Dalbergieae (4.01–4.17)

Genus: *Vataireopsis* W.A. Ducke

Phylogenetic Number: 4.01.

Tribe: Dalbergieae.

Group: Andira.

Species Studied—Species in Genus: 3 spp.—4 spp.

Fruit a legume; unilocular; 8–12 × 2–3 × 0.5–0.6 cm (in our fruits the lateral wing was folded in to fruit body and was not included in width measurement); with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; samaroid; when asymmetrical with both sutures unequally curved; not inflated; seed chamber compressed to flattened (wing); without beak; rounded and emarginate at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with wings. Fruit wings 3 (1 major apical wing and 2 smaller lateral wings folded into seed chamber); major samaroid and valvular (minor); basal; minor wings on both valves; major wing on 1 suture. Fruit substipitate or nonstipitate. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome or multicolored; mottled; greenish to reddish brown; glabrous or pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; tan; with dark spotted mottling; with brown (reddish-brown) overlay; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length oblique to fruit length. Funiculus less than 0.5 mm long; straight. Aril absent.

Seed 20–25 × 0.8–1 × 2.5–3 mm; not overgrown; not angular; asymmetrical; oblong or reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; more or less glossy; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; darker than testa; dark reddish brown; recessed. Hilum partially concealed; concealed by funicular remnant or wing; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.9 mm long; with curved outline; oval; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim. Lens not discernible. Endosperm present. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbose; lobe tip slightly curved; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

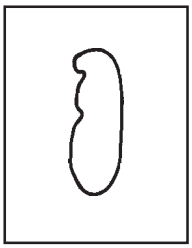
Distribution: Brazil and Surinam.

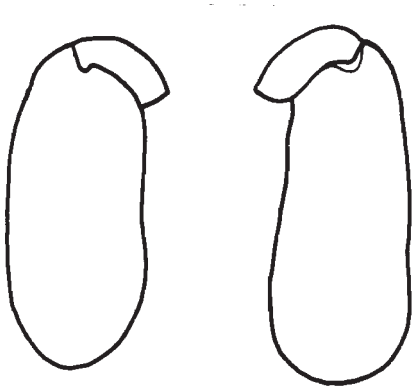
Notes: Lima *(1989)* analyzed the morphological characters of fruits, seeds, and seedlings of the tribe, and his characters and illustrations were used as a much-appreciated source of accurate data. He also discussed the phylogeny of the tribe. The species counts are derived from Polhill *(1981d)*, who also provided fruit and seed illustrations. Sousa and Sousa *(1981)* provided data to support their conclusion that the New World Lonchocarpinae be considered for tribal status—a segregate of the Dalbergieae. Hauman *(1954)* provided data on the Dalbergieae of Central Africa, and Lock *(1989)* listed the Dalbergieae for all of Africa. Thothathri *(1986)* reviewed the taxonomic status and systematic position of Asiatic Dalbergieae and monographed tribe Dalbergieae for the Indian subcontinent (Thothathri *1987*). Morphological (Lima *1989*) and molecular (Doyle et al. *1997*) evidence indicates that tribe Dalbergieae is polyphyletic. Lima *(1980)* monographed *Vataireopsis* and recognized four species, but Polhill *(1981d)* recognized three species and noted that "in time this may be amalgamated with *Vatairea*, the supplementary lateral wings on this seed-chamber (figure 3/9), visible from ovary stage, (figure 3/9),

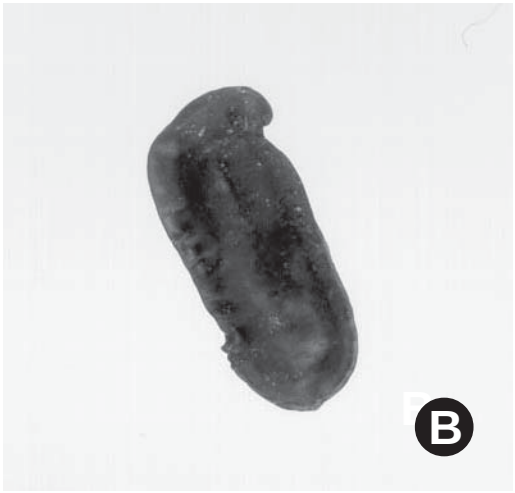
being the only significant difference and a small ridge or thickening is apparent even in species of *Vatairea*" (4.02). Whether maintaining or combining the two genera, one should remember that the testa remains with the embryo in *Vataireopsis* and is fused with the endocarp in *Vatairea*.

Vataireopsis: V. speciosa W.A. Ducke *(A–E). A*, Fruits (× 1.1); *B*, seed (× 2.6); *C–D*, testa (× 50, × 1000); *E*, embryos (× 2).


A



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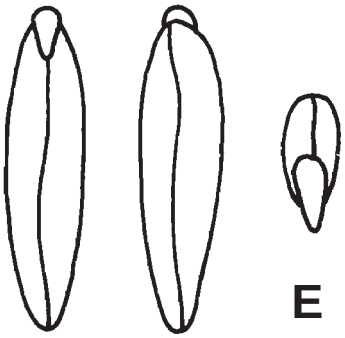
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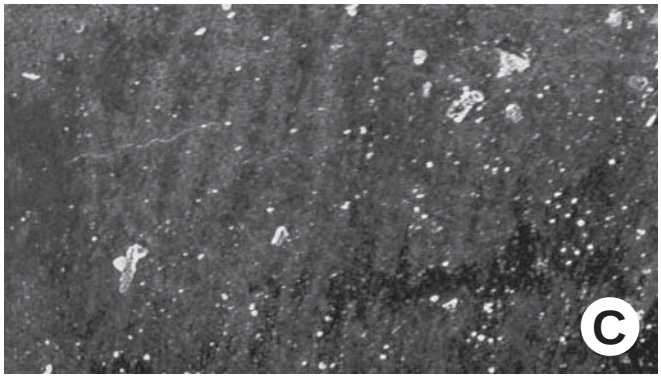
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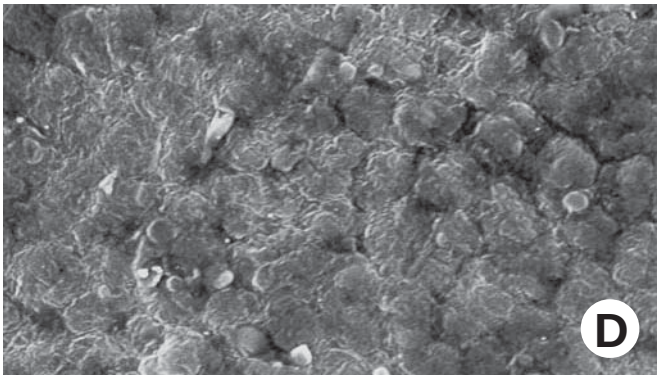

D

Genus: *Vatairea* J.B.C.F. Aublet

Phylogenetic Number: 4.02.

Tribe: Dalbergieae.

Group: Andira.

Species Studied—Species in Genus: 7 spp.—8 spp.

Fruit a legume or nutlet; unilocular; 8.5–14 × 2.5–8 × 0.6–3.5 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight or curved (to slightly curved); not plicate; not twisted; asymmetrical or symmetrical; circular or samaroid; when asymmetrical with both sutures parallelly to unequally curved; not inflated; seed chamber compressed to flattened (wing); without beak; rounded or short tapered at apex; apex oblique or aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous or drupaceous (*V. guianensis* J.B.C.F. Aublet); seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished or plain; with wing. Fruit wing present or absent; 1; up to 80 mm wide; samaroid; basal; on 1 suture. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; brown to reddish brown; glabrous; without spines; not smooth; with elevated features; irregularly veined; not tuberculate; not exfoliating; without cracks. Mesocarp thick (over seed chamber); surface uniformly veined; 1-layered; without balsamic vesicles; with fibers; fibrous throughout; ligneous. Endocarp dull; monochrome; dark reddish brown; nonseptate; coriaceous; exfoliating (with fused testa); separating from epicarp; entire. Seed 1; length oblique to fruit length. Funiculus less than 0.5 mm long; straight. Aril absent.

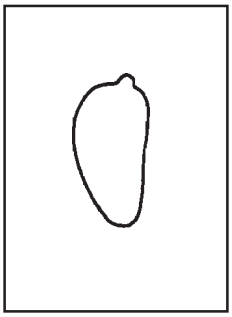
Seed 15–65 × 10–45 × 0.4–8 mm; not overgrown or overgrown, 1 seed filling entire fruit cavity *(V. guianensis);* not angular; asymmetrical or symmetrical; oblong, obovate, or circular; compressed; with surface ridged; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa absent (testa fused to endocarp and endocarp falling with embryo or not). Endosperm absent. Cotyledons not smooth; wrinkled; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; greenish tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique or parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbose or linear; deflexed and parallel to cotyledon width or straight with embryonic axis *(V. guianensis);* centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

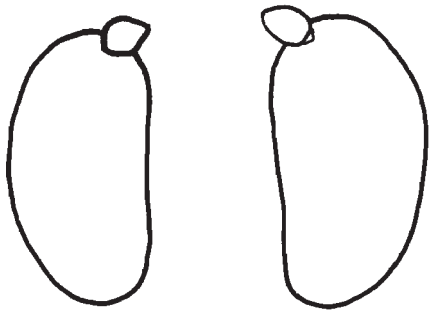
Distribution: Mexico and Central America to Brazil.

Notes: Lima *(1982b)* monographed the genus and recognized eight species, while Polhill *(1981d)* noted "ca. seven species." The testa is fused with the endocarp. Refer to *Vataireopsis* (4.01) for a discussion of the two genera.

Vatairea: V. lundellii (P.C. Standley) P.C. Standley *(C–E), V.* spp. *(A–B). A,* Fruits (× 0.6); *B,* embryos (× 2); *C–D,* endocarp (functioning as testa) (× 50, × 1000); *E,* embryos (× 2).


A



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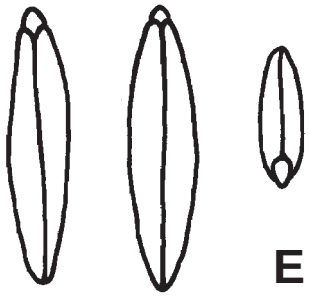
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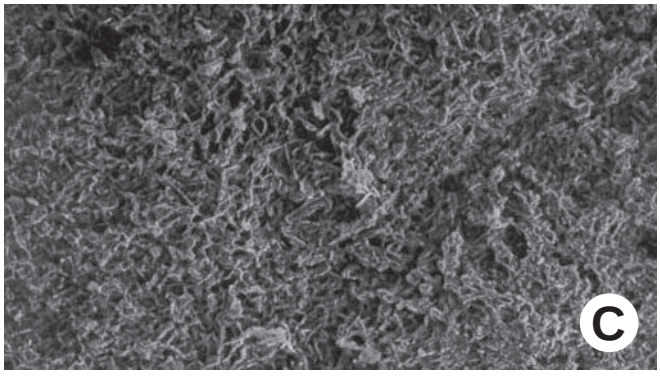
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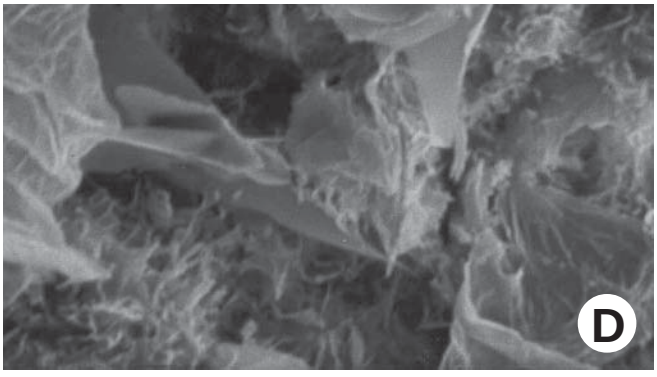

D

Genus: *Hymenolobium* G. Bentham

Phylogenetic Number: 4.03.

Tribe: Dalbergieae.

Group: Andira.

Species Studied—Species in Genus: 11 spp.—17 spp.

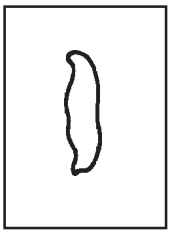
Fruit a legume; unilocular; 4.5–20 × 1.5–6 × 0.17–0.18 cm; with deciduous corolla; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted or twisted (at base in *H. modestum* A. Ducke and folded in other species); symmetrical or asymmetrical; oblong, oblanceolate, linear, elliptic, or circular; when asymmetrical with both sutures parallelly curved or nearly straight; not inflated; flattened; without beak; short tapered, rounded, or emarginate at apex; apex aligned or oblique with longitudinal axis of fruit; short tapered at base; base aligned or right angled with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous, membranous, or chartaceous; seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with wing. Fruit wing 1; 2.5 mm wide; samaroid (and occasionally lower portion of one wing folds over itself); on both sutures. Fruit substipitate. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; reddish purple or brown; glabrous; eglandular; without spines; not smooth; with elevated features; reticulately veined (and with or without one or two major veins arising from stipe); not tuberculate; not exfoliating; without cracks. Mesocarp present (or nearly so in wing areas of some species) or absent; thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous or chartaceous. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1–3(–4); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; slightly curved. Aril absent.

Seed 12–40 × 4–9 × 2–2.5 mm; not overgrown; not angular; asymmetrical; oblong, linear, or C-shaped; flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish purple; glabrous; not smooth; with elevated features; longitudinally wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to lens (at base of seed); not bifurcating; color of testa; reddish purple; slightly raised. Hilum fully concealed; concealed by funiculus; without faboid split; punctiform; between cotyledon and radicle lobe; flush; not within corona, halo, or rim. Lens discernible or not discernible; less than 0.5 mm in length or equal to or greater than 0.5 mm in length; up to 1 mm long; not in groove of raphe; nearly 180 degrees from hilum; mounded; similar color as testa; darker than testa; reddish purple; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; differing at apex (1 concealed by overarching radicle and other auriculate and concealing radicle); not concealing radicle; notched at radicle; without or with lobes; with lobes not touching; without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed or straight; oblique or parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbose; lobe tip straight; deflexed and parallel to cotyledon width or straight with embryonic axis; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical South America and Costa Rica.

Notes: Mattos *(1979b)* monographed the genus, recognizing 17 species, and we are using this count rather than the 10–15 count of Polhill *(1981d)*. Lima *(1982a)* reported on the morphology of the species in this genus that are deposited in the herbarium of the Botanic Garden at Rio de Janeiro (RB).

Hymenolobium: H. heringerianum C.T. Rizzini *(C–E)*, *H.* spp. *(A–B)*. *A*, Fruits (× 1.1); *B*, seeds (curved seed apex has damaged testa) (× 2); *C–D*, testa (× 50, × 1000); *E*, embryos (× 2).

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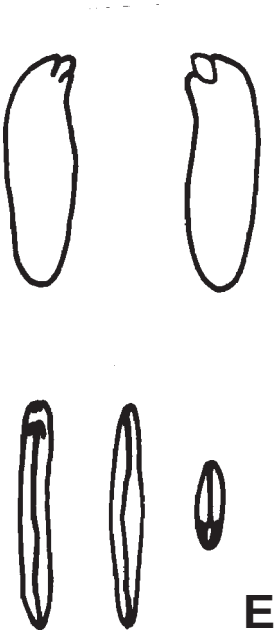
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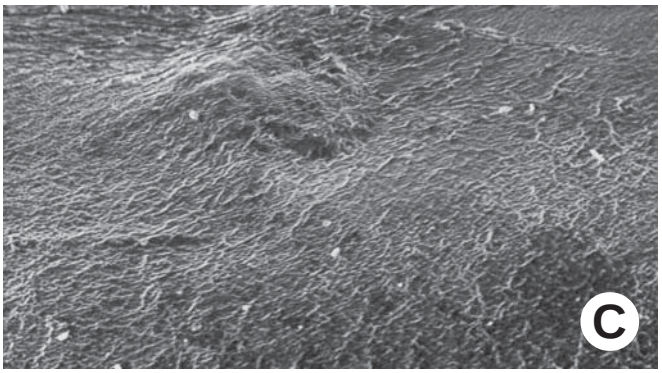
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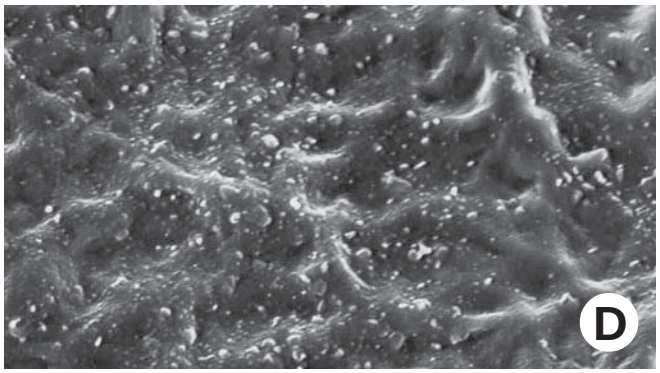

D

Genus: *Andira* A.L. de Jussieu

Phylogenetic Number: 4.04.

Tribe: Dalbergieae.

Group: Andira.

Species Studied—Species in Genus: 14 spp.—ca. 30 spp. (R.T. Pennington, personal communication, 1998).

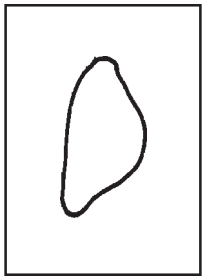
Fruit a legume (described by R.T. Pennington as a drupe—personal communication, 1998); unilocular; 2–13 × 1.5–10 × 1.5–10 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; oblong, obovate, ovate, or circular; when asymmetrical with both sutures parallelly curved; not inflated; terete; without beak; rounded at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; drupaceous (fresh) or ligneous (dry); seed chambers externally invisible. Fruit margin not constricted; with sulcus (slight); plain. Fruit wings absent. Fruit nonstipitate or substipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; dark reddish brown; glabrous or glabrate; eglandular; without spines; not smooth; with elevated or recessed features; not veined; not tuberculate; rugose, verrucose-rugose, or wrinkled; broadly pitted; not exfoliating, checking, exfoliating in part, or exfoliating; with cracks; cracking irregular. Mesocarp thick; surface uniformly veined; 1-layered; without balsamic vesicles; fibrous throughout to fleshy (some when fresh); ligneous. Endocarp dull; monochrome; brown; scurfy; nonseptate or subseptate; with septa thin (tissue paper-like), flexible; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1(–3); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only. Aril absent.

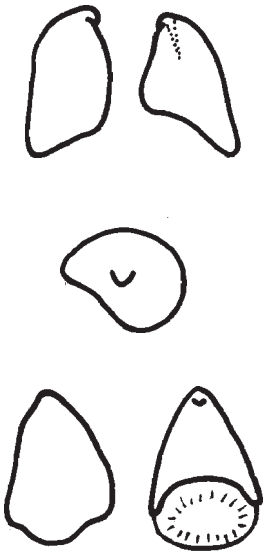
Seed 20–80 × 15–60 × 15–60 mm; overgrown, 1 seed filling entire fruit cavity; not angular; symmetrical; oblong or circular; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa absent or present; not adhering or partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; not smooth; with elevated features; wrinkled; chartaceous (to membransceous). Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum present, even when concealed. Endosperm absent. Cotyledons not smooth (wrinkled) or smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; completely concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; brown or tan; inner face flat; glabrous around base of radicle. Embryonic axis straight or deflexed; parallel or oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; straight with embryonic axis or deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Neotropics, with two subspecies in Africa.

Notes: According to Lock *(1989)*, the species of *Andira* in Africa is now treated as *Andira inermis* (O.P. Swartz) K.S. Kunth ex A.-P. de Candolle subsp. *inermis*, subsp. *grandiflora* (J.B.A. Guillemin & G.S. Perrottet) R.M. Polhill, and subsp. *rooseveltii* (E.A.J. Wildeman) R.M. Polhill. Mattos *(1979a)* monographed the genus in Brazil and recognized 27 species and seven varieties.

Andira: A. fraxinifolia G. Bentham *(C–E), A.* spp. *(A–B). A*, Fruits (without and with epicarps and one in transection) (× 0.5); *B*, seeds (× 2); *C–D*, testa (× 50, × 1000); *E*, embryos (× 1).





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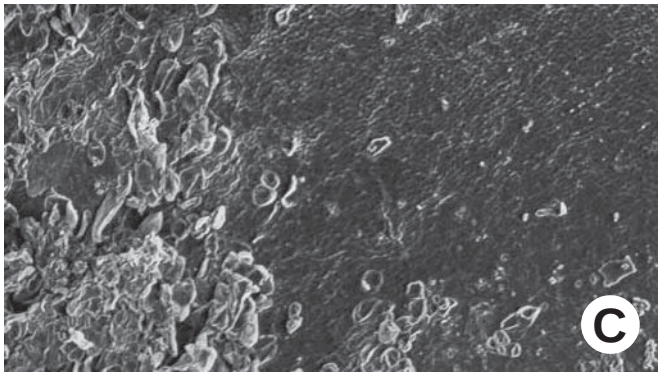
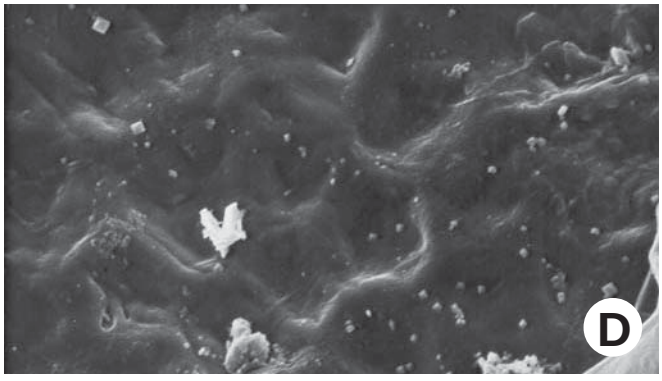




Genus: *Dalbergia* C. Linnaeus f.

Phylogenetic Number: 4.05.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 47 spp.—ca. 100 spp.

Fruit a legume; unilocular; 1.3–14.5 × 1–3.5 × 0.1–0.6 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight to curved (to slightly curved); not plicate; not twisted; symmetrical or asymmetrical; oblong, lanceolate, elliptic, fusiform, circular, reniform, or falcate; when asymmetrical with 1 straight and 1 curved suture, both sutures parallelly curved, or both sutures unequally curved; widest near middle or D-shaped; not inflated; flattened; without beak; rounded at apex; apex aligned or right-angled with longitudinal axis of fruit; rounded at base; base aligned or right angled with longitudinal axis of fruit; with the apex and base uniform in texture; membranous or coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose or torulose. Fruit margin not constricted or constricted along both margins; without sulcus; embellished or plain; with wing. Fruit wing present or absent; 1; up to 30 mm wide; continuous wing around fruit; on both sutures. Fruit stipitate; with the stipe 10–30 mm long. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull or glossy; monochrome; reddish brown or tan; glabrous or pubescent and indurate; with 1 type of pubescence; tomentose; with pubescence gray (assumed); with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; faintly wrinkled or verrucose-rugose; not exfoliating; without or with cracks (over seed chamber). Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; tan; spongy; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1(–4); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril absent.

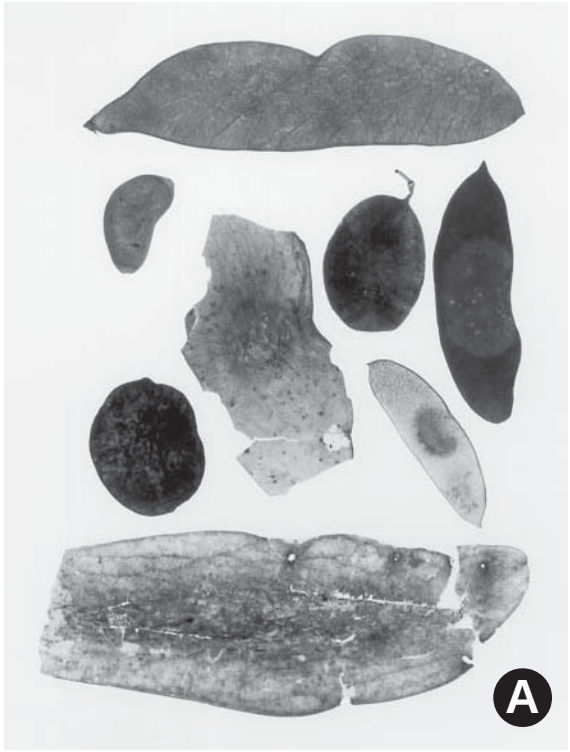
Seed 4–20 × 2–11 × 2–2.3 mm; not overgrown; not angular; asymmetrical; reniform or oblong; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth or not smooth; with elevated or recessed features; shagreen; punctate (scattered especially near hilar area); chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible or visible; from hilum to lens (or lens not visible and terminating well before base of seed); not bifurcating; darker than testa; black; raised. Hilum fully concealed or visible; concealed by funicular remnant; with or without faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; punctiform; between cotyledon and radicle lobe; raised; not within corona, halo, or rim or within halo. Hilum halo color lighter than testa. Lens discernible or not discernible; less than 0.5 mm in length; with margins curved; circular or elliptic; not in groove of raphe; adjacent to hilum; up to 2 mm from hilum; mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; with lobes; with lobes not touching; without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; tan or green (yellowish); inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; lobe tip curved or hooked; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed or rudimentary; glabrous.

Distribution: Pantropical.

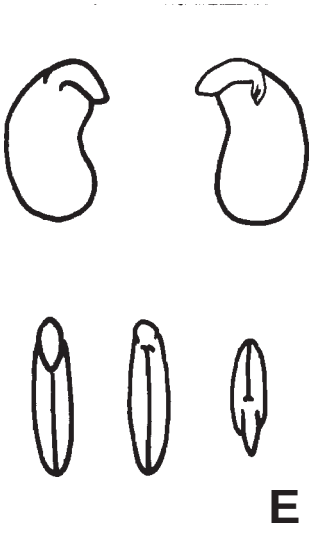
Notes: Hoehne *(1941)* reported on the 42 species of *Dalbergia* that he recognized in Brazil, and Carvalho *(1997)* reviewed Brazilian *Dalbergia* accepting just 41 species of which three were newly described by him. Cronquist *(1954)* treated *Dalbergia* in the Congo, and

Sunarno and Ohashi *(1997)* treated the 21 species of Borneo, including four new ones. The seeds of *Dalbergia* are difficult to score for raphe and lens characters. Some seeds have a black mark on the reddish-brown testae, confluent with the hilum which may represent a raphe or a lens. If a raphe is apparent, then it does not go to the end of the seeds, and if a lens is apparent, then it is atypical in shape and thickness.

Dalbergia: D. arbutifolia A. Ducke *(C–E), D.* spp. *(A–B).* *A,* Fruits (× 0.6); *B,* seeds (× 3); *C–D,* testa (× 50, × 1000); *E,* embryos (× 2).


A


B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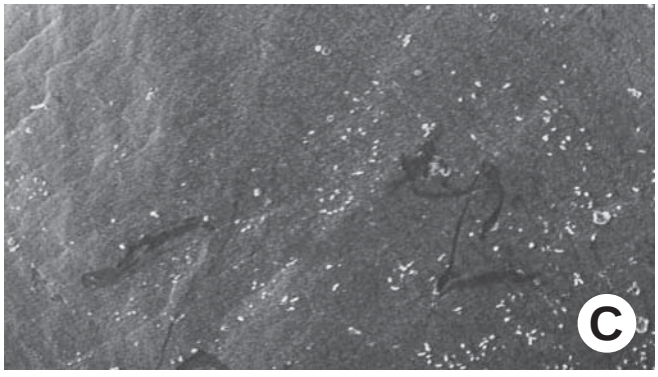
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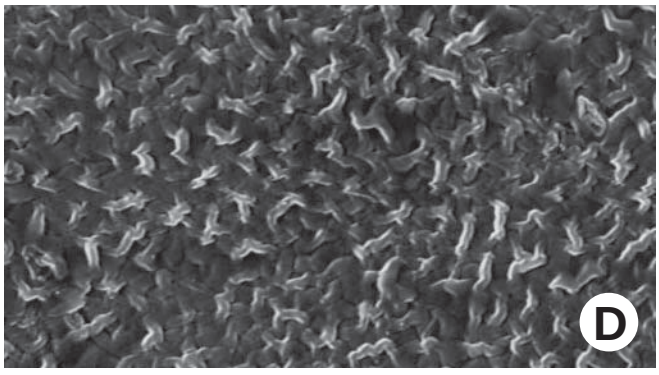

D

Genus: *Machaerium* C.H. Persoon

Phylogenetic Number: 4.06.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 73 spp.—ca. 120 spp.

Fruit a legume; unilocular; 2–9.5 × 0.6–4 × 0.17–0.5 cm; with deciduous corolla; with deciduous or persistent calyx; with calyx shorter than fruit; without or with orifice formed by curving of fruit or fruit segments; straight, curved, 0.5-coiled, or 1-coiled; not plicate; not twisted; asymmetrical; falcate, C-shaped, coiled, circular, or samaroid; when asymmetrical with both sutures parallelly or unequally curved; not inflated; flattened or compressed; without beak; rounded or short tapered at apex; apex aligned or right-angled with longitudinal axis of fruit; rounded at base; base aligned or right angled with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous or ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished or plain; with wings. Fruit wings absent or present; up to 30; samaroid; apical (and usually straight with seed chamber straight to curved or sharply bent (to 90 degrees in *M. robiniifolium* (A.-P. de Candolle) J.R.T. Vogel); on 1 valve; on 1 suture. Fruit stipitate to substipitate; with the stipe 2.5–10 mm long. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome or multicolored; bichrome (wing reddish-brown and seed chamber greenish-brown); brown (to dark or light reddish); glabrous, glabrate, or pubescent and indurate; with hairs appressed or erect; with 1 type of pubescence; puberulent; with pubescence gray or brown (reddish); with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined (especially wings); not tuberculate; warty (well developed on seed chamber of *M. quinta* (J.C.B.F. Aublet) N.Y. Sandwith); not exfoliating; with (somewhat checking over seed chamber) or without cracks; cracking irregular. Mesocarp thin or thick (and corky over seed chamber); surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous or ligneous (sub). Endocarp dull; monochrome or streaked; brown; with streaking above and below seed chambers; with brown (reddish) overlay; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus less than 0.5 mm long; thick; straight. Aril absent.

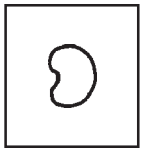
Seed 8.5–30 × 3–15 × 1–7 mm; not overgrown or overgrown, 1 seed filling entire fruit cavity (especially in *M. lunatum* (C. Linnaeus Filins) W.A. Ducke); angular or not angular; asymmetrical; reniform, C-shaped, circular, ovate, or linear; flattened; with surface wrinkled, smooth, or ridged (radiating from hilum area); without visible radicle and cotyledon lobes; with deep hilar sinus or without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; dark reddish brown; with black overlay (areas where vitreous tissue is located); glabrous; not smooth or smooth; with elevated features; wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum to near base of seed (or midway to base) and terminating; not bifurcating; darker than testa; black; raised. Hilum fully concealed (remaining with fruit in *M. lunatum*) or partially concealed; concealed by funicular remnant or wing; without faboid split; punctiform or larger than punctiform; up to 25 mm long; with curved or angular outline; circular; irregular; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim or within halo. Hilum halo color darker (black) than testa. Lens not discernible. Endosperm absent. Cotyledons not smooth or smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially or not concealing radicle; split over radicle; with lobes; with lobes touching (auriculate), overlapping, or not touching; without or with basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; brown (to dark brown), tan, or green (bright); inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; lobe tip straight, curved, or hooked; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed or moderately developed; glabrous.

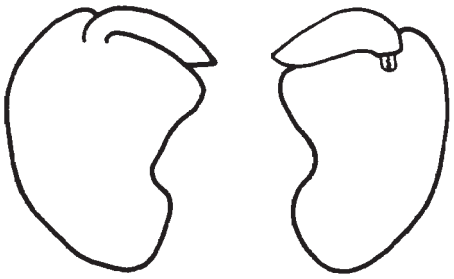
Distribution: Mexico, Central America to Argentina, with *M. lunatum* (C. Linnaeus) A. Ducke naturalized along west coast of Africa.

Notes: Rudd *(1977)* monographed the 14 species of *Machaerium* in Mexico, and Tamayo *(1945)* monographed the 5 species in Argentina. Seeds of *M. robiniifolium* have a unique testa morphology. The testa, like other testae in *Machaerium*, is chartaceous, but there are areas along the "raphe" axis that are thickened and contain vitreous black patches which are quite thick. These patches are visible on the surface of the testa.

Machaerium: M. opacum J.R.T. Vogel *(C–E), M.* spp. *(A–B)*. Fruits (× 0.8); *B*, seeds (× 1.8); *C–D*, testa (× 50, × 1000); *E*, embryos (× 5).


A



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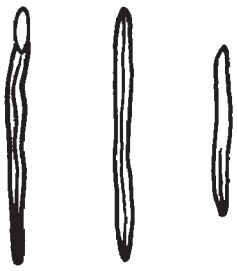
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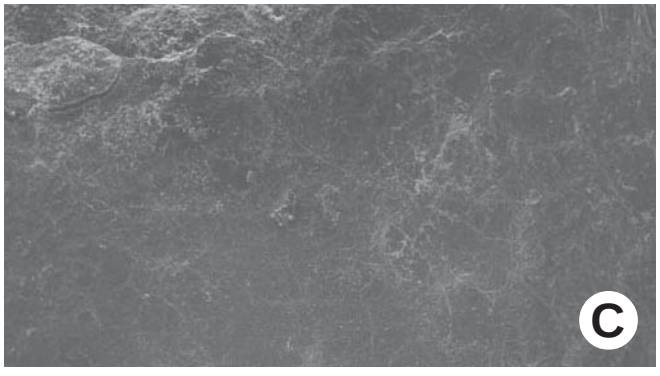
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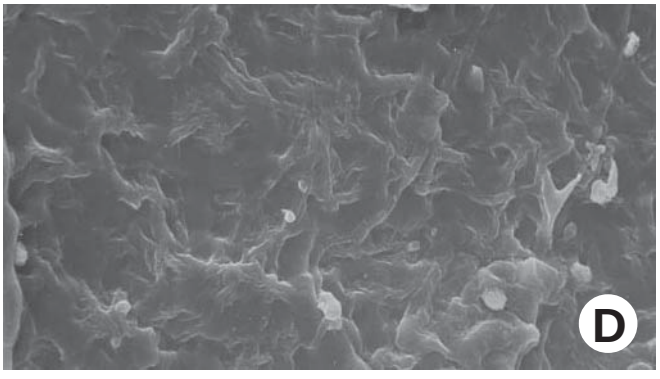

D

Genus: *Fissicalyx* G. Bentham

Phylogenetic Number: 4.07.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 1 sp.—1 sp.

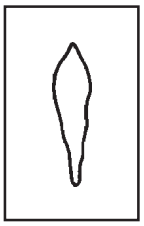
Fruit a legume; unilocular; 4–6 × 2.5–7 × 0.4–0.8 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; oblong; not inflated; flattened; without beak; truncate at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with wing. Fruit wing 1; up to 25 mm wide; samaroid; on both sutures. Fruit substipitate. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; tan (yellowish with darker seed chamber); pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; transversely veined relative to fruit length to reticulately veined (transversely on wings and prominent midrib over seed chamber); not tuberculate; not exfoliating; without cracks. Mesocarp present (around seed chamber); thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy; monochrome (with a few random reddish-brown "glands?"); tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus less than 0.5 mm long; flattened; straight. Aril absent.

Seed 15–25 × 4.5–12 × 4 mm; not overgrown; angular; symmetrical; linear; more or less terete; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or streaked (occasionally with 1 streak on each face); with infrequent streaks; reddish brown; with brown (dark reddish) overlay; glabrous; not smooth; with elevated features; wrinkled (large and small); chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; darker than testa; reddish brown; slightly raised. Hilum partially concealed; concealed by funicular remnant; without faboid split; larger than punctiform; 1.2 mm long; with curved outline; elliptic; subapical to radicle tip; flush; not within corona, halo, or rim. Lens not discernible. Endosperm absent. Cotyledons not smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; notched at radicle; without or with lobes; with lobes not touching; without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis straight; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; lobe tip straight; straight with embryonic axis or oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Panama, Venezuela, and Guyana.

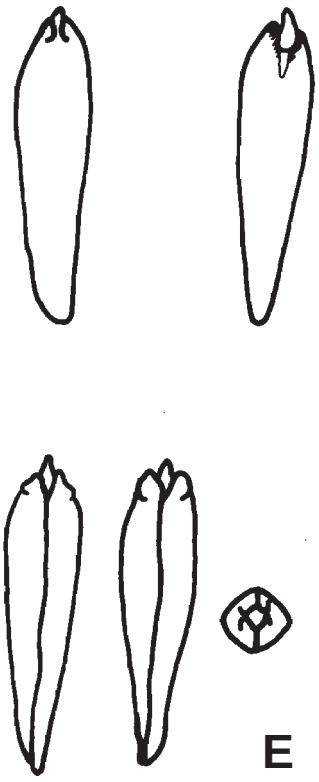
Notes: Seeds were difficult to obtain, thus our data are based on limited material.

Fissicalyx: F. fendleri G. Bentham *(A–E). A,* Fruits (× 0.8); *B,* seed (× 4.2); *C–D,* testa (× 50, × 1000); *E,* embryos (× 2.5).




A


B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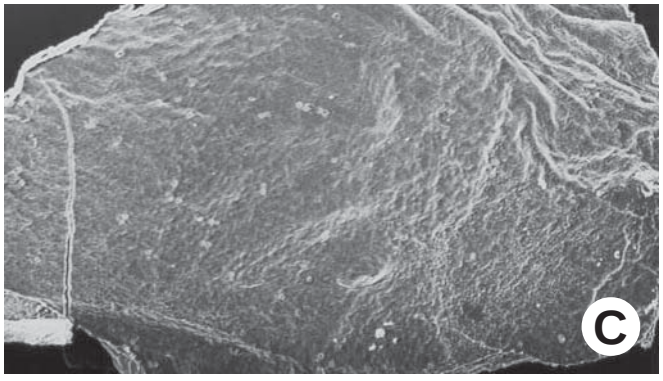
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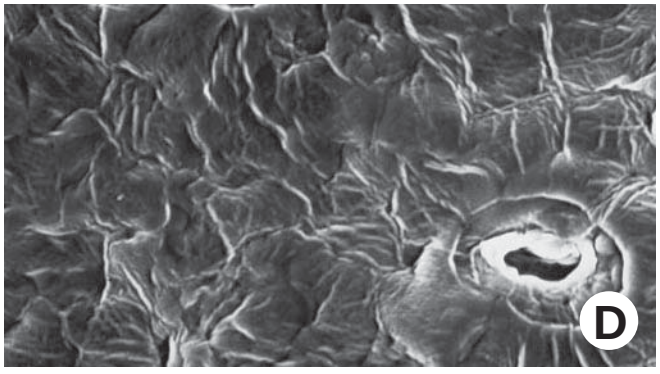

D

Genus: *Platymiscium* J.R.T. Vogel

Phylogenetic Number: 4.08.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 16 spp.—ca. 18 spp. (R.T. Pennington, personal communication, 1998).

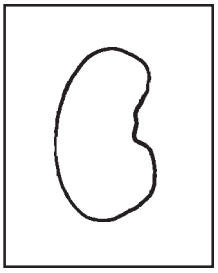
Fruit a legume; unilocular; 4–15 × 1.5–4.5 × 0.09–0.4 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; symmetrical; elliptic or oblong; not inflated; flattened; without beak; rounded at apex; apex aligned or oblique (slightly) with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; embellished; with wing. Fruit wing 1; up to 40 mm wide; samaroid; on both sutures. Fruit stipitate; with the stipe 7–10 mm long. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; brown (to greenish to reddish) or tan; glabrous; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; wrinkled or tuberculate (scattered); not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; reddish brown; smooth and reticulate; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus less than 0.5 mm long; thick; straight. Aril absent.

Seed 7–20 × 3–10 × 1.5 mm; not overgrown; not angular; asymmetrical; reniform (to subreniform); flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown (to greenish); glabrous; smooth or not smooth; with elevated features; slightly wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe faintly visible or not visible; from hilum to lens; not bifurcating; slightly darker than testa; brown (to greenish); raised. Hilum fully concealed; concealed by funicular remnant; without faboid split; punctiform; marginal according to radicle tip; flush; not within corona, halo, or rim. Lens faintly discernible or not discernible; less than 0.5 mm in length; with margins straight or curved; oblong; not in groove of raphe; adjacent to hilum; up to 8 mm from hilum; mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; (almost) partially concealing or not concealing radicle; entire over radicle; without or with lobes; with lobes not touching; without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; reddish brown or tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbose; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: West Indies, Central America, and South America.

Notes: Pittier *(1918)* provided some fruit and seed data for *Platymiscium pinnatum* (N. von Jacquin) A. Dugand, and Zamora and Klitgaard *(1997)* published a new species for Costa Rica, *P. curuense* N. Zamora & B.B. Klitgaard, which is included in the species count.

Platymiscium: P. filipes G. Bentham *(C–E)*, *P.* spp. *(A–B)*. *A*, Fruits (× 0.5); *B*, seeds (× 1.4); *C–D*, testa (× 50, × 1000); *E*, embryos (× 2).

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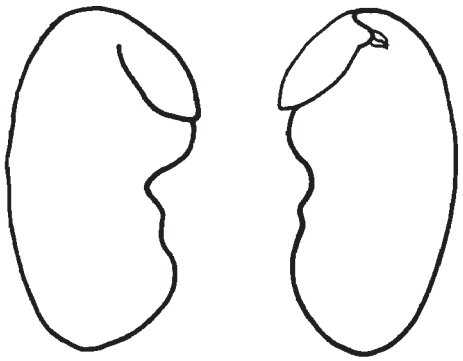


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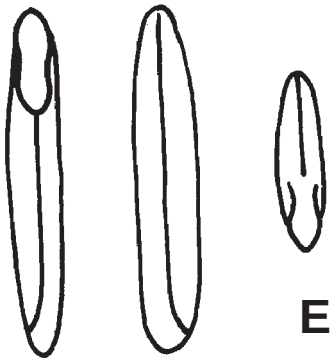
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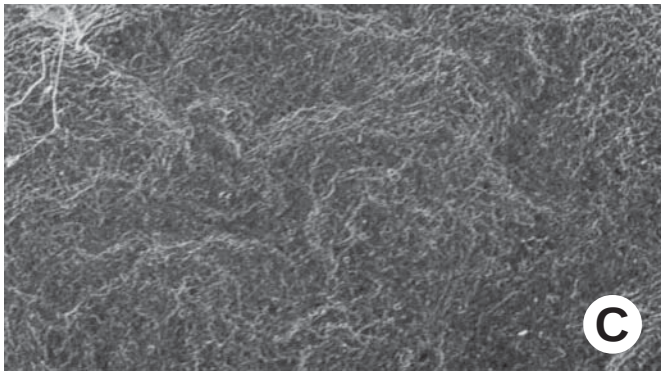
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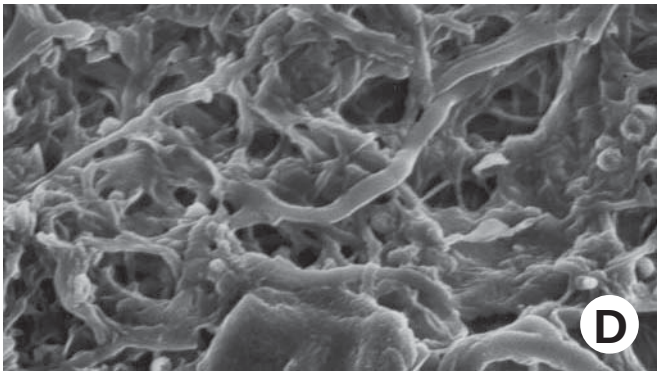

D

Genus: *Grazielodendron* H.C. de Lima

Phylogenetic Number: 4.09.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 1 sp.—1 sp.

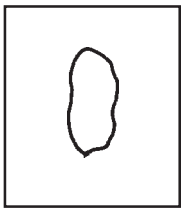
Fruit a legume; unilocular; 8–12 × 4–5 × 0.5 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; oblong or elliptic; when asymmetrical with both sutures parallelly curved; not inflated; flattened; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with wing. Fruit wing 1; up to 50 mm wide; samaroid; on both sutures. Fruit substipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; greenish brown; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; whitish tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1(–2); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril absent.

Seed 25–30 × 10–14 × 2.5 mm; not overgrown; not angular; asymmetrical; oblong; flattened; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark reddish brown; glabrous; not smooth; with elevated features; wrinkled and shagreen; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; darker than testa; dark reddish brown; raised. Hilum visible or partially concealed; concealed by wing; without faboid split; larger than punctiform; 0.5 mm long; with curved outline; elliptic; between cotyledon and radicle lobe; flush; within rim (not well developed). Hilum rim color darker than testa. Lens not discernible. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; with lobes; with lobes not touching or touching (auriculate); without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbose or linear; lobe tip straight or curved; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

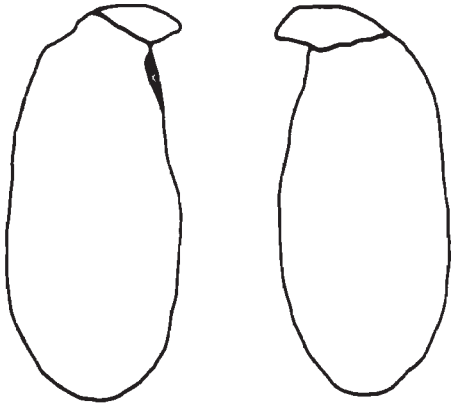
Distribution: Brazil.

Notes: Lima *(1983)* founded this monotypic genus and sent us seeds and fruits for our study.

Grazielodendron: G. rio-docensis H.C. de Lima *(A–E). A,* Fruits (× 0.6); *B,* seed (× 2.2); *C–D,* testa (× 50, × 1000); *E,* embryos (× 2.5).




A

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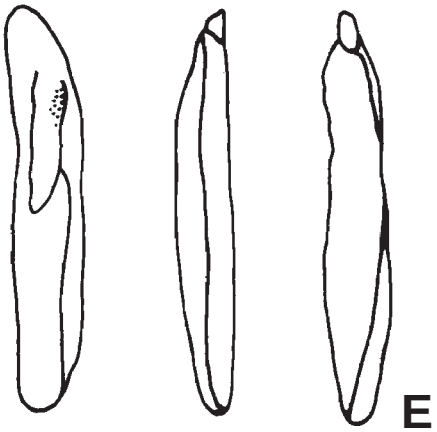
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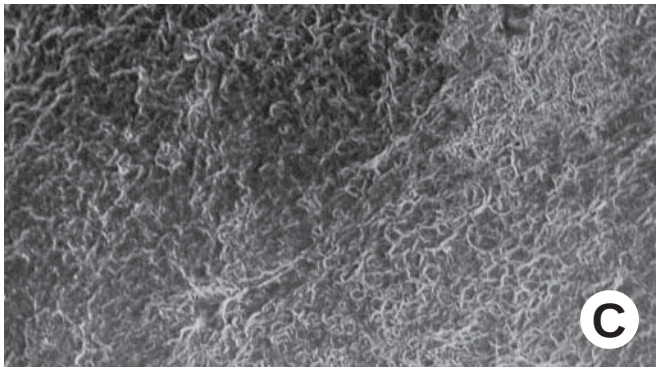
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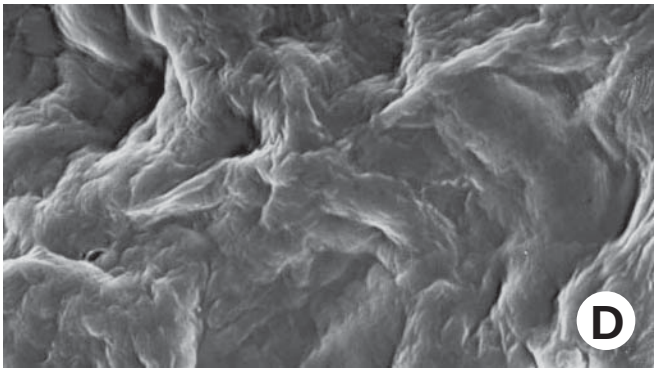

D

Genus: *Paramachaerium* A. Ducke

Phylogenetic Number: 4.10.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 4 spp.—5 spp.

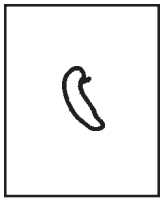
Fruit a legume or nutlet; unilocular; 2.5–12 × 2–6 × 0.7–1 cm; with deciduous corolla; with deciduous calyx; straight or curved (slightly); not plicate; not twisted; asymmetrical; oblong, lanceolate, falcate, C-shaped (barely), or samaroid; when asymmetrical with both sutures parallelly curved, unequally curved, or nearly straight; not inflated; flattened; without beak; rounded or short tapered at apex; apex oblique or right-angled with longitudinal axis of fruit; short tapered or rounded at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous or ligneous (especially seed chambers); seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished or plain; with wing. Fruit wing present or absent (in *P. schomburgkii*); 1; up to 100 mm wide; samaroid; basal; on 1 suture. Fruit substipitate or nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; brown (but turning black on drying) or black; glabrate or pubescent but soon deciduous; with 1 type of pubescence; pilose or tomentose; with pubescence brown (reddish); with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thick (over seed chamber); surface uniformly veined; 2-layered; without balsamic vesicles; with fibers; with fibers over solid layer; coriaceous or ligneous. Endocarp dull; monochrome; tan; smooth; septate or nonseptate; with septa thicker than paper, firm (solid); with septa eglandular; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1 or 2; length transverse to fruit length; neither overlapping nor touching or overlapping and touching; in 1 series. Funiculus of 1 length only; straight. Aril absent.

Seed 1.4 × 0.4 × 0.3 mm; not overgrown; not angular; asymmetrical; linear, oblong, reniform (to oblong), or triangular; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brown (brown to blackish); glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; entire over radicle; without or with lobes; with lobes not touching; without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; reddish brown; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

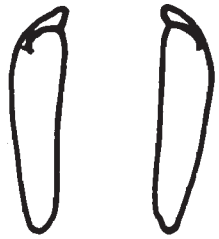
Distribution: Panama, Guyana, and Brazil.

Notes: Rudd *(1981b)* supplied the count of five species, and we are not using the three-species count of Polhill *(1981d).* Rudd noted, “that the two species, *P. schomburgkii* and *P. ormosioides* (A. Ducke) A. Ducke with the least wing development on the pods which are presumably best adapted to flotation, are reported to occur on periodically inundated land, ‘igapó.’ Two other species, *P. gruberi* G.K. Brizicky and *P. schunkei* V.E. Rudd, with conspicuous wing development and *P. krukovii* V.E. Rudd, expected to have winged pods, are found in locations not subject to flooding.” Brizicky *(1960)* presented fruit and seed data for the Panamanian species, *P. gruberi.*

Paramachaerium: P. schomburgkii (G. Bentham) A. Ducke *(B–E), P.* spp. *(A). A,* Fruits (× 0.8); *B,* seeds (× 5.3); *C–D,* testa (× 50, × 1000); *E,* embryos (× 10).




A

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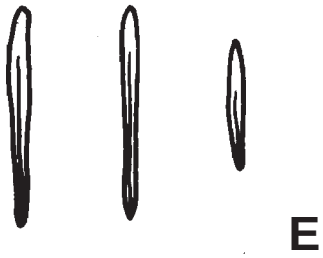
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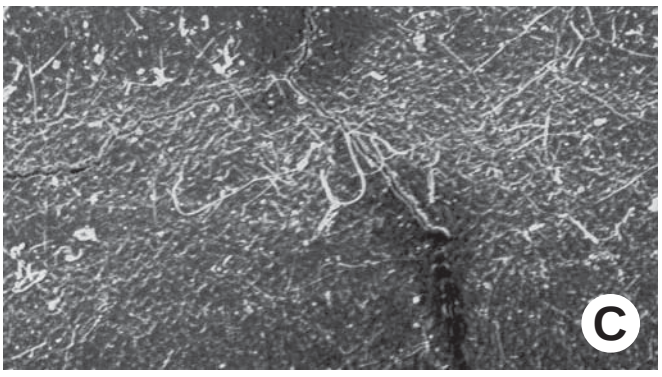
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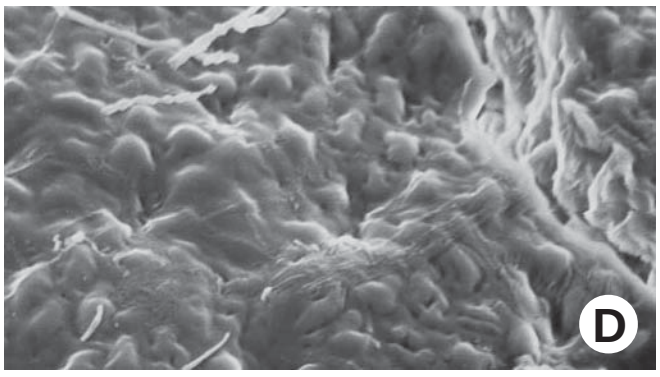

D

Genus: *Ramorinoa* C.L. Spegazzini

Phylogenetic Number: 4.11.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; 3.8–6.5 × 2.5–3.5 × 1.5–2.5 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; oblong or ovate; when asymmetrical with both sutures parallelly curved or nearly straight; not inflated; compressed or terete; without beak; rounded at apex; apex oblique or aligned with longitudinal axis of fruit; rounded at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally visible; with the raised seed chambers not torulose (at most faintly). Fruit margin not constricted; without sulcus; embellished or plain; with wing. Fruit wing 1; up to 0.5 mm wide; sutural; on both sutures. Fruit substipitate. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; brown; pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; ligneous. Endocarp dull; monochrome; tan; smooth; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1–4; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; filiform; straight. Aril present or absent; dry; rim-aril; gray.

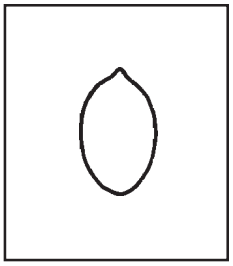
Seed 12–13 × 9–10 × 6.5–7 mm; not overgrown; not angular; symmetrical; ovate; compressed; with surface smooth; without or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; with umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; dark reddish brown; glabrous; not smooth or smooth; with elevated features; wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; without faboid split; punctiform; subapical to radicle tip; deeply recessed; not within corona, halo, or rim. Lens not discernible. Endosperm thick; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; split over radicle; with lobes; without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat; glabrous around base of radicle. Embryonic axis straight; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; lobe tip straight; straight with embryonic axis; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed (barely) or rudimentary; glabrous.

Distribution: Western Argentina.

Notes: Hunziker and Cocucci *(1961)* reported on the fruits and seeds of *Ramorinoa girolae*. As noted in Gunn *(1991)*, dorsoventrally compressed seeds are rare in the Fabaceae. *Ramorinoa* is one of those rare genera as are the caesalpinioid genera *Cassia* (2.16) and *Afzelia* (4.20).

Ramorinoa: R. girolae C.L. Spegazzini *(A–E). A*, Fruits (× 1.2); *B*, seed (× 3.6); *C–D*, testa (× 50, × 1000); *E*, embryos (× 2).


A

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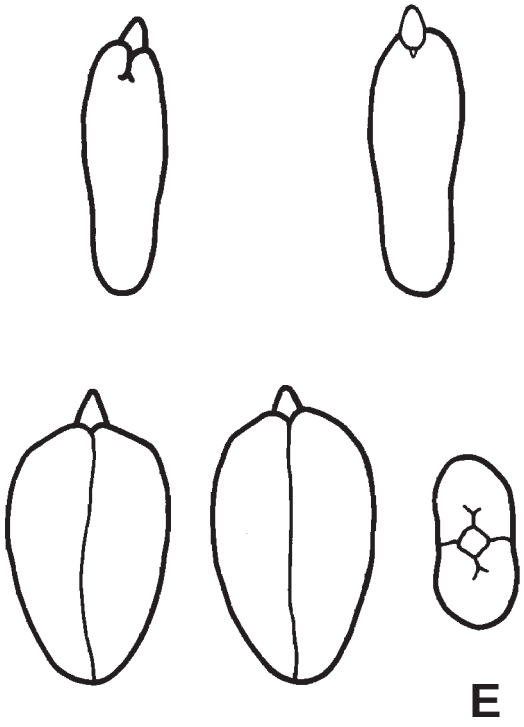
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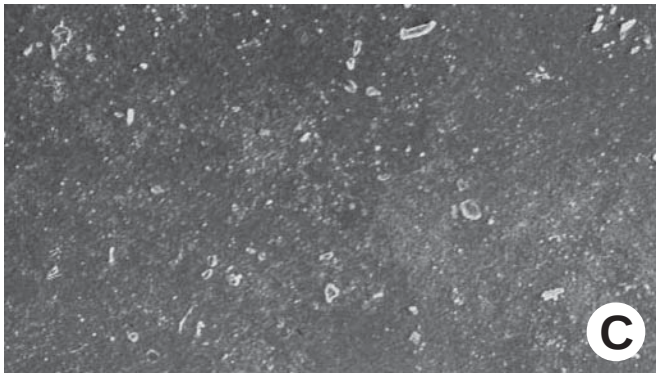
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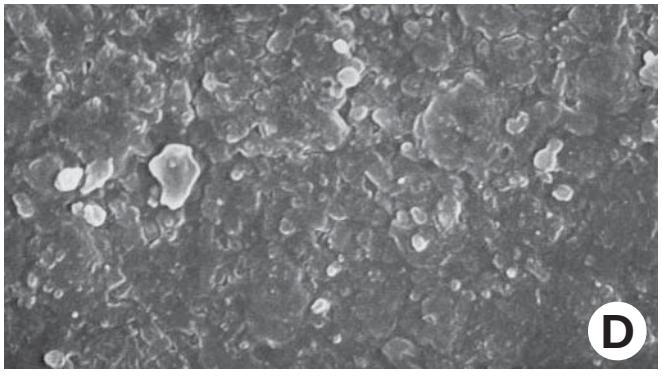

D

Genus: *Centrolobium* C.F.P. von Martius ex G. Bentham

Phylogenetic Number: 4.12.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 5 spp.—6 or 7 spp.

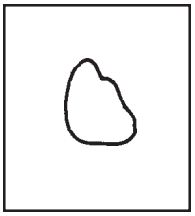
Fruit a legume or nutlet; unilocular; 10–26 × 6–10 × 2–4.5 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical; samaroid; when asymmetrical with both sutures unequally curved; not inflated; terete; without or with beak; straight or declined; with solid beak the same color and texture as fruit; rounded at apex; apex right-angled with longitudinal axis of fruit; short tapered or rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with spines or with wing. Fruit wing present (usually coriaceous to nearly chartaceous); 1; 100 mm wide (widest part of fruit); samaroid; apical. Fruit stipitate to substipitate to nonstipitate (nearly); with the stipe 0.2–20 mm long. Fruit indehiscent. Replum invisible. Fruit an intact article. Epicarp dull; monochrome; dark to light brown; glabrous or pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; tomentose; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular or glandular; with glandular dots (bright reddish); with spines (2–5 cm long); with spines persistent or broken off and their bases evident; with spines same color as the rest of the fruit; not smooth; with elevated features; not veined; tuberculate (if spines broken) or not tuberculate; with solid tubercles on each valve; warty, tuberculate (when spines broken), or glandular dotted; not exfoliating; without cracks. Mesocarp thick; surface not veined; 2-layered; without balsamic vesicles; with fibers; with fibers below solid or compacted fibrous layer; ligneous. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1(–5); length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only. Aril absent.

Seed 12–13 × 3.7–4.3 × 0.9–1.1 mm; not overgrown; angular; asymmetrical; D-shaped; compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; dark reddish brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1 mm long; with curved outline; almost circular; between cotyledon and radicle lobe; flush; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 1 mm long; with margins curved; circular; not in groove of raphe; adjacent to hilum; 1 mm from hilum; mounded; same color as testa; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without or with lobes; with lobes touching (auriculate); with basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Panama to Ecuador, Bolivia, and Brazil.

Notes: Rudd *(1954)* monographed the genus, and Lima *(1988)* studied the three species in Brazil which occur outside the Amazon region. The fruits of *Centrolobium* are unique in their size and morphology in the Fabaceae. The seed is located in a fibrous chamber within the solid or tightly packed fibrous mesocarp at the base of a wing (fig. *A*). The wings are effective in distribution of the genus, and apparently the spines are a defensive mechanism against herbivores.

Centrolobium: C. paraense E.L.R. Tulasne *(B–C)*, C. *parceanum* J. Hill *(A)*. *A*, Fruits (× 0.5); *B*, seed in situ (× 1.6); *C*, seeds (× 4.4).

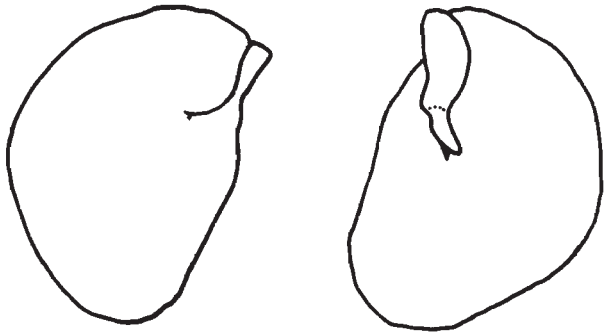



A


B


C

Centrolobium (con.): *C. paraense* E.L.R. Tulasne *(D–F).* *D–E*, testa (× 50, × 1000); *F*, embryos (× 3).



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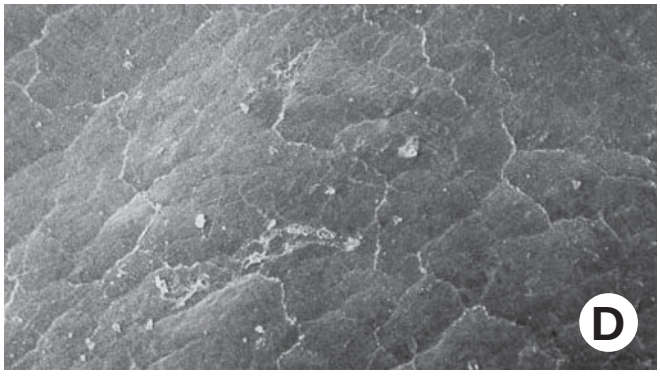
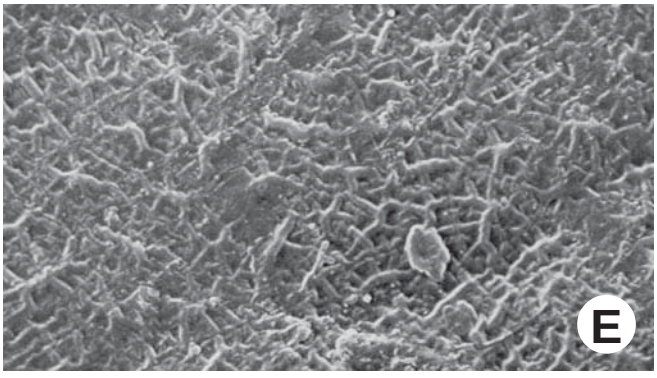




Genus: *Tipuana* (G. Bentham) G. Bentham

Phylogenetic Number: 4.13.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 1 sp.—1 sp.

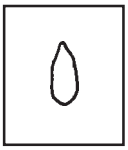
Fruit a legume; unilocular; 4.5–8 × 2–3.2 × 0.7–1 cm; with deciduous corolla; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical; samaroid; when asymmetrical with both sutures unequally curved; not inflated; seed chamber compressed and flattened (wing); without beak; rounded at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; seed chamber ligneous and membranous (wing); seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished; with wing (often eroded). Fruit wing 1; 40–60 mm wide; samaroid; on 1 suture. Fruit stipitate; with the stipe 10 mm long. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; brown to reddish brown; glabrous, pubescent but soon deciduous, or pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thick (seed chamber) or thin (wing area); surface uniformly veined; 1-layered; without balsamic vesicles; with fibers; ligneous. Endocarp dull; mottled and streaked; brown; with mottling over seed chambers; with black overlay; smooth; septate or nonseptate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1–4; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; filiform; S-curved. Aril absent.

Seed 8 × 3 × 1.5 mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface grooved (1 groove); with grooves longitudinal; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; not smooth; with recessed features; grooved (1 on each face); chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; darker than testa; reddish brown; raised. Hilum fully concealed; concealed by funiculus; without faboid split; punctiform; between cotyledon and radicle lobe; flush; within rim. Hilum rim color darker than testa. Lens not discernible. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle (concealing margins of radicle); entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed or with 1 or both recessed (somewhat); tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

Distribution: Bolivia to northwestern Argentina.

Notes: Rudd *(1974)* presented an overview of this genus.

Tipuana: *T. tipu* (G. Bentham) C.E.O. Kuntze *(A–E). A*, Fruits (× 1.1); *B*, seed (× 5.1); *C–D*, testa (× 50, × 1000); *E*, embryos (× 5).

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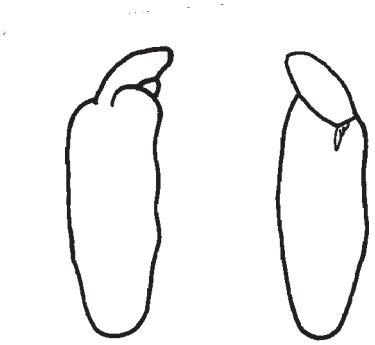


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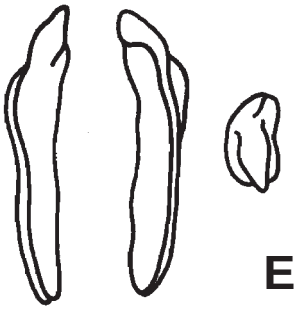
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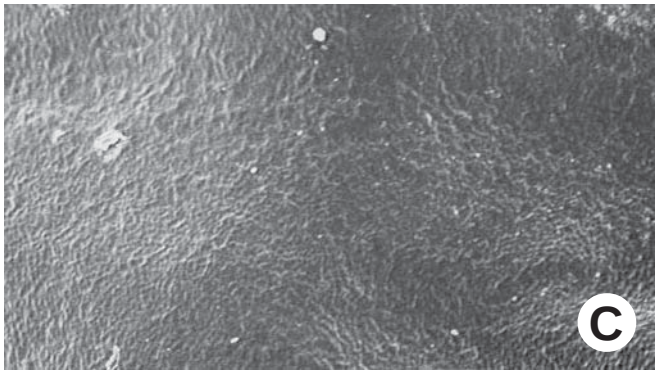
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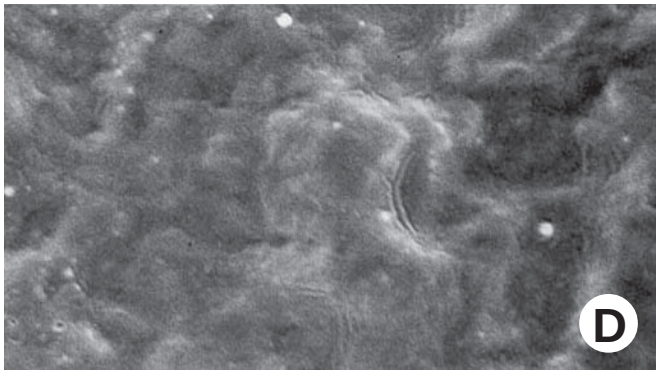

D

Genus: *Platypodium* J.R.T. Vogel

Phylogenetic Number: 4.14.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 1 sp.—1 or 2 spp.

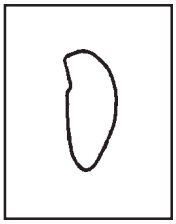
Fruit a legume; unilocular; 6.5–13.5 × 1.9–4 × 0.7–1.2 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical; samaroid; when asymmetrical with both sutures unequally curved; not inflated; flattened (wing) or compressed (seed chamber); without beak; short tapered at apex; apex oblique (slightly) with longitudinal axis of fruit; long tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous (seed chamber); seed chambers externally visible; with the raised seed chambers torulose. Fruit margin not constricted; without sulcus; embellished; with wing. Fruit wing 1; samaroid; basal; on 1 suture. Fruit stipitate; with the stipe up to 15 mm long. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome (though somewhat reddish-brown over seed chamber); brown (reddish over seed chamber and tan winged or with an overall reddish-brown cast) or tan; glabrous; eglandular; without spines; not smooth; with elevated features; reticulately and longitudinally veined relative to fruit length; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; subligneous. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1(–2); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2 mm long; of 1 length only; thick; nearly straight. Aril absent.

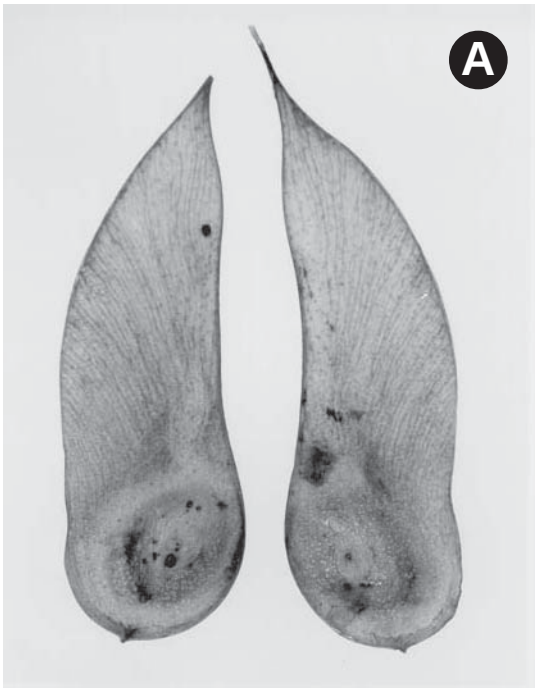
Seed 17 × 10 × 3 mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; not smooth; with elevated features; wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; slightly darker than testa; reddish brown; slightly recessed. Hilum fully concealed; concealed by funicular remnant; without faboid split; punctiform; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim. Lens not discernible. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbose; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule well developed; glabrous.

Distribution: Panama, Guatemala, Colombia, Venezuela, Bolivia, Brazil, and Paraguay.

Notes: Polhill *(1981d)* noted that this genus has "probably only one or two species," but recently annotated herbarium sheets indicate that there may be only one species.

Platypodium: P. elegans J.R.T. Vogel *(A–E). A*, Fruits (× 1.1); *B*, seeds (× 3.2); *C–D*, testa (× 50, × 1000); *E*, embryos (× 2.5).

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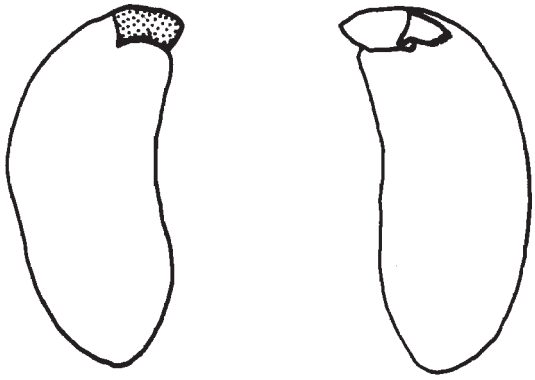


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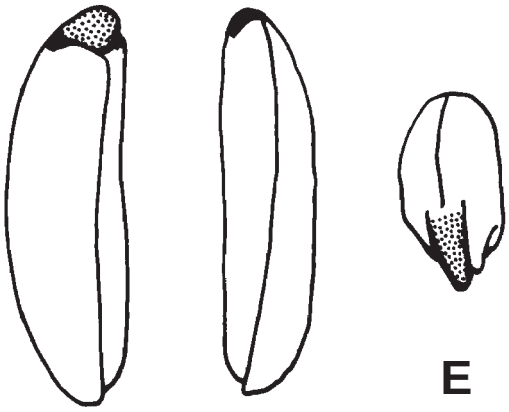
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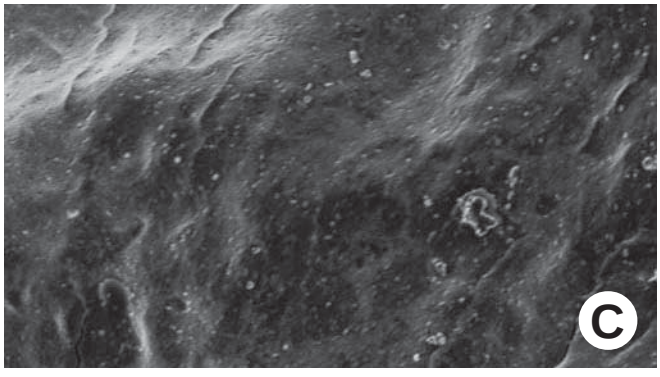
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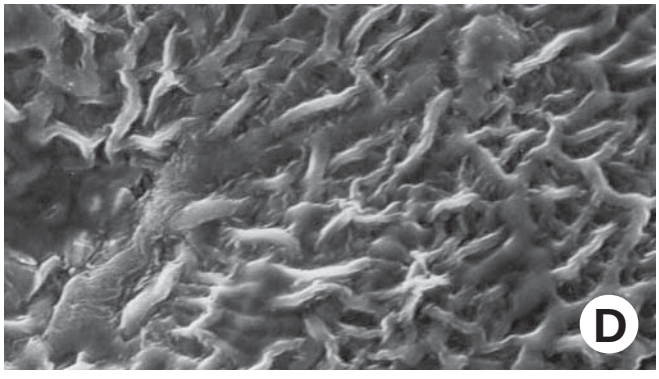

D

Genus: *Geoffroea* N. von Jacquin

Phylogenetic Number: 4.15.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 2 spp.—2 spp.

Fruit a legume or nutlet; unilocular; 1.7–4.5 × 1.8–2.7 × 1–2.5 cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; oblong or circular; when asymmetrical with both sutures parallelly curved; not inflated; terete; without beak; rounded or short tapered at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; drupaceous, fleshy (when fresh), or ligneous (when dry); seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit substipitate or nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull or glossy; monochrome; reddish brown or tan; glabrous, glabrate, or pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; straight; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; faintly wrinkled; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid; with spongy layer over solid layer; ligneous. Endocarp dull; monochrome; tan; scurfy; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only. Aril absent.

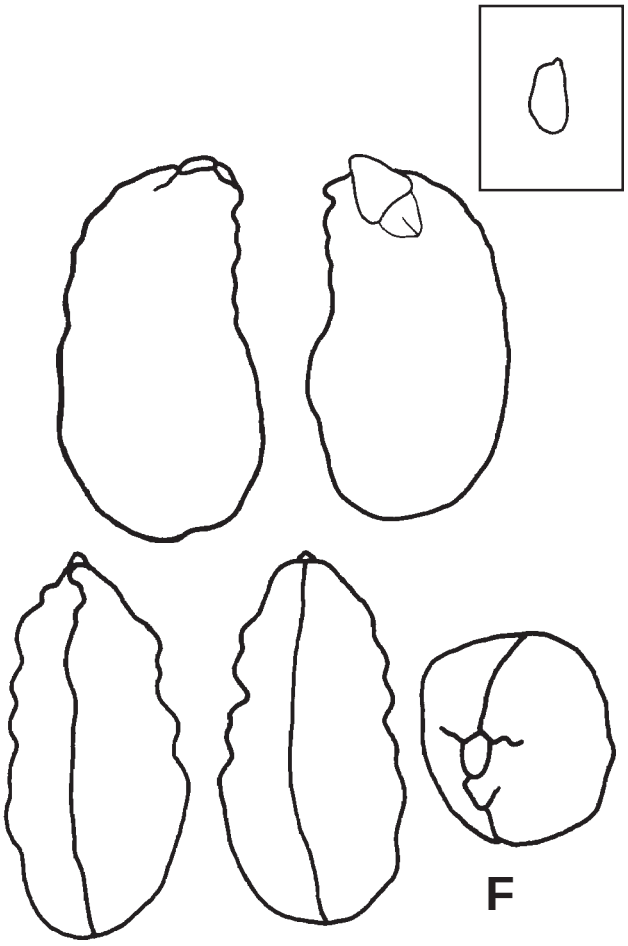
Seed 14–25 × 3–17 × 4–13 mm; not overgrown; not angular or angular; asymmetrical or symmetrical; ovate or elliptic (to fusiform); terete; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa absent or present; not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; not smooth; with elevated features; wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to lens; bifurcating at base of seed with each arm going up antiraphe side, turning (U-shaped) down, and approaching bifurcation; darker than testa; brown (dark reddish-brown); recessed. Hilum present; fully concealed; concealed by funicular remnant; without faboid split; punctiform; subapical to radicle tip; raised; not within corona, halo, or rim. Lens not discernible. Endosperm absent. Cotyledons not smooth (wrinkled to clearly 2–4 transversely ribbed); both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; completely concealing or not concealing radicle; split over radicle; with lobes; with lobes not touching; without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; brown or red; inner face flat; glabrous around base of radicle. Embryonic axis straight; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; straight with embryonic axis or deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Colombia and Venezuela to Chile and northern Argentina (Patagonia).

Notes: Burkart *(1949)* monographed the genus.

Geoffroea: G. decorticans (J. Gillies ex W.J. Hooker & G.A.W. Arnott) A.E. Burkart *(D–E), G. spinosa* N. von Jacquin *(F), G.* spp. *(A–C). A,* Entire fruits (× 1.7); *B,* opened mesocarps above intact mesocarps (× 1.7); *C,* seeds (left and above) and embryo (lower right) (× 2.1); *D–E,* testa (× 50, × 1000); *F,* embryos (× 5).


A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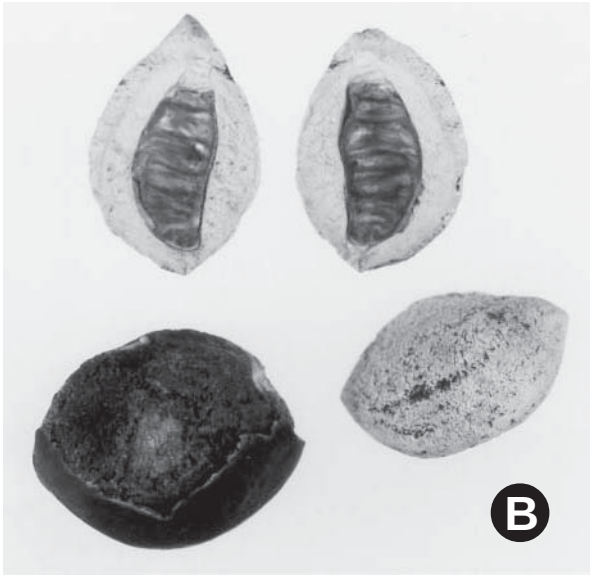
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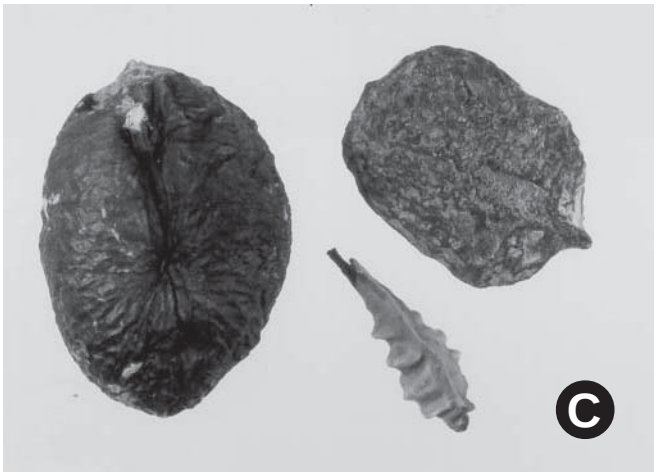
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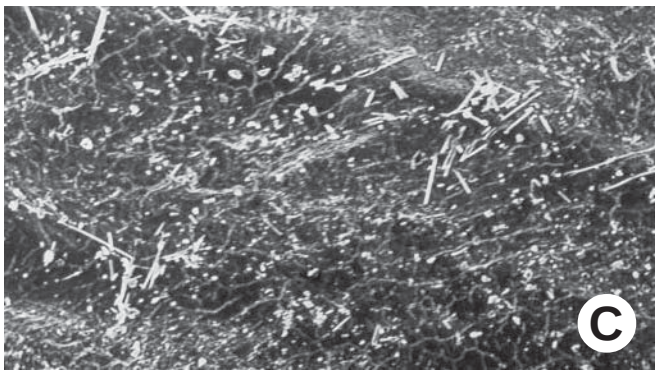
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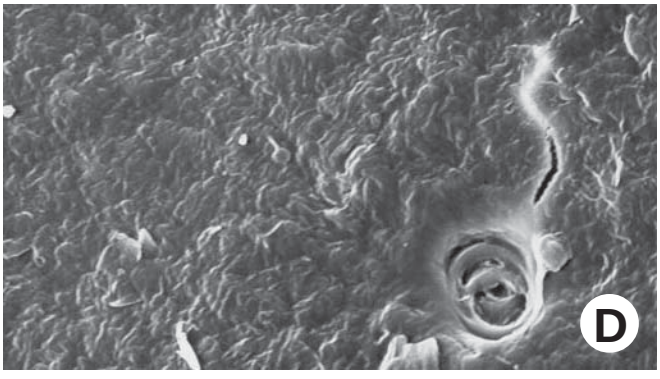

D

Genus: *Cascaronia* A.H.R Grisebach

Phylogenetic Number: 4.16.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 1 sp.—1 sp.

Fruit a legume; unilocular; 2–3.5 × 0.6–1.2 × 0.18–0.22 cm; with deciduous corolla; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; elliptic (oblong) or oblong; when asymmetrical with both sutures nearly straight or 1 straight and 1 curved; widest near middle or D-shaped; not inflated; flattened; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; long tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; membranous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished or plain; with wing (no texture difference between seed chamber and wing: whole fruit acts as samara). Fruit wing absent or present; 1; samaroid; on both sutures. Fruit substipitate. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; brown (with reddish-brown glands); glabrous; glandular; with glandular dots; without spines; not smooth; with elevated features; longitudinally veined relative to fruit length (radiating from base) or reticulately veined (somewhat); not tuberculate; glandular dotted; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; white or tan (almost white); smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 2 or 1; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only. Aril absent.

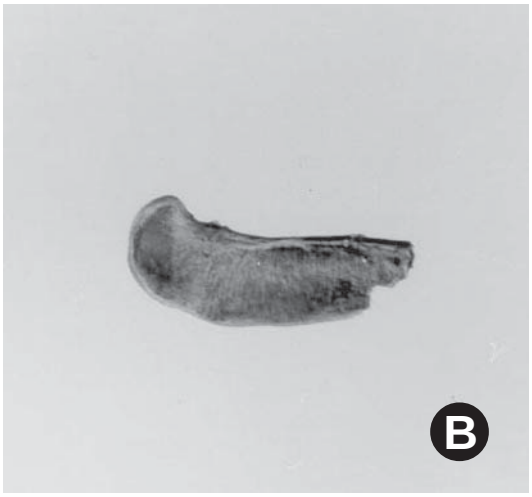
Seed 5–6 (using immature seed) × 1.5–2 mm; not overgrown; not angular; asymmetrical; reniform (elongate); compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth; coriaceous (assumed). Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens to base of seed and terminating; not bifurcating; darker than testa; reddish brown; recessed. Hilum visible; without faboid split; punctiform; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim. Lens discernible; less than 0.5 mm in length; with margins curved; circular; in groove of raphe; adjacent to hilum; 0.3 mm from hilum; mounded; similar color as testa; darker than testa; reddish brown; not within corona, halo, or rim.

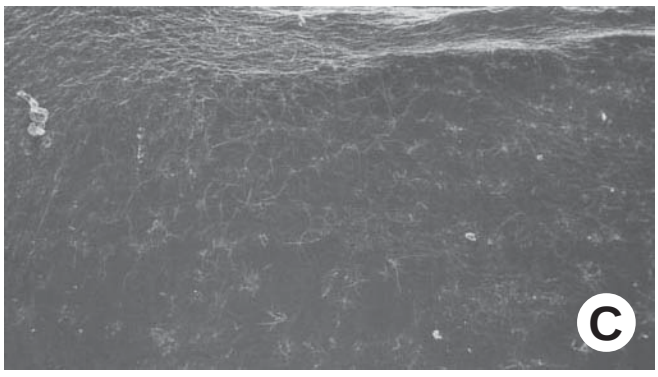
Distribution: Bolivia and Argentina.

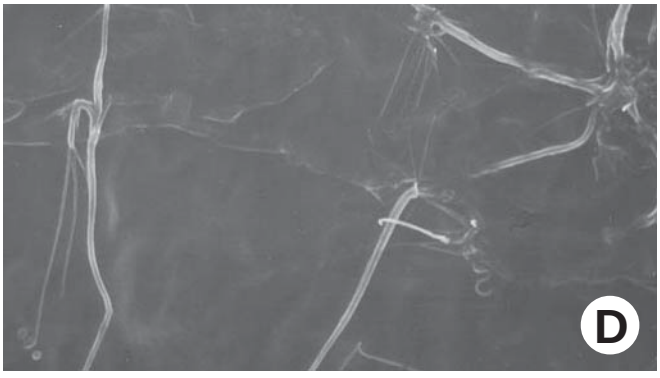
Notes: We studied limited fruit material and immature seeds.

Cascaronia: C. astragalina A.H.R. Grisebach *(A–D). A,* Fruits (× 2.2); *B,* seed (× 4.5); *C–D,* testa (× 50, × 1000).

D







Genus: *Pterocarpus* N. von Jacquin

Phylogenetic Number: 4.17.

Tribe: Dalbergieae.

Group: Dalbergia.

Species Studied—Species in Genus: 11 spp.—20 spp.

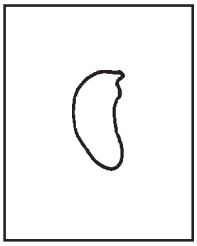
Fruit a legume; unilocular; 2–13 × 2–11 × 0.5–2.5 cm; with deciduous corolla; with deciduous calyx; without (sometimes almost coiled and forming an orifice) or with orifice formed by curving of fruit or fruit segments; straight or 0.5–1-coiled; not plicate; not twisted; asymmetrical or symmetrical; circular, elliptic, or oblong; when asymmetrical with both sutures nearly straight, 1 straight and 1 curved suture, or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed or flattened; without beak; rounded at apex; apex right-angled (to about 180 degrees), oblique, or aligned with longitudinal axis of fruit; short tapered, rounded, or emarginate (to notched) at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; membranous, coriaceous, or ligneous (especially seed chamber); seed chambers externally visible; with the raised seed chambers torulose. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; embellished; with wing. Fruit wing present (and entire but in time eroding) or absent (*P. officinalis* N. von Jacquin); 1; up to 50 mm wide; samaroid; on 1 suture. Fruit stipitate or substipitate; with the stipe up to 15 mm long. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; brown or black; glabrous or glabrate; with 1 type of pubescence; puberulent; with pubescence tan, gray, or brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; with spines (over the seed chambers); with spines persistent; with spines same color as the rest of the fruit; not smooth; with elevated features; not veined or reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp quite thin; surface uniformly veined or not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous to subcoriaceous. Endocarp dull; monochrome; tan; smooth; nonseptate or septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1(–3); length oblique or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; triangular; straight. Aril absent.

Seed 7–14 × 2–9 × 3–3.6 mm; not overgrown; not angular or angular; asymmetrical; reniform, D-shaped, or irregular; compressed; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull or glossy; not modified by a bloom; colored; monochrome; light to dark reddish brown or tan; glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible or visible; from hilum through lens to base of seed and terminating (near base); not bifurcating; darker than testa; reddish brown; slightly raised. Hilum visible, partially concealed, or fully concealed; concealed by funicular remnant or funiculus; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform or punctiform; 0.3–1 mm long; with curved outline; circular or elliptic; between cotyledon and radicle lobe; recessed; within rim. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm in length; with margins curved; nearly circular (with or without attenuate ends); not in groove of raphe; confluent (or nearly so) with hilum; mounded; same color as testa; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth or not smooth; 1–3 grooves on each face; both outer faces convex; both the same thickness; both more or less of equal length; not folded or with only 1 folded; not sufficiently folded for inner face to touch itself; portions of inner folded face unequal; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; reddish brown; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbose; lobe tip straight or curved; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Pantropical.

Notes: Rojo *(1977)* studied the Malesia-Pacific species and listed the 20 species worldwide that he recognized. His report focused on fruit characters and ecological factors relevant to species dispersal and speciation. The monograph by Breitenback *(1973)* of the excellent timber tree of South Africa, kiaat or Transvaal-teak (*P. angolensis* A.-P. de Candolle) included an evaluation of fruits of selected species. The fruits of many species (about 80 percent) are winged, but some fruits have the wings reduced to a keel. The seed chamber may be smooth to spiny even within one species: *P. indicus* C.L. von Willdenow.

Pterocarpus: P. erinaceus J.L.M. Poiret *(C–E), P.* spp. *(A–B). A*, Fruits (× 0.4); *B*, seeds (× 1.6); *C–D*, testa (× 50, × 1000); *E*, embryos (× 5).

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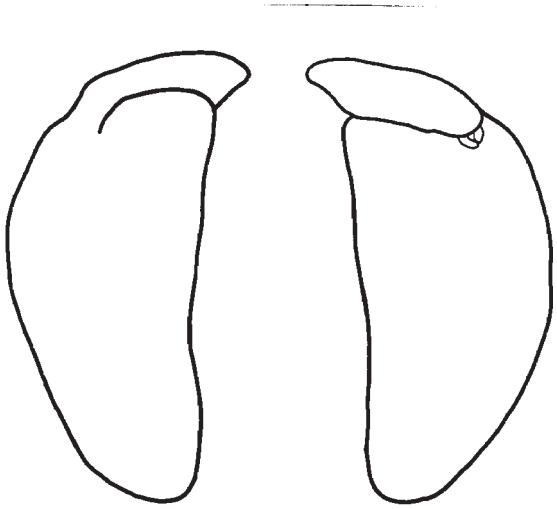


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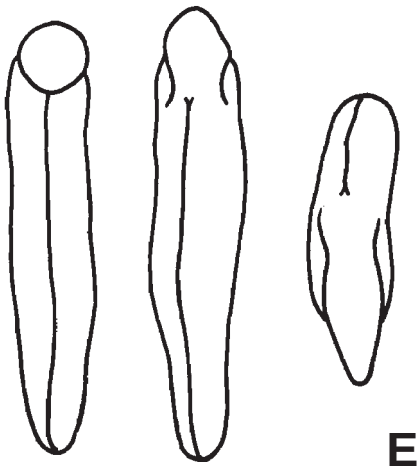
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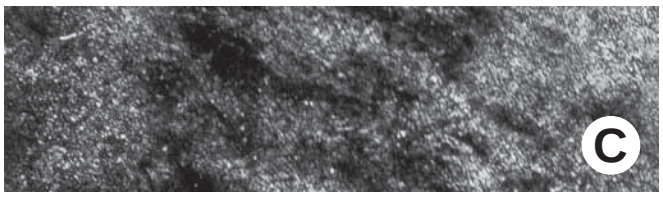
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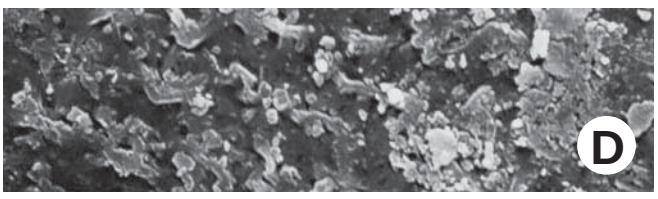
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