

PART XVII
A REVISION OF CARVALHOA K. SCHUM.

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INTRODUCTION

The present paper is a monographic revision of the genus *Carvalhoa*, and the study is based on the examination of herbarium material and spirit collections. The descriptions of the genus and species also appeared in the *Flora Zambesiaca*.

It has been possible to trace all type specimens of the name and synonyms.

K. SCHUMANN (1895, see references with the name) who described the genus, named it after the collector of the type specimen of the type species, Rodriguez de Carvalho. He added two more species in 1901 and 1903 which are not maintained here.

The monotypic genus *Carvalhoa* occurs in eastern and southeastern Africa.

RELATIONSHIP WITH OTHER GENERA

Carvalhoa belongs to the tribe *Tabernaemontaneae* of the subfamily *Plumerioideae*. As is evident from the strikingly uniform habit and seeds, as well as the flowers and fruits, the genus is closely related to *Tabernaemontana*.

The two genera may be distinguished as follows:

Corolla with many red longitudinal lines at the base of the lobes; tube campanulate	Carvalhoa
Corolla without red lines; tube almost cylindrical or more or less bottle-shaped	Tabernaemontana

GENUS DESCRIPTION

Carvalhoa K. Schum. in Engler & Prantl, *Nat. Pflanzenfam.* 4 (2): 189. 1895; Leeuwenberg, in *Fl. Zambesiaca* 7(2): 444. 1984.

Shrub or small tree, repeatedly dichotomously branched and with 2 inflorescences in the forks when flowering, with white latex. Branchlets terete. *Leaves* opposite, those of a pair equal or unequal, shortly petiolate or sometimes sessile; petioles or leaf bases of a pair united at the base and forming a very short ocrea, with a single row of colleters in the axils; blade elliptic, narrowly elliptic, or narrowly obovate, cuneate, rounded or subcordate at the base. Inflorescence pedunculate, corymbose, lax. Bracts caducous before the flowers open. *Flowers* actinomorphic except for the slightly curved corolla tube. *Calyx* pale green, persistent, even under the fruit. *Corolla* white, creamy, or pale yellow, with many red longitudinal lines at the base of the lobes and at the apex of the tube; tube longer than the calyx; lobes spreading(?) or suberect, in bud overlapping to the left. *Stamens* included; anthers sessile, narrowly triangular, acuminate at the sterile apex, sagittate at the base, hirsute-pubescent outside on the connective and inside between the tails, introrse. *Pistil* glabrous; ovary broadly ovoid, composed

of 2 free carpels, surrounded by an entire disk, which is united with the distal sides of the ovary; style only slightly widened at the apex; pistil head composed of an entire, thin, slightly recurved ring and a subglobose head, topped by 2 parallel linear erect stigmatic lobes. Style and stigma remaining on the ovary when the corolla is shed. *Fruit* composed of 2 free carpels which usually both develop and which dehisce adaxially; wall soft, orange inside. *Seeds* surrounded by a darker orange pulpy aril, few, rather large, obliquely ellipsoid or ovoid; at the hilar side with one deep groove to half their width, less deeply grooved at the other sides, minutely pustulate; endosperm copious, starchy, creamy, ruminant, surrounding the spatulate embryo.

Type species: *C. campanulata* K. Schum.

A monotypic African genus.

SPECIES DESCRIPTION

***Carvalhoa campanulata* K. Schum.** in Engler & Prantl, Nat. Pflanzenf. 4(2): 189. 1895; Leeuwenberg in Fl. Zambesiaca 7(2): 445, tab. 102. 1985.

Fig. 1; Map 1

Type: Mozambique: Niassa: Mossuril, Cabaceira Pequena, Rodriguez de Carvalho annis 1884–1885 (Holotype not seen, destroyed in B; lectotype: COI; other isotypes seen: K, P, Z).

Heterotypic synonyms: *C. macrophylla* K. Schum. in Engler, Bot. Jahrb. 30: 381. 1901, **syn. nov.** Type: Tanzania: T7: Kurumbi (= Ngurumbi) Mt., Goetze 1343 (holotype not seen, destroyed in B; lectotype: BR, other isotypes seen: E, K, Z; Schumann erroneously as 1143).

C. petiolata K. Schum., in op. cit. 33: 317. 1903, **syn. nov.** Type: Tanzania: T3: Usambara Mts., Derema, *Scheffler* 219 (holotype not seen, destroyed in B; lectotype: PRE).

Shrub or small *tree* 1–5 m high. *Trunk* 20 cm in diameter (teste Robson 1657). *Branches* pale grey-brown, lenticellate, with shallowly longitudinally fissured bark; branchlets glabrous or pubescent, sulcate when dry, lenticellate. *Leaves* petiolate; petioles glabrous or less often pubescent, 1–7 mm long; blade membranaceous when dry, variable in shape and size, 2–4(5) × as long as wide, 4–26 × 1.5–12 cm, acuminate and sometimes with a blunt tip at the apex, symmetric or assymmetric and cuneate, rounded or subcordate at the base, if assymmetric often cuneate on one and rounded or subcordate on the other side, entire, glabrous, with a few hairs, or less often pubescent on both surfaces; secondary veins 8–15 on each side, arcuate and anastomosing with each other and with the reticulate tertiary venation. *Inflorescences* pendulous, 4–17 × 3–10 cm, 2–4 × branched, partly more or less dichasial. *Peduncle* very thin, 1.5–7 cm long, glabrous or less often sparsely pubescent as both branches and pedicels; pedicels thin, 5–20 mm long, thickened at the apex. *Bracts* minute, sepal-like, without or with a few axillary colleters, leaving large leaf-scars. *Sepals* connate at the base, 1–1.7 × as long wide, 1.5–3.5 × 1.3–2.4 mm, triangular or ovate, acumin-

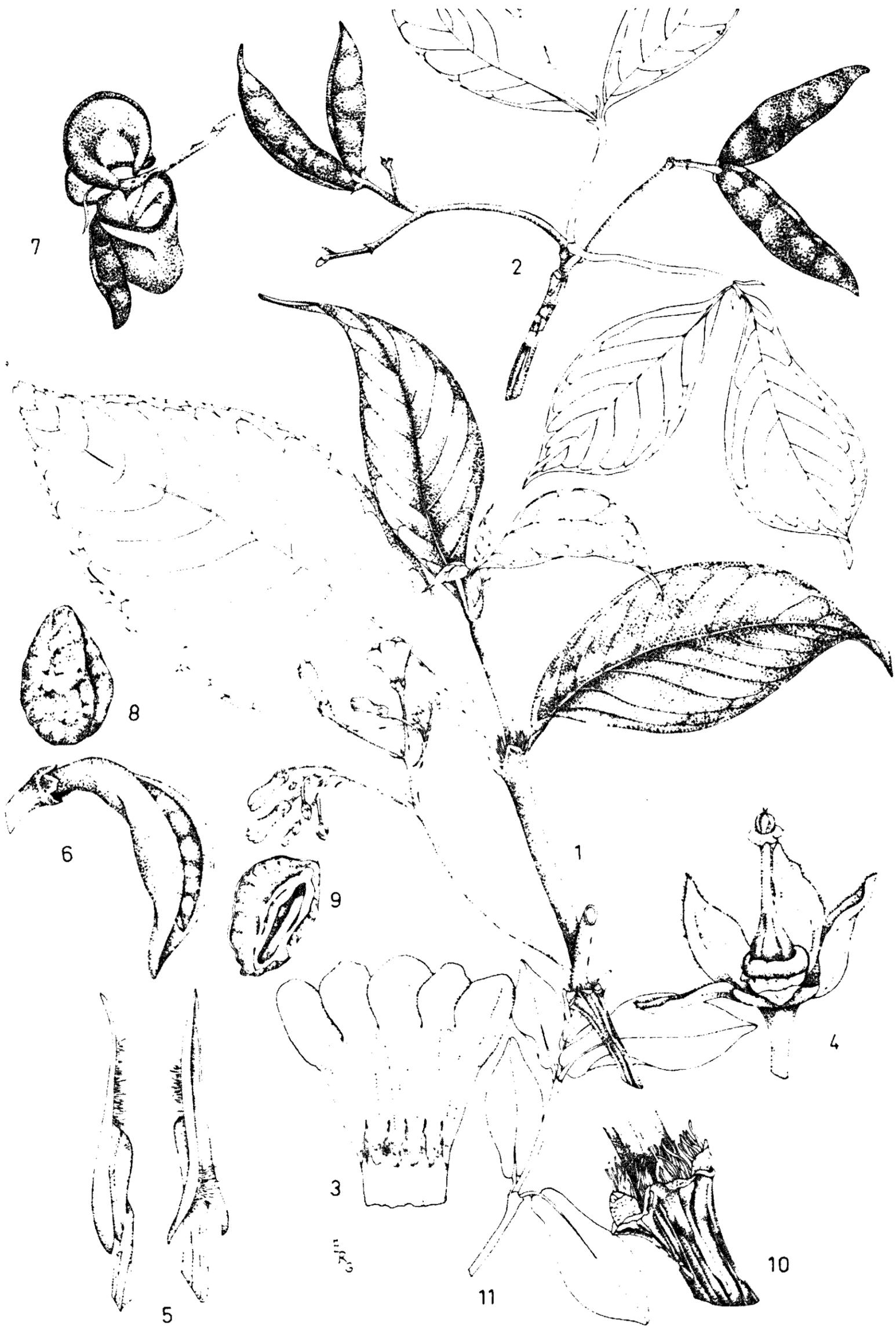
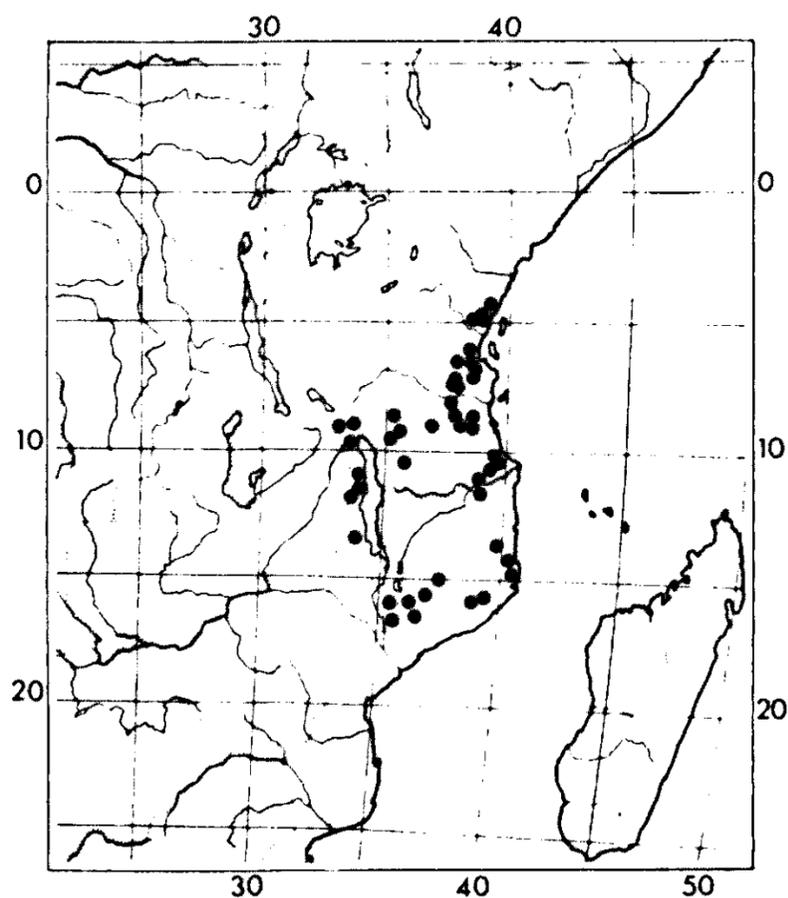


FIG. 1. *Carvalhoa campanulata*. 1, flowering branch ($\times \frac{1}{2}$), from Goetze 1343; 2, fruiting branch ($\times \frac{1}{2}$), from Baagøe et al. 93; 3, opened corolla ($\times 3$); 4, calyx with pistil ($\times 5$); 5, stamens ($\times 8$), 3-5 from Schlieben 5454a; 6, dehiscent fruit ($\times 1$), from Drummond & Hemsley 1703; 7, open fruit, bicarpellate ($\times \frac{1}{2}$); 8, seed ($\times 3\frac{1}{2}$); 9, longitudinal section of seed ($\times 3\frac{1}{2}$); 10, node with colleters ($\times 3$), 7-10 from Milne-Redhead & Taylor 935; 11, branchlet ($\times \frac{1}{2}$), from Mendonça 1136.

ate or acute, imbricate in bud, erect, glabrous, puberulous or pubescent outside, with 0–3 colleters above the base inside near both edges or occasionally with 7 colleters in a single row at the same level (the number may vary within a single flower from 0–3), ciliate or ciliolate. *Corolla* in the mature bud about 10 mm long incl. the lobes (the lobes about 0.25 of the length of the bud and not forming a head), glabrous or puberulous and then with a glabrous base outside, inside hirto-pubescent between and often just below the anthers and above sometimes puberulous; tube 2.5–7 × as long as the sepals, 8–10 mm long, slightly constricted at 4–4.5 mm and there 2–3 mm wide and above gradually widened towards the throat and there 6–9 mm wide; lobes suborbicular, 3–6 × 3.5–6 mm, rounded, entire. *Stamens* inserted 2.8–3.5 mm above the corolla base; anthers sessile (even lower half of connective connate with the corolla tube by a cushion), 3.4–3.7 × 1.2–1.5 mm, with a sterile apex. *Pistil* 4.5–5 mm long; ovary 2–2.5 × 1.5–2 × 0.8–1.5 mm; disk entire, 0.3–1 mm high; style split at the base often for even more than half its length, cylindrical, 1.2–1.5 mm long; pistil head composed of a ring 1–1.2 mm in diameter, a head 0.8 mm in diameter, and stigmoid lobes 0.2–0.4 mm long and about 0.02–0.04 mm thick. Ovules about 30 in 4 rows on one oblong placenta in each carpel. *Follicles* yellow or pale orange or less often green outside, pod-like, recurved or straight, 2–7 × as long as wide, 3–6 × 0.8–1 cm, acuminate at the apex, rounded or cuneate at the base, smooth when fresh, indented around the seeds only when dry, dehiscent throughout by an adaxial longitudinal slit and then becoming flat and up to 7.5 × 2.5 cm. Seeds in 2 irregular rows, pale brown, laterally compressed, 5.5–6 × 4–4.5 × 2.5–3 mm, flat at one side, minutely pustulate; embryo straight, white, 4.1 mm long; cotyledons suborbicular, 1.7 × 1.8 mm, rounded at the apex, subcordate at the base; rootlet 2.5 × 0.6 mm, acute at the tip.



MAP 1. *Carvalhoa campanulata*.

Distribution: Kenya, Tanzania, Malawi, and Mozambique.

Ecology: Montane rain forest or secondary forest. Alt. (300) 800–1900 m. Flowering and fruiting mainly from December to March.

Vernacular names: KENYA: K7: Mwatsaka Bara (Digo); the first word means chilies, and the second uninhabited place. The fruits show some resemblance with those of *Capsicum annum* and *C. frutescens*.

TANZANIA: T1: Libengule (Ngindu). T3: Kiigha (Kishamb.). T6: Mpilipili (near Uluguru Mts.) a name often used in Africa for the fruits of *Capsicum frutescens*, Kibarubaru (Kinguru). T7: Itoki (Safwe), Kivalika (near Mufindi). T8: Nachine (Kimwera), Lucaa (Kingindo), Mnongole (Wamwera).

MOZAMBIQUE: Niassa: Cuireuire (near Memba), Nantiu (Macua).

Specimens examined:

KENYA: K7: Shimba Hills, Makadara For., Bamps 6306 (BR); Longo Mwangandi area, Magogo & Glover 893 (K, PRE).

TANZANIA: sin. loc., Busse 1102 (G, HBG). T1: Balenje, Rodgers 1226B (EA). T3: E. Usambara Mts., Faulkner 1498 (K); *ibid.*, near Ngambo, Peter 58174 partly (WAG); between Ngomei and Ngambo, Peter 58291 (B); Bulwa, near Zigi R., Williams 643 (K); Derema, Scheffler 219 (PRE, type of *C. petiolata*); between Derema and Longuza, Peter 58290 (B, WAG); between Msassa and Derema, Peter 58235 (B, WAG); Amani, Baagøe et al. 93 (C, WAG); *ibid.*, Brunthaler 133 (WU); *ibid.*, Greenway 5915 (K); *ibid.*, Peter 58104a (B), 58141 (B, WAG), 58159 (B), 58236 (B); *ibid.*, Warnecke 224 (A, BM, E, K, Z); *ibid.*, Braun 1577 (EA) = (?) Zimmermann 1577 (EA); *ibid.*, Grote 7708 (B, EA); herb. Amani 223 (B); *ibid.*, Kwamkujo R., Peter 58158 (B); SW of Amani, Drummond & Hemsley 3461 (B, BR, K, S); Amani distr., Moreau 303 (K); *ibid.*, near Kizugu, Williams 641 (BR, K); Gonja Mt., Wessler 810 (EA); between Amani and Monga, Peter 58213 (B); Monga, Peter 58130 (B, WAG), 58282 (B), 58292 (B); between Maneno Mbangi and Kwantili, Peter 58275 (B); Segoma, Bally 170 (K); W. Usambara Mts., near Garaya, Peter 57076 (B), 58195 (B, WAG). T6: Kilosa Distr., Mandege, Robertson 157a (K); Mnyera Mt., Ukaguru Mts., Cribb et al. 10491 (K); *ibid.*, Mabberley 1342 (K), 1407 (K); *ibid.*, Thulin & Mhoro 2758 (EA, K, UPS, WAG); Mikumi Nat. Park, Procter 3620 (K); Maskuti, Robertson 388 (K); S. Ngurus, Wigg 15 (EA); Morogoro, Bruce 191 (BR); Turiani, Milne-Redhead & Taylor 7413 (B, BR, K, LISC); *ibid.*, Semsei 1460 (K), 1897 (K); Uluguru Mts., Vaughan 2462 (BM); *ibid.*, Schlieben 3253 (B, BM, G, K, LISC, M, MO, Z); *ibid.*, Kituanda, Bruce 212 (BM, K); Mtombozi, Haarer 1939 (K, LISC); Mwere Valley, Harris et al. 5092 (K, WAG); Silesian Mission, Peter 39133 (B, WAG), 58147 (B, WAG), 58299 (B, WAG); Bunduki F.R., Paulo 55 (K); E of Mwere R., Polhill & Wingfield 4609 (K); Morningside, Cribb & Grey-Wilson 10432 (K); *ibid.*, Eggeling 6463 (K); *ibid.*, Paulo 88 (K); between Morningside and Bondwa, Wingfield 3525 (EA); Tegetero, Drummond & Hemsley 1703 (B, K, S), 1807 (K); *ibid.*, Pocs 6426/0 (BP); Chonwe Mts., Akeroyd & Mayuga 24 (EA); Ifakara, Haerdi 181/0 (G, WAG, Z); Mahenge Distr., Kwirow F.R., Cribb et al. 11017 (K); Sali, Cribb et al. 11154 (K). T7: Poroto Mts., Cribb et al. 11262 (K); Rungwe Distr., Kiwira R., Procter 2349 (K); *ibid.*, Richards 17611 (K); Ilembo, Umalila, Leedal 1341 (EA); Kondeland, Stolz 84 (E); Ngurumbi (Kurumbi) Mt., Goetze 1343 (BR, E, K, Z, type of *C. macrophylla*); Irambo, Leedal 3951 (K); Rungwe Mt., Richards 6740 (K), 6794 (K); Kyimbila, Stolz 375 (BM, BR, G, GH, HBG, K, L, M, MO, S, US, W, WAG, Z); Mwakaleli, Ilongelo For., Hepper et al. 5433 (K); Soroto For. Milo, Richards 14070 (K); Mufindi, Paget-Wilkes 35 (MO); *ibid.*, St. Clair-Thompson 634 (K); *ibid.*, Polhill & Paulo 1786 (B, BR, K, LISC, MO); Lupeme Tea Est., Perdue & Kibuwa 11336 (EA); Kigogo R., Mufindi, Polhill & Paulo 1796 (K); *ibid.*, Richards 15747 (BR, K); Massagati, Schlieben 1471 (BM, G, HBG, K, M, S, Z); Ditima, Schlieben 1397 (B, BR, LISC, MO); Gologolo Mts., Thulin & Mhoro 971 (UPS). To: Selous Game Res., Mpanga panga, Rodgers 932 (EA); Tundu Hills, Ludanga 1191 (BR, K); *ibid.*, Vollesen & Ludanga 2461 (EA); Luwisa-Kiteza F.R., Semsei 2563 (K); Matenga Mts., Zerny 130 (W); E. Matagoro Hills, NE of Songea, Milne-Redhead & Taylor 9351 (BR, K); Rondo F.R., Gillett 17987 (K); *ibid.*, Bryce 6020 (EA); *ibid.*, Mchinjiri, Semsei 645 (K); Lutambo Lake, Schlieben 5454a (B, BR); Kitangari, Gillman 1303 (K); Newela, Hay 28

(K); Sudi, Gillman 1463 (EA).

MOZAMBIQUE: Niassa: near Nambiti, near Mueda-Negomano Rd., Gomes e Sousa 4559 (COI, K, PRE), 4561 (COI, K, PRE, SRGH); near Namapa, along road to Nacaroa, Mendonça 1136 (LISC); *ibid.*, Torre & Paiva 9582 (LISC); Memba, M.F. de Carvalho 468 (K, LMU); *ibid.*, Torre & Paiva 9481 (LISC); Itoculo, Torre 9370 (LISC); Malema, Inago Mts., Torre & Paiva 11290 (LISC); Mussorila Cabeceira (= Mossuril, Cabeceira Pequena), R. de Carvalho annis 1884–1885 (COI, K, P, Z, type); km 25 Nametil-Napmula Rd., Torre & Correira 17446 (LISC); Chalaua, Torre & Correira 17283 (LISC). Zambésia: Namuli Mts., Mendonça 2233 (LISC); Gurué, Hornby 2740 (PRE); *ibid.*, Barbosa & M.F. de Carvalho 4482 (LMA), 4495 (LMA); *ibid.*, Mendonça 2192 (LISC); *ibid.*, Torre & Correira 14830 (LISC); Tumbine Mts., Correira 494 (LISC); *ibid.*, Hilliard & Burt 6276 (E, LMU); *ibid.*, Mendonça 1401 (LISC); Milange Mts., Torre 4590 (LISC); Chiperone Mts., Correira & Marques 2527 (LMU); Tacuane, Faulkner 124 (K, S); *ibid.*, Torre & Correira 15820 (LISC).

MALAWI: North: Misuki Hills, Pawek 3235 (K); *ibid.*, Mughesse For., Pawek 6203 (SRGH, UC); Wilindi For., Chapman 252 (K, MO); *ibid.*, Richards 10618 (BR, K); *ibid.*, Robson & Fanshawe 577 (BM, BR, K, LISC, SRGH); Kasumbi, Salubeni 3118 (MO); 5 km E of Mughese, Phillips 2896 (MO); 8 km E of Chisenga, Pawek 12208 (K, UC, WAG); 8 km E of Mzuzu, Pawek 2356 (K), 8115 (K, MO); *ibid.*, Phillips 3020 (WAG), 3305 (WAG); Chikangawa For., Salubeni 1214 (K, SRGH); Vipya, Chapman 285 (BM, K); *ibid.*, Banda 643 (K, SRGH); 40 km SW of Mzuzu, Pawek 11277 (MO); between Nzimbi R. and Luwawa, Chapman 1493 (SRGH). Central: Mt. Nchisi, Hilliard & Burt 4478 (E, K); *ibid.*, Robson & Steele 1657 (BM, K, LISC, SRGH); Nchisi F.R., Brummit & Evans 9386 (K); *ibid.*, Chapman 1251 (SRGH); *ibid.*, Salubeni 614 (SRGH). South: Mt. Mulanje, Whyte Sept. 1891 (BM); *ibid.*, Brummit & Banda 9192 (K, WAG); *ibid.*, Ruo Gorge, Hilliard & Burt 4636 (E, K); *ibid.*, Müller 1486 (K, PRE, SRGH); *ibid.*, Lujeri, Richards 16731 (K).

Notes: After comparison of the types of *C. campanulata*, *C. macrophylla*, and *C. petiolata* and the other specimens cited, the present author conclude that they all belong to a single species. The type of *C. campanulata* has small subsessile hairy leaves with a subcordate base and hairy flowers. The type of *C. macrophylla* has much larger shortly petiolate almost glabrous leaves with a cuneate base and almost glabrous flowers. The type of *C. petiolata* has shortly petiolate glabrous leaves of intermediate size with a cuneate base; the Pretoria sheet has no flowers. A great many of the other specimens examined are intermediate in the foregoing characters. Large subsessile glabrous leaves have been observed in, for example, Busse 1102 (HBG), Faulkner 124, Schlieben 1471, and Stolz 375; small glabrous shortly petiolate leaves with a cuneate base occur in Mendonça 2192, 2233, Müller 1486, and Peter 58299. Small hair shortly petiolate leaves with a cuneate base are found in Chapman 252 and Hornby 2740. Finally, Torre & Correira 17446 and Busse 1122 (G) bear small glabrous subsessile leaves with a subcordate base. The leaves of *Carvalhoa* may dry fairly pale, a character not correlating with any other; it therefore cannot be used for distinguishing species. The flowers of the type of *C. macrophylla* bear some hairs, while those of the type of *C. campanulata* are more hairy. Flowers with the densest indumentum are observed in Mendonça 1136 and Torre & Paiva 9481. In most other characters the *Carvalhoa* specimens seen are remarkably similar.

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PHYTOCHEMISTRY AND USES OF CARVALHOA

N. G. BISSET

HAERDI (1964) obtained positive responses in screening tests for the presence of alkaloids in *C. campanulata (macrophylla)*. The occurrence of alkaloids thus implied is in accord with the systematic position of the genus in the family. Tests for saponins were also positive. Nothing further appears to be known about the chemical constituents of the plant.

In *Tanzania* the following uses have been noted: The rasped roots are applied in cases of stomatitis. A decoction of the roots is drunk as a vermifuge, and together with other ingredients, against gonorrhoea and bilharzia (HAERDI, 1964; cf. the annotation to *P. J. Greenway 5915*, 1940). In *Mozambique*, the plant is used in the treatment of hernia (annotations to *M. F. de Carvalho 468* (1961) and *A. R. Torre & J. Paiva 9582* (1963)).

REFERENCES

F. HAERDI, Die Eingeborenen-Heilpflanzen des Ulanga-Distriktes Tanganyikas (Ostafrika), *Acta Tropica*, Suppl. 8, 129–133 (1964).