

The only species that cannot yet be placed in any group is *Cryptocarya velloziana*, in part because it is still known only from few fruiting collections. Although it shares several features with species of the *Cryptocarya moschata* group: its strikingly different leaves (and also the outer bark) that are rigid-coriaceous, relatively large, thick, tip broadly acute to rounded, base obtuse, prominulously and laxly reticulate on both surfaces are more characteristic for Brazilian *Beilschmiedia rigida* (Mez) Kosterm. and *B. linharensis* Sa. Nishida & van der Werff. Therefore, its possible affinity to other species deserves special attention and additional studies.

Contrary to Hyland (1989) working on Australian species of *Cryptocarya*, no clear groups could be discerned in the Brazilian species that have gross morphological resemblance. One of the subdivisions employed by Hyland (1989) was done on the basis of the presence or absence of ruminant cotyledons, from which the former showed to be associated with foetid flowers. As pointed out before, according to Mez (1889) *C. citrifolia* is the only Brazilian species so far reported to have fruits with septa intruding into the cotyledons but its flowers are otherwise faintly scented. Allied to this, the species would be also considered isolated from the others by its unusual large fruits (up to 11.0 x 6.27 cm), only paralleled in size by those of *Anaueria brasiliensis* Kosterm., *Beilschmiedia angustifolia* Kosterm., *B. emarginata*, *B. linharensis*, and *B. rigida*, for instance. However, in spite of these differences, *C. citrifolia* is seemingly related to *C. saligna* based on their overall similarity of leaves, flowers, outer barks, and partially overlapping geographical distributions. Both species have the same distinctive pattern of flowers with the tube slender, anthers of outer whorls broad-ovate with locelli suborbicular, glands sessile to short-pedicelled, staminodes with stalks inconspicuous, and gynoecium exerted at anthesis (nearly always the androecium too). Likewise, the leaves of several collections can also be easily confused, not only due to their likeness in shape and size, but also because they are often glaucous on the lower surface and may be clothed in similar indument. From the reasons given above and from isozyme evidence, I consider both species as pertaining to the *C. citrifolia* group.

In contrast to the previous group, representatives of the *Cryptocarya mandioccana* group (*C. mandioccana*, *C. sellowiana* and *C. wiedensis*) are typical members of the Atlantic rain forest, sharing similar floral features, e.g. infundibular shape, anthers of outer stamens ovate with protruding connectives located mostly above locelli, and constant hairy surface of branchlets, leaves (lower surface, also papillate), petioles, inflorescences and flowers. If this combination of characteristics proves to be really constant within populations of *C. sellowiana* and *C. wiedensis*, which are up to the present only known from very few collections, the relationship proposed would be truly ascertainable. However, as discussed under the treatment of *C. wiedensis*, this species seems to be also linked to the *Cryptocarya moschata* group. For the Brazilian species, the presence of hairs on the surface of vegetative organs, mainly on leaves and branchlets, may be the ancestral condition since the majority of the neotropical species is glabrous and glabrescent forms are frequently found within their populations, which would represent a reversal to the plesiomorphous character (the opposite has not been observed so far).

The *Cryptocarya moschata* group (*C. aschersoniana*, *C. botelhensis*, *C. guianensis*, *C. micrantha*, *C. moschata*, *C. riedeliana*, *C. subcorymbosa*) differs from the *C. mandioccana* group by the absence (or nearly so) of indument on branchlets, petioles, and leaves (lower surface), which is a common feature to all members of the former group. How coherent and reliable a group is, based mainly on those features is legitimately questionable. However, except for *C. botelhensis* and *C. micrantha* which share contrasting foliar affinities in the shape and venation pattern to the other members of this group, the remaining species look quite similar in overall appearance, but may show several diagnostic and/or non-diagnostic characteristics that would allow their recognition. Nevertheless, *C. moschata* is the catch-all species of its group, bordering morphologically on most other species within the group and also sharing characters with *C. mandioccana*.

Another synthetic character used by Hyland (1989) for grouping the Australian *Cryptocarya* was the presence of longitudinal ribs on the pericarp of fruits, a character that allowed him to group three species, viz. *C. laevigata*, *C. meisneriana* Frodin (\equiv *C. meisnerana* Frodin), and *C. pleurosperma*. This character could not be used for the Brazilian species because it proved non-constant within taxa. Nevertheless, it would be really important to evaluate how effective this character could be to diagnose the genus as a whole, comparing species with fruits conspicuously ribbed from Madagascar (e.g. *C. caryoptera* Kosterm.), Asia (e.g. *C. chingii*), Oceania, and America, but also contrasting other characters and/or evidences.

On the basis of isoenzyme data (P.L.R. de Moraes, ined.; Moraes, 2005c), we demonstrated that the discriminant analysis can be used for efficient marker-based allocation of individual trees into pre-defined groups of species of *Cryptocarya*, complementing information obtained from a classical taxonomic study. Since the gold standard for any taxonomic system is its ability to deliver accurate species identifications, the classification criteria generated by the discriminant approach were satisfactorily concurrent, supporting greatly the provenances of individuals and the taxonomic interpretations predicated on morphology. Additionally, the unsupervised classification through the cluster analysis revealed that *Cryptocarya mandioccana* and *C. moschata*, as well as *C. citriformis* and *C. saligna*, are closely related species, corroborating morphological evidence and the former indication by Moraes *et al.* (2002). *Cryptocarya botelhensis* and the two populations ascribed to *C. aschersoniana* have shown that at least genetically they are rather divergent from the formers. However, to infer the phylogenetic relationships within *Cryptocarya*, true cladistical methods should be used, based on relevant and practicable outgroups. Also, DNA sequencing would provide more accurate estimations of genetic divergences among neotropical species of *Cryptocarya*, however such data are presently lacking.

The systematic treatment of the different Brazilian *Cryptocarya* species as described below, only deals with morphology.

9. Systematic treatment

9.1. Generic description

Cryptocarya Robert Brown, *Prodr.* 402 (1810), *nom. cons.*. Nees, *Syst. Laur.* 205 (1836). Gay, *Fl. Chil.* 5: 299. 1851-52 (1849) (misspelled *Cryptocaria*). Meissner, in *Prodr.* (DC.) 15(1): 68 (1864). Mez, *Jahrb. Königl. Bot. Gart. Berlin* 5: 7 (1889). For further bibliography see Kostermans (1964). – Type: *C. glaucescens* R. Br. (lectotype designated by Kostermans, *Not. Syst.* 8: 112 (1939b)). – Lectotype (designated by Frodin, 1976): “East Coast”? Hawkesbury River, *R. Brown s.n.* (BM).

= *Agathophyllum* Jussieu, *Gen. pl.* 431 (1789) – Type: *A. aromaticum* (Sonnerat) Willdenow, *Spec. Pl.* 2(2): 842. 1799.

= *Caryodaphne* Blume ex Nees, *Syst. Laur.* 225 (1836). – Type: *C. laevigata* (Blume) Nees. *Cryptocarya laevigata* Blume, *Bijdr. fl. Ned. Ind.* 11: 556 (1826) (basinym). (lectotype *fide* Kostermans, *J. Sci. Res.* (Jakarta) 1(5): 122 (1952)).

= *Evodia* Gaertner, *Fruct. sem. pl.* 2(1): 100 (1790), non J.R. Forster & G. Forster, 1775, *nom. illeg.* – Type: *E. ravensara* Gaertner, *Fruct. sem. pl.* 2(1): 101 (1790).

= *Icosandra* Philippi, *Linnaea* 29: 39 (1857). – Type: *I. rufescens* Philippi, *Linnaea* 29: 40 (1857-1858).

= *Mossoia* Beccari, in d’Albertis, *New Guinea* 2: 398 (1880). – Type: *M. aromatica* Becc. (basinym) = *Cryptocarya aromatica* (Becc.) Kostermans, *Tectona* 39: 169 (1949).

= *Pseudocryptocarya* Teschner, *Bot. Jahrb. Syst.* 58: 411 (1923). – Type: *P. pauciflora* (Lauterbach & K. Schumann) Teschner. *Cryptocarya pauciflora* Lauterbach & K. Schumann, *Fl. Schutzgeb. Südsee* 333 (1901) (basinym). (= *C. laevigata* Blume, *fide* Kostermans, *Bull. Jard. Bot. Buitenzorg*, ser. 3, 18: 439 (1950); and Hyland (1989)).

= *Ravensara* Sonnerat, *Voy. Indes Orient.* 2: 226; (octavo ed.) 3: 248 (1782). – Type: *R. aromatica* Sonnerat, *Voy. Indes Orient.* 2: 226; (octavo ed.) 3: 248 (1782). (= *Cryptocarya agathophylla* van der Werff, *Adansonia* 30, 2008, in press)

= *Salgada* Blanco, *Fl. Filip.*, ed. 2, 221 (1845). – Type: *S. lauriflora* Blanco (basinym) = *Cryptocarya lauriflora* (Blanco) Merrill, *Philipp. J. Sci.* 4(3): 254 (1909).

Etymology - From Greek κρυπτος, *kriptos* = hidden, and καρυον, *karyon* = nut; the fruit is covered by the accrescent flower tube.

Diagnosis - *Trees* or rarely shrubs, up to 35 m tall. *Branchlets* sericeous to villose or glabrous. *Leaves* alternate or sub-opposite, chartaceous to rigid-coriaceous, exstipulate, glabrous or pilose. *Inflorescences* paniculate and pseudoterminal, sometimes almost cymose and axillary. *Flowers* bisexual, small, trimerous, involucre missing; flower tube conspicuous, deep, enclosing the ovary and later the fruit, usually slender, urceolate, constricted below the tepals, abruptly enlarging into the perianth; tepals 3 + 3, symmetric, usually equal in length; fertile stamens 9, in three whorls, outer 6 introrse + inner 3 extrorse, lateral or introrse; anthers usually large, 2-celled; connectives often strongly protruding beyond the cells; stamens of the third whorl with adnate glands (or somewhat distant from base), the latter often stalked; fourth whorl consisting of conspicuous, stipitate staminodes, usually cordate-ovate, acuminate, foliaceous; ovary superior, glabrous (in American species), immersed in the flower tube; stigma small or inconspicuous, rarely peltate. *Fruits* ellipsoid, pyriform or globose, entirely included in the enlarged flower tube, often leaving only a minute pore at apex, the latter sometimes crowned by the remnants of the tepals. *Seeds* with cotyledons large, flat-convex; plumule and radicle minute.

Comments - Extra Brazilian specimens collected in Costa Rica, Ecuador, Peru, Venezuela and Bolivia likely represent undescribed species. Some Central American species described under *Cryptocarya* proved to belong to other taxa (e.g. *Cryptocarya hintonii* C.K. Allen = *Prunus brachybotrya* Zucc.; *Cryptocarya kostermansiana* C.K. Allen = *Beilschmiedia costaricensis* (Mez & Pittier) C.K. Allen; *Cryptocarya zapoteoides* (Lundell) Miranda ≡ *Beilschmiedia zapoteoides* (Lundell) Kosterm.). The status of specimens from Ecuador and Peru, with resemblance to *Cryptocarya aschersoniana* Mez or *C. moschata* Nees & Martius (van der Werff & Smith, 1989), can only be ascertained once more voucher material, especially flowering material, is collected.

Eighteen of the voucher specimens of Brazilian *Cryptocarya*, deposited at the Herbarium Berolinense – viz. *Araujo in Herb. Schwacke 6680* (holotype of *C. schwackeana*), *Glaziou 14205* (syntype of *C. saligna*), *18436* (holotype of *C. subcorymbosa*), *18437* (holotype of *C. minutiflora*), *19801* (holotype of *C. longistyla*), *20443*, *Hoehne s.n. ex SP-23796*, *s.n. ex SP-23802*, *s.n. ex SP-28200*, *Mélinon 109* and *s.n.*, *Mendonça 184*, *Müller s.n.*, *Riedel s.n.* (isotype of *Aydendron floribundum*), *s.n.* (isotype of *C. mandioccana*), *s.n.* (isotype of *C. micrantha*), *Schwacke s.n.*, *Sellow s.n. (1375)* (syntype of *C. moschata*), *s.n.* (holotype of *C. aschersoniana*) – and listed by Mez (1889, 1892, 1893, 1902, 1907) and Kostermans (1937) were destroyed in World War II. In addition two specimens deposited at the *Museo Historiae Naturalis Vindobonensi* (formerly Museum Palatinum – Vienna Herbarium – W), viz. *Peckolt 166* and *166β* (syntypes of *C. hypoleuca*) – are lost to science.

9.2. Key to the Brazilian species of *Cryptocarya*

Except for *C. sellowiana* and *C. velloziana*, the following key is based on complete material because the study of flowers or fruits is necessary to determine the genus. Due to the variability of several species and the ambiguity of many characters, it became inevitable that some species appeared more than once in the key. In some rare cases, ambiguous collections are likely to key out of their species (see commentaries under species treatment).

1. Leaves relatively large (up to 24 cm long, 12 cm broad), broad-ovate, thick, rigid-coriaceous, tip broadly acute to rounded; petioles relatively large (up to 20.0 mm long), thick (up to 4.0 mm), flattish above **12. *C. velloziana***
- 1'. Leaves smaller (up to 22 cm long, 7 cm broad), narrow-elliptic to lanceolate or obovate, relatively thinner, chartaceous to coriaceous; tip acute to obtuse, rounded or acuminate; petioles mostly smaller (up to 18.0 mm long), seldom larger (up to 29.0 mm long, as in *C. riedeliana*), thinner (up to 3.3 mm), acanaliculate to slightly or deeply canaliculate above..... **2**
2. Lower surface of mature leaves manifestly pubescent..... **3**
- 2'. Lower surface of mature leaves glabrous or glabrescent..... **6**
3. Leaves sparsely pubescent on both surfaces, base obtuse.....
..... **13. *C. wiedensis***

- 3'. Leaves glabrous to glabrescent on upper surface, base acute to cuneate 4
4. Midrib on upper surface of mature leaves prominulous, leaves with long, ± erect straight hairs on lower surface; petioles deeply canaliculate, glabrescent to sparse pubescent, with long, ± appressed and ± ascending hairs 10. ***C. sellowiana***
- 4'. Midrib on upper surface of mature leaves impressed or flattish; leaves with short to long, straight to curled, appressed to ascending or erect hairs on lower surface; petioles slightly to deeply canaliculate, glabrescent to densely tomentellous, with short and/or long, ± appressed and/or ± ascending hairs.... 5
5. Flowers densely rusty-tomentellous, tube slender, stamens and gynoecium exerted, glands (sub)sessile, staminodes stipiform, stalks inconspicuous..... 3. ***C. citriformis***
- 5'. Flowers minutely yellowish-tomentose, tube stout, stamens and gynoecium included, glands long-pedicelled, staminodes sagittate, stalks conspicuous..... 5. ***C. mandioccana***
6. Inflorescences and/or flowers glabrous to glabrescent..... 7
- 6'. Inflorescences and/or flowers manifestly pubescent 10
7. Stamens and/or gynoecium exerted..... 9. ***C. saligna***
- 7'. Stamens and gynoecium included 8
8. Leaves chartaceous, mostly narrow-elliptic to elliptical (0.9-2.9 cm broad), tip mostly long acuminate (acumen up to 1.6 cm), base acute, revolute, with papillae inconspicuous on lower surface; flowers with glands long-pedicelled, adnate to the filaments; staminodes clearly with two small elliptical protuberances at the base in lateral/abaxial side, stalks conspicuous..... 2. ***C. botelhensis***
- 8'. Leaves chartaceous to coriaceous (rigid-coriaceous in some collections), narrow-elliptic to ovate or obovate (0.4-7.0 cm broad), tip acute to acuminate or obtuse to rounded, base acute to attenuate or obtuse, slightly revolute, without or with papillae conspicuous or inconspicuous on lower surface; flowers with glands short to long-pedicelled, somewhat adnate to or distant from the filaments; staminodes without conspicuous protuberances at the base in lateral/abaxial side, stalks conspicuous 9
9. Leaves epapillate or with papillae inconspicuous on lower surface, midrib on upper leaf surface prominulous, impressed to level towards the base, prominulous to prominent on lower surface; flowers with stamens of whorl III with anthers narrow-ovate to ovate, glabrous, 0.67-1.24 mm long, 0.22-0.56 mm broad, filaments rather slender, equal or longer than anthers; glands globose to subglobose, pedicels short to long, somewhat adnate to the filaments; or, flesh portion of mature fruits originated from the accrescent flower tube usually thin (up to 5 mm)..... 1. ***C. aschersoniana***

- 9'. Leaves with papillae conspicuous on lower surface, midrib on upper surface impressed to level to prominulous, prominent on lower surface; flowers with stamens of whorl III with anthers narrow-ovate, ciliate, 0.63-0.86 mm long, 0.26-0.37 mm broad, filaments rather stout, equal or shorter than anthers; glands subglobose, sagittate, pedicels long, rather distant from the filaments; or, flesh portion of mature fruits originated from the accrescent flower tube usually thick **7. *C. moschata***
10. Stamens and/or gynoecium exerted **9. *C. saligna***
- 10'. Stamens and gynoecium included **11**
11. Mature leaves glabrous on both surfaces **12**
- 11'. Mature leaves glabrous on upper surface, glabrescent on lower surface **18**
12. Mature leaves epapillate or with papillae inconspicuous on lower surface. **13**
- 12'. Mature leaves with papillae conspicuous on lower surface **16**
13. Midrib on upper leaf surface prominulous **14**
- 13'. Midrib on upper leaf surface impressed to level or slightly convex or prominulous towards the base **15**
14. Leaves with tip obtuse to acuminate, base acute, tapering, slightly revolute at the base; midrib impressed to level towards the base on upper surface; flowers mostly glabrous, but also glabrescent in some collections; or, mature fruits with pericarp smooth to slightly ribbed **1. *C. aschersoniana***
- 14'. Leaves with tip acute to obtusely or broadly acuminate, or caudate and rarely retuse, base acute to obtuse, midrib not impressed to level towards the base on upper surface; flowers densely yellowish-tomentellous, with ± long, ± ascending hairs; or, mature fruits with pericarp manifestly ribbed **6. *C. micrantha***
15. Petioles 4.5-10.2 mm long, 1.0-2.5 mm thick, slightly to deeply canaliculate above, occasionally flattened; flowers with stamens of whorls I, II, and III with anthers glabrous **4. *C. guianensis***
- 15'. Petioles 12.0-29.0 mm long, 1.0-3.3 mm thick, slightly to canaliculate or acanaliculate to flattish above; flowers with stamens of whorls I, II, and III with anthers sparse pilose or ciliate **8. *C. riedeliana***
16. Flowers with glands long-pedicelled, distant from the filaments, staminodes conspicuously pedicelled; or, mature fruits with pericarp slightly ribbed to smooth or with vestigial ribs **17**

- 16'**. Flowers with glands short pedicelled to sub-sessile, adnate to the filaments, staminodes nearly sessile; or, mature fruits with pericarp manifestly ribbed **6. *C. micrantha***
- 17.** Midrib on upper leaf surface impressed to level to prominulous, prominent on lower surface; venation pattern camptodromous-brochidodromous; flowers with tepals subequal, tube urceolate, relatively long, stamens of whorls I and II with anthers sparse pilose or ciliate; or, mature fruits with flesh portion originated from the accrescent flower tube usually thick, without remnant of tepals..... **7. *C. moschata***
- 17'**. Midrib on upper leaf surface prominulous, impressed to level towards the base, prominulous on lower surface; venation pattern brochidodromous; flowers with tepals equal, tube cylindrical-urceolate, relatively short, stamens of whorls I and II with anthers glabrous; or, mature fruits with flesh portion originated from the accrescent flower tube usually thin, often with remnant of tepals **11. *C. subcorymbosa***
- 18.** Leaves coriaceous to rigid-coriaceous, petioles long and stout, 12.0-29.0 mm long, 1.0-3.3 mm thick; or, mature fruits ellipsoid, 1.9-3.9 cm long, 1.3-2.5 cm broad, with pericarp many-ribbed **8. *C. riedeliana***
- 18'**. Leaves chartaceous to coriaceous (rigid-coriaceous in some collections), petioles shorter and thinner, 3.7-17.7 mm long, 0.7-2.0 mm thick; or, mature fruits ellipsoid to globose, or obovate, or top-shaped, 1.2-3.5 cm long, 1.0-2.8 cm broad, with pericarp smooth to slightly ribbed or with vestigial ribs; if pericarp many-ribbed, then pear-shaped with a neck at base, or ellipsoid to globose, 1.4-4.0 cm long, 0.9-3.0 cm broad..... **19**
- 19.** Flowers densely tomentellous, with ± long, ± ascending hairs completely covering the surface; or, mature fruits with pericarp manifestly ribbed, pear-shaped with a neck at base, or ellipsoid to globose **6. *C. micrantha***
- 19'**. Flowers glabrous or glabrescent or sparsely to densely pubescent, with ± short or ± long, ± appressed hairs, not covering the surface completely; or, fruits with pericarp smooth to slightly ribbed or with vestigial ribs, ellipsoid to globose, or obovate, or top-shaped..... **20**
- 20.** Flowers densely tomentellous towards the base, with ± long, ± appressed hairs; or, mature fruits globose to top-shaped, relatively small, 1.4-1.9 cm long, 1.3-1.9 cm broad, pericarp smooth or with vestigial ribs, often with remnant of tepals **11. *C. subcorymbosa***
- 20'**. Flowers glabrous or glabrescent or sparsely to densely pubescent, with ± short, ± appressed hairs; or, fruits ellipsoid to globose, or obovate, 1.2-3.2 cm long, 1.0-2.8 cm broad, pericarp smooth to slightly ribbed or with vestigial ribs, without remnant of tepals..... **21**
- 21.** Leaves epapillate or with papillae inconspicuous on lower surface, midrib prominulous on upper surface, impressed to level towards the base, prominulous

to prominent on lower surface; flowers with stamens of whorl III with anthers narrow-ovate to ovate, glabrous, 0.67-1.24 mm long, 0.22-0.56 mm broad, filaments rather slender, equal or longer than anthers; glands globose to subglobose, pedicels short to long, somewhat adnate to the filaments; or, flesh portion of mature fruits originated from the accrescent flower tube usually thin (up to 5 mm)..... **1. C. aschersoniana**

21'. Leaves with papillae conspicuous on lower surface, midrib on upper surface impressed to level to prominulous, prominent on lower surface; flowers with stamens of whorl III with anthers narrow-ovate, ciliate, 0.63-0.86 mm long, 0.26-0.37 mm broad, filaments rather stout, equal or shorter than anthers; glands subglobose, sagittate, pedicels long, rather distant from the filaments; or, flesh portion of mature fruits originated from the accrescent flower tube usually thick**7. C. moschata**

9.3. Species descriptions (in alphabetical order)

1. *Cryptocarya aschersoniana* Mez

Jahrb. Königl. Bot. Gart. Berlin 5: 11 (1889). – Lectotype (designated by Moraes, 2005a): Brazil. “Hab. in Brasilia, loco non indicato”, s.d. (fl.), *F. Sellow s.n.* (F-646890! – Photo F Neg. No. 3842! and fragments! from B⁺; photo in UEC!). Plate I A (cf. Appendix 13.5); epitype (designated by Moraes, 2005a): Brazil. Santa Catarina, Ilha de Santa Catarina, Saco Grande, selva 200-400 m, 20 Dec. 1967 (fl.), *A. Lourteig* 2329 (HB!; isoeotypes: P-00571417 – photo in UEC!, K!). Plate I B (cf. Appendix 13.5).

Illustrations - Vattimo-Gil (1966b, Fig. 29-37, flower pieces; 55, leaf; 61, 64-65, fruits), Reitz *et al.* (1988, p. 241, Fig. 50, habit, flowers and fruits), Tressens (1997, Fig. 1, habit, flower pieces and fruits), Moraes (2003, p. 166, pr. 3H, fruit).

Vernacular names - Armecica, canela-amarela, canela-areia, canela-batalha, canela-branca, canela-cinza, canela-de-porco, canela-durão, canela-fogo, canela-lageana, canela-nhotinga, canela-nhutinga, canela-pimenta, canela-pururuca, imbuia, nhutinga.

Description - *Trees* or small trees, (4-10-)20-30 m tall, trunk usually thick, knotted, often multistemmed, DBH 80-120 cm (Vattimo-Gil, 1979a; Reitz *et al.*, 1983, 1988), bark chestnut-brown to brownish or rusty, smooth, flaky in old trees, relatively smooth to rugose in the young (Fig. 17 A-H). *Branches* cylindrical, thick, rusty-red to dark brownish, relatively smooth, with lenticels, breakable. *Branchlets* 5 cm below terminal bud c. 1.4-2.9 mm in diameter, rusty-red to light or dark brownish, initially angular from the beginning, terete towards the base, smooth to rugose, glabrous, somewhat shining; terminal buds minute, ovoid, subglabrous to pubescent, sparsely to densely covered by yellow-rusty or yellowish, short, ± appressed hairs. *Petioles* thin, 5.0-14.8(-15.0) mm long, 1.0-1.7 mm thick, deeply to slightly canaliculate to flattish above, roundish below, glabrous or glabrescent. *Leaves* (Fig. 18 A-F) alternate, narrow-elliptic-lanceolate to ovate or obovate, (1.3-)3.5-7.0(-14.5) cm long, (0.4-)1.1-3.7(-7.0) cm broad, chartaceous-coriaceous or coriaceous, rigid-coriaceous in some collections; young leaves glabrous above, glabrous to glabrescent below, adult leaves mostly glabrous on both surfaces or sometimes glabrescent below, tip obtuse to acuminate, base acute, tapering, slightly revolute at the base, margin flat, hardly recurved, sclerified; on both surfaces shining (less often opaque) and rather poorly reticulate or lax to densely and prominulously reticulate; beneath paler, epapillate or with papillae inconspicuous; midrib prominulous above, impressed to level towards the base, prominulous to prominent below, secondary veins patent to erect-patent (5-12 per side), arcuate, poorly reticulate to prominulous on both surfaces; tertiary venation inconspicuous to densely, prominulously reticulate below; venation pattern camptodromous-brochidodromous. *Inflorescences* (Fig. 16 A) axillary or subterminal, thyrso-paniculate, pyramidal, few or many-flowered, 0.6-1.5 mm in diam. at the base, (2.2-)2.7-9.0 cm long, either glabrescent to glabrous or sparse to densely pubescent, with ± short, ± appressed and ± ascending yellowish or yellow-rusty hairs (rusty-strigose),

usually shorter than leaves; peduncles glabrescent to pubescent; bracts and bracteoles minute, tomentelous. *Flower buds* reddish. *Flowers* (Fig. 16 B-J; 19 A-G) cream, pale-green, green, greenish, green-yellowish or yellow-greenish, mostly glabrous, glabrescent in several collections, c. 2.3-4.0(-7.0) mm long, 1.6-3.4 mm in diam. at apex; tube urceolate to subcylindrical-urceolate, 1.1-2.5(-3.0) mm long, 0.8-1.7(-2.0) mm in diam.; pedicels mostly tomentose or glabrescent, 0.26-1.2 mm long; tepals subequal to equal, 1.5-2.7 mm long ($\bar{X} = 1.98 \pm 0.30$ mm; $N = 35$), 0.8-1.5 mm broad ($\bar{X} = 1.09 \pm 0.17$ mm; $N = 31$), concave, elliptical or ovate-elliptical, tip acute to obtuse, pilose to glabrescent within; stamens included; stamens of whorls I and II introrse, rather incurved, 0.9-1.9 mm long ($\bar{X} = 1.37 \pm 0.30$ mm; $N = 21$), anthers glabrous to sparse pilose or ciliate, ovate to ovate-oblong, 0.57-1.08 mm long ($\bar{X} = 0.79 \pm 0.12$ mm; $N = 39$), 0.3-0.6 mm broad ($\bar{X} = 0.49 \pm 0.08$ mm; $N = 41$), connectives prolonged beyond the large sporangia, tip obtuse, filaments densely pilose, as long or shorter than anthers, adnate to tepals; stamens of whorl III lateral to extrorse-lateral, erect, 0.99-1.91 mm long ($\bar{X} = 1.46 \pm 0.24$ mm; $N = 23$), anthers narrow-ovate to ovate, glabrous, 0.67-1.24 mm long ($\bar{X} = 0.85 \pm 0.11$ mm; $N = 34$), 0.22-0.56 mm broad ($\bar{X} = 0.39 \pm 0.08$ mm; $N = 18$), connectives obtuse to truncate, prolonged beyond the large sporangia, filaments rather slender, equal or longer than anthers, pilose; glands globose to subglobose, 0.34-0.68 mm long ($\bar{X} = 0.54 \pm 0.09$ mm; $N = 35$), 0.31-0.65(-1.0) mm broad ($\bar{X} = 0.46 \pm 0.07$ mm; $N = 26$), pedicel short to long, pilose, somewhat adnate to the filaments; staminodes relatively small, ovate-acute, 0.54-1.1 mm long ($\bar{X} = 0.77 \pm 0.14$ mm; $N = 29$), 0.27-0.77 mm broad ($\bar{X} = 0.43 \pm 0.12$ mm; $N = 16$), tip and abaxial side pilose, stalks conspicuous, mostly short, stout, pilose; gynoecium immersed in the tube, glabrous, 1.88-3.85 mm long ($\bar{X} = 2.57 \pm 0.55$ mm; $N = 12$), ovary ellipsoid, 0.64-1.41(-2.0) mm long ($\bar{X} = 0.95 \pm 0.22$ mm; $N = 14$), 0.29-0.84 mm in diam. ($\bar{X} = 0.52 \pm 0.17$ mm; $N = 15$), gradually merging into the about 0.98-2.53 mm long ($\bar{X} = 1.58 \pm 0.38$ mm; $N = 16$) cylindrical style with small, discoid stigma. *Immature fruits* (Fig. 18 C-D, 20 A-B), 1.16-2.5 cm long ($\bar{X} = 1.75 \pm 0.26$ cm; $N = 265$), 0.86-2.1 cm broad ($\bar{X} = 1.27 \pm 0.17$ cm; $N = 265$). *Mature fruits* (Fig. 9 F, L, M; 16 K; 20 C-D) yellow, light yellow, yellowish, yellow-greenish, cream, whitish, light green or dark green, ellipsoid to globose or obovate, smooth to slightly ribbed, 1.22-3.2 cm long ($\bar{X} = 1.94 \pm 0.36$ cm; $N = 103$), 1.02-2.53(-2.8) cm broad ($\bar{X} = 1.54 \pm 0.34$ cm; $N = 103$); flesh portion originated from the accrescent flower tube usually thin (up to 5 mm).

Phenology - Flowering material mostly from October to December, also in April to September. Immature fruits from October to March, predominantly from January to March. Mature fruits from February to December, mainly in February and March. Three collections with both flowers and immature fruits in October and November.

Distribution and habitat (Fig. 21) - In south and southeast Brazil, Argentina in Province of Misiones and one collection from Uruguay. Tressens (1997) registered the occurrence of the species in hygrophilous forest with *Araucaria* along the stream Gramado, tributary of River Urugua-í Grande, at 685 m altitude. According to Reitz *et al.* (1983, 1988), the species is almost restricted to areas of the east plateau and north of Rio Grande do Sul state, in the Ombrophilous Mixed Forest

(*Araucaria* Forest). According to Mauhs (2002), in Rio Grande do Sul the species is still found in relatively well-preserved remnant fragments of the Ombrophilous Mixed Forest, being absent in disturbed fragments like that studied by him in Vacaria. In the plateau of Santa Catarina, it has a wide and abundant distribution mostly in the region of *Araucaria* forests (Klein, 1974, 1975, 1979; Reitz *et al.*, 1978). Klein (1979) pointed out that it is frequently found in the vegetation of old alluvial terraces along River Itajaí-mirim. In hygrophilous forests (swamp forest), the species is rare and only represented by juveniles. From 3-10 m altitude in Coastal Plain Forest, 50-1000 m altitude in slopes and top regions of the Ombrophilous Dense Forest, 300-1100(-1600) m altitude in the Ombrophilous Mixed Forest, c. 1100 m altitude in Semi-deciduous Forest, and in gallery forests.

Uses - The wood is used for the manufacturing of oars. According to Reitz *et al.* (1988), its wood has a moderate basic specific gravity (0.550-0.600 g/cm³), heartwood whitish, slightly pinkish. It is used for manufacturing boxes and crates, mouldings, beams, wooden posts, boards, linings, laths, for carpentry, interior joinery, baseboards, etc.. Traditionally it was not heavily exploited as the presence of large amount of silica in its wood make it difficult to saw. However, in recent years, it is increasingly used for veneers and plates, what caused an intensive exploitation in the plateau of states of Paraná and Santa Catarina. Rolim & Chiarello (2004) reported that the species is used as a shade tree for cocoa in the state of Espírito Santo. Spencer *et al.* (1984), reported for the first time the antigermination activity of extracts of *C. aschersoniana* seeds against velvetleaf (*Abutilon theophrasti* Medic.), a troublesome competitor of corn and soybeans. At Serra do Japi, São Paulo, the flowers are used as nourishment by the butterfly *Protesilaus protesilaus nigricornis* (Staudinger, 1884) as well as various other species of moths.

Comments - Moraes (2003) followed the circumscription proposed by Kostermans (1937, 1938a) with *C. aschersoniana* encompassing only the specimens with glabrous leaves on the lower surface. In the present circumscription, this character is not used as the main criterion for delimiting the species.

Cryptocarya aschersoniana is here interpreted from the set of characters presented predominantly by populations of southern Brazil, which are in agreement with the pattern of the type collection (Moraes, 2005a). It can be recognised in most cases by its leaves that are usually coriaceous, often glabrous, shining on both surfaces, upper surface smooth, with midrib prominulous but impressed to level towards the base, lower surface epappillate or with papillae inconspicuous, allied with its flowers most nearly glabrous, and mature fruits with pericarp smooth to slightly ribbed, with the flesh portion originated from the accrescent flower tube usually thin. *Cryptocarya aschersoniana* seems to have a characteristic growth form, often with multitemmed trunk, with bark predominantly brownish to rusty and smooth. Additionally, it presents some phenological differences from *C. moschata*, and *C. riedeliana*, by flowering mainly from October to December and fruiting mainly in February to March. *Cryptocarya aschersoniana* shows continuous variation of the shape and the length of the mature leaves, which varies considerably from 1.3 cm to 14.5 cm.

For the state of São Paulo, the population of Parque Estadual Intervales, Sete Barras, is the only one that has been completely collected; the samples can be referred to *C. aschersoniana* without hesitation. Its flowering and fruiting material agree perfectly with several collections from Santa Catarina. Also, the overall appearance in the field, the bark and the multistemmed habit also fit well with *C. aschersoniana*. Collections of Serra do Japi and Parque Estadual de Campos do Jordão are composed of only immature flowers and fruits. Nevertheless, their nearly glabrous flower buds, relatively slow fruit development and field characteristics of the bark (rusty and smooth in Campos do Jordão, like the observed in population of Morro do Bau, SC) and growth habit (multistemmed in Serra do Japi) allowed me to identify the collection as *C. aschersoniana*, although their vegetative morphology is mostly similar to that of *C. moschata*. It should be noted that population of Serra do Japi occurs in a transition between the Ombrophilous Dense Forest and the Semi-deciduous Forest, and the population of Campos do Jordão in a remaining Ombrophilous Mixed Forest. Both populations merit more thorough examination so that more complete material can be gathered. Undoubtedly this would lead to a better delimitation of *C. aschersoniana* and *C. moschata*.

The holotype of *Cryptocarya aschersoniana* was deposited in Berlin and unfortunately was destroyed during WW II. No isotypes are known, except for a poor fragment from F-646890 (therefore selected as lectotype), that contains one leaf, an inflorescence branch and one flower, kept together with the photo of the holotype, and with a drawing of the flower made by C. K. Allen in 1963. As pointed out in earlier work (Moraes, 2005a), these remnants of the type and its photo are not adequate to identify the species without ambiguity, thus justifying my decision to erect an epitype from a well-preserved specimen from southern Brazil, which is the principal region of distribution of *C. aschersoniana*. I chose the *Lourteig* 2329 specimen at HB because it presents the typical form of the species and has duplicates in Kew and Paris.

Kostermans (1938a) considered the syntype of *Cryptocarya moschata* Nees & Martius, *Sellow s.n.* (1375), to be a specimen of *C. aschersoniana* Mez (see discussion with *C. moschata*). Obviously I do not share Kosterman's opinion, as I have elected Sellow's syntype as the lectotype of *C. moschata*.

Specimens examined - 239 (listed in appendix 13.3)

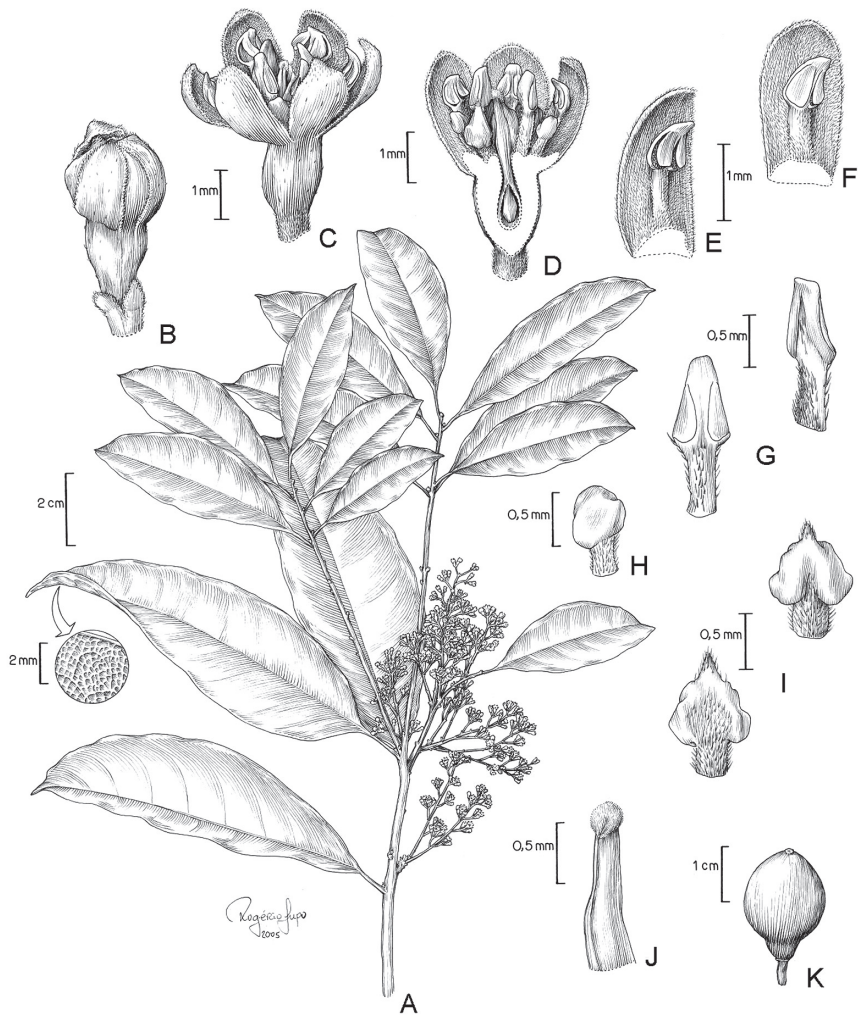


Fig. 16. *Cryptocarya aschersoniana* Mez (habitus and floral parts from *Moraes 2543*).
 A. Habitus; B. Flower bud; C-D. Flowers at anthesis; E. Stamen of androecial whorl I;
 F. Stamen of androecial whorl II; G. Stamens of androecial whorl III; H. Gland;
 I. Stamines; J. Detail of style and stigma; K. Fruit (from *Moraes 2544*).

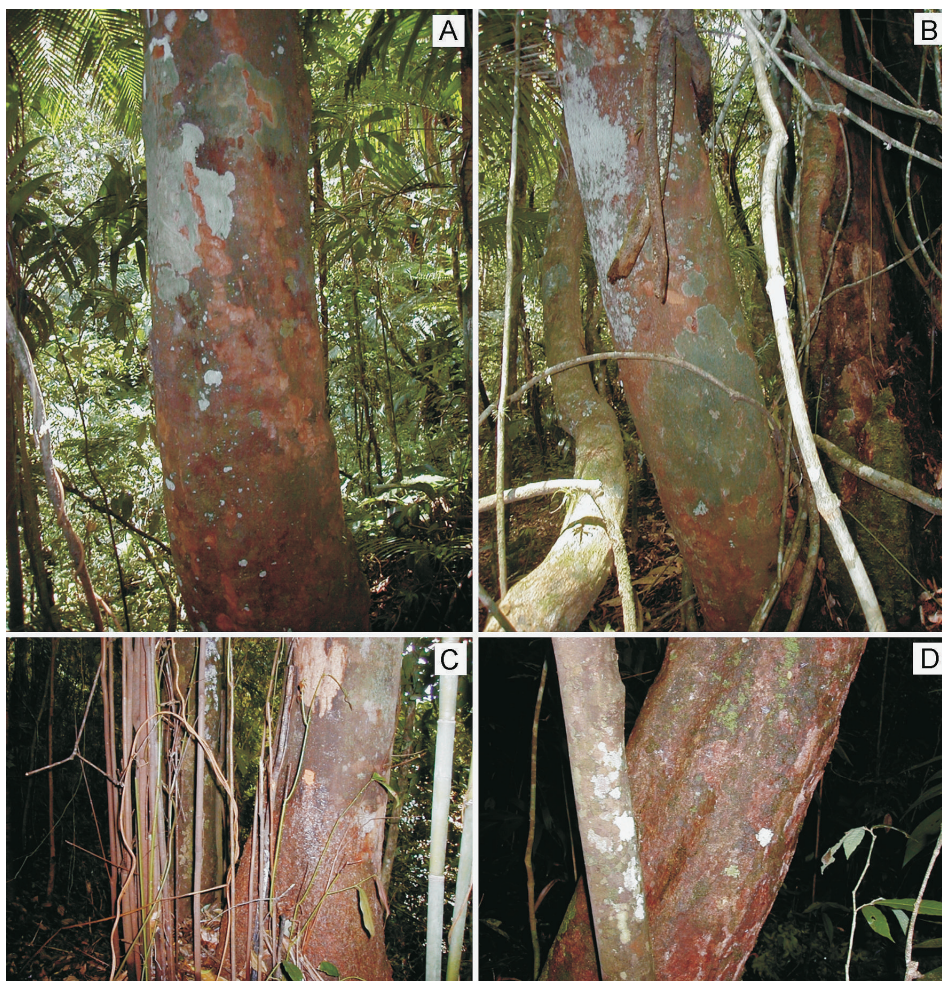


Fig. 17.1. Appearance of barks of *Cryptocarya aschersoniana* Mez. A-B. Morro do Baú, Ilhotas, SC; C-D. Bocaiúva do Sul, PR (Photographs by author).

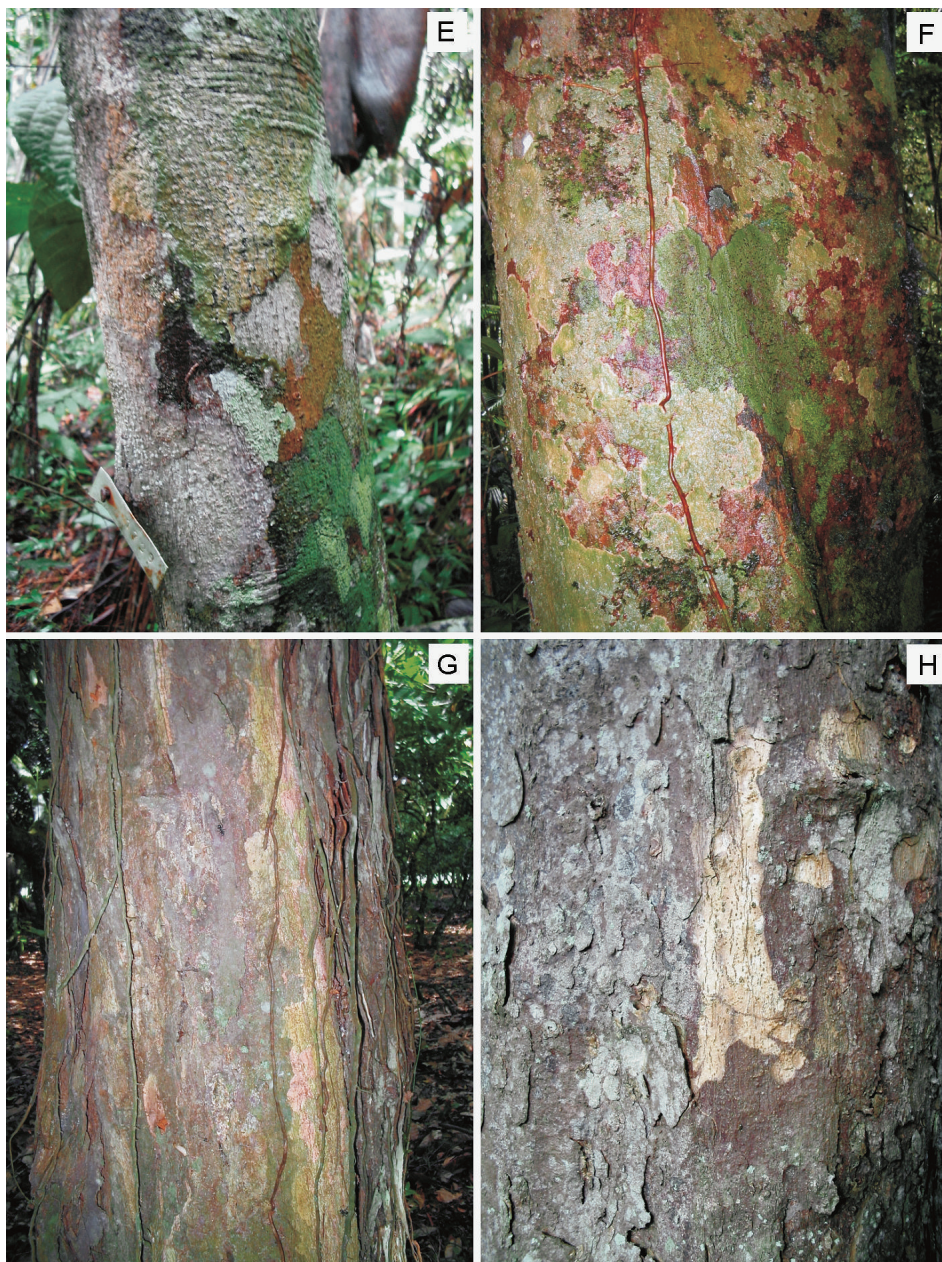


Fig. 17.2. Appearance of barks of *Cryptocarya aschersoniana* Mez. E. Young tree, Estação Biológica de Santa Lúcia, Santa Teresa, ES; F. Estação Biológica de Santa Lúcia, Santa Teresa, ES; G-H. Linhares, ES. (Photographs by author).



Fig. 18. *Cryptocarya aschersoniana* Mez. A-B. Branches collected at E.E. Juréia-Itatins, Núcleo Rio Verde, SP; C-D. Branches collected at Campos do Jordão, SP; E-F. Detail of leaves. (Photographs by author).

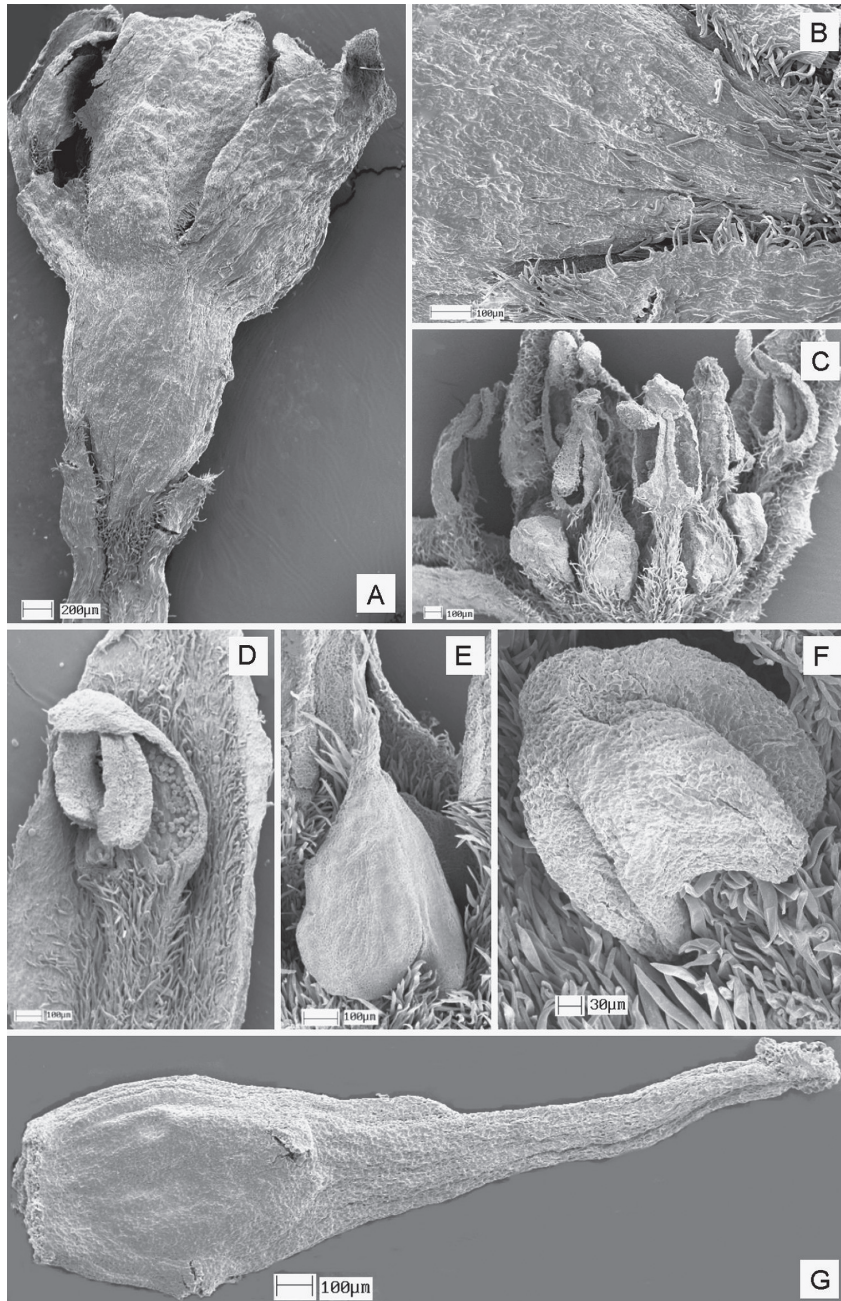


Fig. 19. SEM micrographs of flowers of *Cryptocarya aschersoniana* Mez. A. Flower bud (from *Lourteig* 2329, HB); B. External indument (from *Lourteig* 2329, HB); C. Longitudinal section of flower bud (from *Reitz & Klein* 7523, HBR); D. Adaxial side of stamen of the androecial whorl I, introrse (from *Barbosa & Abe* 397, MBM); E. Abaxial side of staminode (from *Barbosa & Abe* 397, MBM); F. Adaxial side of detail of gland (from *Barbosa & Abe* 397, MBM); G. Gynoecium (from *Barbosa & Abe* 397, MBM). (Photomicrographs by author).

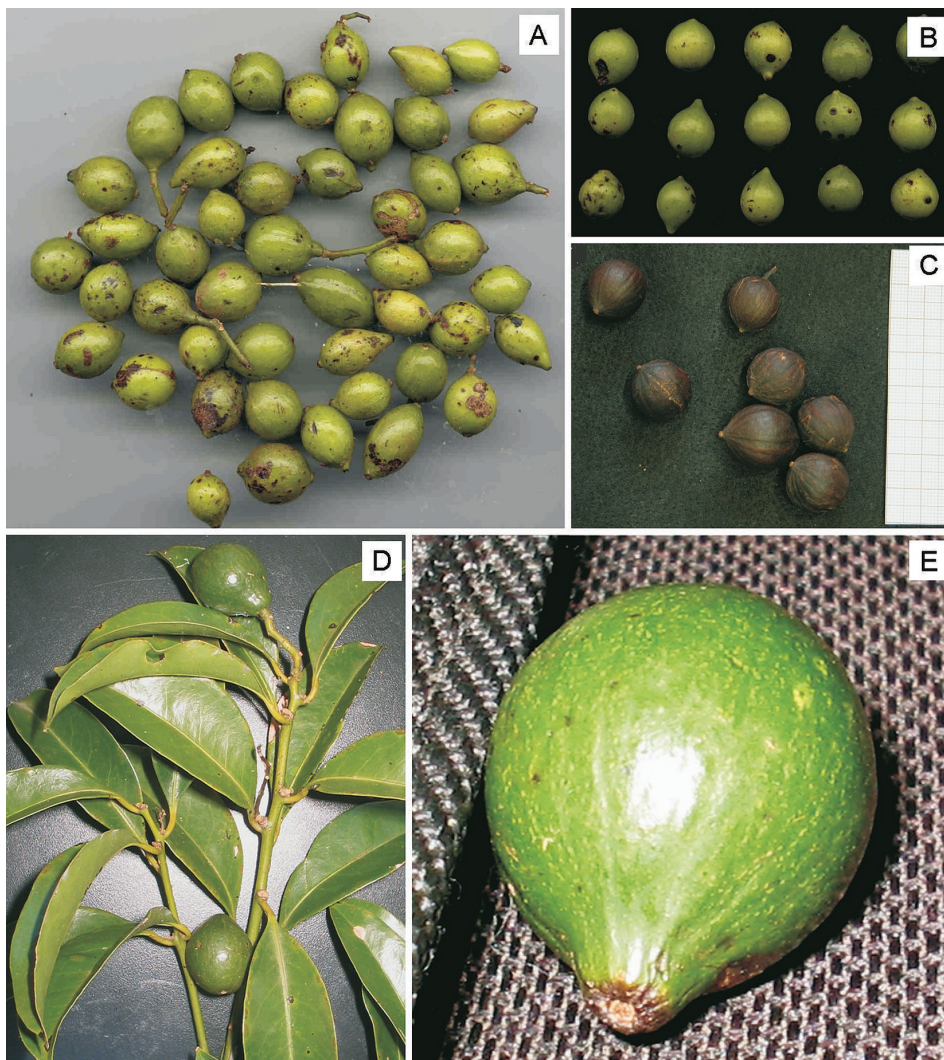


Fig. 20. *Cryptocarya aschersoniana* Mez. A. Immature fruits collected at P.E. Campos do Jordão, SP, in March 2001; B. Immature fruits collected at Serra do Japi, SP, in February 2001; C, E. Mature fruits collected at Linhares, ES, in May 2005; D. Mature fruits from *Reitz & Klein 8581* (HBR), Rio do Sul, SC. (Photographs by author).

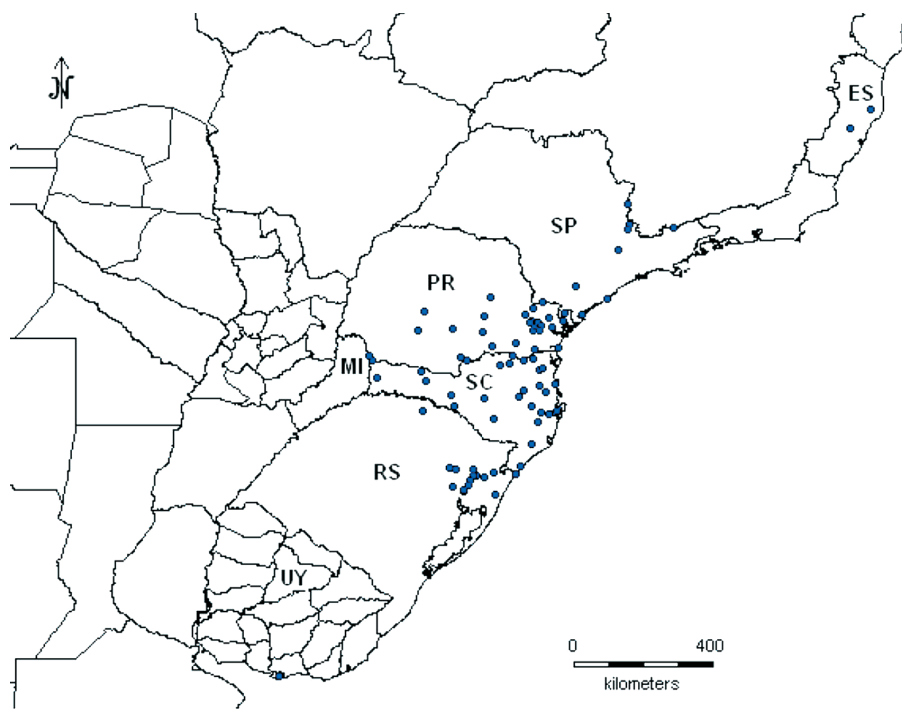


Fig. 21. Distribution of *Cryptocarya aschersoniana* Mez.

2. *Cryptocarya botelhensis* P.L.R. de Moraes sp. nov.

Holotype: Brazil. São Paulo: Parque Estadual Carlos Botelho, São Miguel Arcanjo, 24°03'45.8"S, 47°57'46.2"W, c. 840 m alt., 9 Jan. 2001 (fl.), P.L.R. de Moraes 2323 (UEC; isotypes: B, C, ESA, HBG, M, MBM, MO, NY, RB, SP, UEC). Fig. 22; Plate II B (cf. Appendix 13.5).

A *Cryptocarya micrantha* Meissner et speciebus proximis foliorum apice longo-acuminato, petiolis profunde canaliculatis et floribus glabrescentibus differt.

Differs from *Cryptocarya micrantha* Meissner and related species in the tip of the leaf long acuminate, petioles deeply canaliculate, inflorescences and flowers glabrescent.

Etymology - This species has been found only in a few localities of state of São Paulo, with Parque Estadual Carlos Botelho having its most abundant population; the specific epithet was chosen because of this.

Vernacular name - Canela-de-jacu.

Description - Trees up to 20 m tall, trunk cylindrical, DBH 27-54.11 cm (\bar{X} = 36.88 ± 6.99 cm; N = 12), bark brownish, somewhat flaky, with lenticels (Fig. 23 A-D). *Branches* terete, with longitudinal lenticels. *Branchlets* 5 cm below terminal bud c. 1.2-1.5 mm in diam., light brown in dried material, initially angular and flattened from the beginning, longitudinally striate, glabrous, somewhat shining; terminal buds minute, inconspicuous. *Petioles* 4.8-14.1 mm long, 0.5-1.7 mm thick, slender, somewhat roundish below, deeply canaliculate above, sulcate, glabrous. *Leaves* (Fig. 24 A-D) alternate, mostly narrow elliptical to elliptical, widest at the middle or most slightly below, sometimes obovate, 3.0-9.8 cm long, 0.93-2.92 cm broad, chartaceous, glabrous on both surfaces, tip short to mostly long acuminate, acumen up to 1.6 cm, base acute, revolute, margin flat to slightly recurved, sclerified; above pale, poorly reticulate; beneath paler, with papillae inconspicuous; midrib impressed to level above, slightly convex below, secondary veins rather patent (4 to 8 per side), slightly salient on both surfaces; tertiary venation loosely, slightly raised below; venation pattern brochidodromous. *Inflorescences* (Fig. 22 A) green-yellowish, panicles in the axils of distal leaves, often subterminal, many-flowered, 0.6 mm in diam. at the base, 1.63-9.8 cm long, sparsely pubescent to glabrescent, with ± short, ± appressed hairs; peduncles sparsely pubescent, short or long. *Flowers* (Fig. 22 B-N; 25 A-H) yellow, glabrescent, c. 3.3-3.98(-5.0) mm long, 1.8-2.75 mm in diam. at apex; tube urceolate, 1.2-1.5(-2.0) mm long, 0.7-1.1(-1.5) mm in diam.; pedicels glabrescent, 0.4-0.9 mm long; tepals subequal, 1.58-2.27(-2.6) mm long, c. 0.77-1.21 mm broad, concave, slightly incurved at apex, ovate, roundish to acutish, pilose within; stamens included; stamens of whorls I and II introrse, c. 0.95-1.3 mm long, anthers pilose, ovate, c. 0.46-0.78 mm long, 0.36-0.54 mm broad, connectives prolonged beyond the large sporangia, tip rounded to obtuse, filaments rather slender, pilose, as long as or slightly shorter than anthers, somewhat adnate to tepals; stamens of whorl III lateral to extrorse-lateral, c. 1.1-1.7 mm long, anthers narrowly ovate, pilose, c. 0.6-0.9 mm long, 0.4-0.5 mm broad, connectives rounded to obtuse, prolonged beyond the large sporangia, filaments rather slender, longer than anthers, pilose; glands subglobose, c. 0.38-0.8 mm long, 0.36-0.5 mm broad, long-pedicelled (up to 0.6 mm), pedicel pilose, adnate to the