filaments; staminodes relatively small, triangular-ovate, acute, c. (0.65-)0.7-1.0 mm long, 0.39-0.62 mm broad, tip and abaxial side pilose, adaxial side flattened, glabrous, with two conspicuous small elliptical protuberances at the base in lateral/abaxial side, stalks conspicuous, stout, pilose; gynoecium immersed in the tube, glabrous, c. 1.77-2.67(-4.3) mm long, ovary ellipsoid, c. 0.59-0.93 mm long, 0.2-0.5 mm in diam., gradually merging into the cylindrical-conical, glabrous, 1.1-1.8 mm long style with small, discoid stigma. *Immature fruits* green (Fig. 26 A), *mature* ones yellow, ellipsoid to globose, many-ribbed (Fig. 9 I; 22 O; 26 B-D), 1.86-3.22 cm long ($\bar{X}$ = 2.29 ± 0.24 cm; *N* = 53), 1.42-2.32 cm broad ($\bar{X}$ = 1.74 ± 0.17 cm; *N* = 53); flesh portion originated from the accrescent flower tube relatively thin.

Phenology - Flower buds in December; flowers at anthesis in January and June. Immature fruits in March and August; mature fruits in January, February, April, and June.

Distribution and habitat (Fig. 27) - Up to now, the species is only known from collections of São Paulo state, inhabiting the Montane Ombrophilous Dense Forest, from c. 600 to c. 1000 m altitude. Its populations are relatively abundant at Parque Estadual Carlos Botelho and Parque Estadual da Serra do Mar, Núcleo Cunha-Indaiá. The population at Estação Biológica de Paranapiacaba most possibly suffers from the harmful effects of pollution in recent decades as no individual has been recently located.

Uses - It is known that muriquis (woolly spider monkeys) at P.E. Carlos Botelho consume the fruit and as such contribute to the dispersal of the species.

Comments - *Cryptocarya botelhensis* is recognised by its very characteristic leaf shape, with the slender acumen representing 1/6 to 1/4 of the entire length of the leaf, inflorescences and flowers nearly glabrous, and by its fruits manifestly ribbed, which are constant characters in its different populations. In the state of São Paulo, the species is sympatric with *C. mandioccana*, from which it can be easily distinguished by the absence of leaf indument. A close relative of *C. botelhensis* seems to be *C. micrantha*, which differs mainly by its inflorescences and flowers densely pubescent, and by its fruits usually larger and less clearly ribbed. However, vegetative material of some collections could be a source of confusion between these species.

Specimens examined - 26 (listed in appendix 13.3).

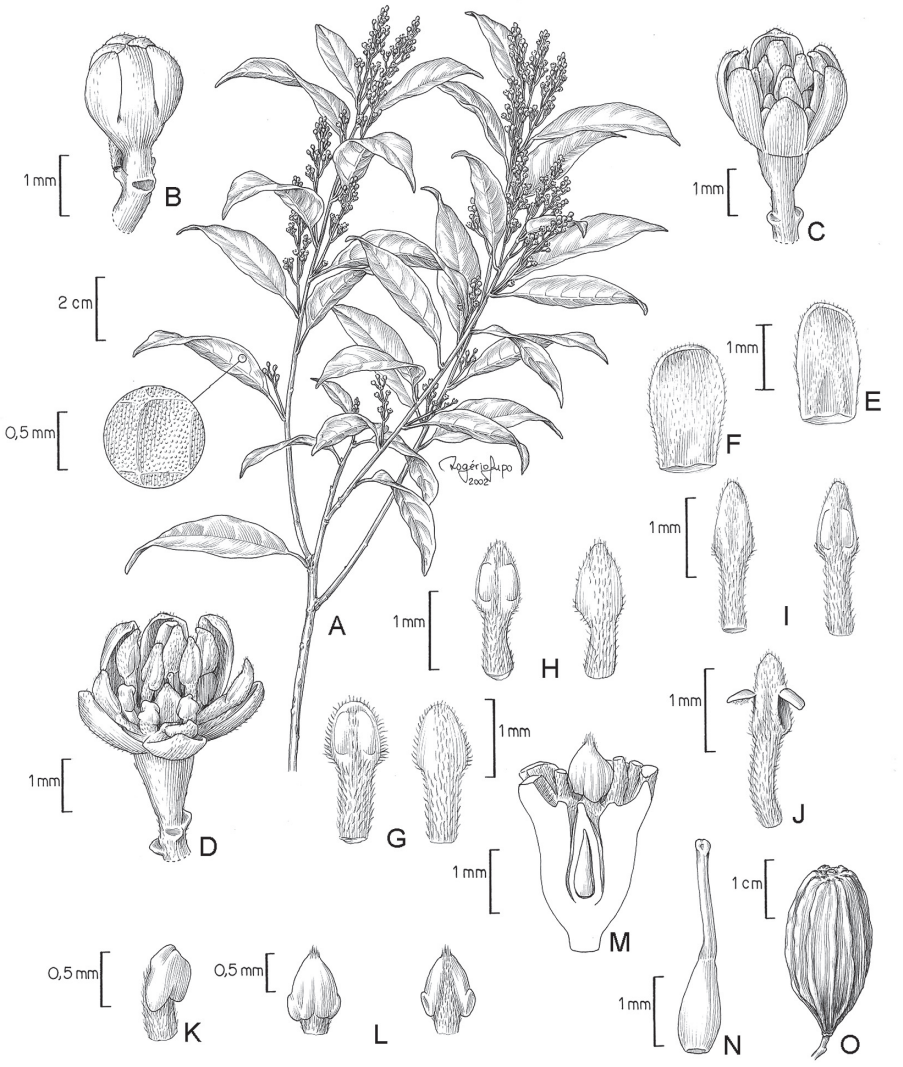

Fig. 22. *Cryptocarya botelhensis* P.L.R. de Moraes. A. habitus (from *Moraes 2311*). Flower pieces (from *Moraes 2325*): B. Flower bud; C-D. Flowers at anthesis; E-F. Tepals of inner and outer whorls, respectively; G. Stamens of whorl I; H. Stamens of whorl II; I-J. Stamens of whorl III; K. Gland; L. Staminodes; M. Cross section of flower tube; N. Gynoecium; O. Fruit (from *Moraes 1264*).

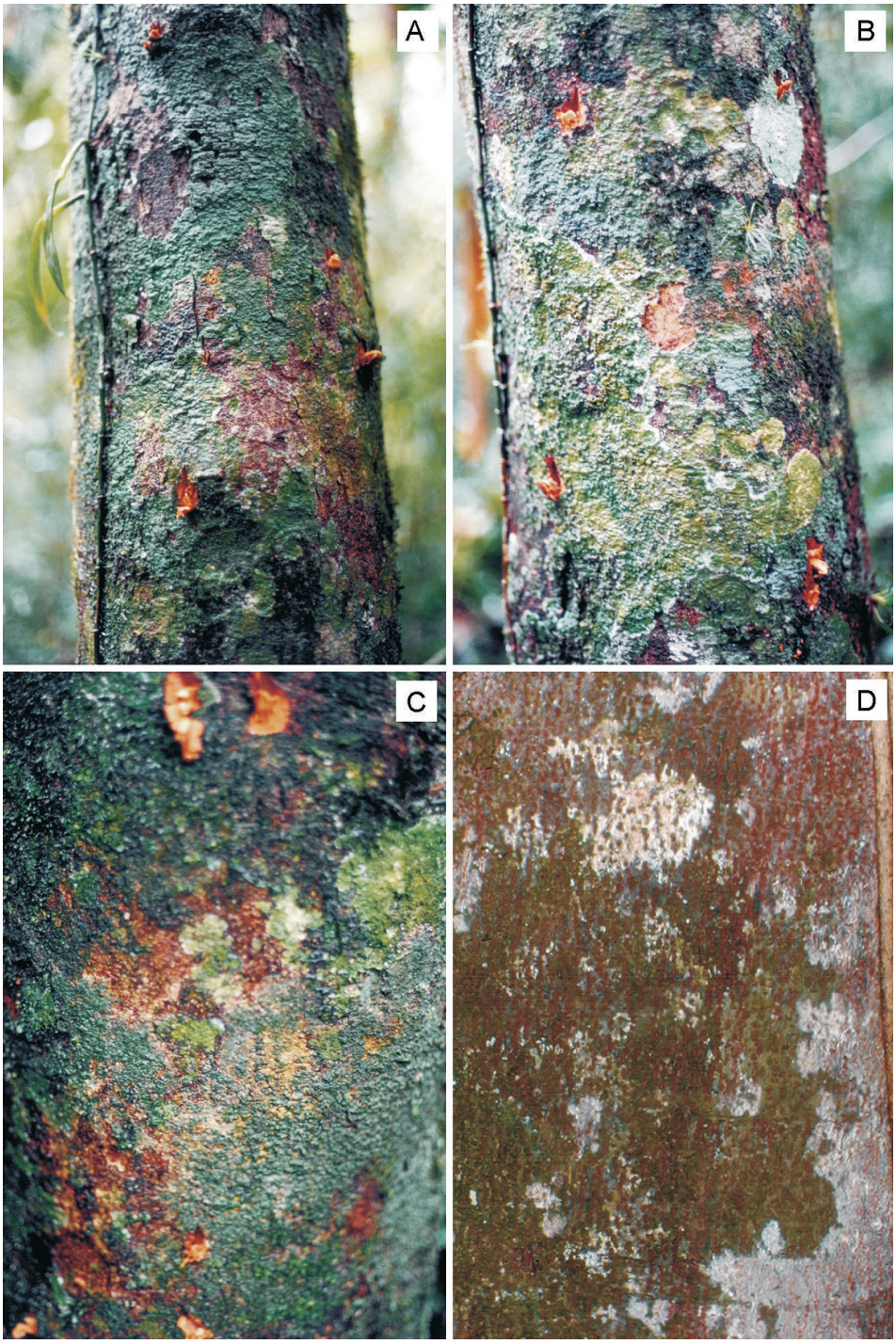

Fig. 23. Barks of *Cryptocarya botelhensis* P.L.R. de Moraes. A-D. Collected at P.E. Carlos Botelho, SP. (Photographs by author).

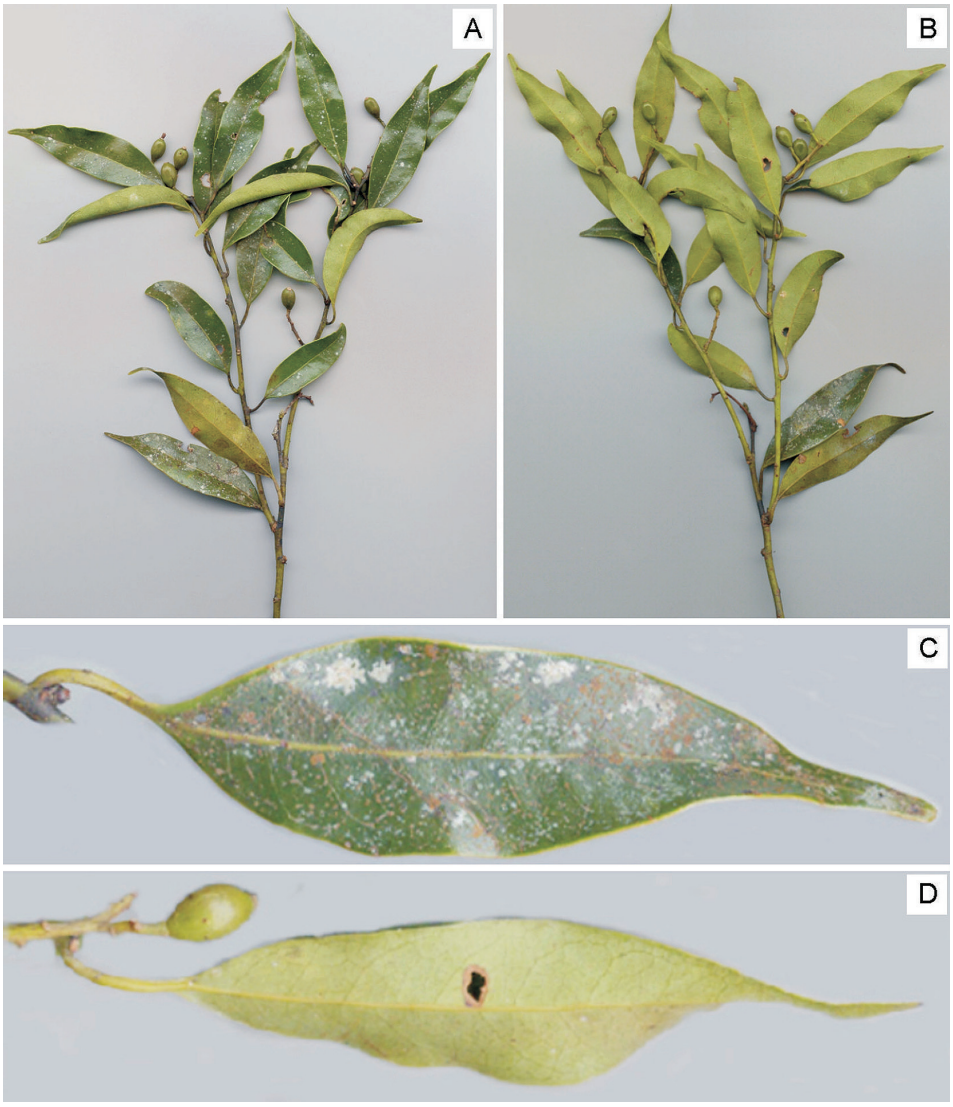

Fig. 24. Branches of *Cryptocarya botelhensis* P.L.R. de Moraes. A-B. Collected at P.E. Carlos Botelho, SP; C-D. Details of leaves. (Photographs by author).

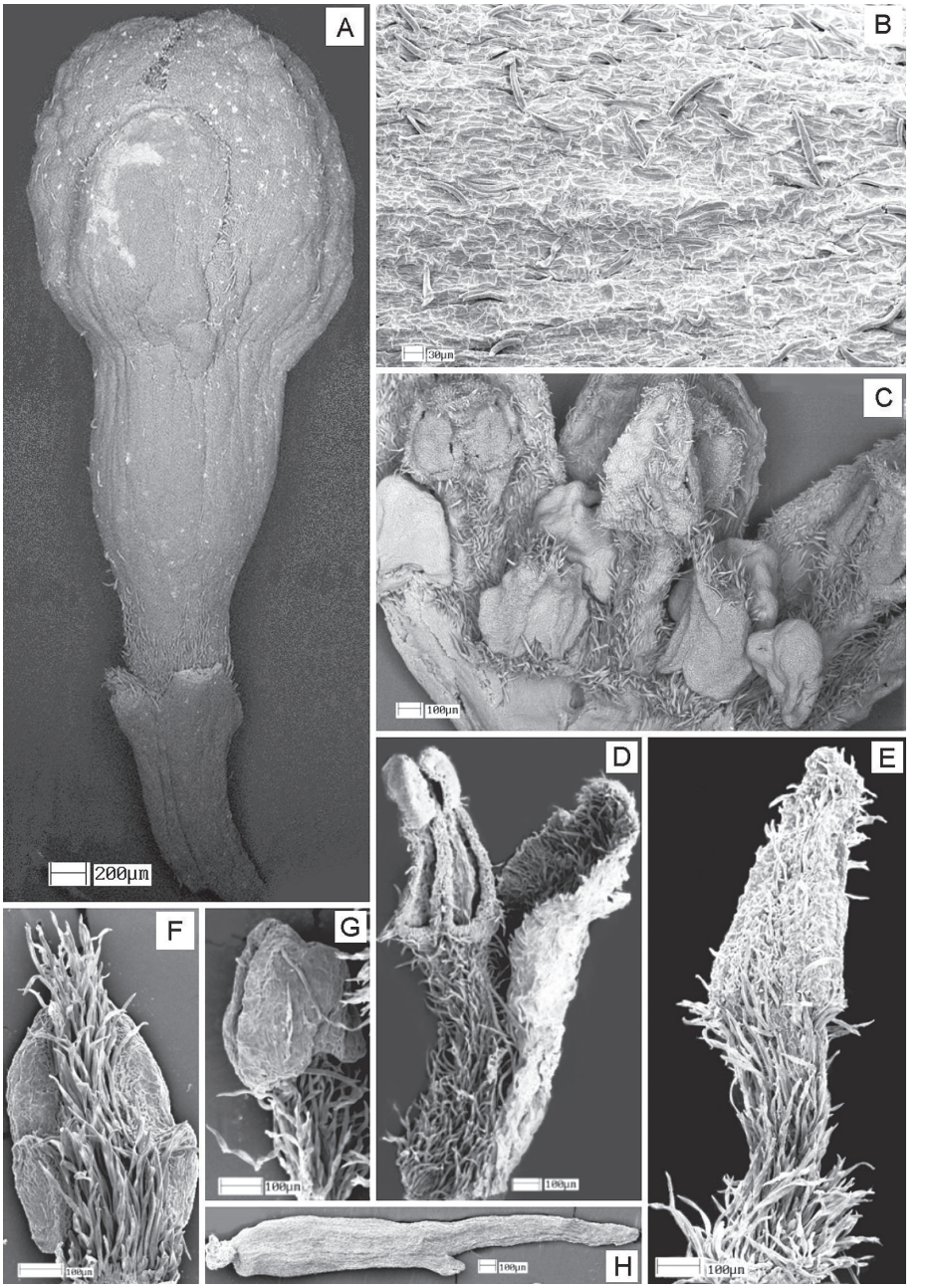

Fig. 25. SEM micrographs of flowers of *Cryptocarya botelhensis* P.L.R. de Moraes. A. Flower bud (from *Moraes 2327*, ESA); B. External indument (from *Moraes 2324*, ESA); C. Longitudinal section of flower (from *Moraes 2327*, ESA); D. Adaxial side of stamen of the androecial whorl II, introrse (from *Moraes 2324*, ESA); E. Adaxial side of stamen of the androecial whorl III, lateral-extrorse (from *Moraes 2324*, ESA); F. Adaxial side of staminode (from *Moraes 2324*, ESA); G. Abaxial side of detail of gland (from *Moraes 2324*, ESA); H. Gynoecium (from *Moraes 2324*, ESA). (Photomicrographs by author).

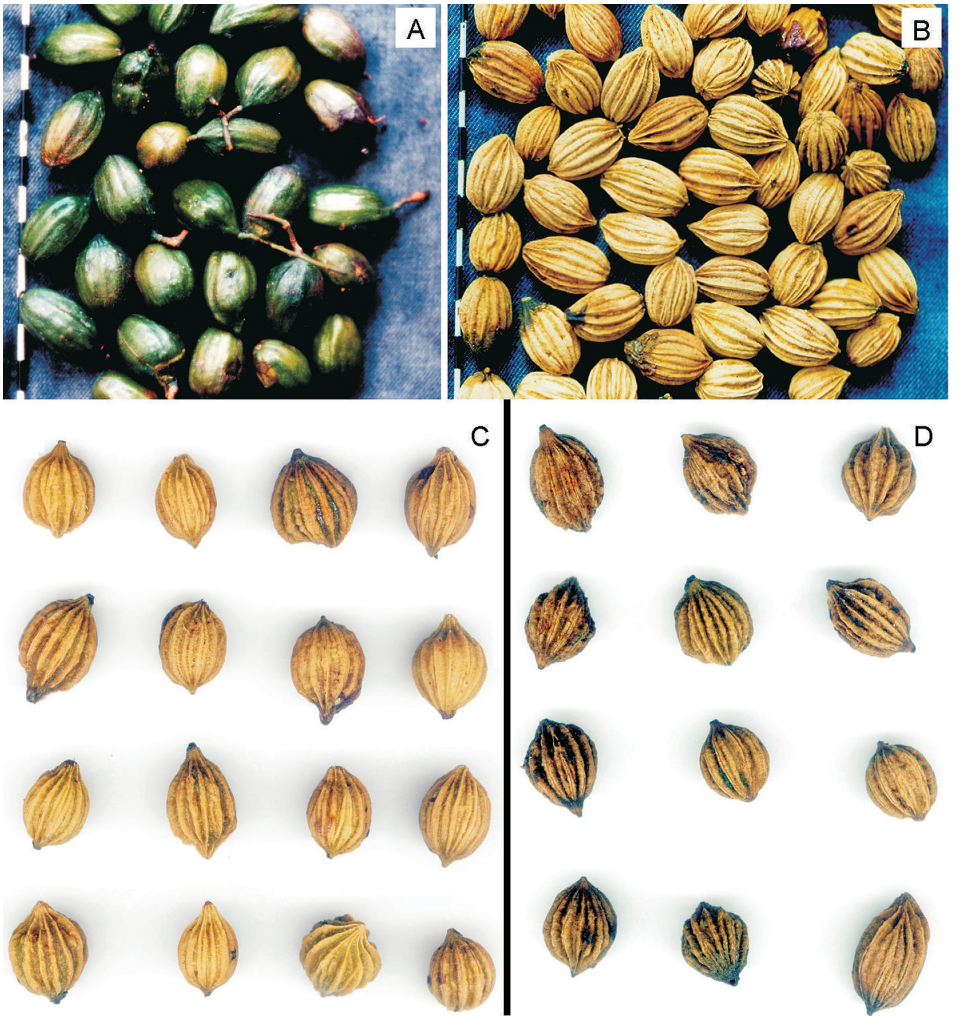

Fig. 26. *Cryptocarya botelhensis* P.L.R. de Moraes. A-B. Fruits and diaspores collected at P.E. Carlos Botelho, SP, February 1996; C. Diaspores collected at P.E. Serra do Mar, Núcleo Cunha-Indaiá, SP, February 2002; D. Diaspores collected at P.E. Serra do Mar, Núcleo Santa Virgínia, SP, August 2001. (Photographs by author).

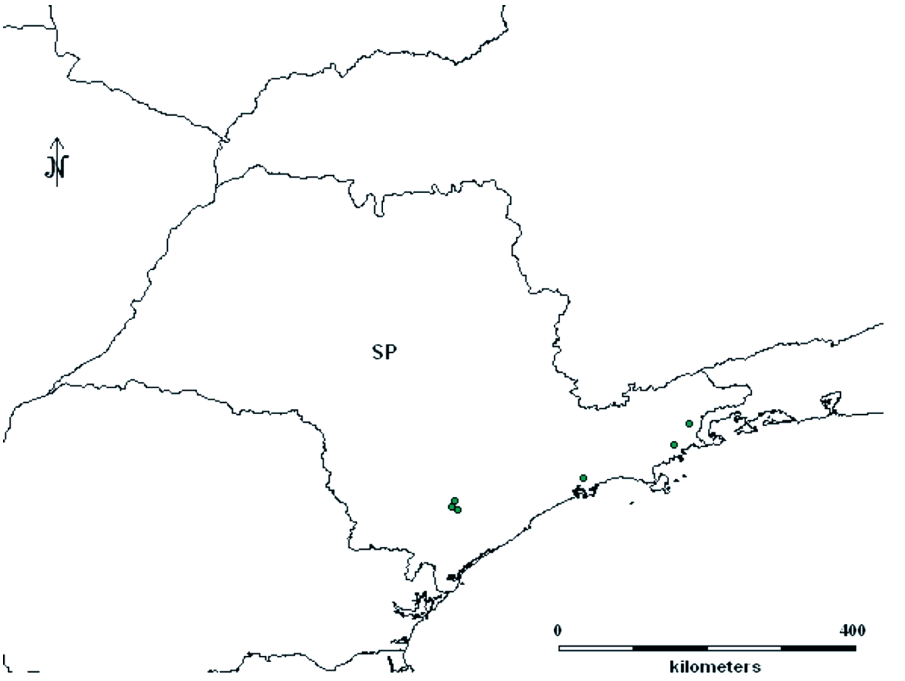

Fig. 27. Distribution of *Cryptocarya botelhensis* P.L.R. de Moraes.

3. *Cryptocarya citriformis* (Vellozo) P.L.R. de Moraes

Taxon 54(3): 791 (2005) ≡ *Laurus citriformis* Vellozo, *Fl. Flumin*.: 251 (1829 [1825]). – Lectotype (designated by Moraes, 2005a): Brazil (original plate! on parchment of "Flora Fluminensis" [photos in UEC!] in the Manuscript Section of the Biblioteca Nacional of Rio de Janeiro, of *Fl. Flumin. Icon*. 4: 53 (1831 [1827]). Plate III A, B (cf. Appendix 13.5).

= *Cryptocarya minima* Mez, *Jahrb. Königl. Bot. Gart. Berlin* 5: 14 (1889). ≡ *Aydendron floribundum* Meissner, in *Prodr*. (DC.) 15(1): 88 (1864). – Holotype: Brazil. Rio de Janeiro, "In sylv. Mandiocca", Sep. 1823 (fl.), *L. Riedel s.n*. [LE, photo in UEC!; isotypes: B†, G (negatives in UEC!), K! (cibachrome in UEC!), L-0036201! (photo in UEC!), LE (2 sheets, photos in UEC!), NY-00354874! (photo in UEC!), NY-00354875! (photo in UEC!), OXF (left-hand specimen, photo in UEC!)]. Plate IV A (cf. Appendix 13.5).

= *Cryptocarya hypoleuca* Mez, in *Ann. K. K. Naturhist. Hofmus*. (Wien) 22(2/3): 139 (1907). – Lectotype (designated by Moraes, 2005a): Brazil. Rio de Janeiro, "Cantagallo", Sep. (fl.), *T. Peckolt 166* [U, photo in UEC! Syntype: W†)]. Plate IV B (cf. Appendix 13.5).

Illustrations - Meissner (1866, *Fl. Bras*. 5(2): t. 62, 105 – II), Vattimo-Gil (1966b, Fig. 54, leaf; 58, fruit).

Vernacular names - Canela-abacate, canela-branca, canela-do-brejo, lombo-de-jacaré, louro-abacate.

Description - *Trees* up to 35 m tall, trunk cylindrical, DBH 21.01-56.66 cm ($\bar{X}$ = 31.13 ± 14.64 cm; *N* = 5), bark brownish to rusty, relatively rough to slightly rugose, with lenticels (Fig. 28). *Branches* cylindrical, glabrous, light to dark-brown or grayish, longitudinally striate to sulcate, with lenticels. *Branchlets* 5 cm below terminal bud c. 1.7-2.4 mm in diam., slender, initially angular from the beginning, sparse to densely yellowish or rusty lanuginose-tomentellous, with ± short, ± appressed hairs; terminal buds yellowish or rusty lanuginose – tomentellous; some collections with perules at terminal and/or axillary buds. *Petioles* 4.5-10.2 mm long, 0.8-2.3 mm thick, hardly canaliculate to canaliculate, roundish below, rugose, flattish above, sparse to densely yellowish or rusty-tomentellous, with short, curled, ± ascending hairs. *Leaves* alternate (Fig. 29), elliptical to lanceolate or ovate to obovate, 5.0-16.8 cm long, 1.4-6.2 cm broad, chartaceous to stiffly chartaceous, tip obtusely, broadly, shortly acuminate, or roundish, base acute, margin flat, hardly recurved, sclerified; above slightly shining, green, glabrous, densely, rather obscurely to prominulously reticulate; beneath dull, pruinose and/or glaucous in some collections, yellowish tomentellous, with ± short, ± appressed hairs, or yellowish to rusty lanuginose-tomentose, with ± short, ± ascending to erect hairs; midrib impressed to level or flattish above, prominent below, secondary veins erect-patent (6-9 per side), slightly arcuate, slightly prominulous above, prominent to prominulous below; tertiary venation densely reticulate, slightly prominulous below; venation pattern camptodromous-brochidodromous. *Inflorescences* axillary, paniculate, rather many-flowered, 0.7-1.7 mm in diam. at base, 2.3-9.7 cm long, dense, narrowly pyramidal, densely yellowish to rusty lanuginose-tomentellous, or sparse yellowish tomentellous, with ± short, ± appressed hairs; peduncles short and thick; bracteoles minute, densely tomentose. *Flower buds* green to greenish. *Flowers* greenish, yellow to yellowish, densely rusty-tomentellous, (2.0-)2.74-3.16(-4.3) mm long, (1.1-)1.3-1.72(-2.2)

mm in diam. at apex (Fig. 30); tube slender, subcylindrical-urceolate, glabrous within, (0.8-)1.17-1.61(-2.0) mm long, 0.6-1.1 mm in diam.; pedicels densely tomentellous, (0.5-)0.61-0.88(-1.1) mm long; tepals equal, rather patent, 0.7-0.94(-1.8) mm long, c. 0.4-0.65(-0.97) mm broad, scale-shaped, incurved, ovate, acute, pilose within; stamens exserted; stamens of whorls I and II introrse, 0.57-1.0 mm long ($\bar{X}$ = 0.72 ± 0.12 mm; *N* = 19), anthers glabrous, broadly ovate to trapeziform, c. 0.2-0.83 mm long ($\bar{X}$ = 0.44 ± 0.12 mm; *N* = 37), c. 0.3-0.53 mm broad ($\bar{X}$ = 0.42 ± 0.06 mm; *N* = 30), connectives obtuse, slightly prolonged beyond the large sporangia, filaments slender, densely villose-hirsute, slightly shorter, adnate to the tepals; stamens of whorl III lateral, c. 0.7-1.16 mm long ($\bar{X}$ = 0.89 ± 0.16 mm; *N* = 12), anthers glabrous, ovate, c. 0.39-0.88 mm long ($\bar{X}$ = 0.58 ± 0.15 mm; *N* = 14), c. 0.22-0.37 mm broad ($\bar{X}$ = 0.28 ± 0.06 mm; *N* = 6), connectives obtuse to truncate, slightly prolonged beyond the sporangia, filaments slightly narrower, about as long, densely hirsute; glands small, globose, 0.2-0.5 mm long ($\bar{X}$ = 0.33 ± 0.09 mm; *N* = 13), 0.27-0.45 mm broad ($\bar{X}$ = 0.35 ± 0.08 mm; *N* = 5), depressed, (sub)sessile; staminodes slender, minute, stipitiform, acute, c. 0.47-0.95 mm long ($\bar{X}$ = 0.64 ± 0.17 mm; *N* = 12), c. 0.55 mm broad, tip and abaxial side pilose, stalks inconspicuous, pilose; gynoecium exserted, glabrous, 1.6-3.3 mm long, ovary ellipsoid, 0.5-0.76(-1.1) mm long ($\bar{X}$ = 0.65 ± 0.08 mm; *N* = 7), 0.27-0.42 mm in diam. ($\bar{X}$ = 0.34 ± 0.06 mm; *N* = 7), gradually merging into the about 1.1-1.83(-2.2) mm long ($\bar{X}$ = 1.43 ± 0.25 mm; *N* = 7), slender style with small, discoid stigma. *Mature fruits* brown, large, oblong-oval, smooth, 3.91-11.0 cm long ($\bar{X}$ = 6.86 ± 1.51 cm; *N* = 20), 3.0-6.27 cm diam. ($\bar{X}$ = 4.89 ± 0.84 cm; *N* = 20), with many broad, obtuse, longitudinal ribs (Fig. 9 D; 31 B); flesh portion originated from the accrescent flower tube relatively thick.

Phenology - Flowering material in July to September. Immature fruits in June to August; mature fruits in June, September, and October.

Distribution and habitat (Fig. 32) - Species sparsely distributed from Bahia to Rio de Janeiro, mostly collected in the Ombrophilous Dense Forest, but also in gallery and hygrophilous (swamp) forests, from 10 to c. 800 m altitude.

Uses - According to Pio Corrêa (1926) the wood is white and porose and thus suitable for carpentry and woodworking; cooked leaves are recommended for washing ulcerations, the pericarp of fruits is strongly astringent, and seeds are tonic and efficient against leucorrhoea (Dragendorff, 1898; Pio Corrêa, 1926).

Comments - *Cryptocarya citriformis* is recognised by its pubescent branchlets, with ± short, ± appressed hairs, leaves chartaceous, lower surface pruinose, pubescent, frequently glaucous, with secondary veins erect-patent, prominent to prominulous, inflorescences and flowers tomentellous, tube slender, stamens and gynoecium exserted, and mostly by its fruits that are unusually large for the genus. The species is closely related to its partly sympatric *C. saligna*, from which it can only easily be discriminated by examination of the fruiting material. In its vegetative characters *C. citriformis* is almost undistinguishable from some populations of *C. saligna* (mainly those of *C. longistyla* pattern), and therefore sterile specimens and individuals with very immature flowers or fruits are difficult

to identify. Nevertheless, the leaves glabrous on both surfaces, with papillae inconspicuous on the lower surface, which are usually found in the latter species, in most cases allows to discriminate between both species.

Specimens examined – 15 (listed in appendix 13.3).

Fig. 28. Appearance of bark of *Cryptocarya citriformis* (Vellozo) P.L.R. de Moraes, Serra da Estrela, Petrópolis, RJ. (Photographs by author).

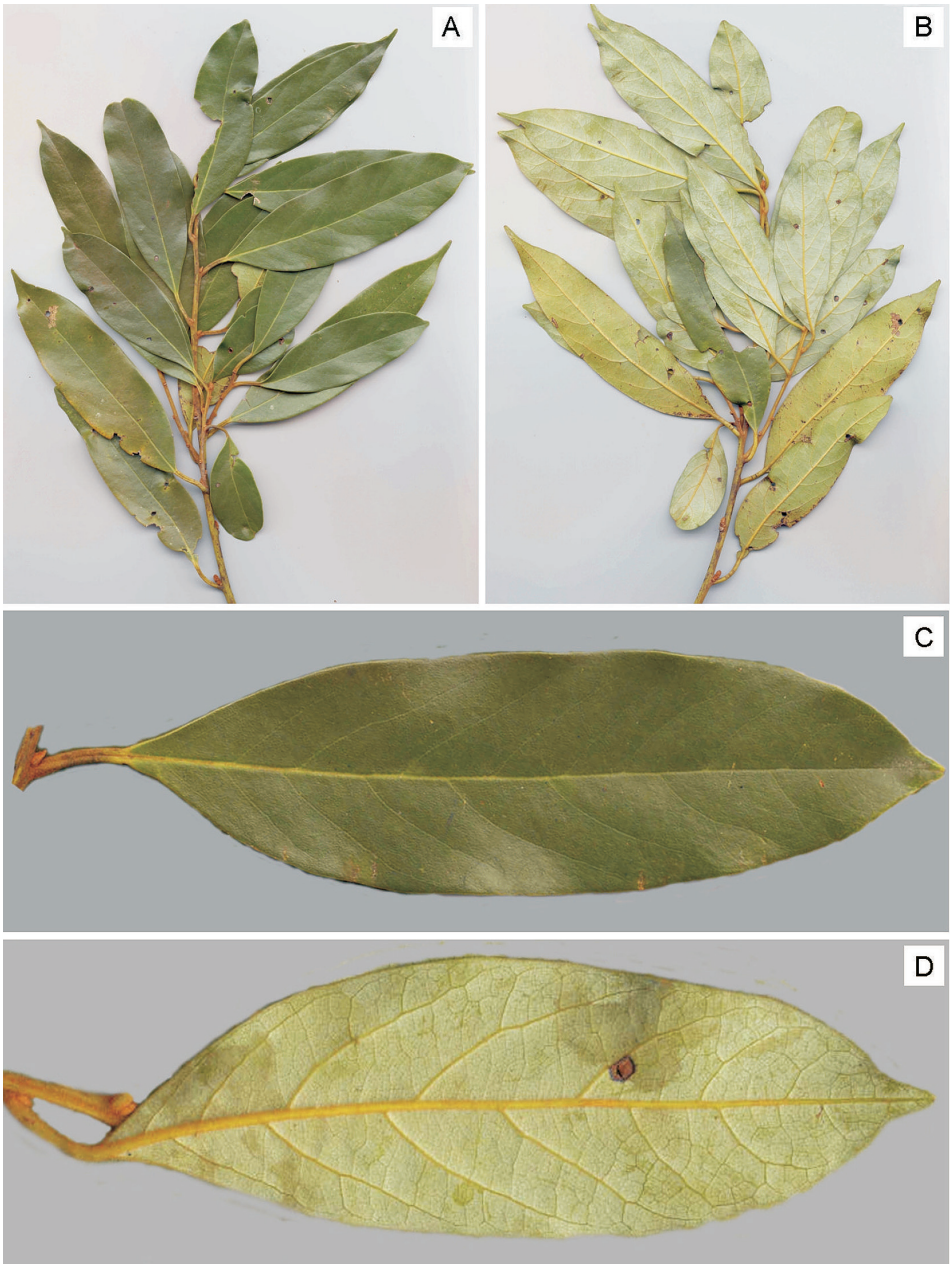

Fig. 29. Branches of *Cryptocarya citriformis* (Vellozo) P.L.R. de Moraes. A-B. Collected at Serra da Estrela, Petrópolis; C-D. Detail of leaves. (Photographs by author).

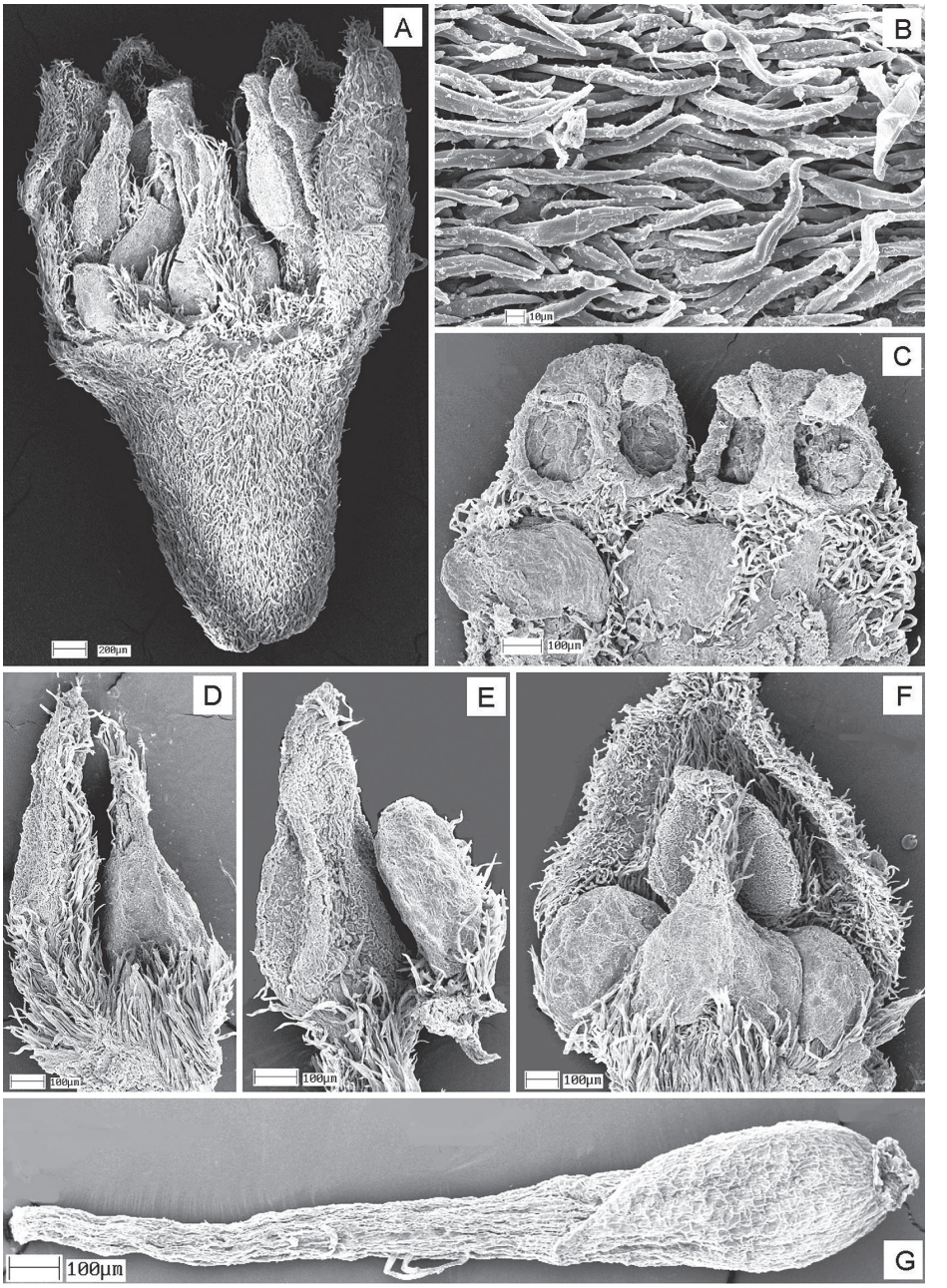

Fig. 30. SEM micrographs of flowers of *Cryptocarya citriformis* (Vellozo) P.L.R. de Moraes. A. Flower bud; B. External indumenta; C. Adaxial side of stamens of the androecial whorls I and II, introrses, and glands; D. Lateral side of stamen of the androecial whorl III, lateral-extrorse, and staminode; E. Abaxial side of stamen of the androecial whorl III, lateral-extrorse, and gland; F. Adaxial side of stamen of the androecial whorl II, introrse, glands and staminode; G. Gynoecium (from *Riedel s.n.*, L-0036201). Only C & G from fully developed flower. (Photomicrographs by author).

Fig. 31. *Cryptocarya citriformis* (Vellozo) P.L.R. de Moraes. A-B. Unripe fruits and diaspores germinating at Serra da Estrela, Petrópolis, RJ, July 2000. (Photographs by author).

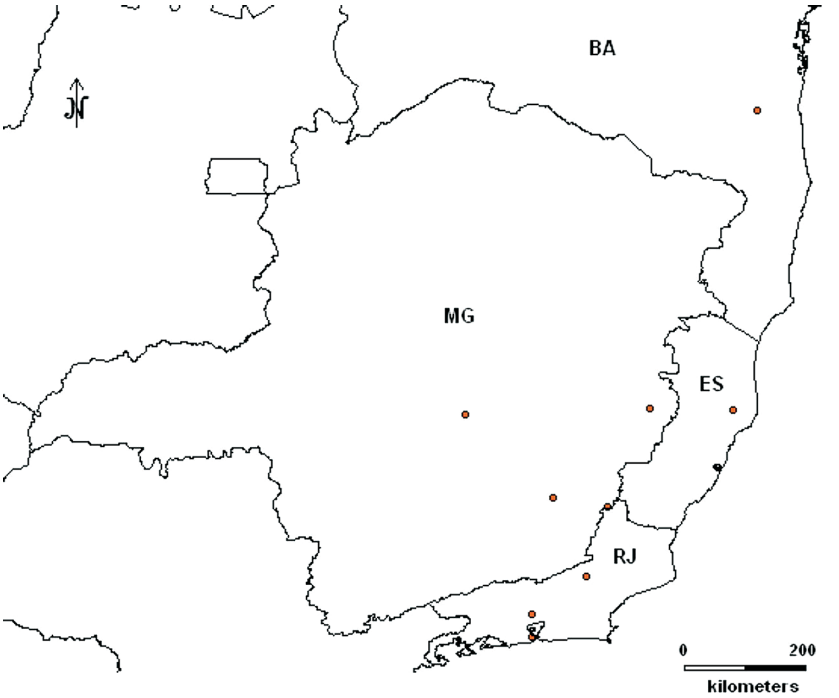

Fig. 32. Distribution of *Cryptocarya citriformis* (Vellozo) P.L.R. de Moraes.

4. *Cryptocarya guianensis* Meissner

in Podr. (DC.) 15 (1): 75 (1864). – Lectotype (designated by Moraes, 2005a): French Guiana. 1839 (fl.), "Laurus", *M.E. Moricand* 113 [G-DC, photo in UEC!; isolectotypes: G (3 sheets, negatives in UEC!)]. Plate V A (cf. Appendix 13.5).

= *Cryptocarya maroniensis* Benoist, *Bull. Mus. Hist. Nat.* (Paris) 30: 510 (1924). – Holotype: French Guiana. Maroni, "environs de Godebert", s.d. (fl.), *G. Wachenheim 68* (P-00221227, photo in UEC!; F Neg. No. 35309!). Plate V B (cf. Appendix 13.5).

= *Cryptocarya nigropunctata* Vattimo-Gil, *Rodriguésia* 25(37): 222, 233, *f.* 17-22, 237, *f.* 66, 70, 73 (1966b) p.p. – Holotype: Brazil. Basin of Rio Madeira, Municipality Humayta, near Tres Casas, on low terra firma", 14 Sep. – 11 Oct. 1934 (fl.), *B. A. Krukoff's 5th Expedition to Brazilian Amazonia 6356* (RB-60616! 2 sheets, photos in UEC!; isotypes: BR-880578! (photo in UEC!), MO-1290390! (photo in UEC!), NY-00621924 (photo in UEC!), U-0017938!). – Lectotype (designated by Moraes, 2005a): unknown provenance, (fl.), *collector unknown* (RB-60616!; only the fragment of inflorescence inside an envelope). Plate VI A (cf. Appendix 13.5).

Illustrations - Vattimo-Gil (1966b, Fig. 23-28, flower pieces; 67, flower; 77, leaf), van Roosmalen (1985, plate 55, Fig. 5 a, b).

Vernacular names - Caá-xió, cahaxio, caiaxio, cèdre, cèdre-canelle, cèdre-de-marécage, cèdre-jaune-de-marécage, cèdre-marécage, ïwa-pane (in Wayãpi, meaning "arbre malchanceux" due to the aspect of the tree), wen kamwi (in Palikur meaning "which resembles wen", this last being *Ocotea guianensis* Aubl., louro-catana).

Description - *Trees* or mostly small trees, 4-25 m tall, trunk cylindrical, DBH 8-40 cm, bark gray, brownish to blackish to green and smooth to greenish stained of gray and red to green-reddish, sapwood white (in the live tree) to yellow to reddish to bright brown. *Branches* cylindrical, striate, with lenticels, very breakable and fibrous. *Branchlets* 5 cm below terminal bud c. 1.6-2.2 mm in diam., brownish to reddish, initially slightly angular or roundish from the beginning, smooth, glabrous, somewhat shining; terminal buds ovoid, sparsely yellowish tomentellous, with a dense cover of ± short, ± appressed hairs. *Petioles* 4.5-10.2 mm long, 1.0-2.5 mm thick, slightly to deeply canaliculate above, occasionally flattened, roundish below, glabrous. *Leaves* alternate, elliptical to oblong-lanceolate, widest at the middle or mostly slightly below, (2.6-)4.2-19.0(-22.0) cm long, 1.16-6.4 cm broad, coriaceous to subcoriaceous, glabrous on both surfaces, tip acuminate (short to long), base acute, margin flat to slightly recurved; above shining, varnished, rather poorly reticulate; beneath paler, rather dull, with papillae inconspicuous; midrib impressed to level or slightly convex above, prominent below, secondary veins rather patent (6-12 per side), impressed above, prominent below; tertiary venation densely, prominulously reticulate below; venation pattern brochidodromous. *Inflorescences* white to whitish to yellow, panicles in the axils of distal leaves, few-flowered, 1.0-1.6 mm in diam. at the base, 1.4-10.0 cm long, densely subsericeous-tomentellous; peduncles glabrescent towards the base, short, branchlets (if present) very short. *Flowers* (Fig. 33 A-G) cream, creamy, pale yellow, yellow, yellow-greenish or green-yellowish, densely grayish to yellowish subsericeous-tomentellous, with ± short, ± appressed hairs, (2.5-)3.25-3.68(-3.8) mm long, (1.6-)1.79-2.25(-3.0) mm in diam. at apex; tube urceolate,

0.86-1.2 mm long, 0.8-1.0 mm in diam.; pedicels sericeous, (0-)0.4-0.6(-2.0) mm long; tepals subequal, white, yellow, (1.7-)1.86-2.4(-2.5) mm long, c. 1.0-1.66 mm broad, slightly concave, erect or erect-patent and slightly incurved at apex, widely ovate to ovate-elliptical, tip acutish or obtuse, pilose to glabrescent within; stamens included, yellowish; stamens of whorls I and II introrse, 0.94-1.44 mm long ($\bar{X}$ = 1.19 ± 0.17 mm; *N* = 10), conspicuously shorter than tepals, anthers large, glabrous, ovate, c. 0.55-0.96 mm long ($\bar{X}$ = 0.68 ± 0.11 mm; *N* = 19), 0.38-0.51 mm broad ($\bar{X}$ = 0.43 ± 0.05 mm; *N* = 12), connectives obtuse, strongly protruding beyond the large sporangia, filaments rather slender, densely pilose, as long as or slightly shorter than anthers, somewhat to manifestly adnate to tepals; stamens of whorl III lateral or extrorse-lateral, c. 1.3-1.7 mm long, anthers narrowly ovate, glabrous, c. 0.7-1.0(-1.5) mm long, 0.4 mm broad, connectives thick, sub-clavate, obtuse, strongly prolonged beyond the sporangia, filaments rather slender, as long or longer, densely pilose; glands subglobose, 0.4-0.7 mm long, 0.4-0.8 mm broad, compressed, rather long to short pedicelled to sub-sessile, pedicel pilose, rather distant from the filaments; staminodes large, triangular-ovate, sub-cordate, acute, 0.56-1.2(-1.5) mm long, 0.37-0.8 mm broad, tip and abaxial side pilose, adaxial side flattened, glabrous, stalks conspicuous, stout, pilose; gynoecium immersed in the tube, glabrous, 2.2-4.3 mm long, ovary ellipsoid, 0.8-1.87(-2.1) mm long, 0.4-1.2 mm in diam., gradually merging into the cylindrical-conical, glabrous, 1.38-2.4 mm long style with small, truncate, discoid stigma. *Fruits* yellow with green tinges, pale yellow, yellow or yellowish with pulp white juicy, green-yellowish, ellipsoid-ovoid to pyriform, usually with a neck at the base, many-ribbed (12-15), c. 2-3.27(-4) cm long, c. 1.36-2.52 cm in diam. (Fig. 9 A-C).

Phenology - Flowering material in March to May, and July to October. Fruiting material in January, February, April, May, and August to December. Mature fruits mostly in December. Three collections with both flowers and immature fruits in August to October.

Distribution and habitat (Fig. 34) - Species with disjunct distribution, registered from Venezuela, Guyana, Surinam, French Guiana, and Brazil. In French Guiana, the species is reported to be rare, occurring in riverine and creek forests (Benoist, 1931; van Roosmalen, 1985). In Brazil, the species has been sparsely collected in Amapá, Bahia, Mato Grosso, Pará and Rondônia, mostly in riparian and floodplain (várzea) forests, but also in terra firme (non-inundated) forest. From sea level to 1300 m altitude.

Uses - According to Pio Corrêa (1926) and Le Cointe (1934), its yellowish wood is well-suited for carpentry and woodworking, fruits are stimulative as well as carminative. Benoist (1931) informed also that the wood is rather soft, excellent for joinery and framing. Dragendorff (1898), citing Peckolt, stated that the species has the same uses as *C. moschata*. Fruits are indicated as endozoochorous (eaten by specialised frugivores; van Roosmalen, 1985). According to P. Grenand (pers. comm.) the vernacular name *Wayãpi* indicates that the fruits are eaten by agoutis.

Comments - *Cryptocarya guianensis* is recognised by its somewhat cinnamon/ochre-coloured-drying leaves, shiny with rudimentary reticulation on upper

surface; flowers with tepals subequal, large; stamens of whorls I and II conspicuously shorter than tepals; anthers glabrous; glands subglobose relatively large and broad, and by its mature fruits usually globose, ribbed, with a neck at the base. Overall similarity of floral features and sometimes even leaves suggests that *C. moschata* is the closest relative of *C. guianensis*.

The type of *Cryptocarya maroniensis*, a subjective junior synonym of *C. guianensis*, was unfortunately not available to me, but its images from Paris and Field Museum were. However, since Benoist's (1924) description does not provide distinguishing characters, I followed Kosterman's (1937) decision on synonymy under *C. guianensis*.

It should be noted that *C. guianensis* as circumscribed here is a species poorly collected in Brazilian Amazon or even in the Guiana Shield (mainly in French Guiana). From information available on specimen's labels, the species has been reported either as small trees ranging from 4 to 15 m thus reproducing in the understorey, or as large trees up to 25 m. Additionally, the contrasting colours quoted on its bark and sapwood would also suggest it is a rather variable entity or that more than one taxon could be involved, not necessarily related to the characters evoked by Benoist. Both *C. guianensis* and *C. maroniensis* have been cited in the checklists of the plants of the Guianas (Boggan *et al.*, 1997; Hollowell *et al*. 2001).

Specimens examined - 43 (listed in appendix 13.3).

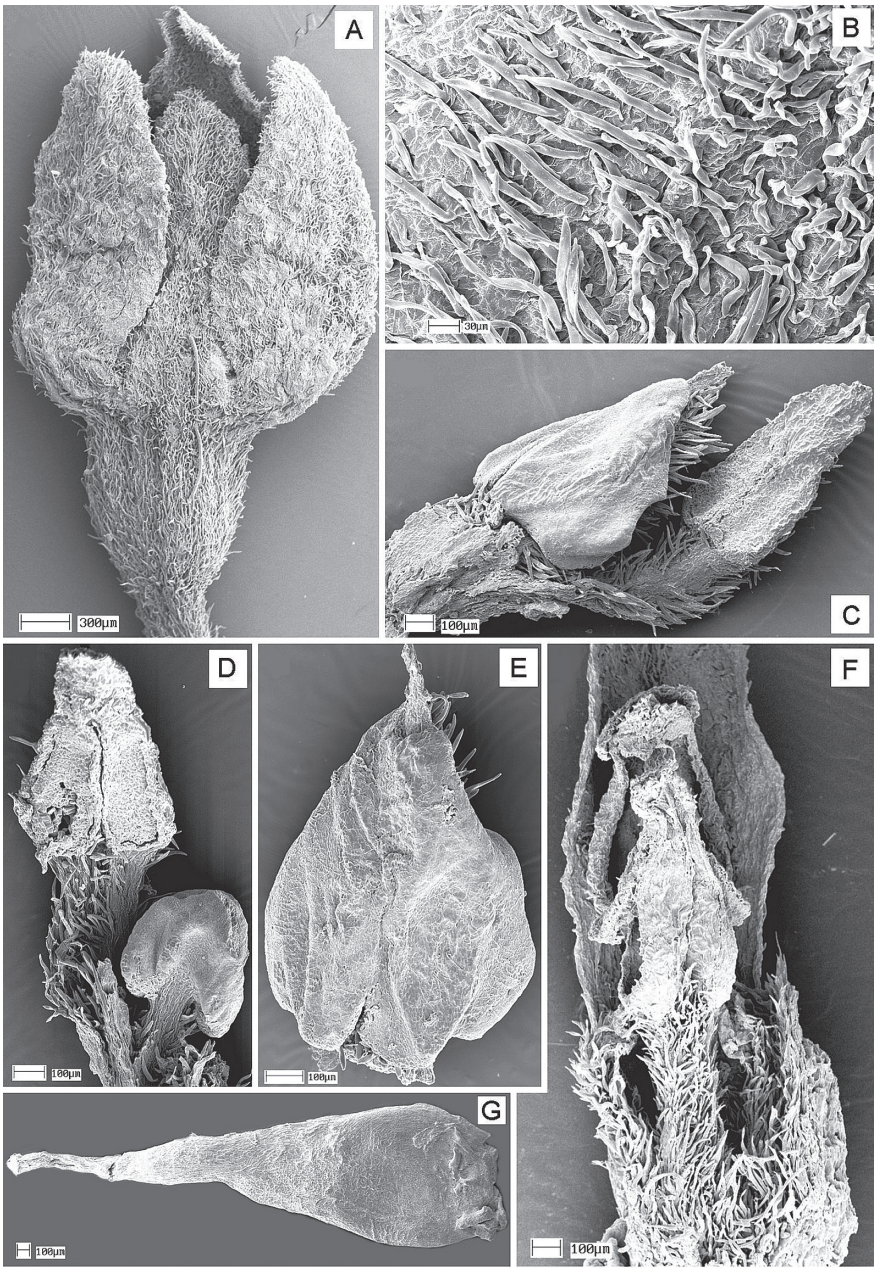

Fig. 33. SEM micrographs of flowers of *Cryptocarya guianensis* Meissner. A. Flower bud (from *Kuhlmann 2118*, RB); B. External indument (from *Kuhlmann 2118*, RB); C. Adaxial side of stamen of the androecial whorl II, introrse, and staminode (from *Pires & Silva 1388*, RB); D. Adaxial side of stamen of the androecial whorl I, introrse, and gland (from *Pires & Silva 1388*, RB); E. Abaxial side of staminode (from *Pires & Silva 1388*, RB); F. Adaxial side of stamens of the androecial whorls I and III (from *Kuhlmann 2118*, RB); G. Gynoecium (from *Kuhlmann 2118*, RB). (Photomicrographs by author).

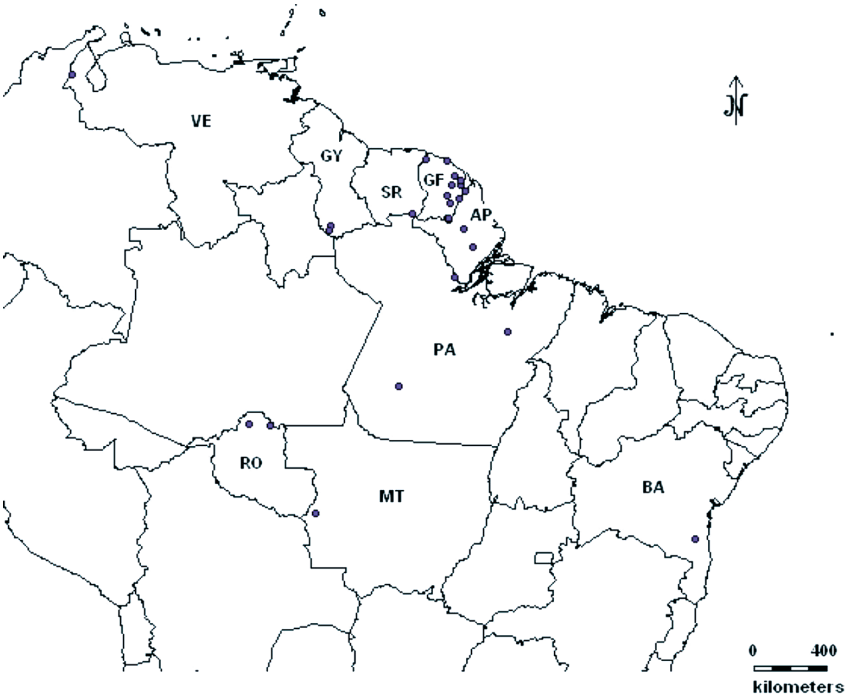

Fig. 34. Distribution of *Cryptocarya guianensis* Meissner.

5. *Cryptocarya mandioccana* Meissner

in *Prodr.* (DC.) 15 (1): 75 (1864). – Holotype: Brazil. Rio de Janeiro, "In sylvis Mandiocensis", Oct. 1823 (fl.), *L. Riedel s.n.* (LE, photo in UEC!; sheet with number 91 in original label, plus label of determination by Carl Mez in 1887, plus label of Holotype, conf. by Henk van der Werff in 1988; isotypes: B† [F Neg. No. 3844!], GOET! (2 sheets, photos in UEC!]), K! (cibachrome in UEC!), L-0036185! (photo in UEC!), L-0036186! (photo in UEC!), LE (photo in UEC!), NY-00355045! (photo in UEC!), OXF (right-hand specimen, photo in UEC!), OXF (photo in UEC!), U (photo in UEC!). Plate VI B (cf. Appendix 13.5).

Illustrations - Vattimo-Gil (1957, Fig. 7, habit and fruit), Vattimo-Gil (1966b, Fig. 38-46, flower pieces; 68, flower; 69, leaf; 74-76, fruits), Coe-Teixeira (1965, táb. I, Fig. 3, leaves, flower pieces and fruit), Moraes (2003, Pr. 3, I, stamen of androecial whorl; I-K, fruits and fresh material).

Vernacular names - batalheira, beribebas, cajati or cajaty, canela-batalha, canela-branca, canela-de-porco, canela-fogo, canela-inhotinga, canela-moscada, canela-nhotinga, canela-nhutinga, canela-noz-moscada, inhutinga, nhotinga, nhutinga, noz-moscada, noz-moscada-brasileira, noz-moscada-do-brasil.

Description - *Trees* up to 35 m tall, trunk cylindrical, DBH 15.91-104.0 cm ($\bar{X}$ = 45.46 ± 15.06 cm; *N* = 494), bark (Fig. 35) laterite (dark brick red) to rusty-brownish, flaky in adult trees, relatively smooth to rugose when young, with lenticels. *Branches* cylindrical, thick, dark to light brownish, relatively smooth to rugose or verrucose. *Branchlets* (Fig. 36 A-D) 5 cm below terminal bud c. 1.6-2.4 mm in diam., dark to light brownish, initially angular from the beginning, terete towards the base, relatively smooth to striate, glabrescent to densely pubescent, with short, appressed, yellowish hairs; terminal buds minute, ovoid, pubescent, densely covered by yellowish appressed hairs. *Petioles* 8.5-18.0 mm long, 1.0-2.0 mm thick, slightly to deeply canaliculate above, roundish below, striate to rugose, glabrescent to minutely pubescent, with short and/or long, curled to straight, ± appressed and/or ± ascending hairs. *Leaves* (Fig. 36 A-E) alternate, narrow-elliptic-lanceolate to broad-ovate or obovate, 5.0-17.7 cm long, 1.85-7.0 cm broad, chartaceous to chartaceous-coriaceous to coriaceous; young leaves pubescent on both surfaces, with short, appressed, yellowish hairs; adult leaves glabrous to glabrescent above, pubescent below, with short to long, straight to curled, mostly appressed to ascending, yellowish hairs, tip acute to acuminate, base acute to cuneate, margin slightly flat to recurved, sclerified; above pale to somewhat shining in some collections, poorly to prominulously reticulate; beneath paler, opaque, with papillae conspicuous; midrib impressed to level above, prominent below, rusty-red in some collections, secondary veins erect-patent (5-9 per side), often arcuate near the margin, inconspicuous to prominulous above, prominulous to prominent below; tertiary venation poorly to prominulously reticulate above, prominulous below; venation pattern camptodromous-brochidodromous. *Inflorescences* (Fig. 5) greenish, axillary to subterminal, thyrso-paniculate, few to often many-flowered, 0.7-1.2 mm in diam. at the base, 4.8-8.7 cm long, pubescent to rusty-strigose, with ± short, ± appressed and ± ascending yellowish or yellow-rusty hairs, often shorter than leaves; peduncles pubescent; bracts and bracteoles deciduous. *Flower buds* cream, white-greenish or greenish. *Flowers* (Fig. 37) white, whitish, greenish, green-yellowish, cream

or yellowish, minutely tomentose, 3.4-4.6(-6.0) mm long, 1.6-2.8(-4.0) mm in diam. at apex; tube urceolate to narrow-subconic-urceolate, 1.3-1.64 mm long, 0.9-1.3 mm in diam.; pedicels tomentose, 0.5-1.5 mm long; tepals equal to subequal, 1.64-2.5 mm long, 0.8-1.34(-2.0) mm broad, concave, ovate to sub-elliptical, tip acute, pilose within; stamens included; stamens of whorls I and II introrse, 1.0-1.64 mm long ($\bar{X}$ = 1.33 ± 0.22 mm; *N* = 18), anthers glabrous to ciliate, sub-triangular, 0.56-1.12 mm long ($\bar{X}$ = 0.79 ± 0.12 mm; *N* = 44), 0.3-0.58 mm broad ($\bar{X}$ = 0.45 ± 0.05 mm; *N* = 30), connectives prolonged beyond the large sporangia, tip obtuse to truncate, filaments densely pilose, shorter than anthers, adnate to tepals; stamens of whorl III lateral to introrse-lateral, erect, 0.99-1.85 mm long ($\bar{X}$ = 1.39 ± 0.25 mm; *N* = 19), anthers narrow-ovate, glabrous to ciliate, 0.64-1.0 mm long ($\bar{X}$ = 0.84 ± 0.11 mm; *N* = 31), 0.29-0.44 mm broad ($\bar{X}$ = 0.36 ± 0.04 mm; *N* = 12), connectives prolonged beyond the large sporangia, tip obtuse-rounded to truncate, filaments rather slender, equal to longer than anthers, pilose; glands subglobose, 0.32-0.89 mm long ($\bar{X}$ = 0.54 ± 0.14 mm; *N* = 31), 0.28-0.6 mm broad ($\bar{X}$ = 0.44 ± 0.08 mm; *N* = 20), pedicel long, pilose; staminodes relatively large, sagittate, 0.59-1.2 mm long ($\bar{X}$ = 0.91 ± 0.16 mm; *N* = 23), 0.4-0.66 mm broad ($\bar{X}$ = 0.49 ± 0.06 mm; *N* = 14), tip and abaxial side pilose, stalks conspicuous, short, stout, pilose; gynoecium immersed in the tube, glabrous, 1.72-3.52 mm long ($\bar{X}$ = 2.57 ± 0.59 mm; *N* = 9), ovary ellipsoid, 0.6-1.0 mm long ($\bar{X}$ = 0.86 ± 0.14 mm; *N* = 10), 0.29-0.65 mm in diam. ($\bar{X}$ = 0.41 ± 0.10; *N* = 10), gradually merging into the about 0.94-2.45 mm long ($\bar{X}$ = 1.67 ± 0.49 mm; *N* = 9) style with small, discoid stigma. *Mature fruits* (Fig. 38) straw-coloured, cream, ivory, white, yellow, pale-yellow, yellowish, yellow-whitish or yellow-greenish. *Mature fresh fruits* (without remotion of the accrescent receptacular tube) from the population of Parque Estadual Carlos Botelho are ellipsoid to globose, 1.45-3.06 cm long ($\bar{X}$ = 2.26 ± 0.28 cm; *N* = 1892), 1.29-2.55 cm broad ($\bar{X}$ = 1.90 ± 0.24 cm; *N* = 1892), longitudinally ribbed (nearly always). The diaspores (pericarp and seed) from the former fruits are 1.34-3.00 cm long ($\bar{X}$ = 2.17 ± 0.27 cm; *N* = 1764), 1.16-1.92 cm broad ($\bar{X}$ = 1.52 ± 0.11 cm; *N* = 1764; Moraes & Alves, 1997). Dried fruits (with receptacular tube adnate) from herbarium specimens, 1.85-3.14 cm long ($\bar{X}$ = 2.52 ± 0.24 cm; *N* = 142), 1.19-2.0 cm broad ($\bar{X}$ = 1.69 ± 0.14 cm; *N* = 142) (Fig. 9 H); flesh portion originated from the accrescent flower tube usually thin.

Phenology - Flowering material in February, and July to December; flowering peak between October and December. Immature fruits in January to April, July, November, and December; mature fruits in March to August, October, and November; fruiting peak mainly from May to August.

Distribution and habitat (Fig. 39) - Species registered from states of Bahia, Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina and São Paulo. Mostly in Montane and Submontane Ombrophilous Dense Forest, less frequent in Semi-deciduous forests of Minas Gerais and São Paulo. From 10 to c. 1180 m altitude.

Uses - von Martius [in von Spix & von Martius' *Reise Bras.* II. 543 n. 1. 1828; 1843, 1868, and *obs. 1095b* (Plate X, B)] registered that the fruits are distinct by their aroma and flavour, being carminative and digestive (cardiac); folk