (P, paratype of *C. edulis* var. *ambungana*); Ankara Mts, *Perrier de la Bâthie* 8962 (P, paratype of *C. edulis* var. *ambungana*); Namoroka Res., *Rakakotovao* RN 3877 (P, TAN); ibid., *B. Du Puy et al.* MB 387 (MO, P); Kaleko, near Itampitso, tributary of Mahavavy R., *Perrier de la Bâthie* 8961 (P, type of *C. edulis* var. *ambungana*); Ankarafantsika, *Ramamanpisoa* RN 2070 (P, TAN); Bemarivo R. basin, Boina, *Perrier de la Bâthie* 840 (K, P); near Antsiatsiaka, SF 116-R-301 (P, WAG); near Ambopitika, E side of Bongalava, *Leeuwenberg & Rapanarivo* 14718 (BR, K, P, TAN, WAG), 14719 (BR, K, P, TAN, WAG); near Analalava, *Perrier de la Bâthie* 12306 (P, US); Mangindrano, *Tsilizy* RN 7534 (K, P, TEF). Antsiranana: Nosy Be, *Pervillé* 489 (K, P, US); Anjanaharibe Mts, W of Andapa, *Humbert* 24590 (B, K, P, WAG); Manongarivo Mts, Bekolosy, *Capuron* SF 11457 (K, P, WAG), 11457bis (P, TEF); Upper Sambirano R., *Perrier de la Bâthie* 8893 (P); Bekaka Mts, Lower Sambirano R., *Capuron* SF 18914 (K, P, TEF, WAG); Mt d'Ambre, *McPherson* 14502 (BR, K, P, WAG); ibid., near Station des Rousettes, *Bernardi* 11980 (G, K, L, P, US, Z); ibid., *Leeuwenberg et al.* 14312 (BR, K, P, TAN, WAG); between Joffreville and Sakaramy, *van Nek* 1957 (TAN, WAG); Mt Andavakoana, *Perrier de la Bâthie* 8934 (P); Marojejy Res., Mt Beondroka, *Miller & Randrianasolo* 4340 (P, WAG); Anjanaharibe Mts, W of Andapa, *Capuron* SF 927 (HBG, K, P, TEF, WAG). Antananarivo: Tampoketsa d'Ankazobe, *Capuron* SF 20327 (G, HBG, K, P, TEF, WAG); km 21 Ankazobe-Maevatanana Road, *Leeuwenberg & Rapanarivo* 14665 (BR, K, P, TAN, WAG); S of Belobaka, *Capuron* SF 6730 (P, TEF); Analalava, Ambatofotsy, SF 80-R-222 (P); Andrangoloaka, *Hildebrandt* 3685 (B, BM, G, K, M, P, WAG); Tsiazompaniry, near Analamihaotra, *Belin* SF 19989 (HBG, K, P, TEF, WAG); Ambatotsipihina, SF 1034 (P, TEF); near Tsinjoarivo, *Viguier & Humbert* 1828 (P); Mt Ibity base, *Perrier de la Bâthie* 13970 (P). Toamasina: Rantabe R. basin, *Capuron* SF 9030 (K, P, TEF, WAG);

Masoala Peninsula, near Ambanizana, *van Nek* 2091 (TAN, WAG); Mananara Nord, Verezanantsoro For., *Raharimalala* 2189 (P); Soanierana-Ivongo, *Decary* 10771 (P, type of *C. edulis* subsp. *madagascariensis* var. *nummularis*); Ste. Marie Island, Ambodena For., *Jacquemin* 417 (P); Andrangovalo Mts, SE of Lake Alaotra, Zakamena Res., *Humbert & Cours* 17962 (P, type of *Cabucala brachyantha*); Antohidava, SF 16-R-245 (P); Analalava For., near Foulpointe, *Leeuwenberg & Rafamantanantsoa* 14483 (BR, P, TAN, WAG); ibid., SF 23848 (G, HBG, K, P, TEF, WAG); Analamazaotra For., *Ramanantoavolana in Thouvenot* 9 (BM, K, P, type of *C. densiflora* var. *microphylla*); ibid., *Viguier & Humbert* 834 (G, K, P, WAG); Masiabarika For., Andranabolahy, SF 23-R-195 (P); near Ambila-Lemaitso, *Schatz & Armbuster* 3153 (K, P, WAG); Solafaka, SF 25883 (P, TEF). Fianarantsoa: Ambatofinanarahana, Itremo, *Labat et al.* 2373 (P, WAG); ca km 20 Ivato-Itremo Road, *Leeuwenberg & Rafamantanantsoa* 14441 (BR, K, P, TAN, WAG); Ambositra, *Decary* 15181 (BM, G, K, P, S, US); Vohibasia, *Perrier de la Bâthie* 8865 (P, type of *C. edulis* subsp. *madagascariensis* var. *subtrinervia*); Ambatofinandrahana, *Decary* 15166 (P, paratype of *C. e.* subsp. *m.* var. *subtrinervia*); Ampamaherana, Fiandrandava, SF 13625 = 1-R-298 (K, P, TEF, WAG); Ranomafana Nat. Park, *Kotozafy & Randriamanantena* 341 (BR, P, WAG); 9 km E of km 26 Fianarantsoa-Ambositra Road, *Leeuwenberg & Rapanarivo* 14640 (BR, TAN, WAG); Ankafina, *Deans Cowan* anno 1880 (K); Analaratsy, Ambalavao, *Rakotovao* RN 7635 (P, TEF); Isalo, SF 91-R-141 (P); near Ambodinanto, SF 174-R-118 (P, WAG); near Maliasoa, Sendrisoa, *Rakotovao* RN 7618 (P, TEF); Isalo Mts, *Decary* 16361 (P, type of *C. oleoides*); ibid., *Humbert* 19544 (B, P, paratype of *C. edulis* subsp. *madagascariensis* var. *subtrinervia*); Ihosy, *Decary* 15048 (P); near Ivohibe, *Armand* 46 (P); Andringitra Mts, Ambodinavao of Antsalova, *Cours* 2328 (B, K, P, WAG, type of *C. obovata*); Iantara R. valley, Ivohibe, SF 1485 (P); S of Jakorano, Vohipeno, SF 47-R-206 (P); S of Farafangana, *Capuron* SF 23595 (K, P, TEF, WAG); Bevata For., *Razanakolona* SF-R-144 (P). Toliara: ca 7 km N of Manantenina, *McPherson* 14396 (K, P, TEF, WAG); Mt Vohitrotsy, Middle Mandrare R. valley, near Anadabolava, *Humbert* 12669 (P, type of *C. horrida*); Mandena Res., *Leeuwenberg et al.* 14205 (BR, K, MA, P, TAN, WAG); Fort-Dauphin, *Scott Elliot* 3071 (BM, E, K, P, type of *C. revoluta*); ibid., *Dorr et al.* 4040 (BR, K, P, US, WAG); Petriky, *Rabevohitra et al.* 1808 (BR, K, P, WAG), 2120 (= SF 33349) (P, TAN, TEF); S of Imonty, *Humbert* 14095 (P, paratype of *C. edulis* subsp. *madagascariensis* var. *subtrinervia*); Andohahela Res., Parcelle 1, *Leeuwenberg et al.* 13992 (WAG); ibid., parcelle 3, *Phillipson* 3531 (K, P, WAG); 5 km S of Manambaro, *Miller & Randrianasolo* 6233 (K, P, TAN, WAG); Ambovombe, *Decary* 2770 (P, paratype of *C. horrida*), 2924 (C, P, S, US, paratype of *C. h.*), 8512 (BM, G, GB, K, P, paratype of *C. h.*), 9158 (L, NSW, paratype of *C. h.*); Irada, S of Ambovombe, *Decary* 9662 (P, paratype of *C. h.*); Bevalany, *Decary* 10944 (P, paratype of *C. h.*); near Antanimoro, *Humbert & Capuron* 28881 (P); 10-20 km from Tsihombe, along Ambovombe-Toliara Road, *Rabevohitra* 2398 (P, TAN, WAG); NW of Cap Ste. Marie, near Lavanono, *Humbert & Capuron* 29316 (P); between Ampanihy and Ampotaka, *Keraudren* 913 (K, P); Beara For., SF 1532 (P, TEF); Mt Vohipolaka, N of Betroka, *Humbert* 11676 (P, paratype of *C. h.*); Zombitsy For., *Leeuwenberg & Rapanarivo* 14623 (BR, P, TAN, WAG); ibid., SF 12423 (= 46-R-82) (P, TEF).

Sin. loc., *Baron* 709 (K, P, type of *C. densiflora*), 3128 (P), 4195 (K), 4207 (K, P), 6863 (K); *Campenon* s.n. (P, type of *C. campenonii*); *Chapelier* s.n. (P, type of *Chapeliera madagascariensis*); *Commerson* s.n. (P-JU 7202B); *Du Petit Thouars* s.n (P, type of *C. madagascariensis*).

Seychelles. Aldabra: *Gibson* 18 (K). Silhouette: *Bernardi* 14691 (FT, G, K, Z); La Passe, *Horne* 511 (K, type of *C. sechellensis*); ibid., *Procter* 4555 (K); Poule Marron, *Lesouef* 183 (G).

Mauritius. *Bouton* anno 1830 (K, P); *Telfair* 23 June 1827 (GH, K, K-WALL 1681, NY, OXF, type of *C. coriacea*); above Ferney, *Coode* 4642 (K, MAU, P), 4645 (K, MAU, P); ibid., *Friedmann* 2345 (P).

Réunion. *Du Petit Thouars* s.n. (P, type of *C. xylopicron*); St. Philippe, *Rivals* 52 (TL); Remparts R.valley, *Friedmann* 3428 (K, P); Palmerie (?), *De Cordemoy* s.n. (MARS).

Rodrigues. *Balfour* Aug.-Dec. 1874 (BM, E, GH, K, P); Plaine corail, *Cadet* 2606 (MAU, P).

Saudi Arabia. Hedjaz, Thoqaif Highlands, *Vesey-Fitzgerald* 16562/4 (BM, C); Bilad Ghamid, *Popov* 71/148 (BM); At Ta'if-Abha Road, 45-50 km S of Biljurshir, *Collenette* 2595 (E); ca 60 km S of Biljurshir, *Lavranos & Collenette* 18424 (E); 100 km N of Abha, *Pittaway* anno 1985 (BM); 12 km SW of Abha, *Baierle et al.* 82-1556 (E); Jabal Fayafa, *Collenette* 3708 (E, K); Lejib Gorge, 90 km NE of Baysh, *Collenette* 7452 (E, K).

Yemen. near Mabayan, *Müller-Hohenstein & Deil* 604 (E); SW of Masar Mt, *Deflers* 404 (G, P, WAG, Z); Mts Hadie, *Forskål* 234 (BM, C-FORSSK, S, type of *C. edulis*); Jebel Bura, *Schweinfurth* 335 (C, G, GH, K, P); Dhamar-Yerim Road, *Deflers* 642 (P); Wadi Afk, *Bisset* 58 (K); ca 5 km NW of Ibb, *Spellenberg* OLE 7336 (K, NY); between Ibb and Udayn Pass, *Hepper & Wood* 5968 (C, K); 5 km N of Qaidah, *A.G. Miller* 522 (E); near Paiz, *Grozovsky* 74 (BM).

Muscat & Oman. Ghadow Road, NW of Salalah, *A.G. Miller* 7030-A (K); Jebel Samhan, *A.G. Miller* 7052 (K, UPS).

Pakistan. Sutlej R. valley, *Cooper* 5003 (E, P); Nurpur, Rawalpindi District, *Stewart* 16282 (A, NY, US); Salt Range, *Bis Ram* 1735 (A); Zafarwal, *Stewart* 661 (K); Margalla Foothills, *Fosberg & Nasir* 56924 (K, NY, US); Murree Mts, N of Rawalpindi, *Horreüs de Haas* 486 (U); 25 km N of Rawalpindi, *Podlech* 20053 (G, M); Buner Pass, *Johnston* 18 Jan. 1898 (E).

Nepal. Nepalganj, *Dobremez* 2329 (BM, G); Bheri Valley, 32 km below Jajarkot, *Stainton* 6210 (BM); Bhairawa, *Stainton et al.* 2401 (A, BM, E, UPS); Marma Khola, near Marma, *Polunin et al.* 3802 (BM, E, UPS).

India. Arunachal Pradesh: Abov, *Ellerton Stocks* 210 (K). Punjab: Hoshiarpur, *Misra* 41669 (K); Kaman Gorki, *Gammie* 31 Aug. 1891 (K). Himachal Pradesh: Dhomi, Simla, *Amar Chand* 108 (K); near Haripur, *Gamble* 5736 (K); Mandi, *Koelz* 10302 (NY); Pathankot, *Watt* 432 (E); Kangra, *Koelz* 4319 (A, F, LG, NY, UC, US); between Sherper and Sandhara, Chamba, *Lace* 1873 (E). Haryana: Karnal, *Drummond* 25503 (E, K, UC), 25504 (E, K, UC). Delhi: Delhi Ridge, *Stewart* 7660 (NY). Bengal: Darjiling, *Gamble* 7560 (K); near Barakpur R., *Watt* 105 (E); Kasiary, Herb. Univ. Hull 559 (E). Bihar: W of Kundrijor, Chaibassa Dn., *Mooney* 103 (K); Bishanpur, *Haines* 4393 (K); Chotah Nagpur, Hazaribagh District, near Gibraltar Hill, *F.H.W. Kerr* 2064 (BM); Ranchi, *Clarke* 20936B (US); Palamu, *J.J. Wood* 13 Feb. 1878 (K); Muhammadgani, *Koelz* 18678 (L);

Bagaha, *Srirastava et al.* 48455 (M); Bankipore, *Watt* Mar. 1879 (E); near Dumra, *Fleming* 129 (E); Parasnath Hill base, Herb. Hort. Bot. Calcutta Nov. 1858 (K). Orissa: Govindpur, *Clarke* 21404C (BM); Barramba, *Brandis* 29 (E); Jambu, Mahanadi Delta, *Mooney* 3390 (A, K); Khurda Forests, *Haines* 4073 (K); Khandpara, *Mooney* 205 (K); Dhuanali For., *Haines* 5919 (K); near Ganjam, Ganges R. mouth, *Roxburgh* s.n. (BR, G-DC, K, K-WALL 1678B, type of *C. diffusa*); Kukkurakhandi, Ganjam District, *Gamble* 13614 (K); Mahendragiri, *Gamble* 14136 (K, lectotype of *C. gangetica*). Uttar Pradesh: Dehra Dun, *Haines* 2159 (K, lectotype of *C. opaca*); ibid., *Singh* 136 (A, NY, UC, W); near Thana, *Winterbottom* 11 (K); Adanpur, Saharanpur, *Sinclair* 4317 (E, US); Garhwal, *Pant* 43655 (G); Bisalpur, *Watt* 2826 (E); Maiwatpura, Pilibhit District, *Duthie* 22147 (UC); Gola, Kheri District, *Inayat* (see also *Gamble*) 2 Apr. 1898, 22147 (A); Bahraich, *Hira Lal.* 16591 (S); Gonda District, *Inayat in Gamble* 27 May 1898, 22147 (K); Gorakpur District, *Haurraukh* in *Duthie* 30 Mar. 1898, 22146 (K); Oudh, *R. Thompson* anno 1870 (HBG); Rajpur, *Panigrahi* 11292 (L). Rajasthan: Karunda, *F. Burger* anno 1876 (HBG); Mt Abu, *Crow* 169 (K); Eklesa-Ghalawath (=Aklesa-Jhalawar) Road, *Majumdar* 10035 (E). Madhya Pradesh: Gwalior, *Maries* 276 (BM); Paharikhera, *Singh et al.* 54145 (M); Panna Valley, *Singh et al.* 55286 (B); Sehore, Bhopal, *Rich* 983 (K); near Marble Rock, Jubbulpore (= Jabalpur), *Rich* 1010 (K); Bilaspur, *Maheshwari* 4076 (BR); Khargaon, *Mooney* 765 (K, L); Panghat, *Kuriakose* 26 Jan. 1933 (NY); Naraimpur District, *Brandis* Mar. 1863 (HBG). Maharashtra: Bhandara, *Haines* 3372 (K); Berar, Akola District, *Watt* 26 (E); Berar, Buldana District, *Wittenbaker* 37 (E); Ellora, *Meebold* 4519 (G); Thana, *Ryan* 2009 (K); Concan, *Stocks* s.n. (GH, K, L, P, W); ibid., Ramghat, *Dalzell* s.n. (K, lectotype of *C. dalzellii*); ibid., *Ritchie* 443, Feb, 1850 (K, paratype of *C. dalzellii)*), 443, May 1850 (E, K, paratype of *C. d.*); Bombay, *Tilak in Watt* 93 (E); Bombay, Khandala, *Santapau* 4407 (K, paratype of *C. congesta* var. *albida*); Lake Fife, *Cooke* 106 (K); Mahabaleshwar, *Ralph* 155, p.p. (MEL, TCD). Gujarat: Koteshwar, *Patel* 21 Nov. 1983 (K, US); Sasan Gir For., Hiran R., *Hod* 53 (K). Karnataka: Badami, *Sedgwick & Bell* 5186 (K); Dharwar, *Børgesen* 147 (C); Londa, E of Goa, *Fernandes* 1033 (A, US); Karwar, *Fernandes* 2121 (A, K); 9 km S of Hulekal, N Kanara, *Kameswara Rao* 89 (K); Santaveri, Bababudan, *Meebold* 8494 (E, S); near Bageshpur, *Saldanha* 1433 (NY, US); Hassan District, road to Hanbal, *Stevens* 588 (US); near Mangalor, *Hohenacker* 105a (G, K, U); between Balupet and Saklespur, *Saldanha & Ramamoorthy* HPF 454 (E, K, US); Byra, *Saldanha* 16705 (K, NY, US); Mysore, *Saran et al.* 40455 (M); Coorg (Kodagu), *Rottler* Mar. 1817 (K); Biligirirangan Hills, *Barnes* 792 (A). Andhra Pradesh: Vizianagaram, *Campbell* 388 (E); Simhachalam, *W. Elliot* anno 1852 (E); Nagarjuna, *Jothathri* 9707 (E); Yeriamalais, Kurnool District, *Gamble* 17715 (BM); Marripadu, Nellore District, *Ramaswami* 1179 (K); Narsapally, Anantapur District, *Gamble* 15250 (K); Sangam, *Ramaswami* 1123 (K). Kerala: Palghat, *Beddome* s.n. (BM); Travancore, *Yeshoda* 495 (NY); Pamba Dam, above Kakkada R., Rani Valley, *Ridsdale* 570 (K, L, UC); Quilon, *Meebold* 12615 (S); Karyavattom, Trivandrum University Campus, *Kramer & Nair* 6059 (U, Z). Tamil Nadu: Tambaram, 24 km S of Madras, *Erlanson* 5659 (NY); 7 Pagodas, *Meebold* 2977a (G); Hosur, *Yeshoda* 496 (NY); Pondicherry, *Perrottet* 315 (G, K, W); ibid., *Legris* 13 Nov. 1956 (TL); near Anakatty & Agali, Coimbatore,

Ridsdale 773 (K); Nilgiri Hills, *Hohenacker* 1384 (A, BM, G, HBG, K, L, M, P, PR, S, UPS, US, W, WAG, Z); ibid., *Leschenault* 203 (G-DC, P, type of *C. paucinervia*); Coonoor, Nilgiri District, *Gamble* 14330 (BM, HBG, K); Tiruchi, *Matthew* RHT 2270 (L); Courtallum (= Kuttalam), *Heyne in Wallich* 1679c (E, K, K-WALL, type of *C. macrophylla*); ibid., *Wight* 547 (E, K, NY); Tranquebar, *Rottler* 10 (M); Amaravathi Dam, *Matthew & Rajendren* RHT 45341 (AAU, K); Mts of Madurai District, *Beddome* 5079 (BM, K, type of *C. suavissima*). S Andamans: Chiriatapu, *Nair* 4191 (L); Jermokle, *Kurz* rec. 23 Sept. 1867 (K). Sin. loc., *Koenig* s.n. (LINN 295.2, lectotype).

Bangladesh. Dhaka, *Clarke* 6813 (BM).

Sri Lanka. near Ponneryn, Jaffna District, *Bernardi* 14286 (K, L, US); Mullaitivu, *Sumithraarachchi* 800 (L); km 19 Vavuniya-Parayalankulam Road, *Hepper & Jayasuriya* 4640 (K); Wilpattu Nat. Park, *Wirawan et al.* 921 (AAU, GH, K, L, NSW, NY, UC, US); km 24 Puttalam-Anuradhapura Road, *Huber* 49 (BM, US); 8-9 km NE of Anuradhapura, *Fosberg & Balakrishnan* 53440 (K, NY, US); Ritigala Res., *Wadhwa et al.* 503 (K); Trincomalee, *Harvey* 8372 (E); W of Kathiraveli, *Bernardi* 15663 (G, Z); Batticoloa, *Petch* 16 Aug. 1922 (A, AMD); Bibile-Nilagala Road, *Kostermans* 25163A (G, K, L); Polonaruwa, *Dittus* 70032601 (UC, US); km 57 Kandy-Dambulla Road, *Tirvengadum & Waas* 401 (K, NY, P, US); ca km 10 Sigiriya-Dambulla Road, *Leeuwenberg* 14781 (WAG); km 43 Kandy-Mahiyangana Road, *Sohmer* 8268 (GH, NY); Talalla, Matara Diistrict, *Cramer* 3435 (US); Tissamaharama, *Huber* 35 (BM, US); near Palatupana, 10 km W of Yala Nat. Park, *Leeuwenberg* 14782 (P, WAG); Yala Nat. Park, *Bernardi* 14203 (L, US, Z); Lahugala, *Comanor* 593 (GH, K, NY, UC); sin. loc., *Thwaites* CV 1822 (B, BM, G, GH, K, MEL, P, TCD, W, WAG).

Myanmar (= Burma). Left Bank Irawaddy R., Ruby Mines District, *Lace* 5792 (E, K); Shwebo District, *Brandis* June 1900 (K); Kyankpadaung, Mandalay Division, *Yin Kyi* 826 (A); Kyankse Hill, Shan States, *Lace* 4874 (E, K); Kyank Jalong, Irawaddy R., *Heyne* 560 in *Wallich* 1680.1 (G-DC, K-WALL, type of *C. hirsuta*); Shinmataung Res., *Gale* 2 12312 (L, Z); Taungpila Res., *Gilbert Rogers* 474 (E, K); Tatmataung F.R., Pakokku District, *Gale* 2 12364 (L, Z); Taunggyi, *Dickason* 9019 (A); Kalaw, *Dickason* 5321 (A); Yinmale, Magwe District, *Gilbert Rogers* 916 (E, K); Lekla, Tayetmyo District, *Lace* 2693 (E, K).

Thailand. Klong Hoy Kong, *Maxwell* 86-795 (A, L); Nakhon Srithamarat, *Sanan* 22491 (K); Kankradai, Prachuap, *Put* 2267 (A, BM, K, L, P, TCD); Sam Roy Yot, *Larsen* 33772 (AAU, K, L); Hua Hin, *Leeuwenberg* 14803 (WAG); ibid., Khoa Kailas, *Soejarto et al.* 5779 (A, F, L); Toong Brong, *Maxwell* 71-430 (AAU, L); Petchaburi, *Marcan* 1174 (BM, K); ibid., *Pierre* 4478, June 1868 (A, NY, P, paratype of *C. cochinchinensis*); Ratchaburi, *Maxwell* 75-330 (AAU, L); Bangkok, *Marcan* 1952 (BM, K); Kanchanaburi, *Merrill King* 5503 (C, F, GH, K, L, UC, US); ca 3 km W of Kampangsean, *Ryding* 934 (UPS); Ayuthia, Saraburi, Muak Lek, *Kerr* 9118 (BM, K, type of *C. laotica* var. *ferruginea*); Salakpra, *Tatemi Shimizu et al.* 21221 (L); Korat, *Kerr* 19898 (BM, K, L, P, TCD); Khok Phayung For., *Wongsatit* 725 (Pharm. Mahidol Univ. Bangkok, L); Chainat, *Put* 2649 (AAU, BM, K, P); Paknampho, *Vanpruk* 1006 (K); 50 km S of Chaiyaphum, *Larsen et al.* 31714 (AAU); Mae Rim, Chiang Mai, *Kerr* 5252 (AAU, BM, K, P); Baw Luang District, *Balick & Nanakorn* 3438 (WAG).

Laos. Mekong R., Stung Streng, *Thorel* 2213 (P, type of *C. laotica*).

Cambodia. near Battambang, *Poilane* 14285 (P); Phom Penh For., *Bejaud* 572 (P); Kompong Speu, *Poilane* 17387 (P, WAG); near Bati, *Pierre* 4479, May 1874 (P, lectotype of *C. cochinchinensis*).

Vietnam. Langbian Province, *Boden Kloss* Apr. 1918 (BM); Phanrang Province, *Boden Kloss* May 1918 (BM); ibid., *Poilane* 9316 (P, paratype of *C. cochinchinensis*); ibid., Hoa Trinh, *Poilane* 5852 (P, WAG); between Phanrang and Tourcham, *Lecomte & Finet* 1425 (P, type of *Strychnos pungens* Gagnep.).

China. Yunnan: Hokei Domei, Yangtze R., *K.M. Feng* 850 (A, IBSC, type of *C. yunnanensis*); Milo Hsien (= Mile Xian), *Tsai* 51384 (A, IBSC); Dakaimen, W of Tunghai, *Wissmann* 83 (W); Huaning County, near Lufeng, *Tsiang* 16324 (A, IBSC); near Yuanjiang, *Tsiang* 12976 (IBSC); ibid., *Wissmann* 741 (W); Mengzi, *Henry* 10156 (A, NY), 10156A (A, E, K); near Joshuitang, *Schneider* 6 (A); Kouai Tien, *Esquirol* 1508 (E, type of *Damnacanthus esquirolii*).

Indonesia. Aru Islands: Pulau Trangan, Meroor, *van Balgooy & Mamesah* 6386 (K, L); Pulau Trangan, Meme, *van Balgooy & Mamesah* 6302 (L). Irian Jaya: near Okaba, *Brandenhorst* 64 (K, L, U, type of *C. papuana*); Merauke, *MacKee* 1681 (L); between Mopa airstrip and Manggatrikke, *van Royen* 4552 (A, K, L).

Papua New Guinea. Wassikussa R., *Henty & Katik* NGF 38722 (L); coast between Oriomo and Fly Rs., *Brass* 6463 (A, BM, L); Hisiu, *Carr* 11403 (A, BM, CANB, K, L); near Mt Lawes, *Frodin et al.* UPNG 569 (K, L, MEL, NSW); Port Moresby, road to Mountain View Estates, *van Royen* 10772 (BISH, L).

Australia. Western Autralia: Running Waters, *Griffith* 7 (CANB); between Ashburton and Yule Rs., *Clement* 19 and 30 (K); Millstream, *Brooker* 2075 (CANB); km 23 Port Hedland-Broome Road, *Telford* 11581 (CANB); near Edgar Range, SE of Broome, *Kenneally* 5678 (CANB); Noonkanbah, *Mojoberg* 61 (S); Fitzroy R., Cherrabun Station, *Fell* 287 (CANB); Gogo Station, *Gardner* 9804 (CANB, K); Louisa Downs, *Gardner* 9715 (CANB); Elvire R., near Halls Creek, *Dunlop & Done* 6000 (CANB); Hall District, Ord R., *Ollerenshaw* 260 (CANB); Napier Range, c. 11 km S of Yammera Gap, *Sands* 4385 (K); Kimberley Region, Fitzroy R. basin, *E.N.S. Jackson* 985 (B); E of Mt Marmion, *Gardner* 1609 (CANB); Meda Station, *Fitzgerald* 400 (CANB); Derby, *Allan* 609 (CANB); km 60 Broome-Beagle Bay Road, *Martin* 10 (K); Broome, *Hochreutinger* 2848 (G, L, UC, Z); Palm Springs, *Rodd* 2822 (NSW); Port Warrender, *Cunningham* 426 (BM); Gibb R. Road, km 54.6 Wyndham-Kununurra, *Aplin* et al. 590 (CANB); Kununurra, *K.T. Richards* 39 (CANB). Northern Territory: Bathurst, *Bailey* 8.11 (PR); Darwin, *Spencer* anno 1912 (NSW); U.A.R.E.S., *Parker* 186 (BRI); W of Coirwong Gorge, between Black Jungle Spring and Goodparla, *Cowie* 710 (BRI); Kakadu Nat. Park, *Craven* 5603 (CANB); Q 49, 12.28 S, 133.07 E, *Story* s.n. (CANB); Coomalie Airstrip, *Must* 789 (K, L, NSW); SSW of junction of Katherine and Flora Rs., *Blake* 17250 (BRI); Homestead Paddock, *Swinbourne* 706 (CANB); Elsey Park, *Evans* 2905 (CANB, MEL); Roper R., Elsey, *Hely* 260 (CANB); Hemple Bay, Groote Eylandt, *Specht* 3 May 1948 (BRI); Sir Edward Pellew Group, Morgan's Island, Blue Mud Bay, *R. Brown* 2852 (BM, CANB, K, P, S, lectotype of *C. lanceolata*); Seven Emus Station, *Paine & Rideout* 8516 (NSW); McArthur R. area, *Craven* 3442 (CANB); 139 km SW of Borroloola, Carpentaris Highway, *Must* 1555 (CANB); Victoria R. District, 4.5 km SE of

junction at Top Springs roadhouse, *Barker* 2764 (CANB, NSW); 15 km S of Victoria R. crossing on Top Springs-Timber Creek Road, *Parker* 1006 (CANB); Victoria R., *Mueller* s.n. (GH, K, TCD); 40 km SE of Kununurra, *Andrews* 247 (CANB); 3 km S of Wave Hill, *Ollerenshaw* 7 (CANB); Elliott, *Latz* 8320 (CANB); Nicholson R. area, *Henshall* 311 (CANB); 6 km E of Brunchilly, *Chippendale* 7087 (NSW); Tennant Creek, *Egan* 681 (CANB); 10 km N of Tanami, *Chippendale* 5601 (L, NSW); 39 km SE of Tanami, *Chippendale* 4238 (NSW); McClaren Creek, 32 km N of Wauchope, *Latz* NT 13223 (K, L); 5 km N of Kurundi Station, *Lazarides* 5871 (CANB, K, NSW); Avon Downs Station, *Nicholls* 13797 (BRI); Georgina Downs Station, *Strong* 634 (CANB); Argadagada S.R., *Chippendale* 297 (BRI, CANB, NSW); between Barrow Creek and Alice Springs, *Gauba* 528 (CANB); 26 km NE of Lake Mackay, *Chippendale* 3387 (NSW); 16 km NE of Vaughan Springs, *Winkworth* 435 (CANB); Mt Doreen, *Conrick* 1433 (CANB); 10 km SE of Mt Allan Homestead, *MacKee* 8632 (K, NSW, P); 11 km E of Coniston H.S., *Chippendale* 5333 (BRI, CANB, NSW); Gorge near Mt Liebig, *Chippendale* 3540 (BRI); Ormiston Gorge, *Hekker* 22 Nov. 1984 (L); 22 km NW of Alice Springs, *Nelson* 1767 (BRI); between Midway Ross R. and Adnarpa Homestead, *Latz* 13041 (CANB, NSW). Queensland: Cook Distirct: Boigu Island, *Waterhouse* 3085 (BRI); Saibai, *Stocker* 1410 (BRI); Prince of Wales Islands, Good's Island, *R. Brown* 2851 (BM, CANB, type of *C. scabra*); Cape York, *MacGillivray* 27 Oct. 1849 (K, type of *C. laxiflora*); Fishbone Creek, tributary of Jacky Jacky Creek, *L.S. Smith* 12433 (BRI); Milman Island, *Card* 17 (BRI); Cairncross Islet West, *Done* 12 July 1969 (BRI); N of Captain Billy Landing, *Johnson* 5033 (BRI); 2 km NW of Bolt Head, Temple Bay, *Forster* 8953 (BRI); Possum Scrub, between Stones Crossing and Weipa, *Forster* 14380 (BRI); Lake Patricia, Weipa, *Forster & O'Reilly* 6478 (BRI); Pacsoe R., *Tracey* 14092 (BRI); NW of mouth of Quintilck Lockart Aboriginal Res., *Tracey* 14094 (BRI, CANB); near Weipa, *Forster et al.* 13474 (BRI); Night Island, *Godwin* 11 June 1991 (BRI); Rokeby Nat. Park, *Fell & Jensen* 3534 (BRI); Chester R., *Forster & Tucker* 10411 (BRI); Upper Massay Creek, *L.S. Smith* 11774 (BRI, L); N of mouth of Stewart R., *Kanis* 2030 (CANB, L); Stanley Island, *Godwin* C3534 (BRI); Howick Island, *Elsol & Stanley* 549 (BRI); 1 km E of West Normanby R., *Clarkson & McDonald* 6750 (L); N of Laura R., *Byrnes* 3340 (BRI); Lavra Galleries, *Webb & Tracey* 13399 (BRI, CANB); McLeod R., *L.S. Smith* 11234A (L); Walsh R., *Barclay* 11 (BRI); between Walsh R. and Nolan Creek, *Hyland* 8057 (L); near Chillagoe, near Walsh R., *Domin* 7811 (PR, lectotype of *C. velutina*); between Chillagoe and Wortham Park, *Forster & Bean* 13020 (BRI); Chillagoe, *Blake* 14744 (BRI); ibid., *Domin* 7818 (PR); near Dimbulah, *Irvine* 85 (K, L); km 1 Lappa-Mt Garnet Road, *Forster & Ryan* 18482 (BRI); 62 km S of Mt Garnet along Kennedy Highway, *Halford* Q772 (BRI); Forest Home, *Dansie* 3782 (BRI); 10 km S of Mt Surprise, *I.J. Dale* 111 (BRI); Georgetown, *C.T. White* Feb. 1922 (NSW); near Einasleigh, *Sankowsky* 742 (BRI); km 255 Hughenden-Mt Garnet Road, *Craven* 3274 (BRI, CANB, HBG, L); Copperfield R., Gilbert Range, *Forster* 14914 (BRI). Burke District: Settlement Creek, *Brass* 231 (A, BRI, CANB); E of Nyuldorg, Mornington Island, *Fosberg* 62069 (BRI); Laura, near Hell's Gate, *Jones* 3208 (CANB); Sweer's and Allen Islands, *R. Brown* 2853 (BM, E, K, paratype of *C. lanceolata*); Flinders R., *Sutherland* s.n. (K); Mt Garnet, *Meyers* 14 Dec. 1960 (BRI); Saxby R., *Sulman*

6150/13 (NSW); road to Croydon, 62 km NNE of Claraville Homestead, *Dalliston* HC386 (BRI); 17 km W of Alexandra R. on Donors Hill to Burketown Road, *Pullen* 8933 (BISH, CANB, E), 8935 (BISH, CANB, E); Lawn Hill Nat. Park, *K.A. Williams* 85091 (BRI); 41 km NE of Burke and Wills, *Gardner* 273 (BRI); between Mt Isa and Camooweal, *Briggs* 1189 (NSW); Byrimine, ca 40 km NE of Cloncurry, *Bishop* 13 Jan. 1970 (K); Prarie Creek Gorge, *Murray & Morgan* 25 (BRI); Dugald R., *Cole & Provan* 277 (BRI); 83 km NW of Mt Isa on Barkly Highway, *Ollerenshaw & Kratzing* 1266 (BRI, CANB); Barkly Downs, *Breen* 44 (BRI); Mt Isa, *Specht* 79 (BRI); 1.6 km N of Dam on Lale Mondarra, *Ollerenshaw & Kratzing* 1210 (BRI, CANB); near Cloncurry, *Domin* 7817 (PR); km 6 Cloncurry-Mt Isa Road, *Forster* 6138 (BISH, BRI); Julia Creek, *C.T. White* Aug. 1916 (BRI, NSW); Richmond, *Barney* 61 (BRI); near Mary Kathleen Town, *Beaumont & Boshoff* 7032 (CANB); Nonda, *Hubbard* 7204 (A, K, L), 7205 (A, K, L). North Kennedy District: 65 km W of Mt Garnet, *Fosberg* 61632 (BRI); 60 km SSW of Mt Garnet, *Batianoff & L.W. Smith* 900120 (BRI); ca 94 km W of Ingham on road to Oak Hills Station, *Morain* 310 (BRI); Cojuboy, *Fensham* 388 (BRI); Cleveland Bay, *Cunningham* 379 (BM); Black Rock, *Webb & Tracey* 10149 (BRI); 2 km W of Laroona, *Jobson* 697 (BRI); Bowen, *Hubbard & Winders* 6576 (K); between Charters Towers and Broughton, *Blake* 15303 (BRI, CANB); Barrabas Scrub, *Hyland* 6087 (BRI); Edgecumbe Bay, *Michael* 1197 (BM, E, GH); Whitsunday Island, *Batianoff & Dalliston* 3461 (BRI); Gold Ch(?) Road, *Webb* 5196 (CANB); Pentland, *Blake* 8396 (BRI); Pajingo, *Forster* 3718 (CANB); Burdekin Falls, *Gulkes* s.n. (P); 6 km S of Torrens Creek, *Simon* 3471 (BRI); 12 km NW of Longton, *Thompson & Robins* 384 (BRI). South Kennedy District: 16 km NE of Natal Downs Station, *Adams* 980 (CANB, K, L, NSW); ca 20 km from Collinsville along Bowen Development Road, *Stanley & Ross* 78342 (BRI); Scawfell Island Nat. Park, *Batianoff* 6162 (BRI); Great Dividing Range, ca 25 km NNW of Yarrowmere Station, *Henderson et al.* 2829 (BRI, CANB); Prudhoe Island Nat. Park, *Batianoff* 921179 (BRI); near Turkey Creek, S of Sarina, *Briggs* 2115 (NSW); 3 km E of Eaglefield Station, *Adams* 1102 (CANB); Nebo, *Jones* 3531 (CANB); 16 km NNW of Moray Downs Station, *Adams* 1179 (CANB); Middle Percy Island, *Tryon* 5 Mar. 1906 (BRI); 19 km W of Avon Downs Station, *Adams* 1047 (CANB, K, L); Eaglefield track, Suttor Development Road, *Champion & Pollock* 1313 (BRI); 11 km past Kyong turnoff on road to Aramac, *Forster* 15005 (BRI); 19 km E of Lotus Creek, *McDonald* 313 (K); Thirsty Sound, *R. Brown* 2850 (BM, CANB, E, K, type of *C. ovata*); Telarah, *Anderson* 3296 (BRI). Mitchell District: km 48 Hughenden-Pentland Road, *Forster* 6140 (BISH, WAG); 58 km S of Pairie, *Hind* 2018 (NSW); km 58 Aramac-Charters Towers Road, *K.A. Williams* 80131 (BRI); W of Lonreach, *Mitchell* 429 (BRI); 25 km NW of Longreach, *Milson* 1202 (BRI); Barcaldine, *C.T. White* 12370 (A); Jericho, *Hubbard* 7795 (K, L); Mt Gowan Range, off Emmet-Blackall Road, *Ballingall* 1577 (BRI); Northampton Downs, 40 km SE of Blackall, *Vasek* 690107-4 (UC); Enniskillen, *C.T. White* 12369 (A, K); 3 km N of Windeyer Creek, *Wilson et al.* 3495 (BRI, NSW); Warren Point Station, *Martensz* 108 (CANB). Gregory North Distict: Carandotta Station, *Blake* 10163 (BRI, CANB); Wangan, 80 km NW of Winton, *Johnson* 3204 (BRI); Warenda Station, *Everist & L. S. Smith* 131 (BRI); between Glenormiston & Toko Ranges, *Boyle* 29 Jan.-5 Feb. 1935 (BRI). Port Curtis District: Pine Islet, Northumberland Group,

Heatwole 6399 (BRI); S of Stanage Bay, *Blake & Webb* 15677 (NSW); 4 km from Lotus Creek crossing on inland highway to Marlborough, *Telford & Rud* 11095 (BISH, BRI, CANB); Ogmore, *Blake* 14314 (K), 15414 (BRI); Double Head, Yeppoon-Emu Park, *Telford* 1707 (CANB); Peak Island, *Batianoff & Dillewaard* 9835 (NSW); Melaleuca Creek Scrub, *Forster & McDonald* 7893 (BRI, K, L); Dingo, *Howard* 6 Jan. 1981 (NSW); Rockhampton, *Boorman* Aug. 1912 (C, G, L, M, NSW, P, UC, Z); 5 km E of Bajool, *Speck* 1791 (BRI, CANB, K); Tarogoola, *Olsen* 335 (NSW); Eurumbula, *Webb & Tracey* 10378 (BRI); near Biloela, *L.S. Smith* 3519 (A, L). Leichhardt District: 8 km S of Lotus Creek, *Forster* 6556 (BRI); Clements Creek, *Fenshaw* 1231 (BRI); ca 25 km from Clermont, foothills of Drummond Range, *Finger* 22 Feb. 1966 (BRI); between Capella and Chirnside, *L.S. Smith* 3429 (A, L); Kaiuroo, *Fensham* 710 (BRI); Rubyvale, *van Royen* 10006 (BISH, L); Gindi, near Emerald, *Francis* Mar.-Apr. 1920 (BM, NSW); 2.5 km S of Blackwater Township, *Lazarides & Story* 59 (BRI, CANB, NSW); km 14-Comet-Duaringa Telecom Tower Road, *Forster & Bean* 15030 (BRI); Edungalba, *Blake* 15342 (BRI); ca 5 km S of Moura, *Henderson* 235 (K); Brigalow Research Station, *Johnson & Batianoff* 3515 (BRI); Wandoan, *C.T.White & Webb* 1135 (A, CANB, K). Wide Bay District: Bundaberg, *Boorman* July 1912 (B, NSW); Monduran, *Bean* 8401 (BRI); 4 km E of Didcot, *Forster* 4823 (K, NSW); Utopia, 14 km SSE of Biggenden, *Forster* 9238 (A, B); Bauple, *Clemens* 10-20 June 1945 (GH, K); Wason L.A., *Forster* 4976 (BRI, NSW); Gympie, *Kenny* BRI 21222 (BRI). Burnett District: 2 km SSE of Mt Fort William, *Telford* 5397 (CANB); near Coalstoun Lakes, *Weston & P.G. Richards* 1471 (NSW); 2 km E of Mt McEuen, *Bean* 10303 (BRI). Maranoa District: near Roma, *Dunlop* NSW 471097 (NSW); Wallumbilla, *C.T. White* May 1916 (BRI); 43 km S of Meandarra, *H. & U. Walter* 2523 (B). Warrigo District: Noonbah, 90 km S of Longreach, *Vallen* July 1989 (BRI); Barcolle, 8 km from Jundah, *Berney* s.n. (BRI); Adavale, *MacGillivray* 1051 (BRI); Warlus III, 13 km W of Morven, *Purdie* 765D (BRI). Darling Downs District: Cypress Downs, *Jones* 167 (BRI); Miles area, *Webb* 1524 (CANB); Chinchilla, *Beasley* 6 (BRI); Warra, *Maiden* Mar.19009 (NSW); Goodna, *C.T. White* 2 Dec. 1910 (BRI); km 35 St. George-Moonie Highway, *Phillips* 440 (CANB); NNW of Bungunya, *Blake* 15856 (BRI); 19 km W of Westmar, *Pedley* 1237 (L); Kindon, *C.T. White* 12701 (A); km 2.5 Texas-Stanhorpe Road, *Wilson* 4280 (BRI, NSW). Moreton District: Nanango, *C.T. White* 15 May 1924 (BRI); Yarraman F.R., *Clemens* Aug. 1944 (A, UC); Dalby Creek, *Bailey* s.n. (NSW 238706); near Dalby, *Bancroft* s.n. (K, type of *C. ovata* var. *stolonifera*); Crows Nest, *Clemens* 43615 (A); Toowoomba, *C.T. White* Jan. 1919 (NSW); N of Ipswich, *J.B. Williams et al.* NRAC4 (CANB); Pimpama, *Simmonds* Easter 1888 (BRI); Moreton Bay, *Leichhardt* 4 July 1843 (NSW); ibid., *Mueller* s.n. (CANB, L, P); Brisbane, *Bancroft* May 1894 (NSW); Kenmore, *Blake* 15835 (A, CANB, K); near Brisbane, *Dietrich* 2025 (B, HBG, NSW, P, W, WAG), 2078 (HBG, L, PR); Mt Tamborine, *Clemens* Mar. 1947 (G, S); 10 km NE of Boonah, *Telford* 509 (CANB); Redwood (not localized), *Clemens* 43433 (A). New South Wales: Yetman, *Walker* Nov. 1949 (NSW); NW of Wallangara, *Julius* 6513-17 (NSW); Grilas Creek, *Floyd* 1164 (NSW); Ballina, *Maiden* 179 (U); Terry Hie Hie, *Barron* 15837 (NSW); Warialda, *Boorman* July 1905 (G, NSW, W, Z); 5 km SE of Bingara, *Wilson & Waterhouse* 2534 (K, L); near Gwydir R., *Cunningham* 23

(BM).

New Caledonia. Buahio R. valley, tributary of Koumac R., *MacKee* 16597 (K, L, P); Pouembot, *MacKee* 16886 (K, L, P), 24548 (K, L, P); Tontouta,, *Kusser in MacKee* 41250 (BR, P, WAG); Noumea, Port Ngea, *MacKee* 27969 (K, L, P); Moro Island, *Guillaumin & Baumann-Bodenheim* 11110 (A, P, Z), 11154 (P).

Cult. USA: Calfornia, near Westcott place, Los Angeles, *Walther* 379 (A); Florida, Miami, from *Koelz* 30, lower slopes of Himalayas, *Gillis* 11408 (BM, S). Panama: Cocle Province, Santa Clara Beach, *Croat* 9594 (WAG). Cuba: Cienfuegas, Harvard Tropical Garden, *Jack* 4244 (A). Dominica: Roseau, Botanical Gardens, *Hodge* 3907 (GH). Brazil: São Paulo, Botanical Garden, *Teixeira* 296 (A). Netherlands: Wageningen, from *Westphal* 416, Ethiopia, *van Setten* 763 (WAG); ibid., from *Leeuwenberg* 10833, Tanzania, *Leeuwenberg* 11035 (WAG). Germany: Berlin, Botanic Garden, *Leeuwenberg* 11598A (WAG). Egypt: Cairo University Zoological Garden, *Badia Diwan* spring 1975 (AAU, NY). Eritrea: Asmara, *Ryding* 1108 (K, UPS). Kenya: Kisserian, *D'Arcy* 9084 (K, P, WAG). Tanzania: 25 km W of Dar es Salaam, near Bahari Beach Hotel, *Lisowski* 45883 (POZG). Cameroun: Ngaoundéré, *Dang* 528 (P). Pakistan: Islamabad University Campus, *Anjum Amin* 14 May 1975 (A). India: Dehra Dun, New Forest, *Raizada* Apr. 1931 (S); Maharashtra, Nagpur, *Haines* 3365 (K), 5717 (K); Hort. Bot. Calcutta, *Wallich* 1680B (BM, K-WALL, L, type of *C. villosa*). Sri Lanka: Hort. Bot. Peradeniya, *Petch* 17 May 1922 (A). China: Yunnan, Kunming Botanic Garden, *Leeuwenberg* 14105 (E, WAG). Singapore: *Hallier* 2 Feb. 1904 (Z). Indonesia: Bogor XVI C 103a, from Maluku, *Leeuwenberg* 13178 (WAG). Philippines: Luzon, Bataan Province, *Wester* 124 (A). Australia: Queensland, Cook District, Tolga, *Sankowsky* 1339 (BRI).

Notes. *Carissa spinarum* is a very variable complex species. It occurs throughout Africa south of the Sahara, South Asia to New Guinea, and Australia to New Caledonia, but it is not represented in Malaysia nor in Western and Central Indonesia. Its area of distribution is among the largest of all Apocynaceae, comparable with *Tabernaemontana pandacaqui* known from Asia, Australia and Oceania and *Holarrhena pubescens* from East Africa and India to Vietnam. These taxa are represented by more than 1500 numbers in the herbaria, resulting in many synonyms. The present authors have had the opportunity to study even more than 3000 specimens of *C. spinarum* from the various herbaria cited, among which almost all type specimens of the numerous names. Moreover, Leeuwenberg observed living plants in the wild in various countries in Africa, in Madagascar and in Sri Lanka and collected herbarium material there. In open vegetations it is a shrub and in forests it becomes a climber or a tree. Trees are mainly known from forests in Madagascar, Malawi, Mozambique and Tanzania. The climbing forms usually have larger leaves than the shrubs, and are well known from Africa,

Southeast continental Asia and New Guinea. In drier vegetations the plants are more spiny, e.g. the type of *C. horrida*, the spines of which are even longer than the leaves. The trees in the forest are spiny when young and spineless when adult.

The spines are simple or occasionally forked. They vary in length and are mostly the longest in the driest localities, e.g. in continental Africa up to 55 mm. Some examples taken from collections made in Madagascar are illustrative. Spines as long as 27 mm are present in *Humbert* 12669, the type of *C. horrida*, and *Decary* 10944. The spines are usually shorter, up to 20 mm in *Perrier de la Bâthie* 8865, the type of *C. edulis* var. *subtrinervia*; even shorter, 11 mm in *Baron* 709, the type of *C. densiflora*; and 5 mm in *Decary* 10771, the type of *C. edulis* var. *nummularis*. However, most other type specimens and many other collections from Madagascar are spineless. When collecting in Madagascar Leeuwenberg found spiny young *Carissa* plants as well as spineless adult trees in the same forest. The savanna shrubs of which he collected were all spiny, but not always conspicuously so. Comparable variation in spines has been observed in material from Continental Africa and the other parts of the world. So, the expression of this character also varies with age.

Leaf characters used by various authors to keep up taxa were not maintained by other authors including the present ones. The leaves vary in shape and size even on a single branchlet. They range from orbicular to narrowly elliptic. Some leaves are from orbicular or nearly so and apically rounded or nearly so, such as in the types of *C. horrida*, *C. madagascariensis* and *C. edulis* var. *nummularis* (Madagascar). They are ovate in the types of *C. dulcis* (Ghana), *C. inermis* and *C. suavissima* (India), *C. laxiflora* (Papua New Guinea) and *C. papuana*. The latter two types also have elliptic leaves. They are elliptic and similarly shaped in the types of *C. edulis* (Ethiopia) (some leaves ovate), *C. richardiana (Ethiopia)*, *C. campenonii*, *C. densiflora*, *C. edulis* var. *microphylla* and *C. edulis* var. *subtrinervia* (Madagascar), *Strychnos pungens* Gagnep. (Vietnam), *C. pauciflora* (India), *C. hirsuta* (India) and *C. yunnanensis*. More narrowly elliptic leaves are known from various specimens collected in Africa, e.g. the types of *C. comorensis* and *C. oleoides* (Madagascar) and one of the two sheets of *C. sechellensis*, of *C. macrophylla* (India) and Australia e.g. the types of *C. lanceolata* and *C. velutina*. Similarly shaped but larger leaves are present in the types of *Chapelieria madagascariensis*, *Carissa obovata* and *Cabu-*

cala brachyantha (Madagascar). Broadly elliptic leaves are present in the type sheets of *C. spinarum* and *C. diffusa* (India), *C. revoluta* (Madagascar), *C. cochinchinensis* (Vietnam) and *C. ovata* and *C. scabra* (Australia).

Very narrowly elliptic leaves are known from *Hubbard* 7205 and narrowly elliptic from *Hubbard* 7204 collected side by side on the same day in Australia.

The venation is prominent above and beneath (e.g. in the types of *C. spinarum*), only above, e.g. in the type of *C. ovata*, or not at all. The venation varied in this respect within a single plant, as Leeuwenberg observed in Sri Lanka (*Leeuwenberg* 14782). This character varies far more than was supposed by Pichon (1949), who kept *C. edulis* separate from *C. spinarum*.

The leaves are glabrous to pubescent on both sides, the variation proves to be continuous. Pubescent leaves are known from e.g. the types of *C. pubescens* and *C. tomentosa* (Ethiopia), *C. laotica* var. *ferruginea*, *C. scabra* and *C. velutina* (the two last from Australia). Glabrous leaves are seen e.g. in the types of *C. spinarum* (India), *C. edulis* (Yemen), *C. dulcis* (Ghana), *C. madagascariensis* and *C. papuana*. Various inermediates exist from almost glabrous to partly hairy, e.g. almost glabrous leaves are present in the type material of *C. laotica* and partly hairy in the type of *C. campenonii* (Madagascar).

The flowers have a remarkable similarity throuhout the area of distribution in almost all details. They just vary mainly in size, even within one country. Therefore flowers did not serve to subdivide *C. spinarum* into infraspecific taxa, as was tried by Pichon (1949) and Markgraf (1970, 1976). The size of corolla tubes and lobes and their ratio show some continuous variation, but no other characters could be discovered. The indumentum varies outside, but more or less continuously and inside it is remarkably uniform. Stamens and pistil only vary in size.

The fruits vary in size from 10 to 60 mm long and contain 2 to 5(12) seeds. In most countries the fruits are up to 25 mm long, but, as far as is known, in forest trees in Madagascar and in savanna shrubs in Thailand they may even measure 30 to 60 mm. In the latter case the seeds may be more numerous and larger.

The above notes may have elucidated why the present authors came to the conclusion of the above given synonymy, even after long hesitation, particularly about the reduction of the well-known

C. edulis to a synonym of *C. spinarum*.

Field observations showed that *C. spinarum* presented Prévost's model in Madagascar and Leeuwenberg's model elsewhere.

7. Carissa tetramera (Sacleux) Stapf in Fl. Trop. Afr. 4, 1: 91 (1902); Dale & Greenway, Kenya Trees and Shrubs: 45 (1961); Codd in Fl. S. Afr. 26: 252 (1963); R.B. Drummond, Kirkia 10: 268 (1975); Compton, Fl. Swaziland: 439 (1976); Kupicha in Fl. Zamb. 7, 2: 400 (1985). — Type: Tanzania, T8, Zanzibar, *Boivin* Nov. 1847 (lectotype P designated here; isolectotype K). *Duparquet* anno 1873 (paratypes K, P), *Sacleux* 234 (paratypes K, P).

Fig.11, p. 71; map 8, p. 72

Basionym: *Arduina tetramera* Sacleux in Morot, Journ. Bot., Paris 7: 312 (1893).

A much branched shrub or small tree up to 4 m high. Bark grey or grey-brown, rough, fissured or peeling off. Branches smooth or rough; branchlets puberulous or glabrous. Spines forked, sometimes simple, mostly robust, axis up to 2.5 cm long; branches up to 4.5 cm long. *Leaves* opposite; petiole 0—2 mm long, with colleters in the axils; blade coriaceous when fresh and when dried, ovate or (narrowly) oblong, 1.3—3 x as long as wide, 1.1—6.4 x 0.4—4.6 cm, minutely mucronate at the apex, rounded or subcordate at the base, sometimes almost cuneate or decurrent into the petiole, glabrous on both sides, sometimes puberulous when young, midrib ending into a very short thorn at the apex, with 12—18 or more straight secondary veins, often ending with a fork into the marginal vein; tertiary venation partly scalariform and partly reticulate. *Inflorescence* terminal, rather lax or congested, few- to many-flowered. Peduncle 0—2.2 mm long, puberulous; pedicels 1.6—2.8 mm long, puberulous or glabrescent. *Flowers* tetramerous, fragrant. *Sepals* green, ovate, 1—1.7 x as long as wide, 1.1—3.4 x 0.7—1.9 mm, acute or apiculate at the apex, sometimes mucronate, auriculate at the base, often keeled outside, usually glabrous, sometimes partly pubescent outside, ciliate, glabrous inside. *Corolla* white or reddish, turning red at anthesis, tube pale green, glabrous or with a few hairs outside, ciliate at the left side of the lobes or not, with a pubescent or sparsely pubescent belt from 2—4.5 mm above the base to the mouth and at the mouth a dense belt of long hairs;

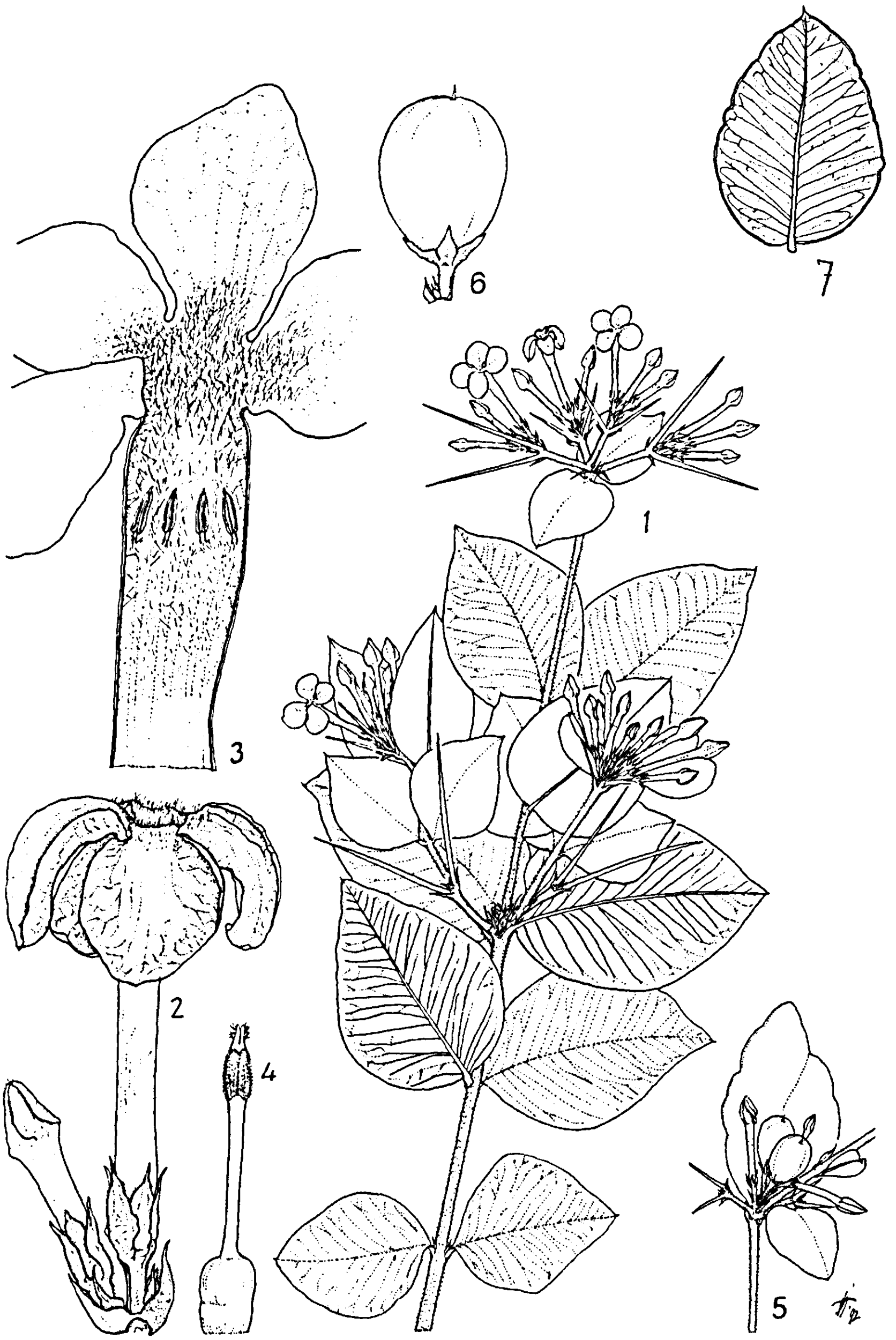
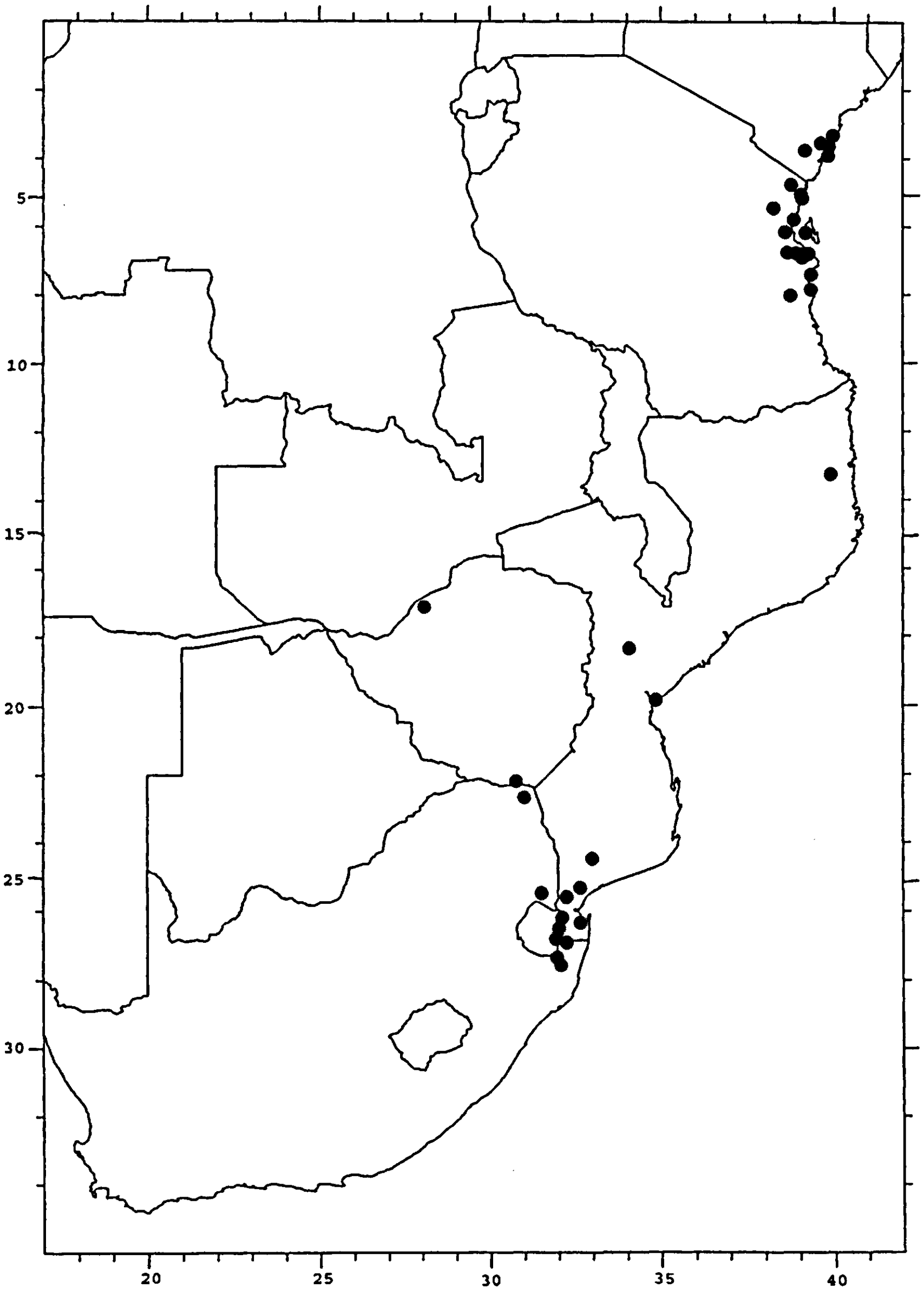


Fig. 11. *Carissa tetramera*. **1.** habit (x 2/3); **2.** flower (x 4); **3.** opened corolla (x 4); **4.** pistil (x 8); **5.** branchlet with buds and immature fruits (x 2); **6.** fruit (x 2/3); **7.** leaf (x 2/3). 1 and 7 from Reitsma 478; 2-6 from Lap 114.



Map 8. *Carissa tetramera.*

tube 3.5—7.2 x as long as the calyx, 5.1—13 mm long; lobes ovate, suborbicular or sometimes more or less oblong, 0.3—0.5 x as long as the tube, 1—1.4 x as long as wide, 2—5.8 x 2—4.9 mm, obtuse at the apex, auriculate at the base, overlapping to the left in bud. *Stamens* with apex 0.9—2.2 mm below mouth of corolla tube, inserted 0.5—0.67 of the length of the corlla tube, at 3.1—7.1 mm from the base; filaments 0.2—0.4 x 0.1—0.2 mm, pubescent or glabrous inside; anthers 1—1.7 x 0.2—0.4 mm, apiculate at the apex, glabrous. *Pistil* 3.3—4.8 mm long; ovary cylindrical or bottle-shaped, 0.7—1.2 mm, glabrous, rarely with some hairs at the acute apex; style 1.7—2.1 mm long, glabrous; pistil head 0.6—1.3 x 0.3—0.4 mm; basal part 0.6—1 mm long, glabrous; stigmoid apex 0.2—0.3 mm long, pubescent, rarely sparsely so or glabrous. *Fruit* dark red, purple or black, globose or ellipsoid, 9—13 x 7—10 mm, 4—8-seeded. *Seeds* ovate, elliptic or nearly orbicular, 3—6.5 x 2.7—4 x 0.3—1.1 mm. Embryo 2—2.8 mm long; cotyledons 0.9—1.3 x 0.4—0.8 mm; rootlet 1.1—1.5 x 0.2—0.4 mm.

Distribution: East to South Africa.

Ecology: Woodland and forest, on sandy soil or sandstone. Flowering throughout the year, fruiting as far as is known from March to May and from August to December. Altitude 0-520 m.

Geographical selection of the approximately 80 specimens examined:

Kenya. K4/7: near Jakabuko Hill, *Bally* 16743 (K). K7: near Taru, *Drummond & Hemsley* 4179 (B, BR, K); between Ganze and Bamba, *Reitsma* 478 (WAG); Mida, *Elliot* 752 (A, BR, FHO, K, US); Kilifi, *Jeffery* K 180 (G, K); between Mombasa and Takaungu, *Whyte* anno 1902 (K).

Tanzania. T3: Daluni, *Greenway* 4126 (FHO, K); Amboni, *Holst* 2474a (HBG, K, M, W); Machui, *Faulkner* 1560 (B, BR, K, P, S); Kwamkoro, 30 km E of Handeni, *Archbold* 2215 (BR); Mkwaja, *Tanner* 2681 (B, BR, K, NY, UC, WAG). T6: Zaraninge Forest, Bagamayo District, *Frontier-Tanzania Coast. For. Research Prog.* 993 (C); Kibaha, *Flock* 999 (S); km 90 Dar-es-Salaam to Morogoro Road, *Proctor* 1964 (K); km 27 of same road, *Welch* 311 (BR, K); Kinondoni District, *Ruffo & Mmari* 3189 (K, WAG); near DSM University, *Batty* 1171 (B, K); Pugu F.R., *Semsei* 3707 (K, WAG); Utete Road, *Vaughan* 2764 (BM); Kisiju, *Paulo* 150 (BR, K); Rufidji R., *Busse* 2325 (BR, HBG). Zanzibar: sin. loc., *Boivin* Nov. 1847 (P, lectotype); *Duparquet* anno 1873 (P, paratype); *Sacleux* 234 (P, paratype); Mazizini, *Vaughan* 2028 (BM, FHO).

Zimbabwe. Mashonaland: Sengwe, *Cleghorn* 741 (SRGH). Matabeleland South: Tshiturapadsi, *Wild* 5387 (COI, K, M, PRE, SRGH).

Mozambique. Nampula: Antonio Enes (= Angoche), *Mogg* 32508 (LISC, SRGH). Sofala: Gorongosa Nat. Park, *Tinley* 2338 (K, SRGH); Beira,

Swynnerton 1068 (BM, K). Gaza: Camiçado, *Correia & Marques* 918 (LMA, WAG). Maputo: ca km 28 Manhiça-Chinhanguanine Road, *Marques* 2241 (LMA, WAG); Moamba, *de Koning et al.* 8800 (BR, WAG); Goba, *Balsinhas* 196 (COI, K, LISC, PRE, SRGH); Bela Vista (= Matutuine), *de Koning et al.* 8565 (BM, K, WAG).

Swaziland. Big Bend-Siphofani Road, *Brenan & Vahrmeijer* 14279 (K); Matimbane R., *Prior* 409 (K).

South Africa. Transvaal: Punda Maria (= Punda Milia), *van der Schijff* 975 (K); Hlalabisa Hill, near Malelane, *Codd* 6098 (K). Natal: Ndumo Game Res., *Pooley* 356 (E); Pongola R., above Jozini Dam, *Edwards* 2923 (K, M); Ubombo, *Tosh* 42 (E); False Bay, Hlabisa District, *Gerstner* 4931 (K).

Excluded species

Arduina ouabaio Cornu ex Holmes, nomen, Pharm. Journ. 3, 23: 965 (1893), nomen = *Acokanthera schimperi* (A. DC.) Schweinf.

A. schimperi (A. DC.) Baill., Hist. des Pl. 10: 168 (1888) = *Acokanthera schimperi* (A. DC.) Schweinf.

A. venenata (Thumb.) Baill., Hist. des Pl. 10: 168 (1888) = *Acokanthera oppositifolia* (Lam.) Codd.

Carissa abyssinica R. Br., nomen, Salt, Voy. Abyss. App. IV: 64 (1814) = *Acokanthera schimperi* (A. DC.) Schweinf.

C. acokanthera Pichon in Mém. Mus. Nat. Hist. Nat. Paris sér. 2, 24: 132 (1948) = *Acokanthera oppositifolia* (Lam.) Codd.

C. cryptophlebia Baker in Journ. Linn. Soc. 20: 204 (1883). *Jasminonerium cryptophlebia* (Baker) Kuntze, Rev. 2: 415 (1891) = *Petchia cryptophlebia* (Baker) Leeuwenb.

C. deflersii (Schweinf. ex Markgr.) Pichon in Mém. Mus. Nat. Hist. Nat. Paris sér. 2, 24: 132 (1948) = *Acokanthera schimperi* (A. DC.) Schweinf.

C. friesiorum (Markgr.) Cufod. in Bull. Jard. Bot. Nat. Belg. 39, suppl. 30 (1969) = *Acokanthera schimperi* (A. DC.) Schweinf.

C. ?grandis Bert. ex A. DC., Prod. 8: 336 (1844), nomen = *Fagraea berteriana* A. Gray ex Benth. in Journ. Linn. Soc 1:98 (1857), Loganiaceae). Tahiti, herb. *Richard* s.n. (P).

C. inepta Perrot & Vogt in Trav. lab. Mat. Méd. Paris 9: 114 (1913) = *Acokanthera schimperi* (A. DC.) Schweinf.

C. longiflora (Stapf) G.H.M. Lawr. in Baileya 7: 90 (1959) = *Acokanthera oppositifolia* (Lam.) Codd.

C. mepte Hochst. in Flora 1844: 101 (1844) = *Acokanthera schimperi* (A. DC.) Schweinf.

C. mitis Vahl, Symb. Bot. 3: 44 (1794) = *Holarrhena mitis* (Vahl) R. Br.

C. oblongifolia Hochst. in Flora 27, II: 827 (1844). *Jasminonerium oblongifolium* (Hochst.) Kuntze, Rev. 2: 415 (2891). = *Acokanthera oblongifolia* (Hochst.) Codd.

C. oppositifolia (Lam.) Pichon in Bull. Jard. Bot. Brux. 22: 109 (1952) = *Acokanthera oppositifolia* (Lam.) Codd.

C. ouabaio Poisson in Assoc. Fr. l'Avanc. Sc. Congrès d'Oran 3 (1888), nomen = *Acokanthera schimperi* (A. DC.) Schweinf.

C. schimperi A. DC., Prod. 8: 675 (1844) = *Acokanthera schimperi* (A. DC.) Schweinf.

C. schimperi var. *ouabaio* (Schweinf. ex Lewin) Cuf. in Jard. Bot. Nat. Belg. 30: 686 (1960) = *Acokanthera schimperi* (A. DC.) Schweinf.

C. spectabilis (Sond.) Pichon in Mém. Mus. Nat. Hist. Nat. Paris sér. 2, 24: 132 (1948) = *Acokanthera oblongifolia* (Hochst.) Codd.

C. venenata (Baill.) Palaky, Cat. Pl. Madag. 2: 29 (1907) = *Menabea venenata* Baill. (Asclepiadaceae).

C. verticillata Sessé & Mociño, Pl. Nov. Hispan. ed 1: 29 (1887) = *Alstonia longifolia* (A. DC.) Pichon.

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Index of exsiccatae

When several collectors collected together in the same number sequence, only the first one is listed here.

Codes: *Carissa bispinosa (bi), C. boiviniana (bo), C. carandas (c), C. macrocarpa (m), C. pichoniana (p), C. spinarum (s), C. tetramera (t).*

Halford, D., Q755, Q757, Q766, Q772, Q774, Q780 (s).
Hall, J.B., 1590 (s).
Hallier, H., C 50a, C 50b (c), C 51 (s).
Hall-Martin, A., 1500 (s).
Hambleton, E.J., 1 (s).
Hamilton, F.B., 714, 714a (s).
Hancock, G.L.R., 759 (s).
Hansen, O.J., 432 (t), 3484 (bi), 6400, 6401 (s).
Harden, G.J., 81283 (s).
Harder, D.K., 1341, 1909 (s).
Hardy, D.S., 415 (s), 1536 (t).
Harker, K.W., 210 (s).
Harmsen, R., 6420 (s).
Harris, B.J., K5, 4458 (s).
Harris, J.A., C1688 (m).
Harvey W.H., 8372 (s).
Haugen, T., 492 (s).
Hayata, B., 711 ? (s).
Heatwole, H., 6399 (s).
Hedberg, O., 4798 (s).
Hedrén, M., 614 (s).
Heine, M., 411 (s).
Helms, R., 5608 (s).
Hely F.W., 260 (s).
Hemming C.F., 27, 1045, 1194 (s).
Henderson, R.J., 235, 2829 (s).
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Hening, 6433, 6442 (s).
Henlocker, D., 86 (s).
Henriques, C., 180 (s).
Henry, A., 10156, 10156A (s).
Henshall, T.S., 311 (s).
Henty, E.E., NGF 38722 (s).
Hepper, F.N., 4640, 5968 (s).
Herbst, D., 545 (m).
Herman, P., 785 (s).
Heslop, A., 18 (s).
Hiemstra, H., 268 (s).
Hiepko, A., 2589 (s).
Hildebrandt, J.M., 486 (s), 1271 (t), 3685 (s).
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Hilliard, O.N.J., 15076 (bi).
Hilner, O., 75 (bi), 505 (m).
Hind, P., 2018 (s).
Hochreutinger, B.P.G., 2848 (s).
Hod, K.T.B., 53 (s).
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Hohenacker, R.F., 105a, 1384 (s).
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Sinclair, J., 3971 (c), 4317 (s), 5414 (c).
Singh, A., 54145, 55286 (s).
Singh, U., 136 (s).
Singleton, W.R., 249 (m).
Sinsin, 774 (s).
Siwon, J., 902 (c).
Skene, E., 49 (s).
Slee, A.V., 2901 (s).
Sloet van Oldenruitenborgh, C.J.M., SA 015 (m).
Smeds, H., 38, 1435 (s).
Smeyers, F., 295 (s).
Smith, A.R., 437 (s).
Smith, C.S., 12/92 (t).
Smith, L.S., 490, 3429, 3519, 11234A, 11774, 12051, 12433 (s).
Smith, P.A., 97, 1074 (s).
Smuts, J.C., 936, 3133 (s), 3279 (bi).
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Soejarto, D.D., 4918, 5779 (s).
Sohmer, S.H., 8070, 8139, 8155, 8268 (s).
Sollazzo, T., 247, 251 (s).
Solymosy, S.L., SC 06307122 (m).
Sonko, I., 007 (s).
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Sparshott, K.M., 438 (s).
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Staynes, Z.J., 34 (bi).
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Stephen, J., 719 (t).
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Strid, Åke, 2076 (s).
Strid, Arne, 2253, 2322 (s).
Strong, B.W., 634 (s).
Stroder, K., Rar.1971 (s).
Stuhlmann, F.L., 446 (t).
Sturgeon, K.E., SRGH 30782(bi).
Sturrock, B.M., A170 (m).
Subramanian, K.N., 426 (s).
Sulman, F., 6150/13 (s).
Sumithraarachchi, D.B., 489, 800 (s).
Sutherland, J., 256 (s).
Swart, L.S., SKF 516 (m).
Swenson, U., 142 (s).
Swiestra, C.J., 2187 (s).
Swinbourne, R., 706 (s).
Swynnerton, C.F.M., 43 (t), 69 (bi), 70, 960 (s), 1066 (bi), 1067, 1068 (t), 6147 (bi), 6621, 6623 (s).
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Tanner, R.E.S., 1702 (s), 2681 (t), 4267, 4383, 4452, 5622A, 6011 (s).
Taschdjian, E., 332 (s).
Taton, A., 49, 986, 1356 (s).
Taylor, H.C., 8338 (bi).
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Theron, G.C., 673, 707, 1811 (bi).
Thomas, A.S., M19 (s).
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Thompson, J.B., 313 (m).
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Wood, J.M., 300, 7636, 11383, 11394, 11731, 12413 (bi).
Wood, J.R.I., Y/74/92, Y/76/1056, Y/76/1091 (s).
Worthinton, T.B., 2707 (c).
Wrigley, J., 1477 (s).
Wulfhorst, A., 45 (s).
Wylie, A., 80 (bi).
Wylie, J., 7898, 8631, 10350 (bi).

Yalala, A.M., 156 (bi).
Yayasuriya, A.H.M., 8318 (s).
Yeshoda, K., 347 (c), 495, 496 (s).
Yin Kyi, Y., 826 (s).
Young, A.P., 5070 (s), 5071 (c).
Young, R.G.N., A668 (s).

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Zeyher, C.P.L., 163, 307, 308, 428, 3414, 3414a, 3414b, 3415, 3416 (bi).
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Zunguze, D., 497 (bi).

Index of scientific names

New names are in **bold face**, synonyms in *italics*. Page numbers of principal entries are in **bold face**, those of figures and maps in *italics*.

Series of revisions of Apocynaceae L
Keys to Apocynaceae in continental Africa

by A.J.M. Leeuwenberg

Abstract

The present paper contains two keys, one to the Apocynaceae genera represented in Africa by indigenous species and one to the extra-African species cultivated in Africa. After that a few notes are added on the revision of *Cerbera* L.

A complete list of relevant references is added. It completes the series of taxonomical monographs of Apocynaceae prepared in or in collaboration with Wageningen's Herbarium Vadense.

Introduction

The present paper provides three contributions to the knowledge of the Apocynaceae; concluding the series prepared by the author or co-authored or supervised by him:

1. Key to the genera represented by species indigenous in Africa, exclusive of Madagascar with references to the revisions of the genera containing keys to the species and many illustrations. The numbers adopted in the list of the references are given between brackets after the genus names in this key.
2. Key to the non-indigenous species cultivated in Africa. Some species indigenous in Africa may be cultivated outside their area of distribution and may be identified by the key to the genera indigenous and the relevant revision of the genus.
3. Additional notes on *Cerbera* L.

1. Key to the Apocynaceae genera indigenous in Africa, excluding Madagascar

Number of reference between brackets after genus name.

1. Leaves alternate.....2
   Leaves opposite or whorled.....4
2. Plants spiny and succulent.....**Pachypodium** (37)
   Plants not spiny, succulent or not.....3
3. Plants succulent; corolla ample, pink.....**Adenium** (3)
   Plants not succulent; corolla narrowly infundibuliform, white,

with pink throat. Pemba and Seychelles .....**Cerbera** (36)

4. Leaves whorled (see also *Ochrosia* (18) from the Mascarenes)....
.....5
Leaves opposite, sometimes subopposite.....7

5. Leaves dull glaucous beneath, with many dense straight secondary veins; large trees; fruits long slender dry follicles; seeds bicomate.....**Alstonia** (2, 35)
Leaves green beneath; secondary veins not dense, usually curved; small trees or shrubs.....6

6. Disk present; peduncle usually more than 2 cm long; fruit a drupe with fleshy mesocarp; widespread.....**Rauvolfia** (25)
Disk absent; peduncle up to 1 cm long; fruit a dry rather thick slightly moniliform follicle; seeds winged. E and W Cape Provinces of South Africa .....**Gonioma** (34)

7. Spiny shrubs, climbers or sometimes trees; corolla white or pink; fruit a red to black berry .....**Carissa** (38)
Plants not spiny; corolla variously coloured; fruits baccaceous or capsular.....8

8. Herb or undershrub; corolla with a narrow almost cylindrical tube and a wide flat limb, white and/or pink.....
.....**Catharanthus roseus** (32)
Plants woody; corolla various 9

9. Corolla lobes overlapping to the left 10
Corolla lobes overlapping to the right 36

10. Carpels completely fused 11
Carpels free or nearly so 25

11. Trees or shrubs 12
Climbers or (see couplet 21) rhizomatous shrubs 14

12. Repeatedly dichotomously branched shrub with clearly pedunculate inflorescences in the forks; corolla pale yellow with red, purple or violet stripes or dots; fruits orange, often bumpy, 29-64 mm long, resembling mandarines or limes.....
.....**Tabernanthe iboga** (22)
Usually differently branched trees or shrubs; with terminal and/or axillary fasciculate inflorescences; corolla white or sometimes pink, without stripes or dots; fruits red to almost black, smooth, up to 32 mm long, subglobose or ellipsoid.....13

13. Ramification not furcate; inflorescence axillary; anthers with stiff hairs; sap extremely poisonous.....**Acokanthera** (7)
Ramification usually furcate; inflorescence terminal and sometimes also axillary; anthers glabrous; sap not poisonous.....

.....**Carissa** (38)

14. Corolla tube 25-100 mm long, if 10-17 mm long then lobes falcate; fruits fleshy apocarpous thick follicles.....
.....**Tabernaemontana** (24)
Corolla tube up to 22 mm long; lobes not falcate.....15

15. Calyx with many colleters inside 16
Calyx without colleters, rarely with 5-15 colleters inside in groups of 1-3 alternating with the sepals 17

16. Leaves with 5-10 pairs of distant secondary veins; flowers conspicuous; corolla lobes 17-44 mm long .....**Vahadenia** (27)
Leaves with more than 20 pairs of dense secondary veins; flowers small; corolla lobes 2-3 mm long .....**Cyclocotyla** (15)

17. Inflorescences of elongate branched terminal panicles.....18
Inflorescences contracted, short and often clustered, terminal or axillary, exceptionally some of them elongate 19

18. Anthers keeled along the back; ovary and fruit pubescent; stipules absent .....**Ancylobotrys** (28)
Anthers not keeled; ovary glabrous and fruit usually glabrous; stipules interpetiolar, early caducous .....**Dictyophleba** (21)

19. Length of anthers almost half or more of the length of the corolla tube; corolla lobes often longer than the tube.....
.....**Landolphia** (26)
Length of anthers up to one third of the length of the corolla tube, frequently less 20

20. Wall of the corolla tube thickened above the anthers; anthers not keeled.....21
Wall of the corolla tube not thickened above the anthers; anthers keeled or not (see also *Landolphia nitidula* and *L. robustior* (26))
.....22

21. Rhizomatous shrub with straight stems; corolla tube 9-13 mm long; stamens inserted 18-24% of the length of the corolla tube from the base .....**Chamaeclitandra** (19)
Climber with curled tendrils; if rhizomatous shrub, stamens inserted 55-90% of the length of the length of the corolla tube from the base (*Landolphia gossweileri, L. lanceolata* and *L. thollonii*) .....**Landolphia** (26)

22. Only terminal inflorescence developed.....**Saba** (20)
Inflorescence axillary or axillary and at the same time terminal...
.....23

23. Anthers not keeled; stamens inserted above the middle of the corolla tube; secondary leaf veins in 6-16 pairs; tertiary venation

reticulate.....24
Anthers keeled along the back; stamens inserted below the mouth of the corolla tube; many parallel secondary veins close together .....**Orthopichonia** (23)

24. Endosperm copious, 20 mm thick; cotyledons 0.2 mm thick; pistil 0.7-1.3 mm long, with head never reaching the stamens; corolla tube 3.2-6.5 mm long.....**Clitandra** (19)
Endosperm thin, thinner than 1 mm; cotyledons 2-3 mm thick; pistil 1.7-4.7 mm long, with head reaching the anthers; corolla tube 2.2-4.3 mm long .....**Cylindropsis** (27)

25 (10). Climber; leaves with at least 15 pairs of secondary veins, much paler and with black dots beneath; corolla dark pink; lobes about 3 x as long as the tube, 3-7 mm long.....**Pycnobotrya** (9)
Trees or shrubs; leaves usually with fewer pairs of secondary veins; corolla not dark pink; lobes various.....26

26. Corolla with corona 27
Corolla without corona.....29

27. Corona as in *Narcissus*.....**Stephanostema** (11)
Corona of slender lobes.....28

28. Corona lobes branched, about as long as the corolla lobes..... .....**Pleioceras** (11)
Corona lobes unbranched, much shorter than the corolla lobes.... .....**Wrightia** (17)

29 (26). Petiole about 1/3 of the blade; fruit composed of 2 dry follicles; seeds winged .....**Diplorhynchus** (3)
Petiole less than 1/4 of the blade; fruit composed of 2 fleshy or less often dry follicles; seeds unwinged (see also *Gonioma*) 30

30. Bracts large, 4-11 x 2.5-7 cm; completely covering the sepals; inflorescence 1-2-flowered with large pendulous flowers. Gabon to Angola .....**Crioceras** (30)
Bracts shorter to slightly longer than the sepals, never covering them.....31

31. Seemingly unbranched shrub about 50 cm high with seemingly axillary inflorescences; corolla infundibuliform. Southern Cameroun and Gabon.....**Calocrater** (30)
Plants clearly dichotomously branched; inflorescences in the forks; corolla infundibuliform or not.....32

32. Pistil head coherent with the anthers and therefore style and pistil head shed with the corolla; calyx also shed along with the corolla or some time after, at least before the fruit matures; in the latter case the corolla tube up to 1.4 x as long as the calyx (exceptions

to this last character: *V. bracteata* and *V. chalotiana*).....
.....**Voacanga** (12)
Pistil head not coherent with the anthers and therefore pistil still complete after the corolla has been shed; calyx persistent even in fruit; corolla tube probably never less than twice as long as the calyx 33
33. Corolla lobes inflexed in bud and therefore seemingly much shorter in bud than in open flowers .....**Tabernaemontana** (24)
Corolla lobes not inflexed in bud and therefore not or only slightly shorter in bud than in open flowers.....34
34. Corolla large, tube (13)20-110 mm long; lobes with 2 apices, one rounded and one acute; sepals mostly more than 5 mm long.....
.....**Callichilia** (1)
Corolla much smaller, tube (3)5-10 mm long, lobes with a single rounded or obtuse apex; sepals up to 4 mm long 35
35. Corolla tube campanulate, not contracted at the mouth, 8-10 mm long, lobes in bud not forming a head; mericarps smooth. East Africa .....**Carvalhoa** (14)
Corolla tube almost cylindrical, contracted at the mouth, widest just above the base and there often wider than the ovoid apical head when in bud, (3)5-8.7 mm long; mericarps fused and smooth or lumpy and separate and with soft blunt prickles. Central Africa .....**Tabernanthe** (22)
36 (9). Trees or shrubs; corolla lobes not caudate.....37
Climbers, if shrubs then corolla lobes caudate.....44
37. Repeatedly dichotomously branched shrubs; inflorescences in the forks 38
Not repeatedly branched shrubs or trees; inflorescences terminal and/or axillary.....39
38. Corolla tube 22-49 mm long; fruit smooth, beaked. West Africa
.....**Callichilia subsessilis** (1)
Corolla tube 4-5.2 mm long; fruit irregularly striate, rounded. Central and East Africa and Comoro Islands....**Schizozygia** (11)
39. Leaves with domatia, often consisting of pits 40
Leaves without domatia (see also *Funtumia africana* (6))).....41
40. Stamens exserted, corolla tube 12-36 mm long and lobes ovate or stamens included, corolla tube 4.5-5.5 mm long and lobes narrowly oblong; seeds without coma.....**Malouetia** (15)
Stamens included, corolla tube 5.5-10.5 mm long and lobes mostly ovate; seeds with large coma .....**Funtumia** (6)
41. Fruit a drupe with fleshy mesocarp; peduncle usually more than

2 cm long; corolla slightly zygomorphic.....**Rauvolfia** (25)
Fruit a dry follicle; peduncle up to 1 cm long; corolla actinomorphic.....42

42. Follicle thick and short, slightly moniliform; seeds winged; corolla lobes transversely elliptic or ovate, up to 2 mm long, rounded. West and East Cape Provinces of South Africa.....
.....**Gonioma** (34)
Follicles mostly slender, not moniliform; seeds not winged but with coma 43

43. Corolla lobes conduplicate in bud, ovate, acute or acuminate, tube clearly widened around the stamens; leaves coriaceous. East Africa .....**Mascarenhasia** (34)
Corolla lobes not conduplicate, narrowly obovate, rounded or nearly so, tube cylindrical, not widened around the stamens; leaves herbaceous, papery when dried.....**Holarrhena** (4)

44. Corolla with paired corona appendages between the (frequently long-tailed) corolla lobes; when corolla lobes not long-tailed tube 24-45 mm long.....**Strophanthus** (8)
Corolla with non-paired corona lobes or without corona; tube less than 10 mm long; if corolla tube up to 21 mm long then stamens exserted and corona absent (*Isonema* (9)) or supra-axillary glands on the petiole (*Farquharia* (6)) 45

45. Stamens exserted.....46
Stamens included 47

46. Corolla tube 7-19 mm long; filaments straight, shorter than the anthers .....**Isonema** (9)
Corolla tube 0.3-0.5 mm long; filaments twisted around the style, longer than the anthers.....**Dewevrella** (15)

47. No supra-axillary glands on the petiole; corolla limb usually spreading or recurved .....**Alafia** (33)
Supra-axillary glands on the petiole developed; corolla limb often suberect 48

48. Corolla tube 10-21 mm long; seeds with an apical and a basal coma .....**Farquharia** (6)
Corolla tube less than 7 mm long; seeds with an apical coma only 49

49. Inflorescence terminal; follicles widest near the base, with a deciduous brown tomentum .....**Motandra** (10)
Inflorescence axillary and often at the same time terminal; follicles widest near the middle or cylindrical.....50

50. Anther tails straight, acute; corolla lobes 0.6-29 mm long, often

suberect or halfway recurved; follicles narrowly cylindrical, up to 100 cm long, mostly up to 1 cm in diameter.....**Baissea** (29)
Anther tails curved, obtuse; corolla lobes 1.7-7.3 mm long, usually spreading; follicles from less than 1 cm to 6.1 cm wide... .....**Oncinotis** (13)

2. Key to the extra-African species cultivated in Africa

This key is made for species introduced to Africa and cultivated there in Botanic Gardens and elsewhere. For the cultivated, but indigenous species refer to the first key, also when these plants are cultivated outside their area of distribution. These species are *Allamanda blanchetii* A. DC., *A. cathartica* L., *A. schottii* Pohl, *Mandevilla laxa* (Ruiz & Pav.) Woodson, *Plumeria alba* L., *P. obtusa* L., *P. rubra* L. ("*Frangipani*"), *Thevetia peruviana* (Pers.) K. Schum. and *T. thevetioides* (Kunth) K. Schum. from tropical America, *Alstonia macrophylla* Wall. ex G. Don, *A. scholaris* (L.) R. Br., *A. venenata* R. Br., *Alyxia ruscifolia* A. Cunn., *Beaumontia grandiflora* Wall., *Tabernaemontana divaricata* (L.) R. Br. ex Roem. & Schult., *Trachelospermum jasminoides* (Lindl.) Lem. and *Vallaris solanacea* (Roth) Kuntze from tropical Asia and finally *Vinca major* L. from Europa.

1. Plants herbaceous with opposite almost cordate leaves on creeping vegetative and short erect flowering stems; corolla blue-violet.....**Vinca major**
   Plants woody.....2
2. Leaves alternate, narrowly or very narrowly elliptic.....3
   Leaves opposite or whorled.....7
3. Leaves very narrowly elliptic, up to 1 cm wide; flowers large, yellow; branchlets thin; evergreen tree or shrub.....4
   Leaves at least 3 cm wide; flowers variously coloured, fleshy; branchlets thick, more or less succulent; shrub or small tree, often leafless, but still flowering, in the dry season.....5
4. Corolla lobes erect, remaining contorted and overlapping at anthesis; leaves always glabrous beneath.....**Thevetia peruviana**
   Corolla lobes spreading, separating at anthesis; leaves often hairy beneath.....**Thevetia thevetiodes**
5. Leaves hairy beneath, often more or less bullate, with margin clearly revolute. This Caribbean species is rarely cultivated in

Africa; known from the Botanic Garden at Harare, Zimbabwe.... .....**Plumeria alba**
Leaves glabrous or hairy beneath, flat or slightly revolute at margin, not bullate 6

6. Leaves dull or mat, glaucous or nearly so, acuminate, glabrous; flowers variously coloured, never pure white. Very commonly cultivated.....**Plumeria rubra**
Leaves shiny above, dark green, often hairy beneath; flowers white, often with yellow throat. In Africa in the Eastern parts..... .....**Plumeria obtusa**
7. Leaves whorled; usually trees or shrubs; flowers variously coloured 8
Leaves opposite; usually climbers; flowers usually white.....13
8. Leaves up to 25 mm long, sharply pointed at apex; flowers about 5-7 mm long.....**Alyxia ruscifolia**
Leaves larger, usually more than 4 cm long, not sharply pointed; flowers usually at least 2 cm long 9
9. Leaves strictly ternate, stiffly coriaceous, with a minute reticulate venation beneath; flowers usually pink, often double; anthers with long hairy appendages.....**Nerium**
Leaves ternate or quaternate, herbaceous when fresh, venation not reticulate; flowers variously coloured; anthers without appendages.....10
10. Trees or shrubs; flowers small; tube nearly cylindrical, up to 30 x 2 mm; fruit of slender long follicles, smooth; seeds with a coma at both ends .....**Alstonia** (2, 35)
Climbers or shrubs; flowers much larger; tube infundibuliform or nearly so, at least 50 mm long; fruit subglobose, prickly 11
11. Corolla mauve .....**Allamanda blanchetii**
Corolla yellow, often with some red.....12
12. Corolla tube widely infundibuliform; the wide part about as long as the narrow; corolla usually not red-striped; climber with white latex.....**Allamanda cathartica**
Corolla narrowly infundibuliform to almost cylindrical; the wide part about 3 times as long as the narrow, inside in throat with red longitudinal lines, clearly longitudinally veined outside when dried; shrub with clear sap.....**Allamanda schottii**
13. Repeatedly dichotomously branched shrub or small tree with inflorescences in the forks; flowers usually double and sweet-scented ("coffee rose").....**Tabernaemontana divaricata**
Climbers, variously but not dichotomously branched.....14

14. Flowers very large; corolla tube (65)75—130 mm long; sepals (22.5)30—55(60) mm long; follicles 22—31 x 5—6 cm.....
.....**Beaumontia grandiflora**
Flowers much smaller; corolla tube less than 60 mm long; sepals up to 12.5 mm long.....15
15. Corolla with a very wide limb; tube 5—10 mm long; follicles 8—15 cm long; leaves cuneate or rounded at the base.....16
Corolla more or less infundibuliform; tube 25—55 mm long; follicles 25—40 x 0.5 cm; leaves more or less cordate at the base
.....**Mandevilla laxa**
16. Corolla tube slightly widened around the included anthers; follicles slender; about 5 mm in diameter.....
.....**Trachelospermum jasminoides**
Corolla tube not widened; anthers exserted; follicles wider, 1.5—3.5 cm in diameter.....**Vallaris solanacea**

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3. Notes on *Cerbera* L.

Cerbera manghas L. and *C. odollam* Gaertn. occur side by side in various countries, e.g. Thailand, Malaysia and western Indonesia, where they are the only *Cerbera* species represented. As they can only by recognized with open or almost open flowers an extra key is given.

1. Stamens inserted near the mouth of the corolla tube, which is 17—55 mm long; corolla tube usually white and with a red eye, less often with a yellow eye.....**C. manghas**
   Stamens inserted around the middle of the corolla tube, which is 15—25 mm long; white with a yellow eye or entirely white.....
   .....**C. odollam**

The colour photograph of a flowering branch of *C. laeta* erroneously was omitted in the revision of the genus. It appears here (p. 126).

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Leeuwenberg, A.J.M., 1999. Series of Revisions of Apocynaceae XLIX. The genus *Cerbera* L. Wageningen Agric. Univ. Pap. 98-3: 1-64.

Phot. 1. *Carissa carandas*. phot. Wongsatit; herb. Leeuwenberg 14789.

Phot. 2. *Carissa carandas*. phot. Wongsatit.

Phot. 3. *Carissa macrocarpa*. phot H.C.D. de Wit.

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Phot. 6. *Carissa spinarum*. Phot. Wongsatir, Surin Province, Thailand.

Phot. 7. *Carissa spinarum* Phot. Wongsatit, Surin Province, Thailand.

Phot. 8. *Cerbera laeta*. Phot and herb. Staples (1139).