

Millettieae (A–X, 41 genera)

Genus: *Afgekia* W.G. Craib

Tribe: Millettieae.

Species Studied—Species in Genus: 1 sp.—3 spp.

Fruit a legume; unilocular; $7-17 \times 3-7.5 \times$ ca. 1 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; elliptic to fusiform or obliquely obovate; when asymmetrical with both sutures parallelly or unequally curved; not inflated; cruciform; without beak; rounded to short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; tapered to truncate at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; leathery to ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; with surface texture uniform; glabrate or pubescent and indurate; with hairs erect; with 1 type of pubescence; velutinous; with pubescence brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thick; surface not veined; 2-layered; without balsamic vesicles; without fibers; with vitreous layer over solid layer; ligneous. Endocarp dull; opaque; mottled; white; with mottling (dark); with brown overlay; hairy; without adhering pieces of testa; with hairs scattered over endocarp; nonseptate; chartaceous to pulpy; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–2; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 20–30 mm long; of 1 length only; thick; curved. Aril dry; rim-aril and tongue-aril; white to tan.

Seed $15-60 \times 13-40 \times 10-13$ mm; not overgrown; not angular; symmetrical; elliptic to ovate to circular (nearly); terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; glossy; not

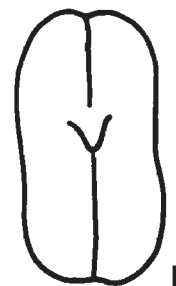
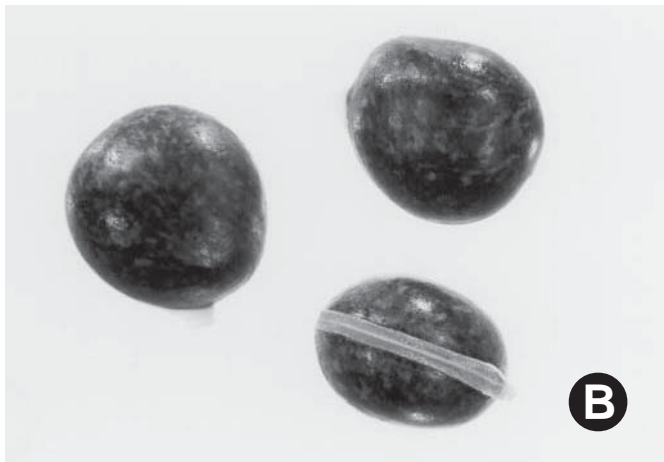
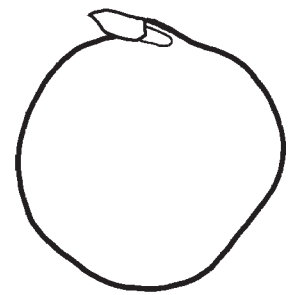
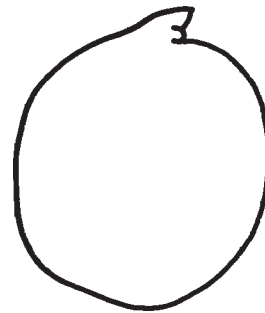
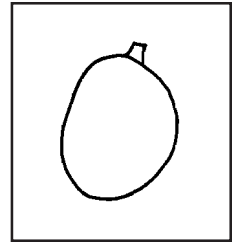
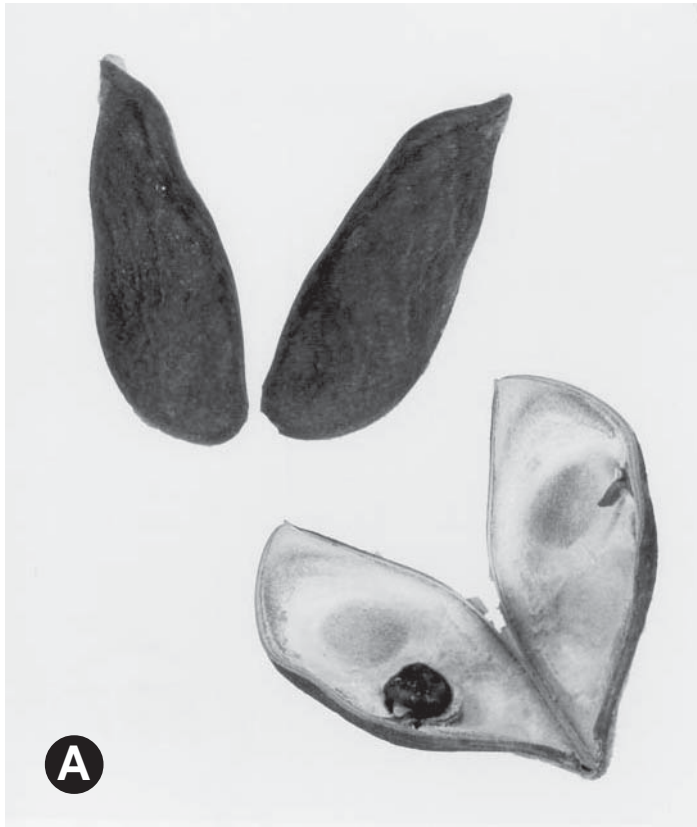
modified by a bloom; colored; mottled; with frequent mottles; brown; with brown (darker) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 15–25 mm long; with straight outline; linear; apical according to radicle tip but marginal according to seed length; flush; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; 3–3.5 mm long; with margins straight; narrowly triangular; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; not within corona, halo, or rim. Endosperm absent. Cotyledons 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; margin entire 180 degrees from base of radicle; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; pale yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Southern China, Burma, and Thailand.

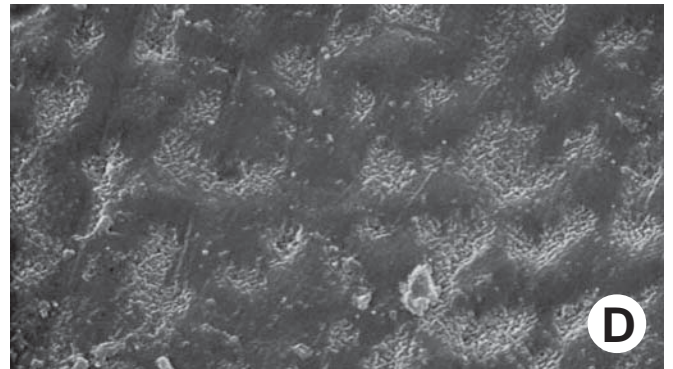
Notes: Geesink (1981) treated this tribe, as others before him, under the tribal name Tephroseae, but we now know that its correct name is Millettieae. Recent tribal studies (Geesink 1981, 1984; Polhill 1994a,b) have arranged the genera in alphabetical order without phylogenetic numbers, and they are so arranged here. Geesink (1984) monographed tribe Millettieae and presented descriptive notes about fruits and seeds and *in situ* fruit and seed drawings. However, we are not entirely following Geesink (1984) for generic parameters because he either questioned the status of many of his new genera or did not make the necessary species transfers. The few new genera which he clearly recognized are being accepted. Lavin et al. (1998) developed a preliminary infratribal classification of six informal groups using phytochrome nucleotides: *Millettia* group, *Lonchocarpus* group, *Derris* group, *Tephrosia* group, “primitive” group, and *Phaseoleae* group. Lavin (1987) transferred *Sphinctospermum* to Millettieae. Lavin and Doyle (1991) carried out

cladistic analyses integrating morphological and chloroplast DNA data and concluded that it is a member of Robineae, where we have placed it (now 8.12). Only one species of *Afgekia* was studied although some information from *A. filipes* (S.T. Dunn) R. Geesink was included.

Afgekia: *A. sericea* W.G. Craib (A–E). A, Fruits ($\times 0.8$);
B, seeds ($\times 2$); C–D, testa ($\times 50$, $\times 1000$); E, embryos
($\times 2$).



E



Genus: *Aganope* F.A.W. Miquel

Tribe: Millettieae.

Species Studied—Species in Genus: 6 spp.—6 spp.

Fruit a legume; unilocular; 4.5–25 × 2.5–5 × 0.25–0.8 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight to curved; not plicate; not twisted; symmetrical or asymmetrical; elliptic or irregular; when asymmetrical with 1 straight and 1 curved suture or both sutures unequally curved; narrowing slightly once or twice on one side; not inflated; compressed to flattened; without beak; rounded or short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; rounded or short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins or constricted on 1 margin and slightly constricted on the other margin; without sulcus; embellished. Fruit wings 1 or 2; 2.5–10 mm wide; sutural; on 1 or both sutures. Fruit substipitate or nonstipitate; with the stipe up to 3 mm long. Fruit indehiscent. Epicarp dull; monochrome or multicolored; mottled; brown; with brown (darker) overlay; with surface texture uniform; glabrous, glabrate, or pubescent and indurate; with hairs appressed; with 1 type of pubescence; sericeous; with pubescence golden; with pubescence uniformly distributed or denser near sutures, sparse centrally; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; papillose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; opaque; monochrome or mottled; brown or tan to brown; with mottling (dark); with brown overlay; smooth to scurfy; without adhering pieces of testa; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–6; length parallel with to oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2–3 mm long; of 1 length only; flattened; triangular. Aril absent.

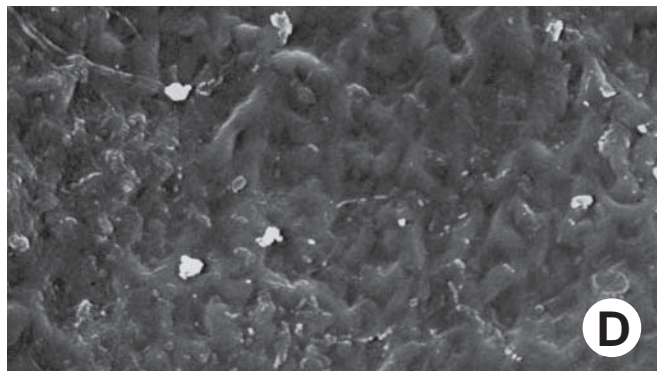
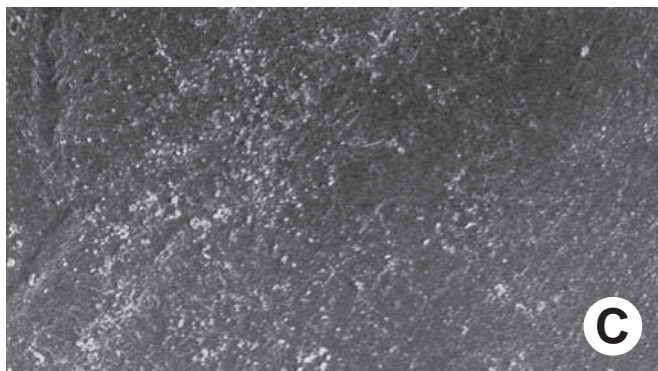
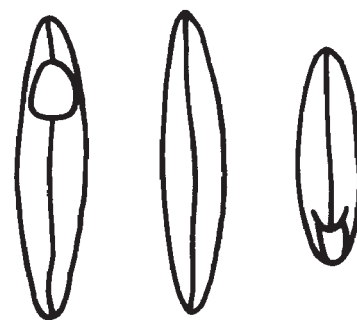
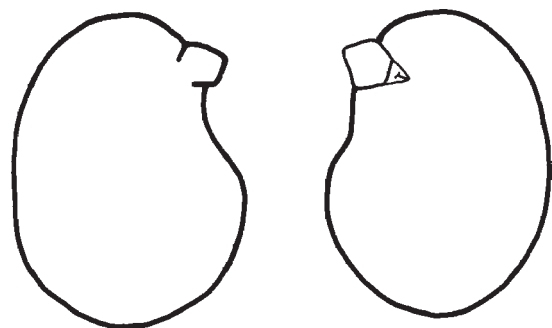
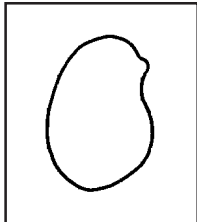
Seed 21–28 × 9.5–17 × 3–6.5 mm; not overgrown; not angular; asymmetrical; flattened; with surface wrinkled; with visible radicle and cotyledon lobes; without

external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; brown; with brown (darker) overlay; glabrous; not smooth or smooth; with elevated features; veined and wrinkled, veined, or wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; darker than testa; flush. Hilum visible; without faboid split; larger than punctiform; 1.3–1.8 mm long; with curved outline; circular or fusiform; apical according to radicle tip but marginal according to seed length; flush; within halo. Hilum halo color darker than testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; up to 3.5 mm long; with margins straight; triangular; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; brown; not within corona, halo, or rim. Endosperm absent. Cotyledons not smooth; 1–3 grooves on each face, 5–7-branched grooves (from veins of testa) on each face, or wrinkled; both outer faces convex; both the same thickness; both more or less of equal length or 1 longer than other; not folded; margin entire or not entire 180 degrees from base of radicle; wavy; similar at apex; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; brown, green, or tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique to right angled (nearly); oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight or curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary to moderately developed; glabrous.

Distribution: Tropical Africa to Southeastern Asia.

Notes: Geesink (1984) placed *Aganope* and *Xeroderris* in *Ostryocarpus* without making species transfers. Following Wiersema et al. (1990), Thothathri (1992), Lock and Heald (1994), Polhill (1994a,b), and Schot (1994), we recognize *Aganope* as a separate genus from *Ostryocarpus* and *Xeroderris*.

Aganope: *A. impressa* (S.T. Dunn) R.M. Polhill (C–E), *A. spp.* (A–B). A, Fruits (× 0.4); B, seeds (× 1.7); C–D, testa (× 50, × 1000); E, embryos (× 2).



Genus: *Antheroporum* F. Gagnepain

Tribe: Millettieae.

Species Studied—Species in Genus: 1 sp.—1–3 spp.

Fruit a legume; unilocular; 6–9 × 3–4 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; elliptic to fusiform; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; inflated; compressed to terete; without beak; short tapered at apex; apex oblique to right-angled with longitudinal axis of fruit; short tapered at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome to multicolored; mottled; brown; with brown overlay; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; very short sericeous; with pubescence tan; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not smooth; with recessed features; not veined; not tuberculate; slitted obliquely; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined; 2-layered; without balsamic vesicles; without fibers; with spongy layer over solid layer; ligneous. Endocarp dull; opaque; monochrome; brown; smooth and cracked (usually marginally); without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1(–2); length parallel with to oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2–3 mm long; of 1 length only; partially filiform and partially thick; triangular. Aril dry; rim-aril and tongue-aril; tan.

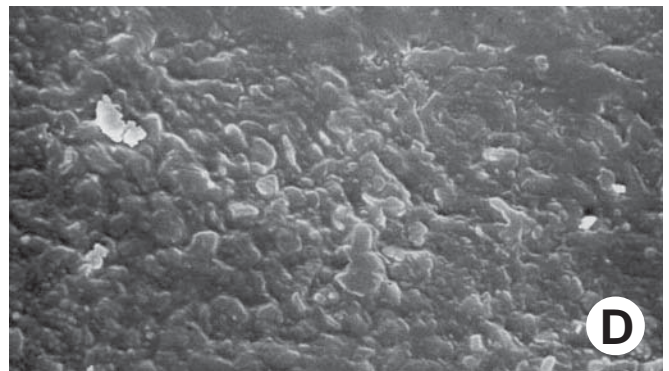
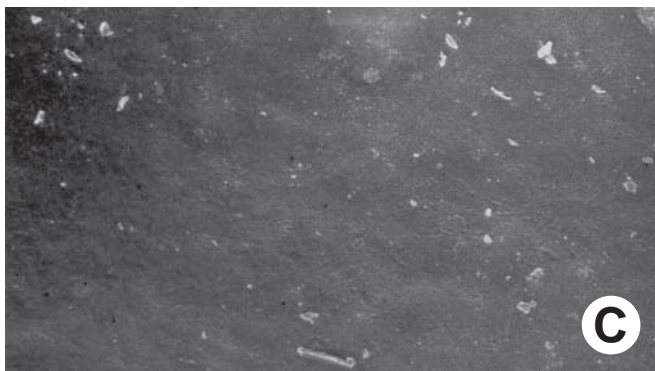
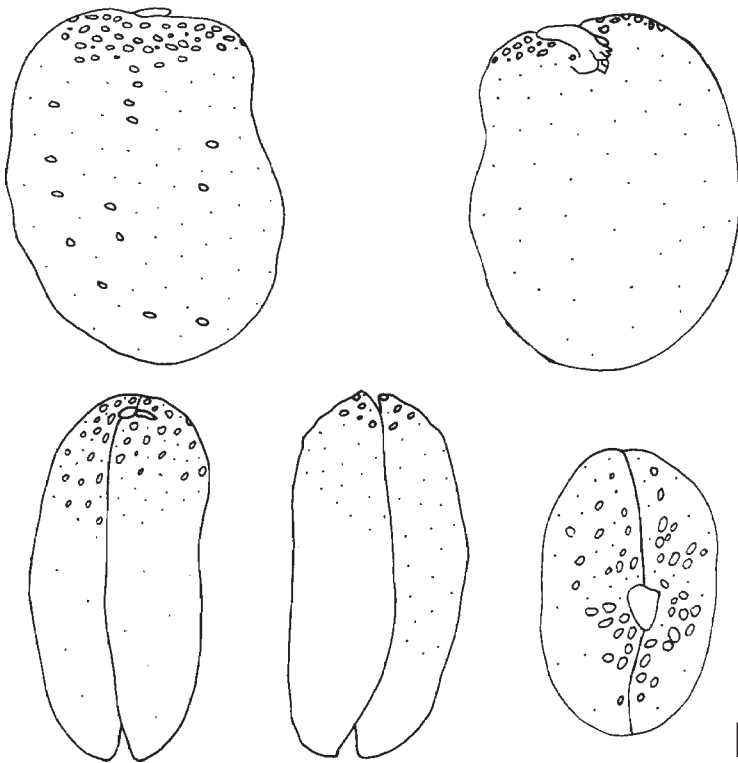
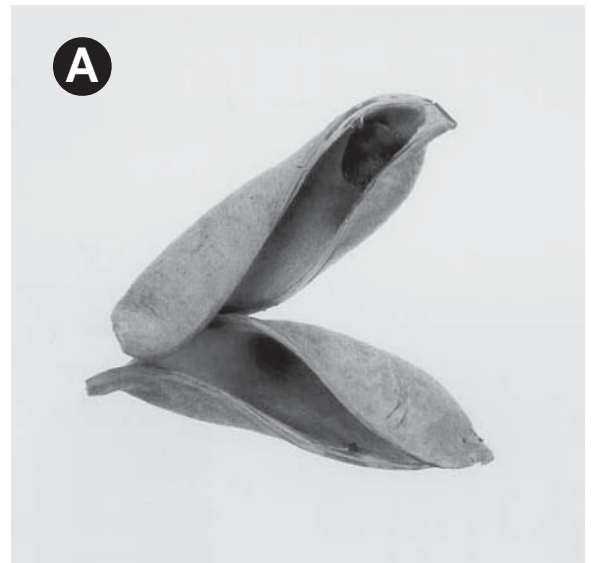
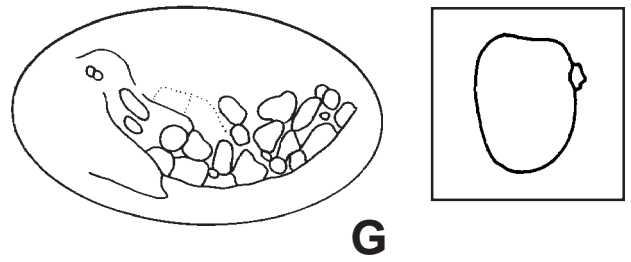
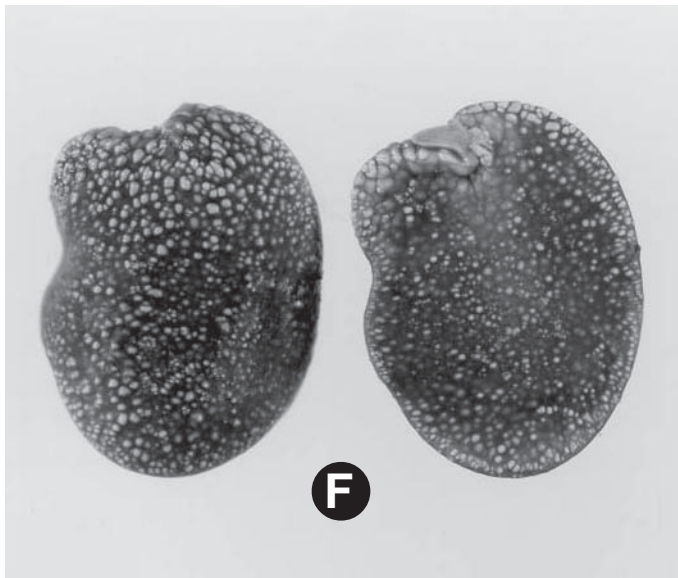
Seed 15–20 × 13–16 × 7–10 mm; not overgrown; not angular; asymmetrical; obliquely elliptic or ovate (obliquely); compressed to terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; glossy; not modified by a bloom; colored; monochrome or

mottled; with infrequent mottles; brown or red; with brown (darker) overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; without faboid split; larger than punctiform; 2–3 mm long; with curved outline; elliptic to circular; apical according to radicle tip but marginal according to seed length; raised; within halo. Hilum halo color darker than testa. Lens not discernible. Endosperm absent. Cotyledons not smooth; glandular dotted (yellow latex-like substance inside); 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; touching (auriculate); without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat and glandular dotted (with yellow latex-like substance inside); glabrous around base of radicle. Embryonic axis right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; with 90-degree turn; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Thailand, Indochina, and southern China.

Notes: The cotyledons have pits that vary in size and distribution and that are the same color as the nonpitted areas. When hydrated, however, the pits swell and are filled with a yellow, latex-like substance.

Antheroporum: *A. pierrei* F. Gagnepain (A–G). A, Fruit (× 0.7); B, seed (× 2.7); C–D, testa (× 50, × 1000); E, embryos (× 3); F, cotyledon with glands (× 3.3); G, magnification of inner cotyledon surface with glands (× 10).



Genus: *Apurimacia* H.A.T. Harms

Tribe: Millettieae.

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

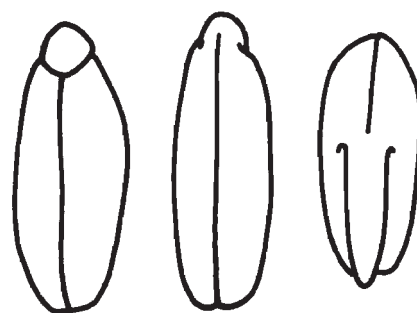
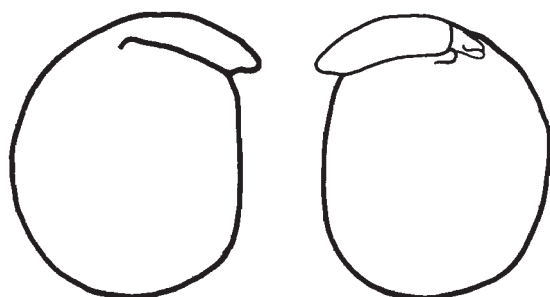
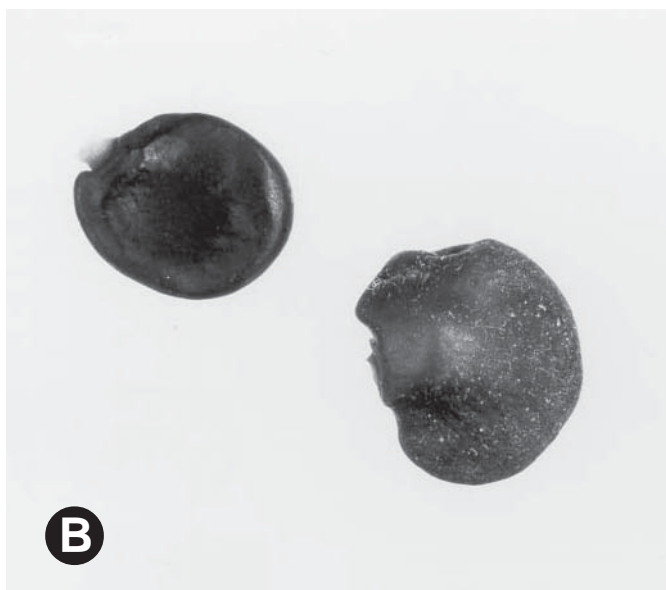
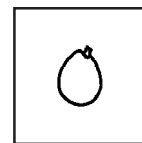
Fruit a legume; unilocular; $3.7\text{--}6.5 \times 0.9\text{--}1.3 \times 0.2\text{--}0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; falcate or fusiform (or obliquely so); when asymmetrical with both sutures parallelly curved; not inflated; compressed; with or without beak; declined; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; tan; with brown or yellow overlay; with surface texture uniform; glabrate; with hairs appressed; with 1 type of pubescence; sparsely sericeous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with recessed features; not veined; not tuberculate; slitted obliquely; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; opaque; white; smooth; without adhering pieces of testa; nonseptate to subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–6; length parallel with, oblique to, or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1.5–2 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril and tongue-aril; cream or yellow.

Seed $7\text{--}12 \times 5\text{--}10 \times 3\text{--}4.2$ mm; not overgrown; not angular; symmetrical or asymmetrical; circular, elliptic, or ovate (obliquely); compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp;

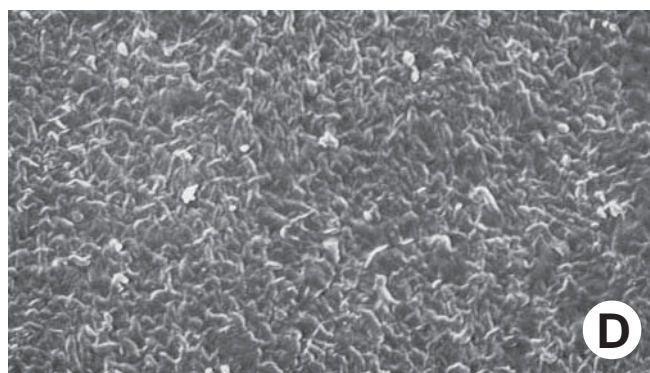
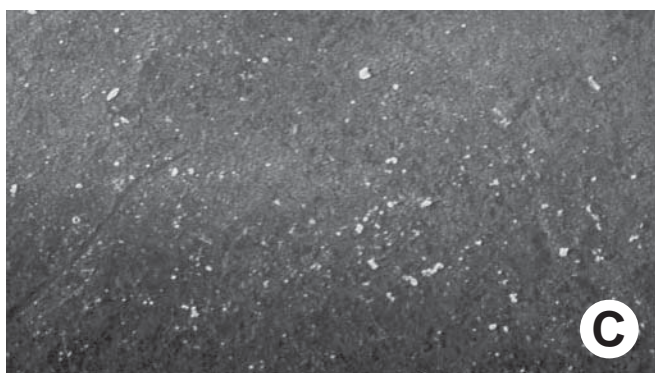
not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; red-brown or brown; glabrous; smooth or not smooth; with elevated features; minutely rugose or wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; larger than punctiform; 1.2–2 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush; within rim. Hilum rim color lighter or darker than testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; 1.2–1.8 mm long; with margins straight or curved; linear or 2 oblong mounds separated by groove; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; brown; within rim or not within corona, halo, or rim. Lens rim color of testa. Endosperm absent. Cotyledons smooth or not smooth; sparsely glandular dotted (yellow latex-like substance inside); 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 lobes; with the interface division terminating at base of radicle; without margins recessed; green or tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique or right angled; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or linear; lobe tip straight or curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary to moderately developed; glabrous.

Distribution: Bolivia, Peru, and Argentina.

Apurimacia: *A. michelii* (H.H. Rusby) H.A.T. Harms (*C–E*), *A. spp.* (*A–B*). *A*, Fruits ($\times 1.6$); *B*, seeds ($\times 4$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 5$).



E



Genus: *Austroteenisia* R. Geesink

Tribe: Millettieae.

Species Studied—Species in Genus: 1 sp.—4 spp.

Fruit a legume; unilocular; $3\text{--}10.8 \times 0.9\text{--}2.1 \times 0.1\text{--}0.2$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; elliptic to fusiform to oblong to moniliform (slightly) or falcate; when asymmetrical with both sutures parallelly curved; not inflated; flattened; with beak; straight; with solid beak the same color and texture as fruit; rounded or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; rounded or short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Epicarp dull; multicolored; mottled; tan; with brown overlay; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; sericeous; with pubescence golden; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp trace; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; opaque; monochrome; tan; smooth; without adhering pieces of testa; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Aril absent.

Seed ca. $4.5 \times 3 \times 1.5$ mm; not overgrown; not angular; asymmetrical; reniform; compressed; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; larger than punctiform; ca. 0.7 mm long; with curved outline; circular; apical according to radicle tip but marginal according to seed

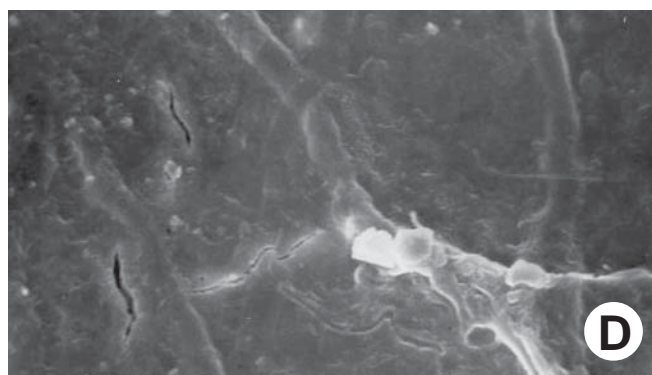
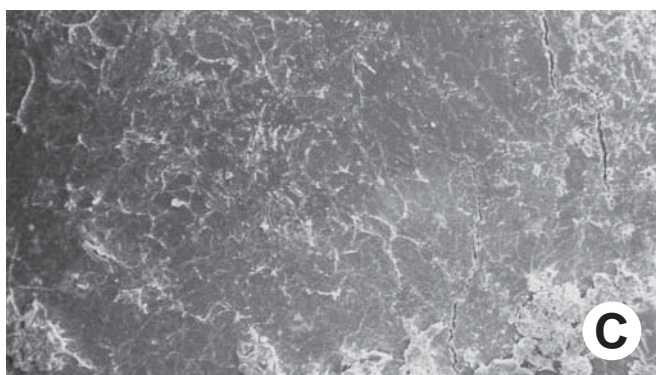
length; recessed; not within corona, halo, or rim. Lens not discernible.

Distribution: Northern Australia (2 spp.) and New Guinea (1 sp.).

Notes: Dixon (1997) revised the genus, describing one new species which increased the species count to four. The only seeds available for study were badly damaged by insects.

Austroteenisia: *A. blackii* (F. von Mueller) R. Geesink (A–D). A, Fruits ($\times 1.3$); B, seed ($\times 8$); C–D, testa ($\times 50$, $\times 1000$).

0



Genus: *Behaimia* A.H.R Grisebach

Tribe: Millettieae.

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

Fruit a legume; unilocular; $2.2-3 \times 1-1.3 \times 0.3-0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; elliptic to fusiform to obovate; not inflated; compressed; with beak; straight or declined; with solid beak the same color and texture as fruit; truncate at apex; apex aligned to oblique with longitudinal axis of fruit; rounded to tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves reflexing. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown; with brown (darker) overlay; with surface texture uniform; glabrate to pubescent and indurate; with hairs appressed; with 1 type of pubescence; sericeous; with pubescence golden; when mature denser near sutures, sparse centrally; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; transversely veined relative to fruit length and reticulately veined; not tuberculate; occasionally lenticular; not exfoliating; without cracks. Mesocarp absent. Endocarp dull; opaque; monochrome; tan to brown; smooth and scurfy (marginally); without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; separating from epicarp; entire. Seeds 1(-2); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1.5-2 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril; tan.

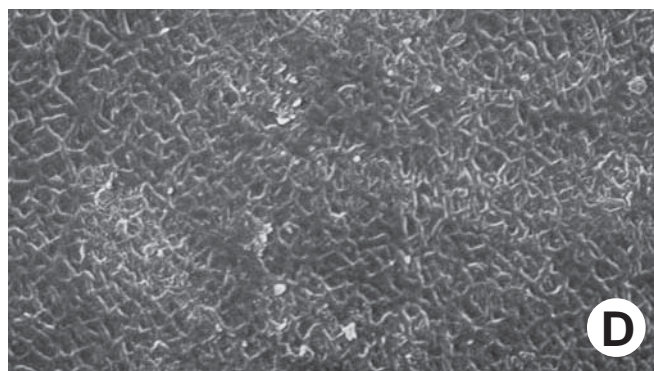
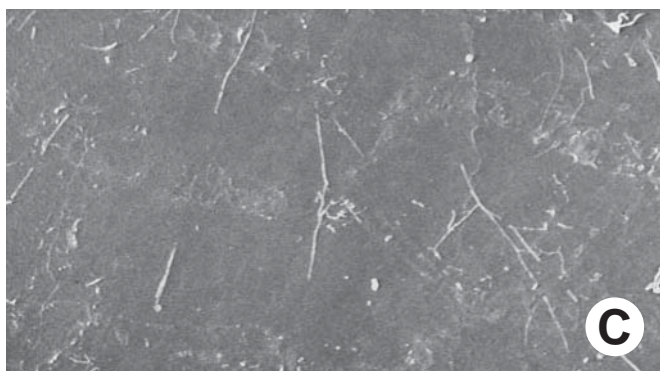
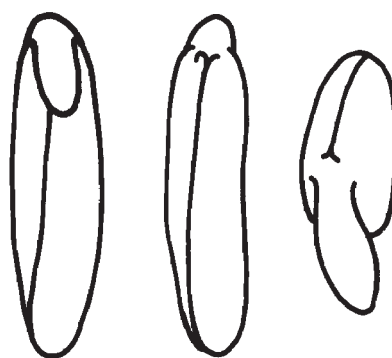
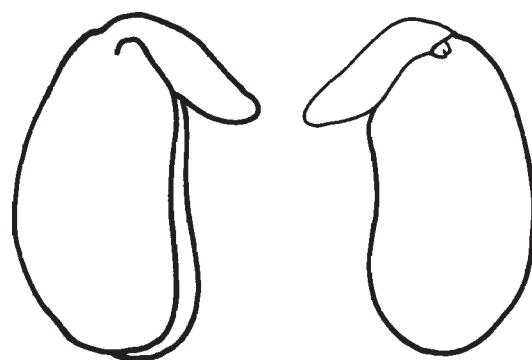
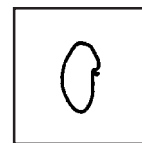
Seed $8-10.5 \times 5-7 \times 2-3$ mm; not overgrown; not angular; symmetrical; elliptic to reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; glossy; not modified by a bloom; colored; mottled; with infrequent mottles; brown; with brown (darker or lighter) overlay; glabrous; smooth;

chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; larger than punctiform; 0.8-1 mm long; with curved outline; circular; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 1 mm long; with margins straight; oblong; not in groove of raphe; adjacent to hilum; ca. 0.5 mm from hilum; mounded; same color as testa; brown; 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; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; brown; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Cuba.

Notes: Lewis (1988) illustrated and elaborated on the description of this little-known and rarely collected genus.

Behaimia: B. cubensis A.H.R. Grisebach (A-E). A, Fruits ($\times 2.2$); B, seeds ($\times 4.3$); C-D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Bergeronia* M. Micheli

Tribe: Millettieae.

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

Fruit a legume or loment (or a loment segment); unilocular; 3–8.5 × 0.5–0.8 × 0.3–0.5 cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; curved to 0.5-coiled; not plicate; not twisted; asymmetrical; C-shaped and moniliform; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Loment indehiscent. Loment segments (articles) conspicuous; 10–15 mm long; widest across seed area; with upper 1 different shape than middle ones and lower 1 different shape than middle ones; oblong. Epicarp dull; monochrome; brown; with surface texture uniform; pubescent and indurate; with hairs erect and appressed; with 2 types of pubescence; sericeous and villous; with pubescence tan; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain to swollen (slightly); eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; dotted; not exfoliating; without cracks. Mesocarp thin (thicker near sutures); surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; opaque; mottled; tan; with mottling (dark); with brown overlay; scurfy and smooth; without adhering pieces of testa; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–7; 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 dry; rim-aril; cream.

Seed 5–7 × 4–4.5 × 2–2.5 mm; not overgrown; angular or not angular; asymmetrical; oblong to reniform; compressed; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliat-

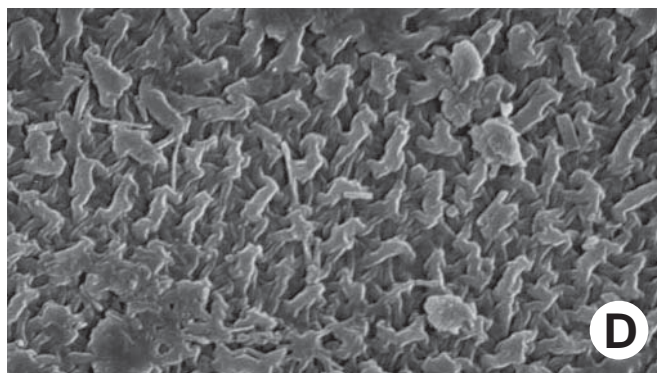
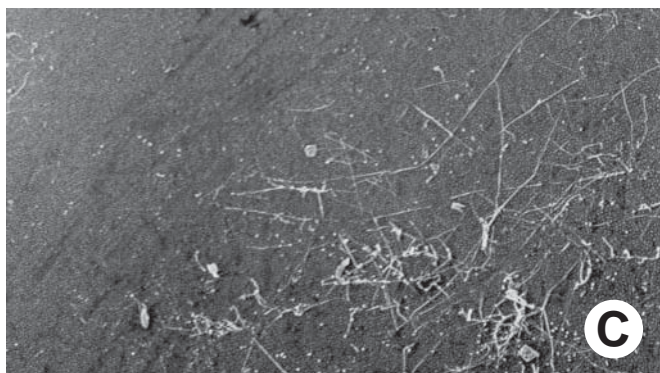
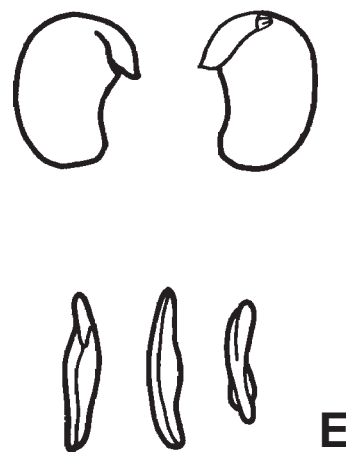
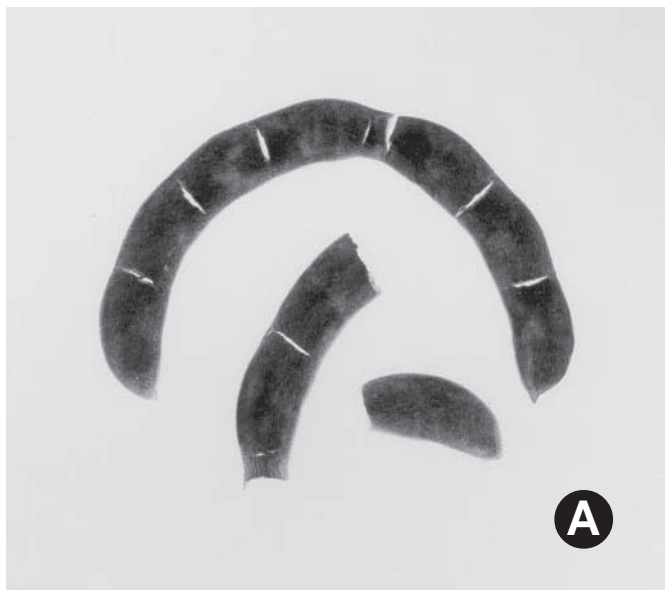
ing; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–1.3 mm long; with curved outline; circular to elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7–1 mm long; with margins straight; narrowly triangular; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; very dark brown; within halo. Lens halo color darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; 1 longer than other; 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 oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip slightly curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Paraguay and northern Argentina.

Notes: Micheli (1883) had excellent seed-fruit drawings.

Bergeronia: *B. sericea* M. Micheli (A–E). A, Fruits (× 1.3); B, seed (× 7); C–D, testa (× 50, × 1000); E, embryos (× 5).

3



Genus: *Callerya* Endlicher

Tribe: Millettieae.

Species Studied—Species in Genus: 7 spp.—19 spp.

Fruit a legume; unilocular; $4-29 \times 1-6 \times 0.5-4.8$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; fusiform, linear, ovate, or irregular; when asymmetrical with both sutures unequally curved; inflated or not inflated; compressed to terete; with or without beak; straight, declined, or hooked; with solid beak the same color and texture as fruit; long tapered, tapered, or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; rounded or tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to ligneous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted only on 1 margin; without or with sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate to stipitate; with the stipe up to 12 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown or green; with brown overlay; with surface texture uniform; glabrous, glabrate, or pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; sericeous, tomentose, velutinous, or villous; with pubescence brown or golden; with pubescence uniformly distributed (sometimes wearing off centrally); with simple hairs; stiff or pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated or recessed features; not veined; not tuberculate; lenticular, rugose, warty, or wrinkled; grooved; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick, thin, or trace; surface not veined; 1- or 2-layered; with or without balsamic vesicles; without fibers; solid or with solid layer over solid layer or vitreous layer over solid layer; chartaceous to coriaceous to ligneous. Endocarp dull; opaque or translucent; monochrome or mottled; tan or white; with mottling (dark); with brown overlay; scurfy and smooth; without adhering pieces of testa; septate or subseptate; with septa thin (tissue paper-like), flexible or thicker than paper, firm; with septa eglandular; chartaceous; exfoliating in part or not exfoliating;

remaining fused to mesocarp and epicarp; entire. Seeds 1–7 (according to Schot (1994), 2–3 seeds may be fused together in some species.); length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; at least 1.5–2 mm long; of 1 length only; thick; contorted or triangular. Aril dry; rim-aril, tongue-aril, rim-aril and tongue-aril, or 2-lipped rim-aril; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream to tan to brown.

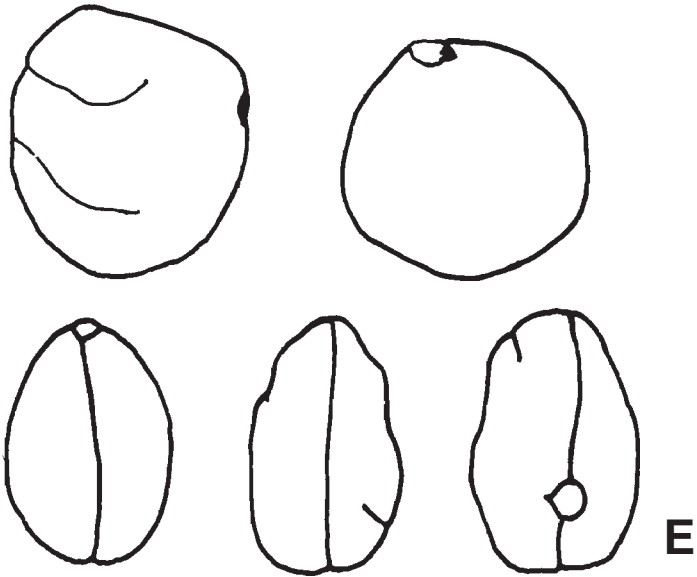
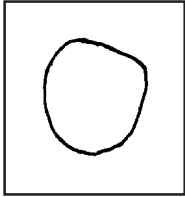
Seed $9-65 \times 9-40 \times 2-26$ mm; not overgrown; not angular or angular; symmetrical; circular, elliptic, mitaform, oblong, or ovate; terete to compressed to flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome, mottled, or streaked; with infrequent mottles; with infrequent streaks; brown; with brown (darker or lighter) overlay; minutely pubescent (patchy, in literature); smooth or not smooth; with elevated features; veined and wrinkled, veined, wrinkled, or rugose; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by aril; with or without faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2–5 mm long; with curved outline; elliptic to oval; subapical to radicle tip or apical according to radicle tip but marginal according to seed length; raised, flush, or recessed; within rim or not within corona, halo, or rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 2–3 mm long; with margins straight or curved; oblong, 2 oblong mounds separated by groove, or ovate; not in groove of raphe; confluent with hilum; mounded; same color as testa; not within corona, halo, or rim. Endosperm present or absent; thin; covering entire embryo; adnate to embryo. Cotyledons smooth or not smooth; 1–3 grooves on each face or rugose; both outer faces convex; both the same thickness or 1 thicker than the other; both more or less of equal length or 1 longer than other; not folded or with both folded; not sufficiently folded for inner face to touch itself; portions of inner folded face unequal; margin entire or not entire 180 degrees from base of radicle; wavy; similar at apex; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without or with margin recessed; with 1 margin recessed;

recessed on side opposite from radicle; light green or tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight or curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

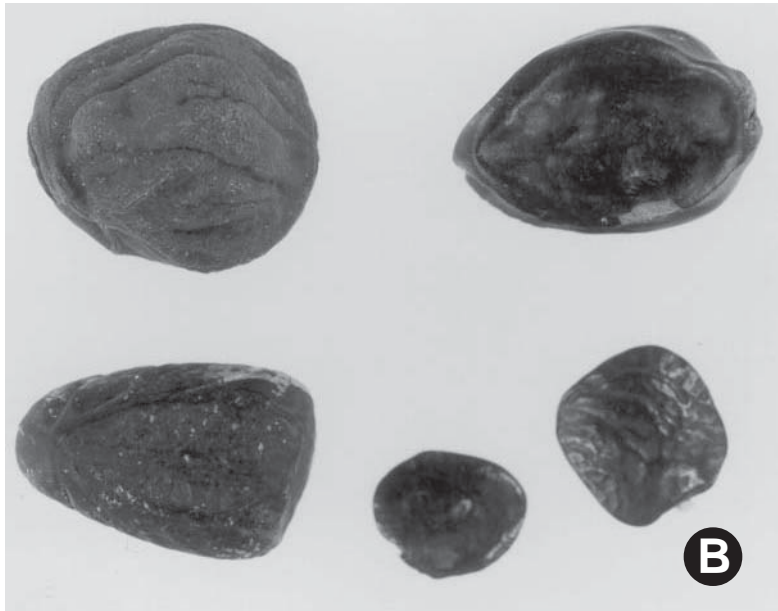
Distribution: India to southeastern Asia, China, Australia, and Philippines (introduced into Japan and Florida, USA).

Notes: Geesink (1984) suggested that *Callerya* should be reinstated and included *Padbruggea*, *Whitfordiodendron*, and paniculate sections of *Millettia* (sect. *Eurybotyae* and sect. *Austromillettia*). Schot (1994) agreed and made the necessary combinations.

Callerya: *C. cinerea* (G. Bentham) A.M. Schot (*C–D*), *C. speciosa* (J.G. Champion) A.M. Schot (*E*), *C. spp.* (*A–B*). *A*, Fruits ($\times 0.5$); *B*, seeds ($\times 2$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 2.6$).



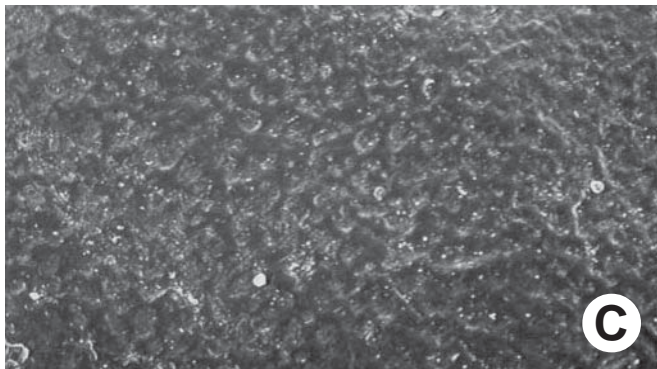
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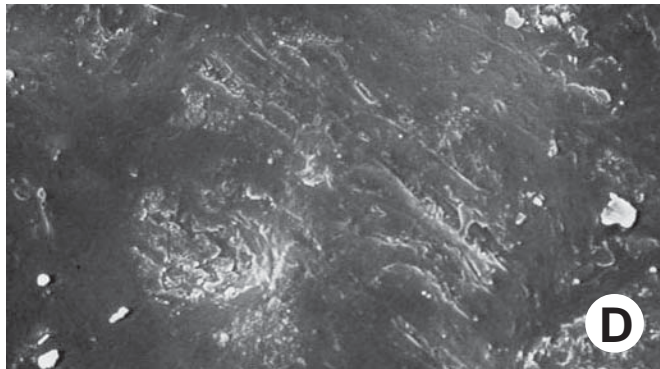
B



A



C



D

Genus: *Chadsia* W. Bojer

Tribe: Millettieae.

Species Studied—Species in Genus: 2 spp.—18 spp.

Fruit a legume; unilocular; 4–17 × 0.5–1.1 cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; fusiform to linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; declined; with solid beak the same color and texture as fruit; long tapered or tapered at apex; apex aligned or oblique with longitudinal axis of fruit; long tapered or tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; sericeous; with pubescence white; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; monochrome; tan; smooth; without adhering pieces of testa; subseptate; with septa thin (tissue paper-like), flexible; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 6–10; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca 0.5 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril; cream.

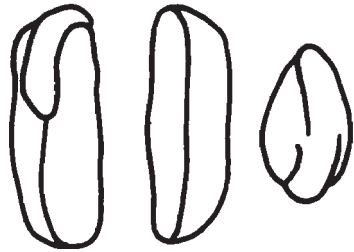
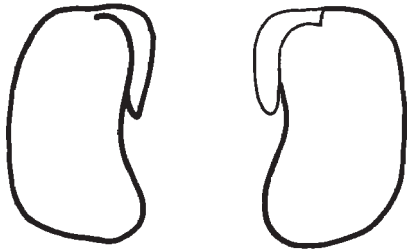
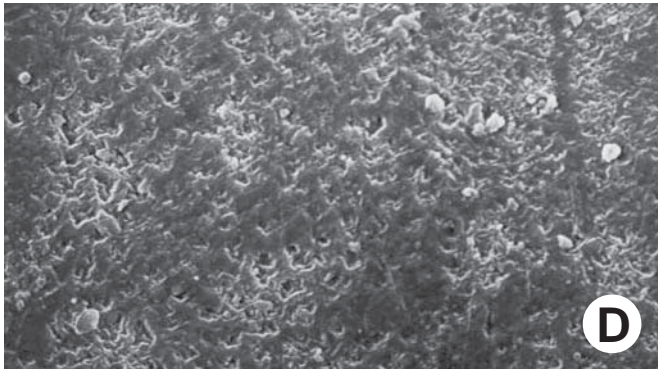
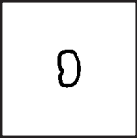
Seed 5.7–8 × 3.5–4.5 × 2–2.5 mm; not overgrown; angular or not angular; symmetrical; elliptic to oblong to reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; mottled; with frequent mottles; brown; with black overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings

absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.5–0.8 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; flush; within halo. Hilum halo color darker than testa. Lens discernible; less than 0.5 mm in length; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; within halo. Lens halo color darker than testa. 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; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; pale tan; inner face with central ridge on 1 and central groove on other; glabrous around base of radicle. Embryonic axis parallel; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; with 180-degree turn; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Madagascar.

Notes: Only one valve from one fruit and one seed were studied.

Chadsia: *C. andravinensis* H.E. Baillon (A–E). A, Fruit (× 1.4); B, seeds (× 6); C–D, testa (× 50, × 1000); E, embryos (× 5).



E

Genus: *Craibia* H.A.T. Harms & S.T. Dunn

Tribe: Millettieae.

Species Studied—Species in Genus: 4 spp.—10 spp.

Fruit a legume; unilocular; 7–11 × 2.5–3.5 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; irregular or obliquely obovate; when asymmetrical with both sutures unequally curved; not inflated; compressed; with beak; straight or declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; long tapered or tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous or leathery; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled or streaked; brown; with brown (darker) overlay; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with recessed features; not veined; not tuberculate; slitted obliquely; not exfoliating or exfoliating in part; without or with cracks; cracking oblique to fruit length. Mesocarp thick; surface not veined or uniformly veined; 2-layered; without balsamic vesicles; without fibers; with solid layer over solid layer or spongy layer over solid layer; coriaceous. Endocarp dull; opaque; monochrome or mottled; tan or white; with mottling (dark); with brown overlay; scurfy and transversely wrinkled; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–2(–6); length oblique to fruit length; neither overlapping nor touching or touching; in 1 series. Funiculus measured; ca. 1 mm long; of 1 length only; flattened; straight or triangular. Aril dry; rim-aril and tongue-aril; brown, cream, tan, or yellow.

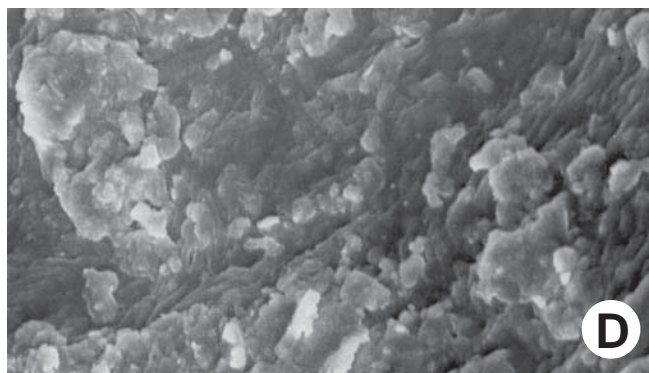
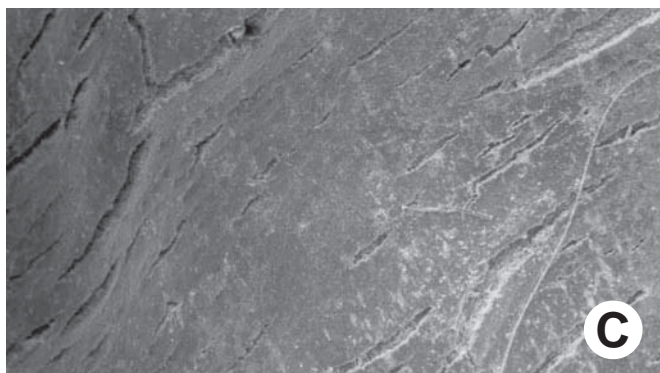
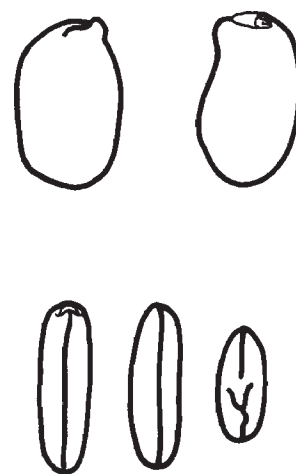
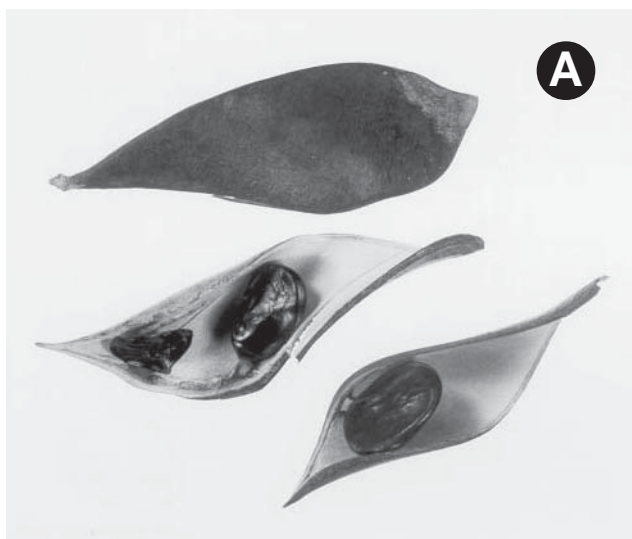
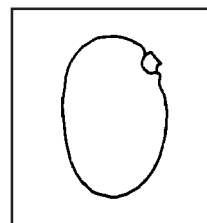
Seed 16–20 × 10–14 × 3–9 mm; not overgrown; angular or not angular; symmetrical or asymmetrical; elliptic or irregular; compressed or flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; with or without medial ridge on each face. Cuticle not

exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified or modified by a bloom; colored; monochrome or mottled; with infrequent mottles; dark brown; with brown (darker) overlay; glabrous; smooth or not smooth; with elevated or recessed features; wrinkled; pitted with small separate pits; chartaceous to coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens to base of seed and terminating; not bifurcating; color of testa; raised. Hilum partially concealed; concealed by aril; without faboid split; larger than punctiform; 2.5–4 mm long; with curved outline; elliptic; subapical to radicle tip or marginal according to radicle tip; recessed; within rim. Hilum rim color of or darker than testa. Lens not discernible. Endosperm absent. Cotyledons smooth or not smooth; wrinkled; both outer faces convex; both the same thickness; both more or less of equal length; with both folded or not folded; 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; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; brown; inner face flat or wrinkled; glabrous around base of radicle. Embryonic axis oblique or parallel; oblique, parallel, or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous to triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

Distribution: Tropical Africa.

Notes: Gillett (1960b) treated the genus.

Craibia: *C. brownii* S.T. Dunn (C–E), *C. spp* (A–B). A, Fruits (× 0.7); B, seeds (× 2.1); C–D, testa (× 50, × 1000); E, embryos (× 1).



Genus: *Craspedolobium* H.A.T. Harms

Tribe: Millettieae.

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

Fruit a legume; unilocular; $5-10 \times 1.3-1.5 \times$ ca. 0.25 cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; linear to moniliform; when asymmetrical with both sutures nearly straight or parallelly curved; not inflated; flattened; without or with beak (short); declined; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; short tapered to rounded at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted; slightly constricted along both margins; without sulcus; embellished. Fruit wing 1; 2–3 mm wide; sutural; on 1 suture (upper). Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down. Replum invisible. Epicarp with surface texture uniform; pubescent and indurate; hairs appressed; 1 type of pubescence; densely sericeous; pubescence brown (rusty); with pubescence uniformly distributed; simple hairs; pliable; hair bases plain; eglandular; without spines; smooth or not smooth; elevated features; veined or not veined; transversely veined relative to fruit length; not tuberculate; not exfoliating; without cracks. Mesocarp absent. Endocarp glossy; opaque; monochrome; golden tan; smooth; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 2–8; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1.5–2 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril and tongue-aril; brown.

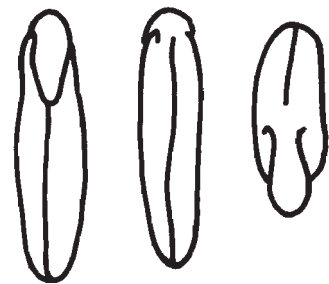
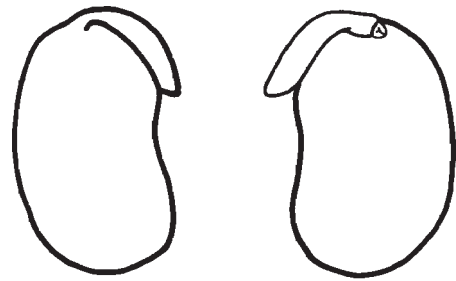
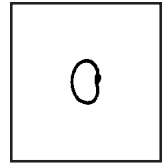
Seed ca. $6 \times$ ca. $4.5 \times$ ca. 2 mm; not overgrown; not angular; symmetrical; elliptic to reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; reddish brown; with black overlay;

glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; ca. 1 mm long; with curved outline; broadly elliptic; apical according to radicle tip but marginal according to seed length; recessed; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; ca. 1.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; 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; partially concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; with 180-degree turn; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

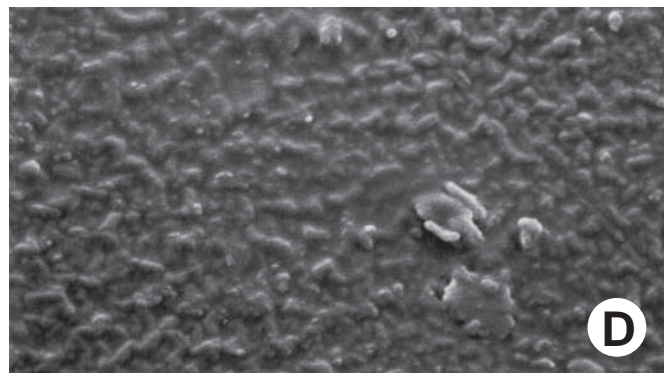
Distribution: China (Yunnan).

Notes: Geesink (1984) noted that “only few collections are extant.”

Craspedolobium: *C. schochii* H.A.T. Harms (A–E). A, Fruits ($\times 1.1$); B, seeds ($\times 6.2$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



E



Genus: *Cyclolobium* G. Bentham

Tribe: Millettieae.

Species Studied—Species in Genus: 3 spp.—5 or 6 spp.

Fruit a legume; unilocular; $3\text{--}5.5 \times 1.8\text{--}2.9 \times 0.3\text{--}0.4$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; circular, elliptic, obliquely obovate, or obliquely ovate; when asymmetrical with both sutures parallelly or unequally curved; not inflated; flattened; without beak; rounded at apex; apex aligned or oblique 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; chartaceous to coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished. Fruit wings 1 or 2; 2–4 mm wide; sutural; on 1 or both sutures. Fruit stipitate; with the stipe 5–7 mm long. Fruit indehiscent. Epicarp dull; monochrome or multicolored; mottled; orange brown; with brown overlay; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; papillose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; opaque; monochrome; creamy yellow; smooth and scurfy; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1(–3) (three in literature, not observed); length parallel with or oblique to fruit length. Funiculus measured; 0.5–1 mm long; of 1 length only; filiform; straight. Aril absent.

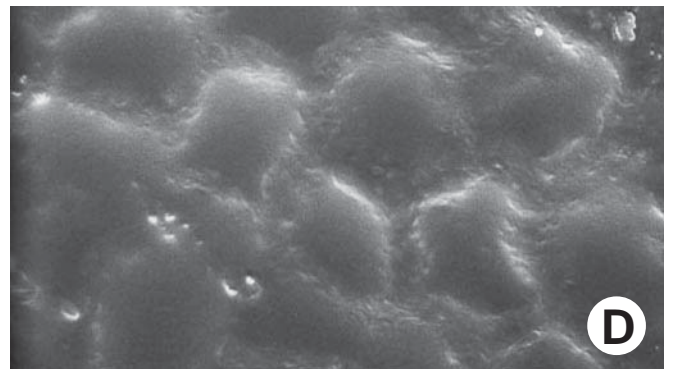
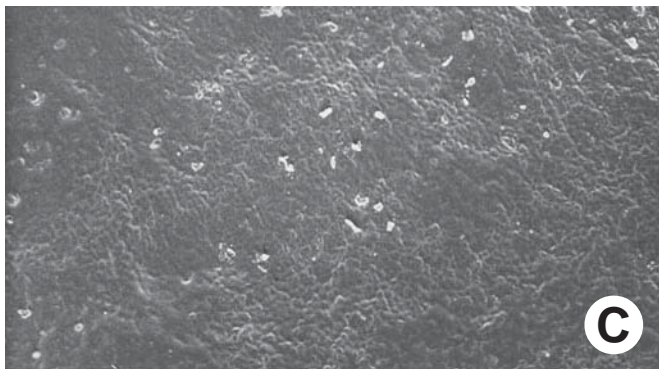
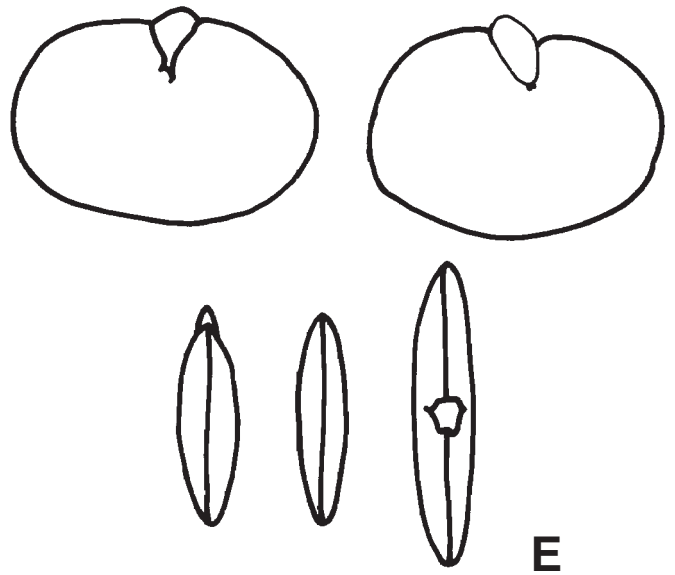
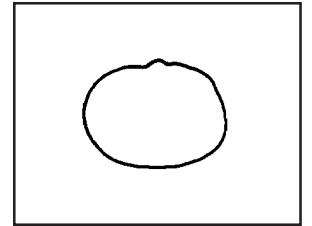
Seed $17\text{--}22 \times 16\text{--}21 \times 2.5\text{--}3$ mm; not overgrown; not angular; symmetrical to asymmetrical; elliptic to ovate or irregular; flattened; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; orange; with brown overlay; glabrous; not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through base of seed and up the other side; not bifurcating; darker than testa; brown;

raised. Hilum fully concealed; concealed by funicular remnant; larger than punctiform; ca. 0.5 mm long; with curved outline; elliptic; subapical to radicle tip; flush; 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; partially concealing radicle; notched at 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; 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 differentiated from cotyledon; bulbous; lobe tip straight; straight with embryonic axis; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical South America.

Notes: Hoehne (1941) monographed the genus.

Cyclolobium: *C. blanchetianum* E.L.R. Tulasne (B–E), *C.* spp. (A). A, Fruits ($\times 1.5$); B, seed ($\times 2.6$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2$).



Genus: *Dahlstedtia* G.O.A. Malme

Tribe: Millettieae.

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

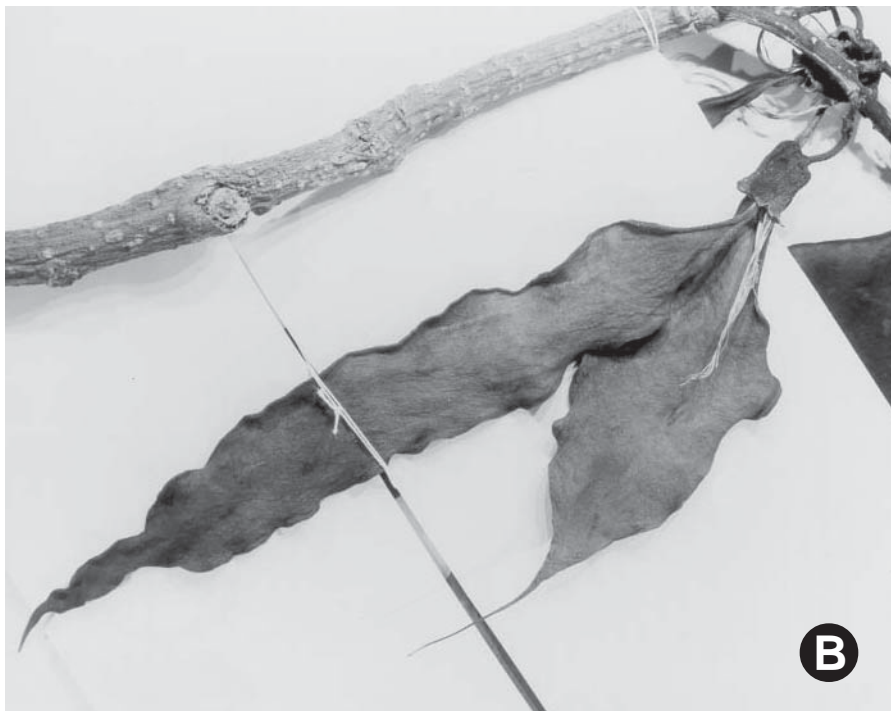
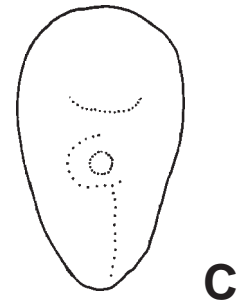
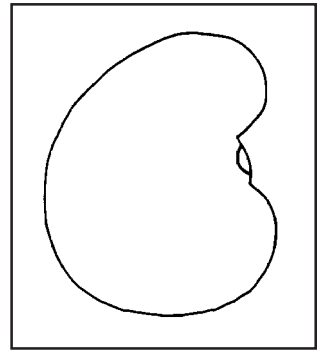
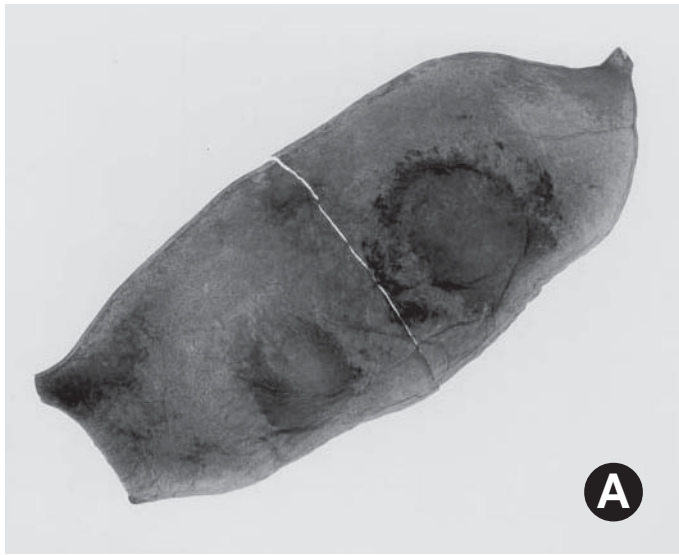
Fruit a legume; unilocular; $7-16 \times 2.5-5 \times$ up to 3 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; irregular; when asymmetrical with both sutures unequally curved; not inflated or inflated (slightly, in literature); compressed; without beak; blunt to short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; tapered to short tapered at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit substipitate. Fruit indehiscent (from literature). Epicarp dull; monochrome or multicolored; mottled; brown; with brown (darker) overlay; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with elevated features; veined; reticulately veined to irregularly veined; not tuberculate; wrinkled; not exfoliating; without cracks. Seeds 1–4 (from literature); length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series.

Seed $30-35 \times 20-25 \times 15-20$ mm; not overgrown; not angular; asymmetrical; obliquely reniform; compressed. Testa present. Hilum larger than punctiform; with curved outline; circular.

Distribution: Southern Brazil.

Notes: Only one immature fruit was available for study. Other information was derived from photocopies of herbarium specimens and the literature (Geesink 1984).

Dahlstedtia: *D. pinnata* (G. Bentham) G.O.A. Malme
(A–C). A, Fruit ($\times 1$); B, fruits ($\times 1$); C, seed ($\times 1$).



Genus: *Dalbergiella* E.G. Baker

Tribe: Millettieae.

Species Studied—Species in Genus: 2 spp.—3 spp.

Fruit a legume; unilocular; $7-10 \times 2-2.5 \times 0.75-0.9$ 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; oblong or lanceolate; when asymmetrical with both sutures parallelly curved; not inflated; flattened; without beak; long tapered at apex; apex oblique 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; membranous; seed chambers externally visible. Fruit margin not constricted or slightly constricted only on 1 margin; without sulcus; embellished; with wing and fringe (reddish-brown hairs along sutures of *D. nysae*). Fruit wing present (both species have winged fruit though wing is inconspicuous); 1; up to 30 mm wide; samaroid or continuous wing around fruit; on both sutures. Fruit substipitate. Fruit indehiscent. Replum invisible. Fruit entire. Epicarp dull; monochrome; greenish brown or tan (with reddish-brown fringe); pubescent and indurate or glabrous; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple or complex hairs (plumose hairs especially along sutures in *D. nysae*); pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; spongy; chartaceous. Endocarp glossy; monochrome; golden brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; up to 70 mm long; filiform; straight. Aril present (*D. nysae*) or absent (*D. welwitschii* (E.G. Baker) E.G. Baker); fleshy; knotty; covering less than 1/2 of seed; tan.

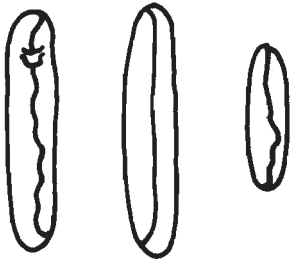
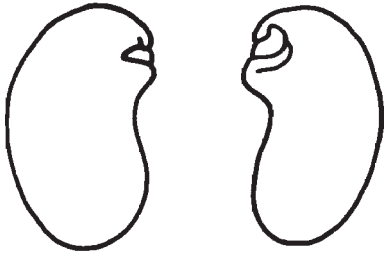
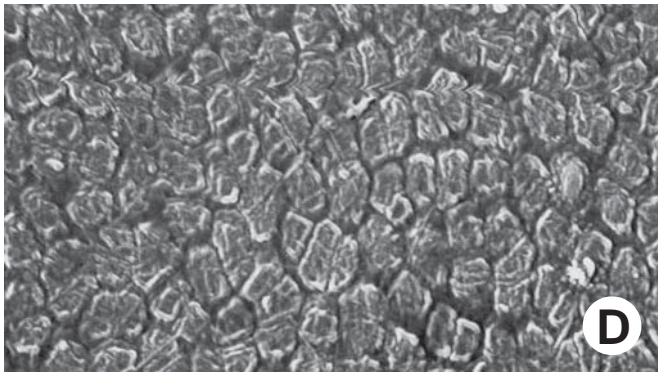
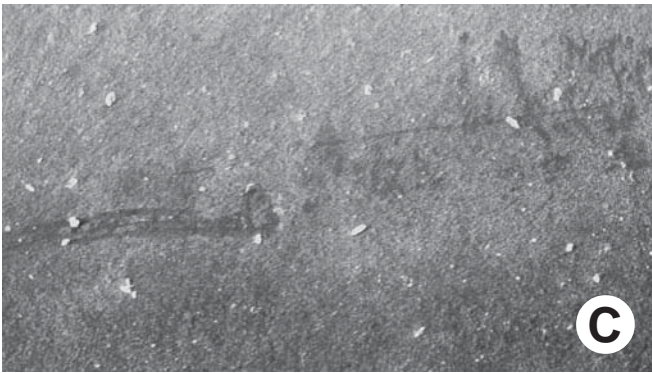
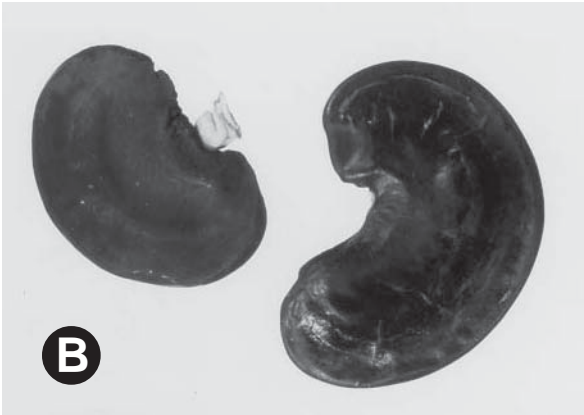
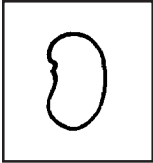
Seed $12-15 \times 6-10 \times 1.8-2$ mm; not overgrown; not angular; asymmetrical; D-shaped or reniform; flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or streaked; with frequent streaks; reddish brown; with

brown (bright reddish) overlay; glabrous; smooth; coriaceous or chartaceous. 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 straight outline; oblong; marginal according to radicle tip or between cotyledon and radicle lobe; flush; not within corona, halo, or rim. Lens not discernible. 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 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 linear; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical Africa.

Notes: Geesink (1981) had placed *Dalbergiella* in the Tephrosieae (now Millettieae), but later (Geesink 1984) transferred the genus to the Dalbergieae without relating *Dalbergiella* to other genera in the Dalbergieae. The fruits of *Dalbergiella nysae* and *D. welwitschii* are similar in many respects, but there is one significant difference. The fruits of *D. nysae* are tan with a reddish-brown fringe composed of plumose hairs along the sutures, while *D. welwitschii* is greenish-brown with sutures that are entire and hairs that are simple. The seeds of *D. nysae* also have an aril, which is absent on seeds of *D. welwitschii*. It is unfortunate that we were unable to study fruits and seeds of the third species: *D. gossweileri* E.G. Baker.

Dalbergiella: *D. nysae* E.G. Baker (C–E), *D. spp.* (A–B). A, Fruits ($\times 0.9$); B, seeds ($\times 2.9$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2$).



E

Genus: *Derris* J. de Loureiro

Tribe: Millettieae.

Species Studied—Species in Genus: Ca. 15 spp.—ca. 45 spp.

Fruit a legume; unilocular; $2.5\text{--}14\text{--}(20) \times 0.8\text{--}3.5 \times 0.2\text{--}1$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; elliptic, moniliform (slightly), oblong, falcate, irregular, or obliquely obovate; when asymmetrical with both sutures parallelly or unequally curved; not inflated; compressed or flattened; without or with beak; declined; with solid beak the same color and texture as fruit; rounded, blunt, tapered, or long tapered at apex; apex aligned or oblique with longitudinal axis of fruit; rounded or tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins or only on 1 margin; without sulcus; embellished. Fruit wings 1 or 2; 1–5 mm wide; sutural; on 1 or both sutures. Fruit substipitate or nonstipitate; with the stipe up to 3 mm long. Fruit indehiscent. Epicarp dull; monochrome or multicolored; mottled; brown or tan; with brown (darker) overlay; with mottling over seed chambers; with surface texture uniform; glabrous, pubescent and indurate, or pubescent but soon deciduous; with hairs erect or appressed; with 1 type of pubescence; sparsely puberulent to pilose or sericeous (sparsely); with pubescence golden to brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; sometimes dotted; not exfoliating; without cracks. Mesocarp present or absent; thin; 1-layered; without balsamic vesicles; without fibers; solid or firm-walled open empty cells; chartaceous. Endocarp dull; opaque or translucent; monochrome or mottled; brown, tan, white, or yellow; with mottling (dark); with brown overlay; floury-filamentous or smooth; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating or exfoliating in part; remaining fused to mesocarp and epicarp or to only the epicarp; entire. Seeds 1–2(–8); length oblique or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5–3 mm long; of 1 length only;

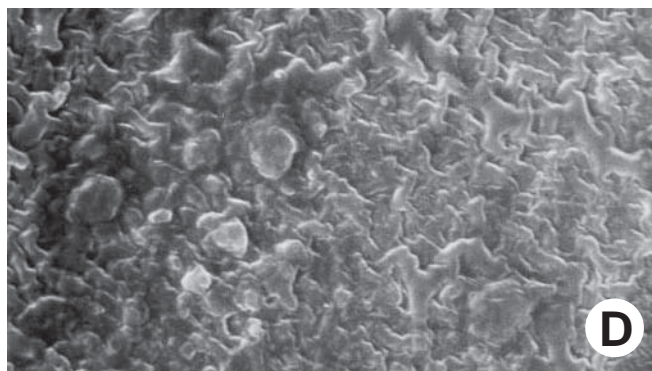
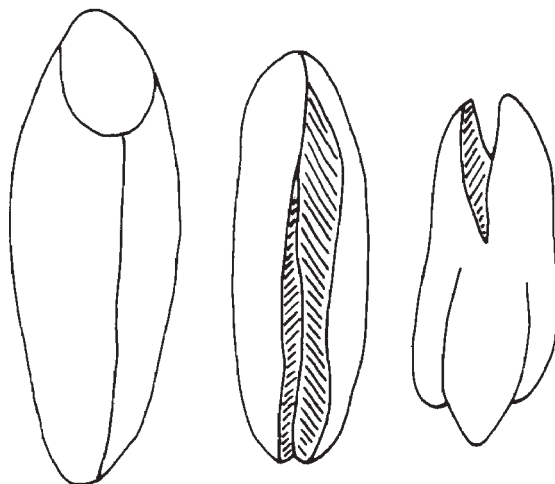
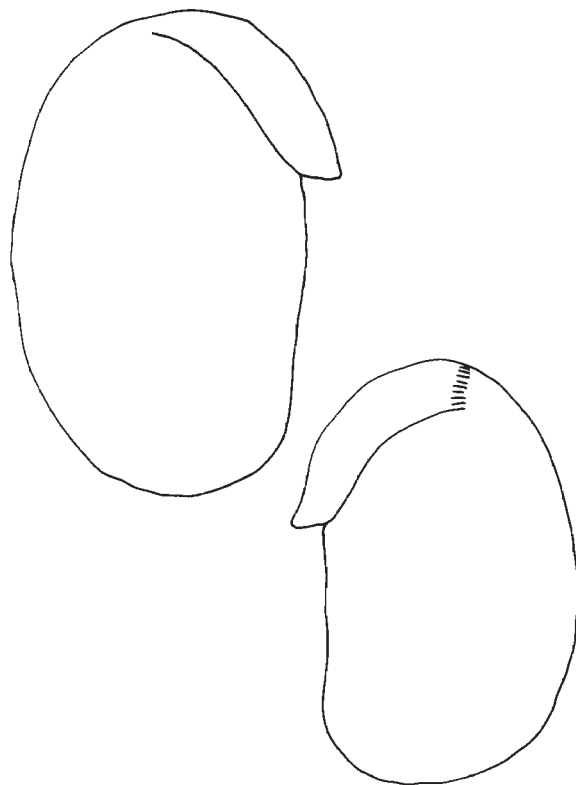
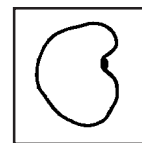
flattened; straight or triangular. Aril present or absent; dry; rim-aril; cream.

Seed $3.5\text{--}25 \times 3\text{--}17 \times 1.8\text{--}10$ mm; not overgrown; not angular; symmetrical or asymmetrical; elliptic, ovate, or reniform; compressed or flattened; with surface smooth or wrinkled; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle present or absent; not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; brown (various shades); glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible or visible; from hilum to near base of seed and terminating; not bifurcating; slightly lighter than testa; recessed. Hilum partially or fully concealed; concealed by aril or funiculus; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–4 mm long; with curved outline; elliptic or oval; apical according to radicle tip but marginal according to seed length; flush or recessed; within halo or not within corona, halo, or rim. Hilum halo color darker than testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; 0.5–1.5 mm long; with margins straight; linear or triangular; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown or black; not within corona, halo, or rim. Endosperm present or absent; trace; covering entire embryo, covering at least 1/2 of embryo, but not entire embryo, or restricted to region of embryo; adnate to testa or embryo. Cotyledons smooth or not smooth; sulcate or wrinkled; both outer faces convex; both the same thickness; 1 longer than other or 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 or split over radicle; with or without lobes; with lobes touching (auriculate); without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; tan or tan and brown; inner face flat or concave; glabrous around base of radicle. Embryonic axis oblique, right angled, or straight; oblique, parallel, or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous, linear, or triangular; lobe tip straight or curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary, moderately developed, or well developed; glabrous.

Distribution: Southeast Asia; *D. trifoliata* J. de Loureiro from east Africa to Australia and west Pacific; 4–5 spp. in South America (*Deguelia* J.B.C.F. Aublet in Geesink (1984)).

Notes: Geesink (1981) recognized three sections: *Derris* sect. *Brachypterum* (R. Wight & G.A.W. Arnott) G. Bentham, “three or possibly more species in southeast Asia,” which he raised to generic rank (Geesink 1984); *Derris* sect. *Paraderris* F.A.W. Miquel, “six species in southeast Asia,” which he also raised to generic rank (Geesink 1984); and *Derris* sect. *Derris*, “(including section *Dipteroderris* Bentham) more than 50 species in southeast Asia, one mangrove species extending to east Africa, three species in Australia, and four species in Brazil and the Guianas.” Thothathri (1982) treated *Derris* for India, and recognized four sections: *Derris* sect. *Brachypterum*; *Derris* sect. *Derris*; *Derris* sect. *Dipteroderris* G. Bentham; and *Derris* sect. *Paraderris*. We did not accept either *Brachypterum* R. Wight & G.A.W. Arnott or *Paraderris* (F.A.W. Miquel) R. Geesink at the generic rank.

Derris: *D. robusta* (W. Roxburgh ex A.-P. de Candolle) G. Bentham (*C-E*), *D. spp.* (*A-B*). *A*, Fruits ($\times 0.6$); *B*, seeds ($\times 2.1$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 14$).



Genus: *Dewevrea* M. Micheli

Tribe: Millettieae.

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

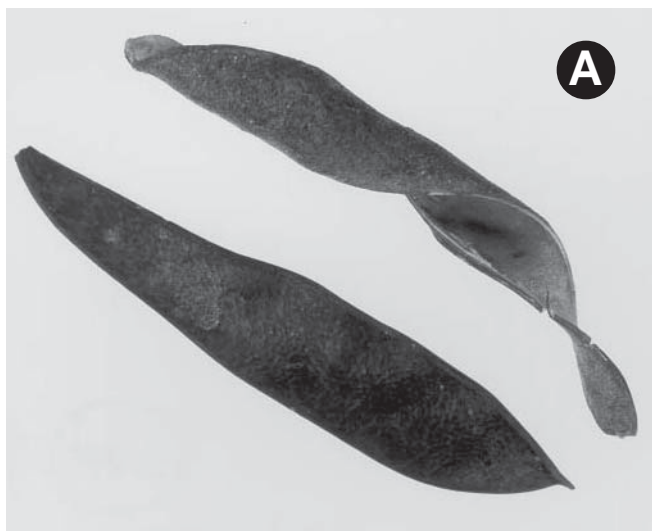
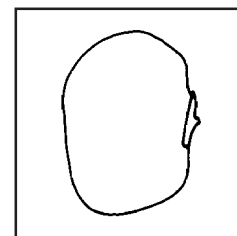
Fruit a legume; unilocular; 15–17 × 2.5–3 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; narrowly obovate; when asymmetrical with both sutures parallelly curved; not inflated; compressed to flattened; with beak; straight; with solid beak the same color and texture as fruit; tapered at apex; apex aligned with longitudinal axis of fruit; long tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; liginous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with ridges or thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; with surface texture uniform; pubescent but soon deciduous; with hairs erect; with 1 type of pubescence; sparsely velutinous; with pubescence brown; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases swollen (slightly); eglandular; without spines; not smooth; with elevated features; veined (immature fruit) or not veined (mature fruit); reticulately veined; not tuberculate; lenticular (mature fruit); not exfoliating; with cracks; cracking oblique to fruit length. Mesocarp thick; 2- or 3-layered; without balsamic vesicles; without fibers; with vitreous layer over solid layer or with vitreous layer over 2 distinct solid layers; liginous. Endocarp dull; opaque; mottled; brown; with mottling (dark); with brown overlay; smooth and floury-filamentous; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–5; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 2.5 mm long; of 1 length only; thick; broadly triangular. Aril dry; rim-aril and tongue-aril; brown.

Seed 24.5–26 × 16.5–20 × ca. 8 mm; not overgrown; angular or not angular; symmetrical; oblong or ovate; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on

each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible; from hilum through lens to base of seed and terminating; not bifurcating; darker than testa; dark brown; raised. Hilum fully concealed; concealed by funicular remnant; larger than punctiform; 6–6.5 mm long; with curved outline; narrowly elliptic; apical according to radicle tip but marginal according to seed length; flush; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 4 mm long; with margins straight; oblong; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; not within corona, halo, or rim. Endosperm absent. Cotyledons not smooth; convoluted; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin not entire 180 degrees from base of radicle; notched (strongly to shallowly so); similar at apex; partially concealing radicle; notched at or split over radicle; brown; inner face wrinkled; glabrous around base of radicle. Embryonic axis right angled; perpendicular to length of seed. Radicle triangular; lobe tip straight; straight with embryonic axis. Plumule rudimentary; glabrous.

Distribution: Equatorial West Africa.

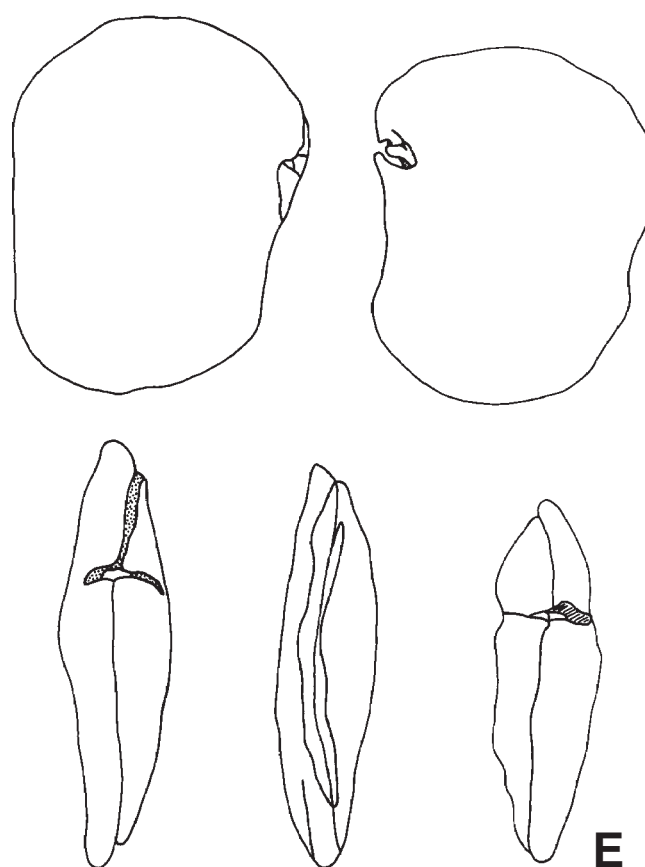
Dewevrea: D. bilabiata M. Micheli (A–E). A, Fruits (× 0.6); B, seeds (× 1.8); C–D, testa (× 50, × 1000); E, embryos (× 2).



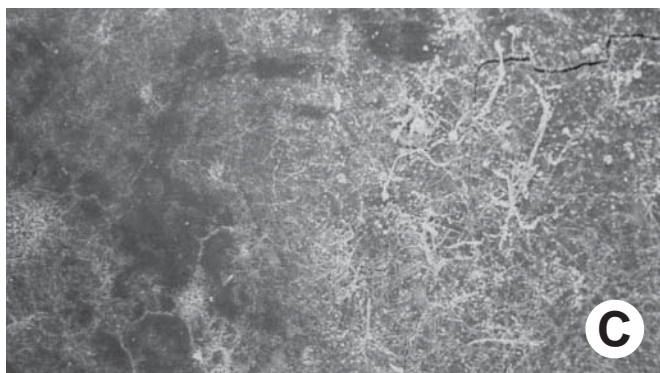
A



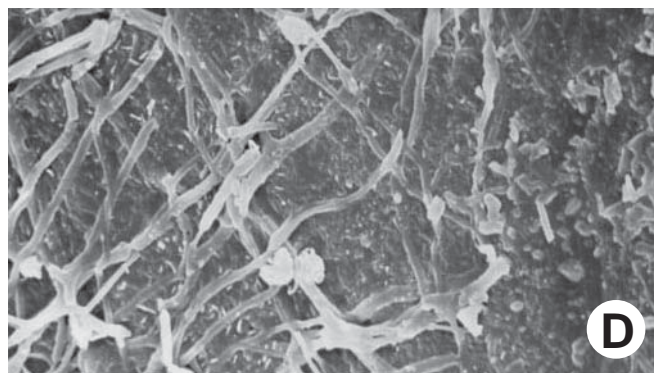
B



E



C



D

Genus: *Disynstemon* R. Viguier

Tribe: Millettieae.

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

Fruit a legume; unilocular; 6–8 × 1.3–1.5 cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; terete; without beak; rounded at apex; apex aligned or oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; lignous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; with surface texture uniform; pubescent and indurate; with hairs erect; with 1 type of pubescence; puberulent; with pubescence white; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not smooth; with recessed features; not veined; not tuberculate; pitted; not exfoliating; without cracks. Mesocarp thick; 3-layered; without balsamic vesicles; without fibers; with solid layer over vitreous layer over solid layer; coriaceous. Endocarp dull; translucent; mottled; white; with mottling (dark); with brown overlay; smooth; without adhering pieces of testa; nonseptate; chartaceous; exfoliating; separating from mesocarp; entire. Seeds 5–8; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 2.5 mm long; of 1 length only; thick; broadly triangular. Aril dry; rim-aril and tongue-aril; tan.

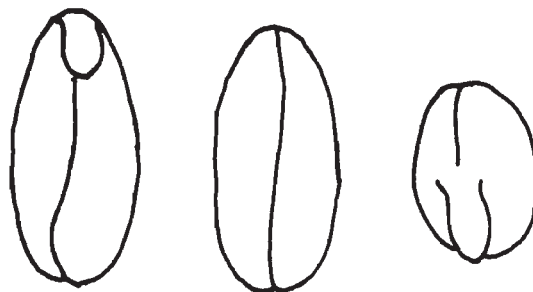
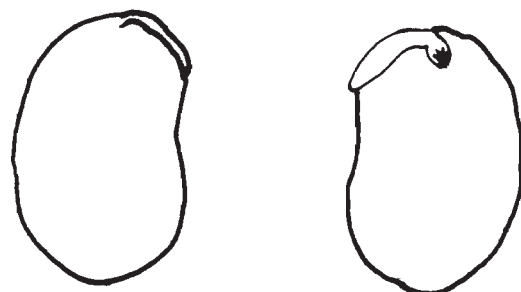
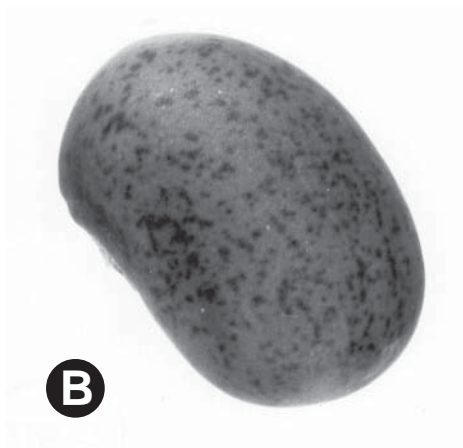
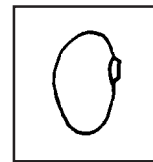
Seed 8–9 × 6–7 × 4.5–5 mm; not overgrown; not angular; symmetrical; elliptic; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; dark reddish brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens to base of seed and terminating; not bifurcating; color of testa; brown; slightly raised. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the

rest of the hilum; larger than punctiform; 1.5–2 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; raised; within rim. Hilum rim color slightly darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 2 mm long; with margins straight; linear to triangular; not in groove of raphe; confluent with hilum; slightly mounded; similar color as testa; slightly darker than testa; brown; 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 lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

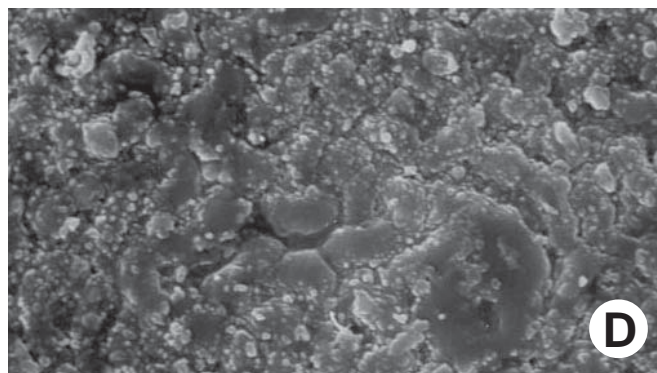
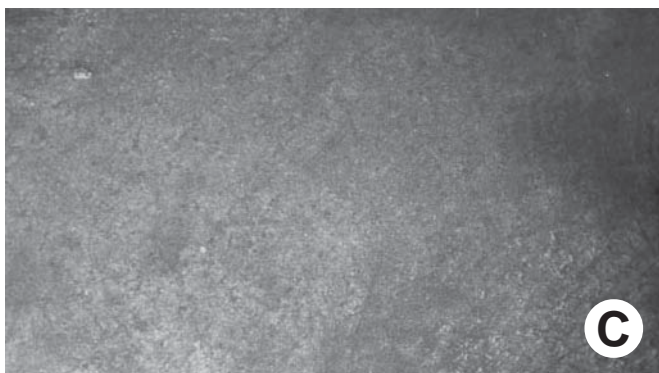
Distribution: Madagascar.

Notes: Peltier (1977) treated *Disynstemon*.

Disynstemon: *D. paullinioides* (J.C. Baker) M.A.G. Peltier (A–E). A, Fruit (× 1.4); B, seed (× 6.7); C–D, testa (× 50, × 1000); E, embryos (× 3.1).



E



Genus: *Endosamara* R. Geesink

Tribe: Millettieae.

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

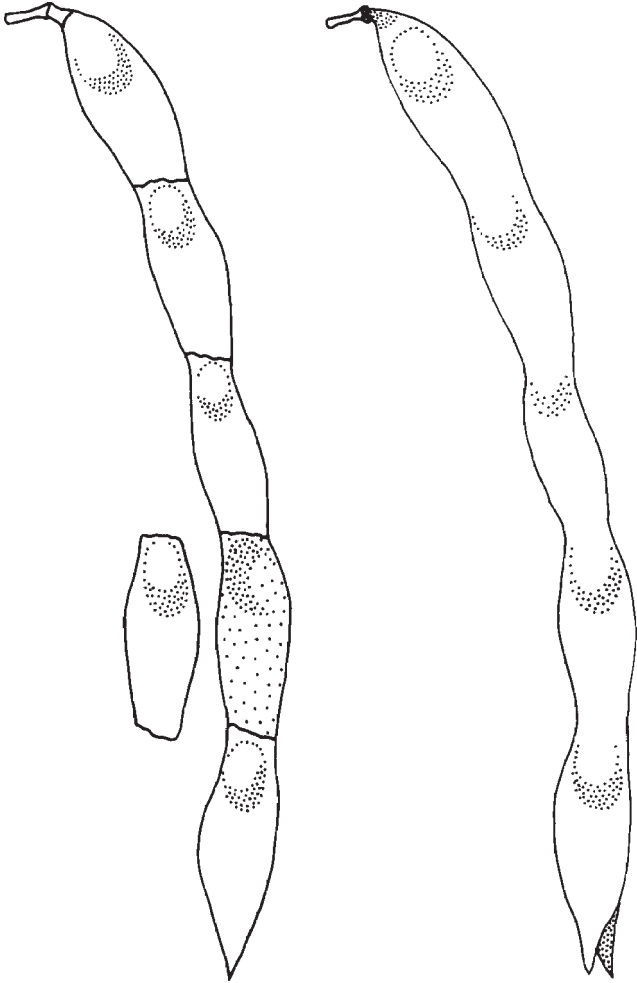
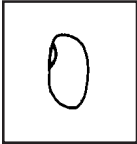
Fruit a legume; unilocular; 10–25 × 1–1.6 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; linear (or nearly so); when asymmetrical with both sutures parallelly curved; with or without beak; straight; with solid beak the same color and texture as fruit; rounded or tapered at apex; apex aligned or oblique with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture. Fruit margin constricted (in literature) or not constricted; slightly constricted along both margins. Fruit wings absent. Fruit substipitate; with the stipe 2–3 mm long. Fruit with epicarp and mesocarp dehiscent and endocarp not dehiscent; with epicarp and mesocarp splitting along suture, endocarp lomented, forming an envelope around each seed, with a flat winglike part. Dehiscence of valves along both sutures; apical and down. Epicarp glabrous; without spines. Endocarp chartaceous; separating from mesocarp; separating into 1-seeded winged segments. Seeds 4–5; length parallel with fruit length; neither overlapping nor touching; in 1 series. Aril absent.

Seed ca. 10 × 5–7 × 2–6 mm; not overgrown; not angular; symmetrical; elliptic (with one end somewhat pointed); terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; dark reddish brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible; from hilum through lens to base of seed and terminating; not bifurcating; color of testa; raised. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2–3 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 1 mm long; with margins straight; triangular; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; not within corona, halo, or rim.

Distribution: South India to Indochina and Philippines.

Notes: Geesink (1984) noted that Dunn (1912) placed *Millettia racemosa* (W. Roxburgh) G. Benth in the monotypic section *Bracteatae*. Dunn mentioned the separating endocarp, but may have considered the lomentation of the endocarp to be an artifact. Geesink regarded this lomentation to be unique in the Fabaceae, but it is also found in *Glottidium* (8.01). No fruits and only one seed were studied; limited information was taken from literature and photocopies of herbarium specimens. Adema (personal communication, 1998) confirmed that there are two species in this genus, and his species count is used.

Endosamara: *E. racemosa* (W. Roxburgh) R. Geesink (A–B). A, Fruits (× 0.7); B, seeds (× 3.8).



A



B

Genus: *Fordia* W.B. Hemsley

Tribe: Millettieae.

Species Studied—Species in Genus: 3 spp.—ca. 16 spp.

Fruit a legume; unilocular; 6–30 × 1.5–5 × 0.4–0.8 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; fusiform, obovate, falcate, elliptic, or obliquely obovate; when asymmetrical with both sutures parallelly or unequally curved; not inflated; flattened; with beak; straight or declined; with solid beak the same color and texture as fruit; tapered or long tapered at apex; apex aligned or oblique with longitudinal axis of fruit; rounded, tapered, or short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished or plain; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate to stipitate; with the stipe up to 15 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; dark brown to tan; with brown overlay; with surface texture uniform; pubescent and indurate; with hairs erect; with 1 type of pubescence; sparsely puberulent to velutinous; with pubescence white or brown to black (nearly); with pubescence uniformly distributed; with simple hairs; stiff or pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated or recessed features; not veined; not tuberculate; dotted or striate; slitted obliquely; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined or uniformly veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid or with spongy layer over solid layer; coriaceous. Endocarp dull; opaque; monochrome or mottled; tan to brown; with mottling (dark); with brown overlay; floury-filamentous to scurfy; without adhering pieces of testa; nonseptate; chartaceous; exfoliating in part or not exfoliating; remaining fused to mesocarp and epicarp or separating from mesocarp; entire. Seeds 2–7; length oblique or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–2.5 mm long; of 1 length only; thick; convoluted. Aril dry; 2-lipped rim-aril or rim-aril; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; brown.

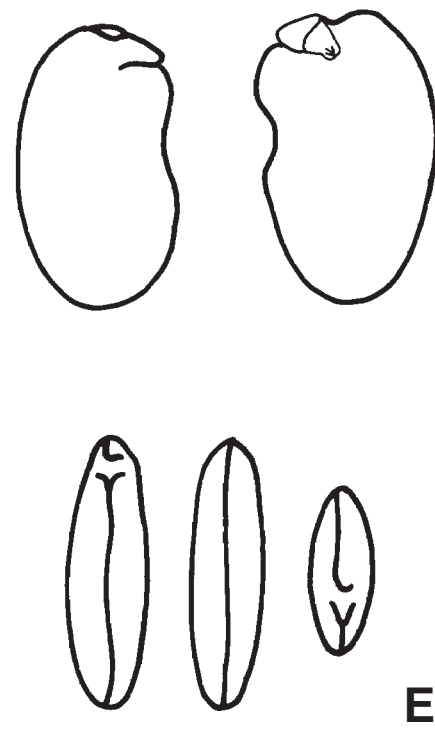
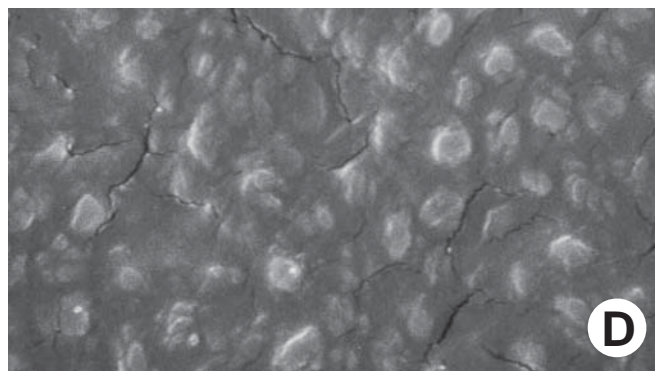
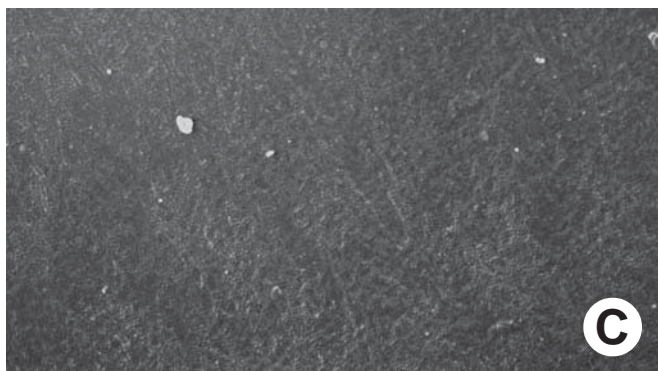
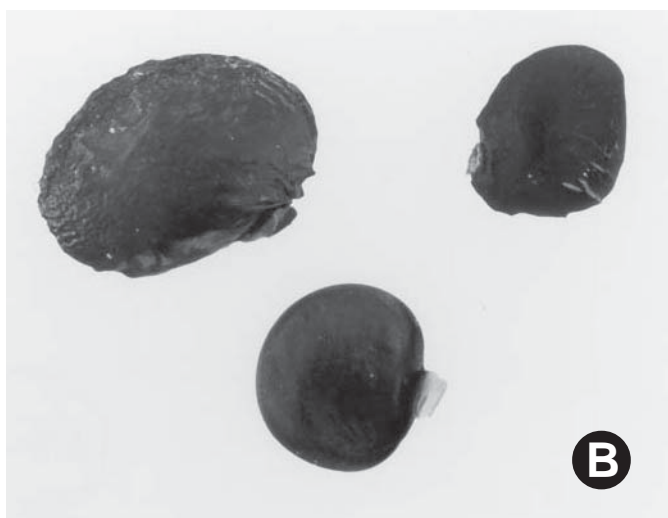
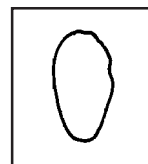
Seed 10–23 × 10–22 × 4–5 mm; not overgrown; not angular or angular (in literature); symmetrical or asymmetrical; circular, elliptic, irregular, or quadrangular (rarely); compressed to flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome, mottled, or streaked; with infrequent mottles; with infrequent streaks; brown; with brown (darker) overlay; glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent or present; irregular. Rim absent. Wings absent. Raphe visible or not visible; from hilum to near base of seed and terminating; not bifurcating; darker than testa; raised. Hilum partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2–4.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; raised or flush; within halo or rim. Hilum halo color darker than testa. Hilum rim color darker than testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; 2–4 mm long; with margins straight; linear to triangular (narrowly); not in groove of raphe; confluent with hilum; flush; same or similar color as testa; darker than testa; 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; partially concealing radicle; notched at 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 oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

Distribution: Continental southeastern Asia, Sumatra, and Borneo.

Notes: Dasuki and Schot (1991) revised *Fordia*, and included *Imbralyx* Geesink. Schot (1991) provided a phylogenetic analysis that supported uniting *Fordia* and *Imbralyx*. Buijsen (1988) also revised *Fordia*, but did

not include *Imbralyx*. We followed Dasuki and Schot, and included *Imbralyx* in *Fordia*. Some information was supplemented from those sources. Few seeds were available for study.

Fordia: *F. splendidissima* (C.L. von Blume ex F.A.W. Miquel) J.R.M. Buijsen (*C-E*), *F. spp.* (*A-B*). *A*, Fruits ($\times 0.9$); *B*, seeds ($\times 2.1$); *C-D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 2.5$).



Genus: *Hesperothamnus* T.S. Brandege

Tribe: Millettieae.

Species Studied—Species in Genus: 2 spp.—ca. 5 spp.

Fruit a legume; unilocular; 5–10 × 0.6–1.7 × 0.3–0.6 cm; with deciduous or persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; linear to moniliform or falcate (slightly); when asymmetrical with both sutures parallelly curved; not inflated; compressed; with or without beak; straight; with solid beak the same color and texture as fruit; tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted along both margins; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; tan to green; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; sericeous to tomentose; with pubescence golden or white; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; solid or with solid layer over solid layer; coriaceous. Endocarp dull; opaque or translucent; monochrome; green or white; smooth and scurfy or cracked and scurfy; without adhering pieces of testa; nonseptate; chartaceous; exfoliating in part or not exfoliating; separating from mesocarp; entire. Seeds 2–4; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–2.5 mm long; of 1 length only; thick; contorted. Aril dry; rim-aril and tongue-aril; creamy yellow.

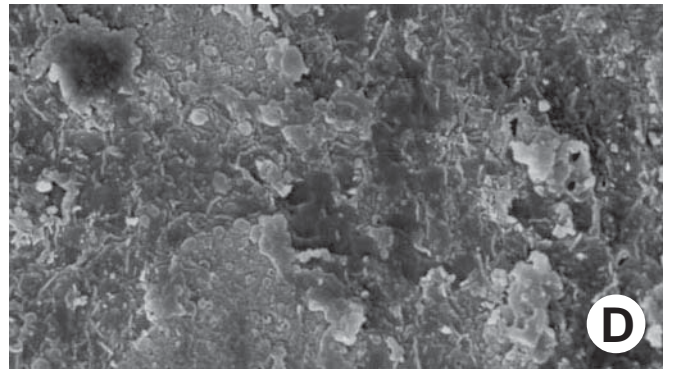
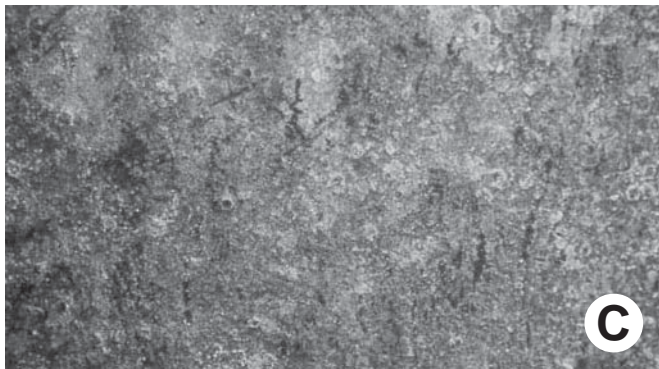
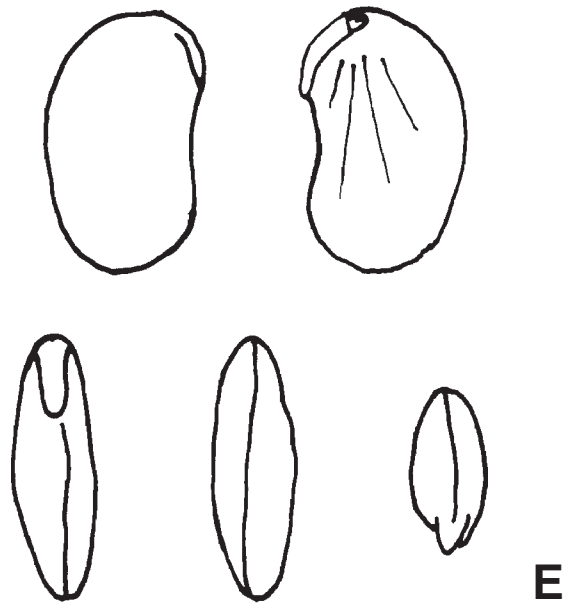
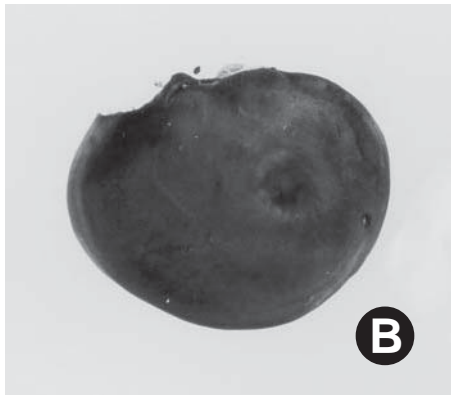
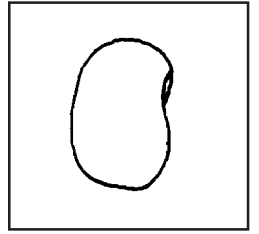
Seed ca. 11 × 7–9 × 3–3.5 mm; not overgrown; not angular; symmetrical; elliptic; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of

adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; smooth or not smooth; with elevated features; lightly rugose; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; ca. 1.8 mm long; with curved outline; oval; recessed; within rim. Hilum rim color of testa. Lens not discernible. Endosperm absent. Cotyledons smooth; 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; brown; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; with a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Mexico.

Notes: This genus was included in *Millettia* by Geesink (1984). Because Geesink did not make any combinations for the species of this genus in *Millettia* (and there has been no recent treatment of the group), we have recognized the genus. Only one whole, mature seed was seen.

Hesperothamnus: *H. littoralis* (T.S. Brandege) T.S. Brandege (B–E), *H.* spp. (A). A, Fruits (× 1.7); B, seed (× 2.2); C–D, testa (× 50, × 1000); E, embryos (× 2.6).



Genus: *Kunstleria* D. Prain

Tribe: Millettieae.

Species Studied—Species in Genus: 3 spp.—10 spp.

Fruit a legume; unilocular; $6-15 \times (1.5-2-5 \times 0.1(-0.3)$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical (slightly); elliptic; when asymmetrical with 1 straight and 1 curved suture; narrowing slightly once or twice on one side; not inflated; flattened; with or without beak; straight or declined; with solid beak the same color and texture as fruit; emarginate or rounded at apex; apex aligned or oblique with longitudinal axis of fruit; cordate, unequally cordate, rounded, or unequally rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally invisible. Fruit margin constricted or not constricted; slightly constricted only on 1 margin; without sulcus; embellished; with thickened sutural areas. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Epicarp dull; monochrome; brown; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; sericeous to tomentose; with pubescence brown to 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 absent. Endocarp dull; opaque; monochrome or mottled; brown; with mottling (dark); with brown overlay; scurfy; with adhering pieces of testa; 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; ca. 0.7 mm long; of 1 length only; flattened; straight. Aril absent.

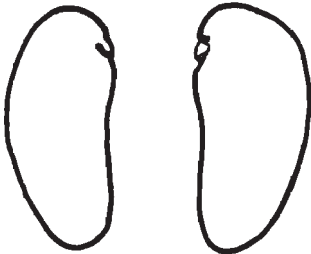
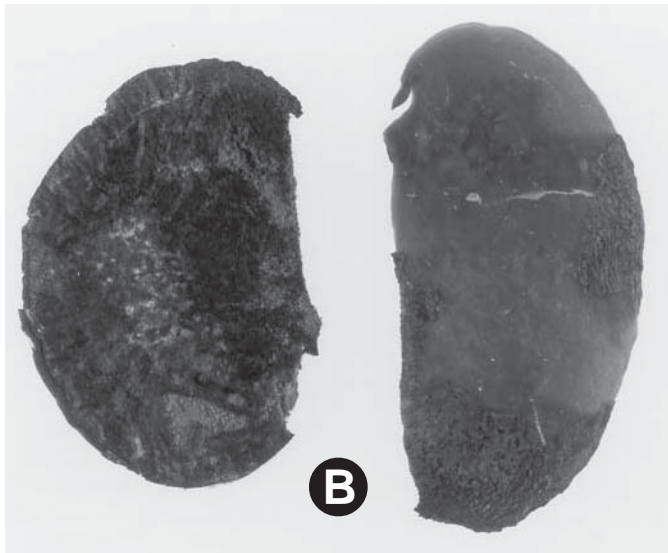
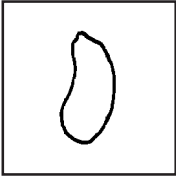
Seed 18–33 \times 10–16 \times 0.3–1 mm; not overgrown; not angular; asymmetrical; reniform (with beak-like flap near end furthest from hilum); flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle absent. Testa with or without pieces of adhering epicarp; partially adhering to endocarp; fused to endocarp, at most a transparent brown tissue; dull; not modified by a bloom; colored; monochrome; brown; glabrous; not smooth; with elevated features; rugose; chartaceous.

Fracture lines absent. Rim absent. Wings absent. Raphe from hilum to near base of seed and terminating; not bifurcating; color of testa; raised. Hilum visible; without faboid split; larger than punctiform; 1–3 mm long; with curved outline; fusiform; apical according to radicle tip but marginal according to seed length; raised or flush; not within corona, halo, or rim. Lens not discernible. Endosperm absent. Cotyledons smooth; both outer faces flat; 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; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis parallel; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

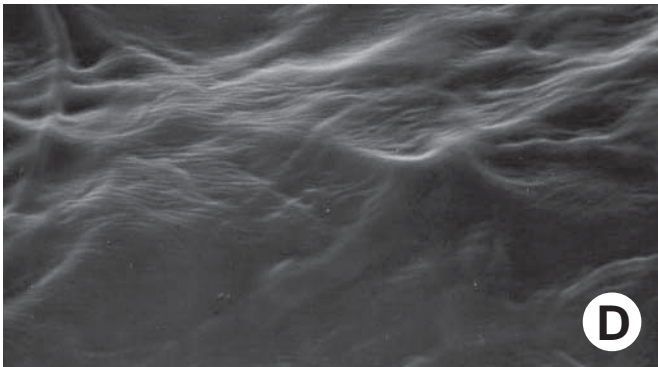
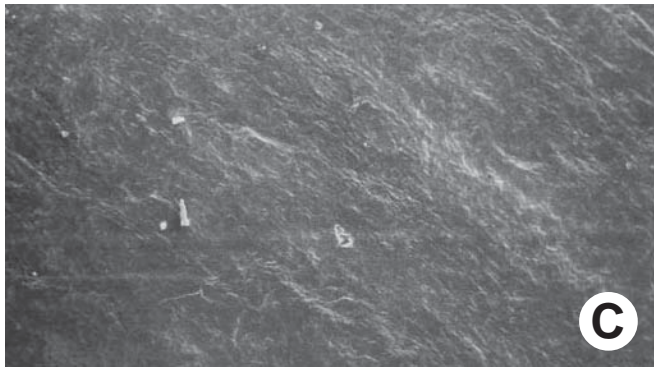
Distribution: Western Malesia, Philippines (neither in Java nor in Australia), and India (Kerala).

Notes: Mohanan and Nair (1981) reported it from India for the first time. Geesink (1984) transferred the two Australian and New Guinean species to *Austrosteenisia*. Ridder-Numan (1995) considered *Kunstleria* to be closely related to *Butea* (10.04), *Meizotropis* (10.06), and *Spatholobus* (10.05, Phaseolae subtribe Erythrineae). Further study by Ridder-Numan and Ham (1997) supported the close relationships of these four genera, but was unable to resolve the placement of *Spatholobus*. Our fruit and seed data do not support this. Ridder-Numan and Kornet (1994) revised *Kunstleria*.

Kunstleria: *K.* spp. (A–E). A, Fruits ($\times 0.7$); B, seeds ($\times 2.8$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2$).



E



Genus: *Leptoderris* S.T. Dunn

Tribe: Millettieae.

Species Studied—Species in Genus: 6 spp.—20–30 spp.

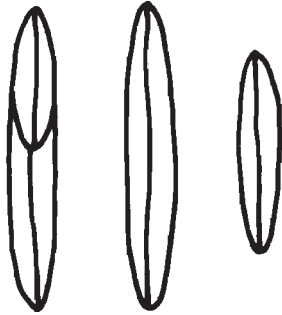
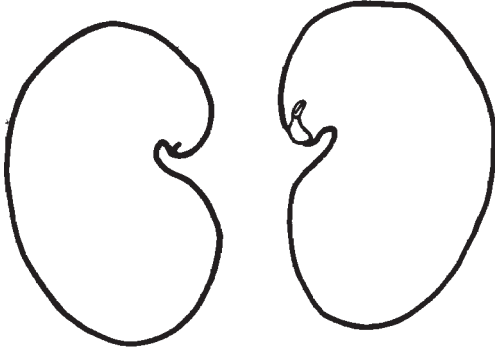
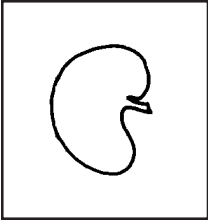
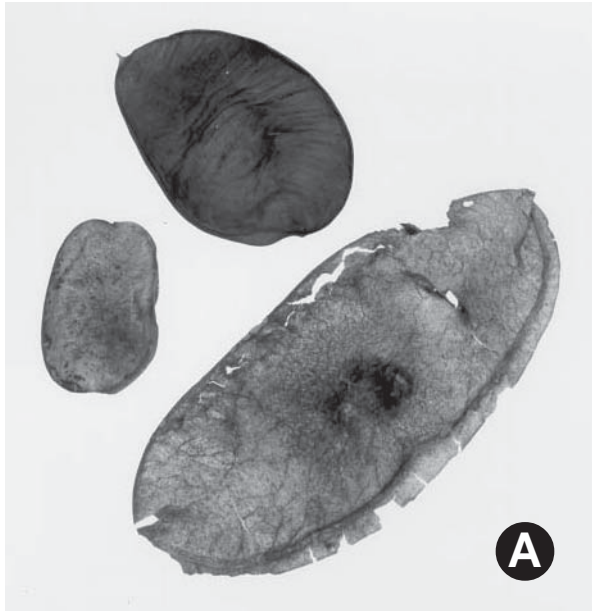
Fruit a legume; unilocular; $2.6\text{--}10 \times 1.2\text{--}3.6 \times 0.3\text{--}0.4$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; circular (or obliquely so), elliptic, or falcate; when asymmetrical with both sutures parallelly curved; not inflated; flattened; with or without beak; straight; with solid beak the same color and texture as fruit; emarginate or rounded at apex; apex aligned or oblique with longitudinal axis of fruit; rounded or short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with thickened sutural areas or wing. Fruit wing present or absent; 1; up to 4 mm wide; sutural; on 1 suture. Fruit nonstipitate. Fruit indehiscent. Epicarp dull; multicolored; mottled; tan; with brown overlay; with surface texture uniform; glabrate or pubescent and indurate; with hairs appressed; with 1 type of pubescence; sericeous to strigose; with pubescence golden; with pubescence uniformly distributed; with simple hairs; stiff or pliable; with hair bases swollen or plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; sometimes wrinkled; not exfoliating; without cracks. Mesocarp present or absent; thin or trace; surface uniformly veined or not veined; 1-layered; without balsamic vesicles; without fibers; firm-walled open empty cells or mealy; chartaceous. Endocarp dull; translucent; monochrome or mottled; tan; with mottling (dark); with brown overlay; scurfy, veined, or scurfy and veined; without adhering pieces of testa; nonseptate; chartaceous; exfoliating in part or not exfoliating; remaining fused to mesocarp and epicarp or just to epicarp; entire. Seeds 1(–3); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–7.5 mm long; of 1 length only; flattened; straight. Aril absent.

Seed $13\text{--}23 \times 11\text{--}20 \times 1.8\text{--}3$ mm; not overgrown; not angular; symmetrical; reniform; flattened; with surface smooth or wrinkled; without visible radicle and cotyledon lobes; with deep hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa with or

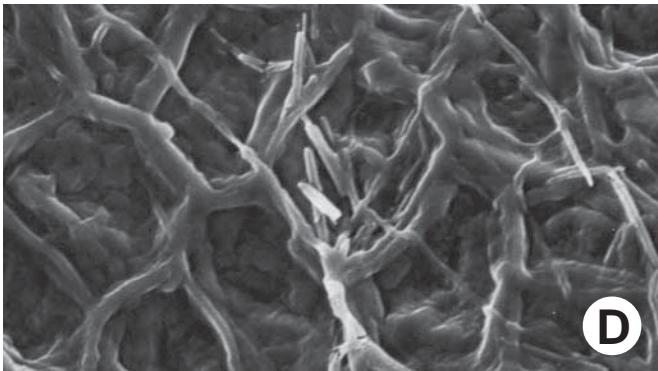
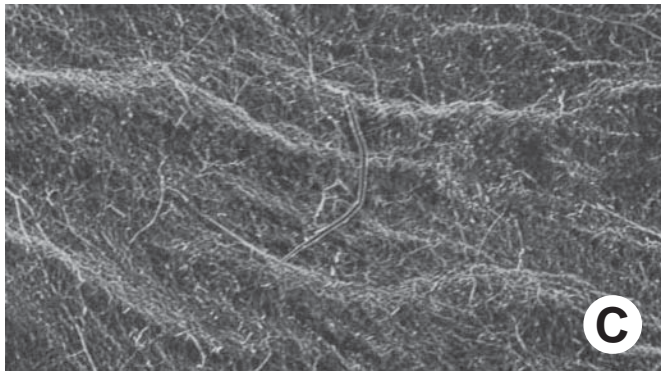
without pieces of adhering epicarp; partially or not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; brown; with brown overlay; glabrous; not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum to near base of seed and terminating; not bifurcating; darker than testa; raised. Hilum visible or fully concealed; concealed by funiculus; without faboid split; larger than punctiform; 0.8–1.5 mm long; with curved outline; fusiform; apical according to radicle tip but marginal according to seed length; raised; not within corona, halo, or rim. Lens not discernible. Endosperm absent. Cotyledons smooth or 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; partially 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; tan; inner face flat or wavy; glabrous around base of radicle. Embryonic axis oblique, parallel, or right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight or curved; deflexed and parallel to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Tropical Africa.

Leptoderris: *L. aurantiaca* S.T. Dunn (*E*), *L. nobilis* S.T. Dunn (*C–D*), *L. spp.* (*A–B*). *A*, Fruits ($\times 0.9$); *B*, seeds ($\times 2.2$); *C–D*, testa ($\times 50$, $\times 1000$); *E*, embryos ($\times 3$).



E



Genus: *Lonchocarpus* K.S. Kunth

Tribe: Millettieae.

Species Studied—Species in Genus: Ca. 48 spp.—ca. 150 spp.

Fruit a legume; unilocular; $2-16 \times 0.9-4.5 \times 0.1-1$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; elliptic, falcate, fusiform, linear (nearly), moniliform, obovate, or obliquely obovate; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed or flattened; without or with beak (very short); straight; with solid beak the same color and texture as fruit; rounded, emarginate, truncate, tapered, or long tapered at apex; apex aligned or oblique with longitudinal axis of fruit; long tapered, tapered, or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; membranous to chartaceous to coriaceous to ligneous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins or only on 1 margin; with or without sulcus; plain or embellished; with ridges or wings. Fruit wings absent or present; 2; 1–2 mm wide; sutural; on 1 suture. Fruit nonstipitate to substipitate to stipitate; with the stipe 0–7 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; tan to brown or yellow; with brown overlay; with surface texture uniform; glabrous, glabrate, pubescent and indurate, or pubescent but soon deciduous; with hairs erect or appressed; with 1 type of pubescence; puberulent or velutinous; with pubescence golden to brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; veined or not veined; reticulately or irregularly veined; not tuberculate or tuberculate; with solid tubercles on each valve; papillose or rugose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1- or 2-layered; without or with balsamic vesicles; without fibers; without reniform canals; solid or with solid layer over solid layer or spongy layer over solid layer; coriaceous or chartaceous. Endocarp dull or glossy; opaque or translucent; monochrome; brown to

tan or yellow; smooth; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–6; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured or less than 0.5 mm long; 0.5–6 mm long; of 1 length only; flattened or thick; curved, straight, or triangular. Aril dry; rim-aril; without tongue (or flap-like) on lips of 2-lipped rim-aril; white to tan.

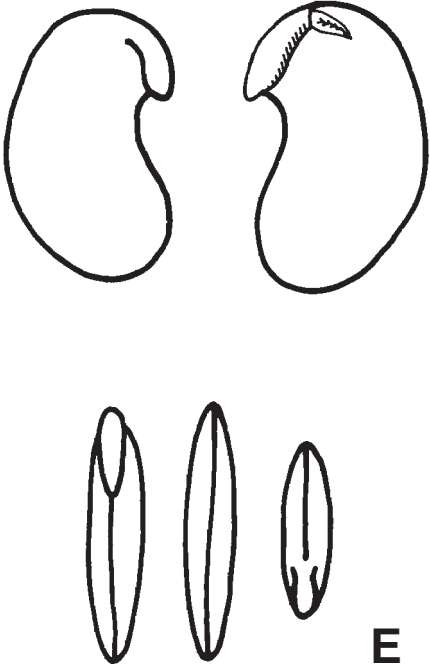
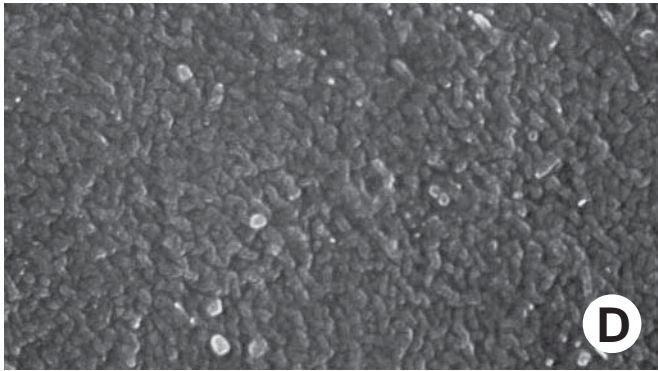
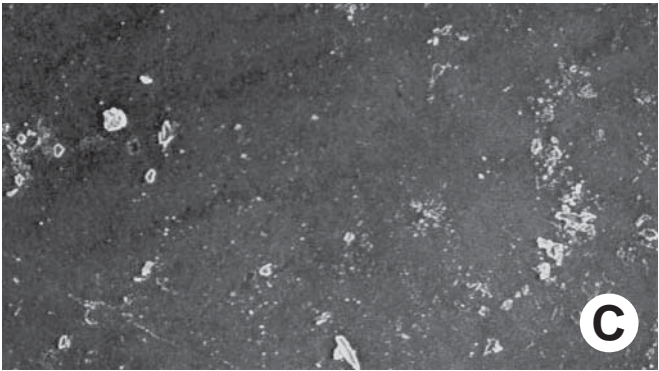
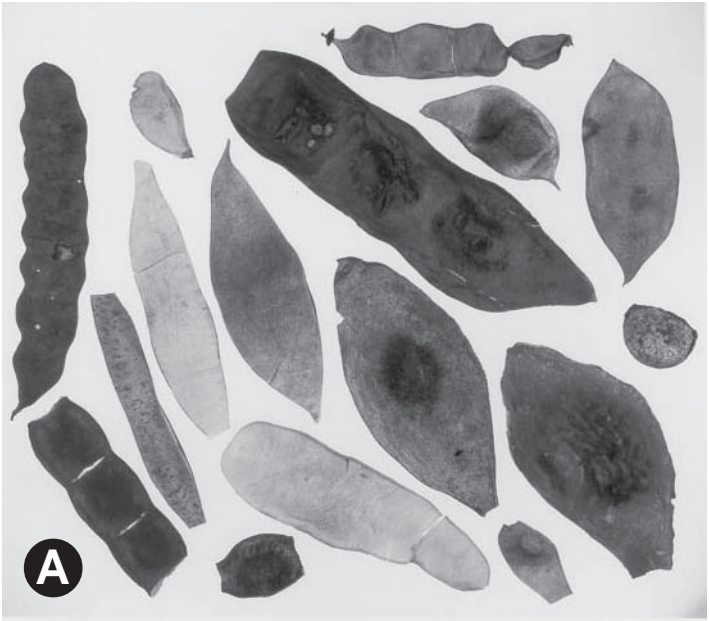
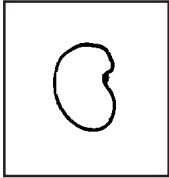
Seed $8-27 \times 4-16 \times 1-4$ mm; not overgrown; not angular; symmetrical; reniform to C-shaped or ovate; compressed or flattened; with surface smooth; without or with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with deep or shallow hilar sinus or without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull to glossy; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; pale to dark brown, purple, or tan; with brown overlay; glabrous; smooth or not smooth; with elevated features; rugose or wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum to near base of seed and terminating; not bifurcating; color of or darker than testa; brown; flush or raised. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum or lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 1–4 mm long; with curved outline; elliptic or oval; apical according to radicle tip but marginal according to seed length; recessed; not within corona, halo, or rim or within rim or halo. Hilum halo color lighter or darker than testa. Hilum rim color lighter or darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; same color as testa; brown; within rim or not within corona, halo, or rim. Lens rim color darker than testa. Endosperm thin; not pluglike and not resembling tip of radicle; covering entire embryo or at least 1/2 of 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 lobes; with the interface division terminating at base of radicle; without margins recessed; brown, green, or tan; inner face flat; glabrous around base of radicle. Embryo-

onic axis oblique or right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight or curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary to moderately developed; glabrous.

Distribution: Central America, tropical South America, and *L. sericeus* (J.L.M. Poiret) K.S. Kunth ex A.-P. de Candolle in the West Indies.

Notes: Pittier (1917) monographed the Central American species of *Lonchocarpus*. Geesink (1984) included *Willardia* J.N. Rose and *Terua* P.C. Standley & F.J. Hermann. Wiersema et al. (1990) recognized *Willardia*, but Sousa (1992) reduced *Willardia* to a section of *Lonchocarpus*, making the combinations. *Lonchocarpus* spp. are frequently used as a fish poison and as a commercial source of rotenone.

Lonchocarpus: *L. capassa* R.A. Rolfe (C–E), *L. spp.* (A–B).
A, Fruits ($\times 0.5$); B, seeds ($\times 1.5$); C–D, testa ($\times 50$,
 $\times 1000$); E, embryos ($\times 2.5$).



Genus: *Millettia* R. Wight & G.A.W. Arnott

Tribe: Millettieae.

Species Studied—Species in Genus: Ca. 26 spp.—ca. 90 spp.

Fruit a legume; unilocular; $4-23 \times 0.6-4 \times$ up to 3.5 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; linear, oblanceolate, obovate, or irregularly fusiform; when asymmetrical with both sutures parallelly curved; inflated or not inflated; compressed or terete; without beak; blunt to short tapered to tapered to long tapered at apex; apex aligned with longitudinal axis of fruit; rounded, tapered, or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous, leathery, or ligneous; seed chambers externally visible or invisible; with the raised seed chambers torulose or not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins; with or without sulcus; plain. Fruit wings absent or present (3 spp., Adema, personal communication, 1998); 2 or 4; valvular (along suture or parallel to it, but not on it; perpendicular to the plane through the sutures); on both valves. Fruit stipitate, substipitate, or nonstipitate; with the stipe 5–20 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; tan to brown (dark); with brown overlay; with surface texture uniform; glabrous, glabrate, pubescent and indurate, or pubescent but soon deciduous; with hairs erect; with 1 type of pubescence; tomentose or velutinous; with pubescence tan to brown; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; densely lenticular, rugose, or verrucose-rugose; not exfoliating; without cracks. Mesocarp thick or thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; without reniform canals; solid or with solid layer over solid layer; ligneous or coriaceous. Endocarp dull; opaque to translucent; monochrome or mottled; brown, orange, or tan; with mottling; with brown overlay; fibrous, scurfy, or smooth; without adhering pieces of testa; septate, subseptate, or nonseptate; with septa thin (tissue paper-like), flexible or thicker than paper, firm; with septa eglandular; chartaceous or pulpy; exfoliating

in part or not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length oblique or transverse to fruit length; touching or neither overlapping nor touching; in 1 series. Funiculus measured; 1–10 mm long; of 1 length only; flattened or thick; straight or triangular. Aril dry; hippocrepiform rim-aril and tongue-aril, 2-lipped rim-aril, or partial rim-aril; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril or 2 tongues or flaps, 1 on each lip of 2-lipped rim-aril; cream to tan.

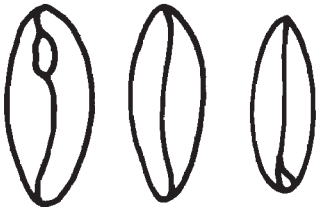
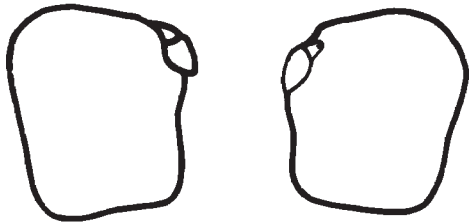
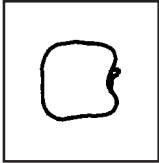
Seed $8-50 \times 6-35 \times 1-25$ mm; overgrown, 1 seed filling entire fruit cavity or not overgrown; not angular; symmetrical or asymmetrical; oblong to ovate, reniform, irregular, or rhombic (irregularly); terete, compressed, or flattened; with surface smooth or wrinkled; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus or without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull to glossy; not modified by a bloom; colored; monochrome; brown to black; glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent or present; transverse. Rim absent. Wings absent. Raphe not visible or visible; from hilum through lens to base of seed and terminating; not bifurcating; color of testa; brown; slightly raised or recessed (slightly). Hilum visible or fully concealed; concealed by radicle lobe; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–4 mm long; with curved outline; circular or elliptic; subapical to radicle tip or apical according to radicle tip but marginal according to seed length; raised, flush, or recessed; within rim or not within corona, halo, or rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 1–2 mm long; with margins straight; linear to triangular or oblong; not in groove of raphe; confluent with hilum; flush; same or similar color as testa; darker than testa; brown to black; not within corona, halo, or rim. Endosperm present or absent; thin; not pluglike and not resembling tip of radicle; covering entire embryo or covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons smooth or 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; partially

concealing radicle; split over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; brown, orange, white, or yellow; inner face flat or concave; glabrous around base of radicle. Embryonic axis oblique or right angled; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length or 1/2 to nearly length of cotyledons. Plumule rudimentary to moderately developed; glabrous.

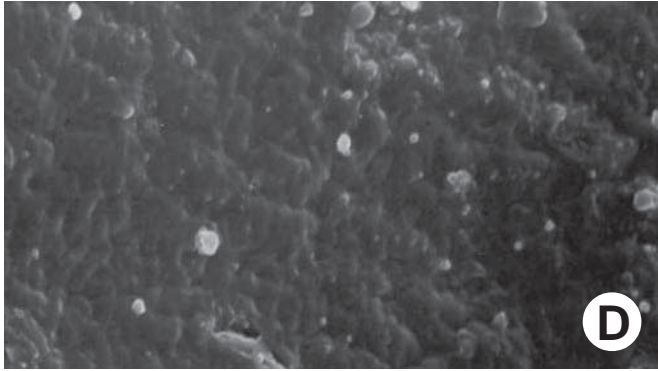
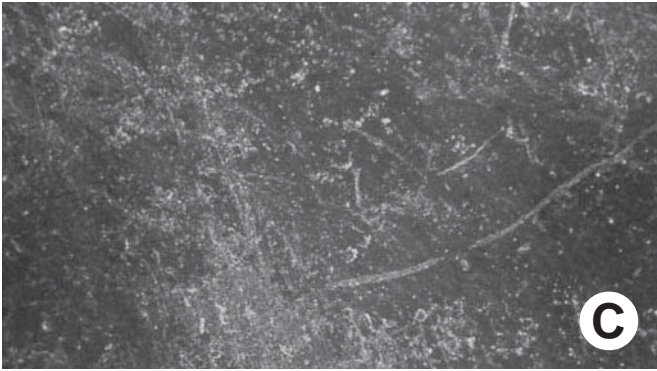
Distribution: Tropical Africa and Asia to Malaysia.

Notes: Geesink (1984) included both *Hesperothamnus* and *Pongamia* in *Millettia*. We recognized both genera because neither he nor anyone else made the species transfers for either genus. Wei (1985) revised the Chinese species of *Millettia*.

Milletia: *M. cinerea* G. Benth (E), *M. grandis* (E.H.F. Meyer) H.C. Skeels (C-D), *M. spp.* (A-B). A, Fruits ($\times 0.5$); B, seeds ($\times 1$); C-D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2$).



E



Genus: *Muelleria* C. Linnaeus f.

Tribe: Millettieae.

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

Fruit a loment (or a loment segment); 1–10 × 0.6–3 × 0.6–2.5 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; irregularly moniliform; when asymmetrical with both sutures parallelly curved; not inflated; terete to compressed; with or without beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; leathery or ligneous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted along both margins or constricted on 1 margin and slightly constricted on the other margin; without sulcus; plain. Fruit wings absent. Fruit stipitate, substipitate, or nonstipitate; with the stipe 5–10 mm long. Fruit indehiscent. Loment an intact article; indehiscent. Loment segments (articles) conspicuous; 10–30 mm long; widest across seed area; with all essentially similar in shape; circular or D-shaped. Epicarp dull; multicolored; mottled; green to brown; with brown overlay; with surface texture uniform; glabrous; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; rugose or wrinkled; not exfoliating; without cracks. Mesocarp thick or thin; 1-layered; without balsamic vesicles; without fibers; without reniform canals; solid; ligneous or coriaceous. Endocarp dull; translucent; mottled; tan; with brown overlay; scurfy or smooth; without adhering pieces of testa; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–6; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 1 mm long; of 1 length only; flattened; straight. Aril absent.

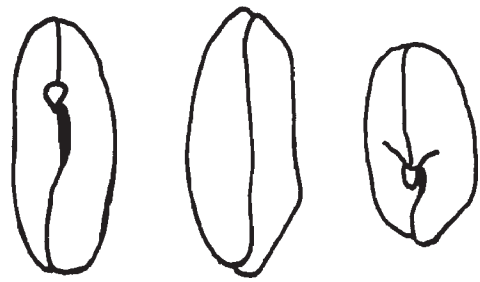
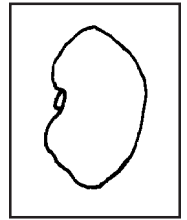
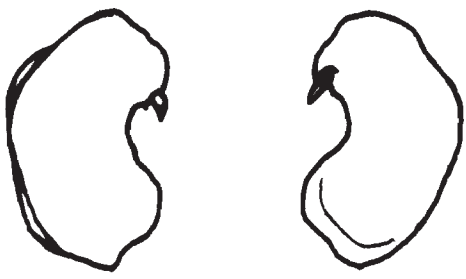
Seed 15–20 × 6–12 × 5–10 mm; not overgrown; not angular; symmetrical or asymmetrical; ovate or reniform; terete; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with deep hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle absent. Testa without pieces of adhering epicarp; not adhering to endocarp; free

from endocarp; dull; not modified by a bloom; colored; monochrome or streaked; with frequent streaks; brown; with brown overlay; glabrous; smooth or not smooth; with elevated features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens to base of seed and terminating; not bifurcating; darker than testa; brown; flush. Hilum partially or fully concealed; concealed by funicular remnant; larger than punctiform; 2–5 mm long; with curved outline; elliptic; marginal according to radicle tip; raised; within rim or not within corona, halo, or rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 2–4 mm long; with margins straight; linear; not in groove of raphe; confluent with or adjacent to hilum; ca. 1 mm from hilum; flush; similar color as testa; darker than testa; brown; within halo or not within corona, halo, or rim. Lens halo color darker than testa. Endosperm trace; not pluglike and not resembling tip of radicle; restricted to region of embryo; adnate to testa. Cotyledons smooth or 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; tan to yellow; inner face concave; glabrous around base of radicle. Embryonic axis oblique or right angled; oblique or perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; triangular; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

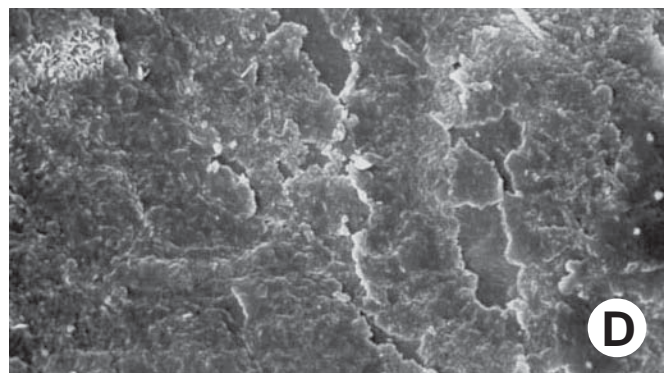
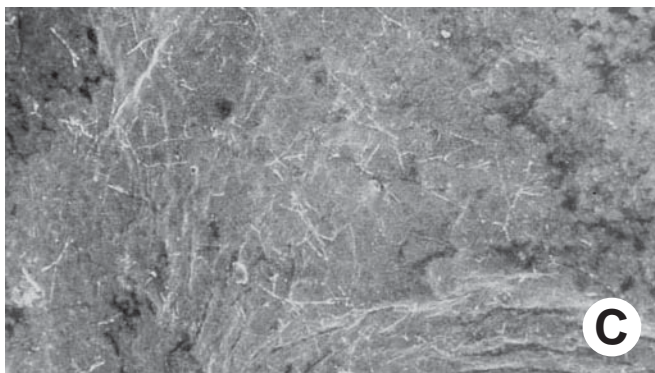
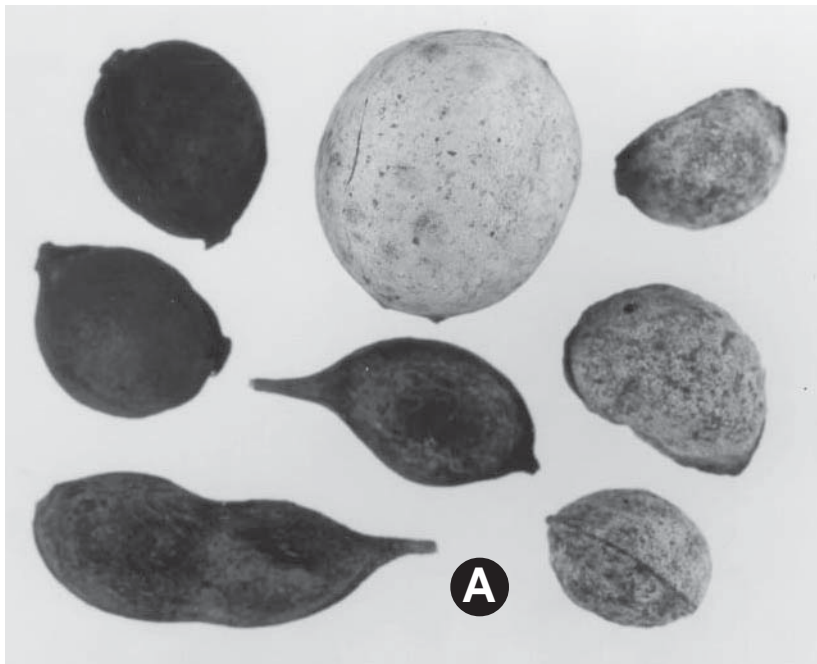
Distribution: Central and South America.

Notes: Fortunato and Palese (1997) transferred *Muelleria fluvialis* (C.A.M. Lindman) A. Burkart to *Lonchocarpus* as *L. fluvialis* (C.A.M. Lindman) R.H. Fortunato & R. Palese.

Muelleria: *M. moniliformis* C. Linnaeus f. (B–E), *M.* spp. (A). A, Loments and loment segments (× 1.4); B, seed (× 3.3); C–D, testa (× 50, × 1000); E, embryos (× 1.8).



E



Genus: *Mundulea* (A.-P. de Candolle) G. Benth

Tribe: Millettieae.

Species Studied—Species in Genus: 2 spp.—ca. 16 spp.

Fruit a legume; unilocular; 5–11 × 0.7–1 × 0.2–0.4 cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear or moniliform; not inflated; compressed or flattened; with beak; straight; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous to coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; embellished; with ridges. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown to tan; with surface texture uniform; pubescent and indurate; with hairs erect; with 1 type of pubescence; tomentose to velutinous; with pubescence brown to tan; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface uniformly veined; 1-layered; without balsamic vesicles; without fibers; without reniform canals; solid; chartaceous. Endocarp dull; translucent; monochrome; yellow; scurfy and smooth; without adhering pieces of testa; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 4–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5–1 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril; cream.

Seed 4–7 × 3–5 × 1.2–2.3 mm; not overgrown; not angular; symmetrical; ovate to reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces; without medial ridge on each face.

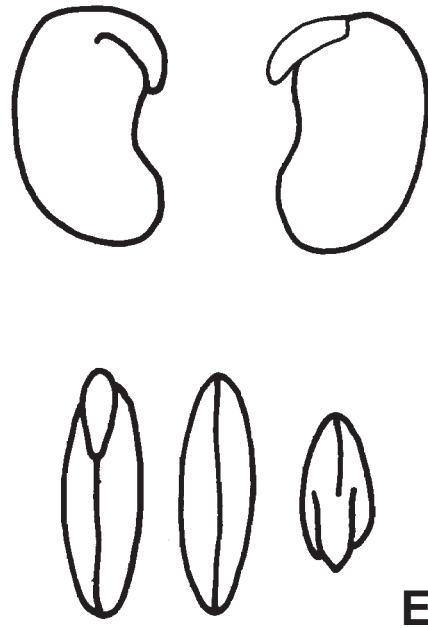
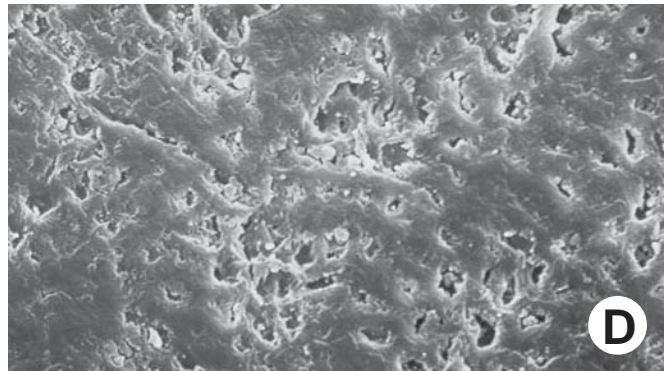
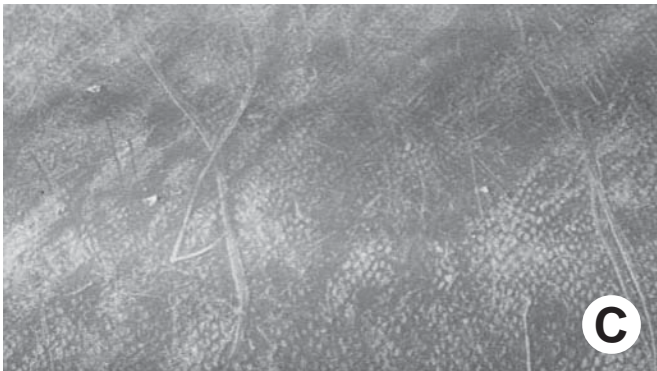
Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; green to tan; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; ca. 1 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color darker than testa. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; brown; 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; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white to yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique to right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Madagascar with *M. sericea* also in many African countries, India, and Sri Lanka.

Notes: Geesink (1984) noted “*Mundulea* is strikingly similar to *Tephrosia*,” and our fruit and seed observations support him.

Mundulea: *M. sericea* (C.L. von Willdenow) A.J.B. Chevalier (C–E), *M. spp.* (A–B). A, Fruits (× 1); B, seeds (× 5.8); C–D, testa (× 50, × 1000); E, embryos (× 5).

8



Genus: *Ostryocarpus* J.D. Hooker

Tribe: Millettieae.

Species Studied—Species in Genus: 1 sp.—6 spp.

Fruit a legume; unilocular; $6-7 \times 4-5 \times 0.3-0.5$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; elliptic to ovate or obliquely ovate; when asymmetrical with both sutures unequally curved; not inflated; flattened; with or without beak; straight or hooked; with papery fragile beak up to 1 cm long or solid beak the same color and texture as fruit; rounded or tapered at apex; apex aligned or oblique 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 invisible. Fruit margin not constricted; without sulcus; embellished. Fruit wings 2; 2–3 mm wide; sutural; on both valves; on 1 suture. Fruit nonstipitate. Fruit indehiscent. Epicarp dull; monochrome or multicolored; mottled; brown; with brown (darker) overlay; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; sometimes blistered; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; opaque; monochrome; brown; smooth or transversely wrinkled; with or without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–6 (from literature); length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 4–5 mm long; of 1 length only; flattened; straight. Aril absent.

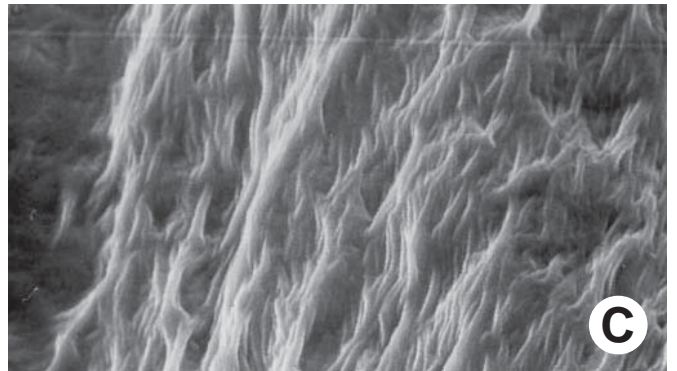
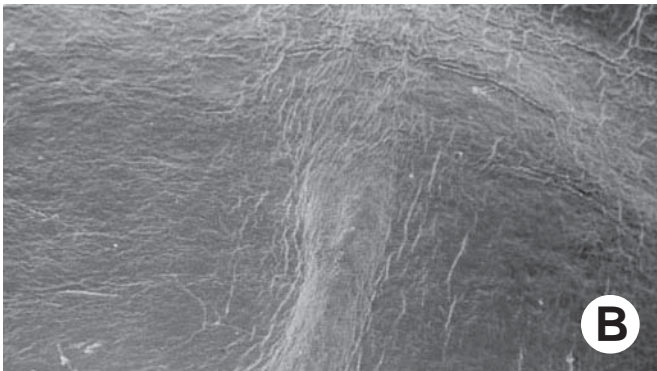
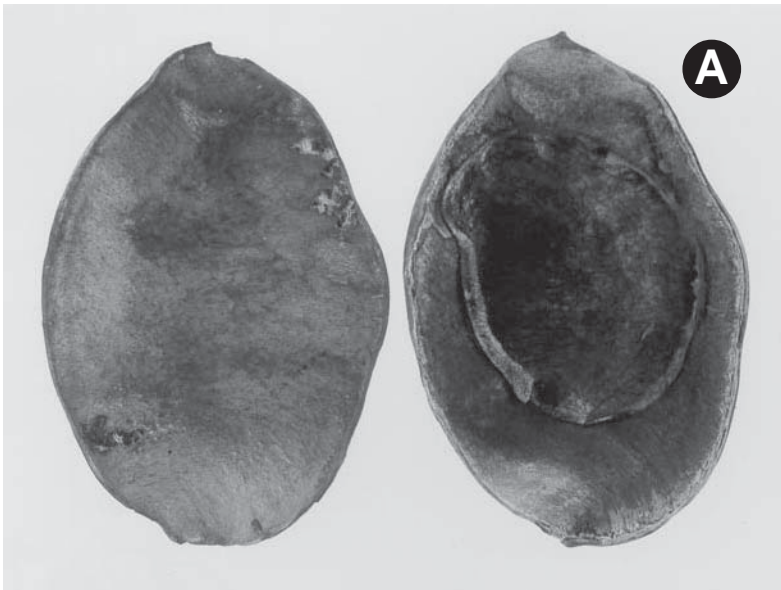
Seed ca. $36 \times 28 \times 3.5$ mm; not overgrown; not angular; asymmetrical; irregularly reniform; flattened; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces; without medial ridge on each face. Testa without pieces of adhering epicarp; completely adhering to endocarp; fused to endocarp, at most a transparent brown tissue; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by fusion to endocarp. Lens not discernible. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; with only 1 folded; 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; 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 differentiated from cotyledon; bulbous; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Tropical Africa to southeast Asia.

Notes: Little material was available for study, and no mature seeds were seen. The only seed was destroyed during rehydration and examination and could not be illustrated.

Ostryocarpus: *O. riparius* J.D. Hooker (A–C). A, Fruits ($\times 1.2$); B–C, testa ($\times 50$, $\times 1000$).



Genus: *Piscidia* C. Linnaeus

Tribe: Millettieae.

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

Fruit a legume; unilocular; 3–20 × 0.8–5 × 0.3–0.8 cm; with deciduous or persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear or moniliform; not inflated; compressed; without or with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered or short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished. Fruit wings 4; 1–25 mm wide; valvular; on both valves. Fruit stipitate or substipitate; with the stipe 5–15 mm long. Fruit indehiscent. Epicarp dull; monochrome or multicolored; mottled or streaked; brown or green; with brown overlay; with surface texture uniform; glabrous or pubescent and indurate; with hairs erect and appressed, erect, or appressed; with 1 type of pubescence; sericeous, puberulent, or tomentose to velutinous; with pubescence white to brown; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; veined or not veined; transversely veined relative to fruit length (on wings) or reticulately veined (on legume); not tuberculate; irregularly papillose; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; without reniform canals; spongy; coriaceous. Endocarp dull; opaque or translucent; monochrome; brown or tan; smooth; without adhering pieces of testa; septate or nonseptate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–10; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured or less than 0.5 mm long; up to 1 mm long; of 1 length only; triangular; straight. Aril fleshy or dry; when fleshy annular; entire; covering less than 1/2 of seed; when dry rim-aril; cream to white.

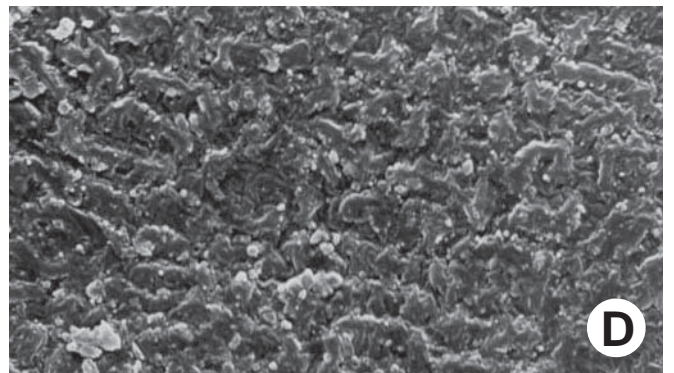
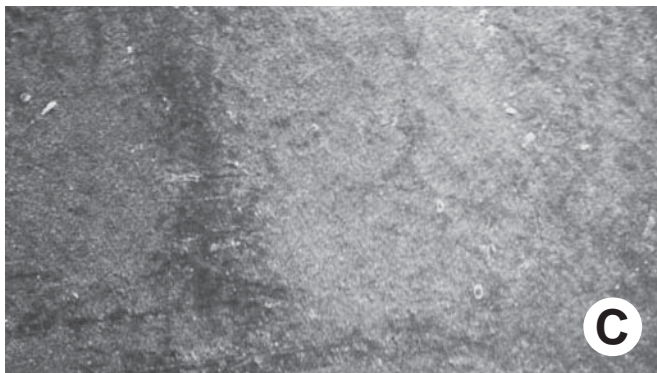
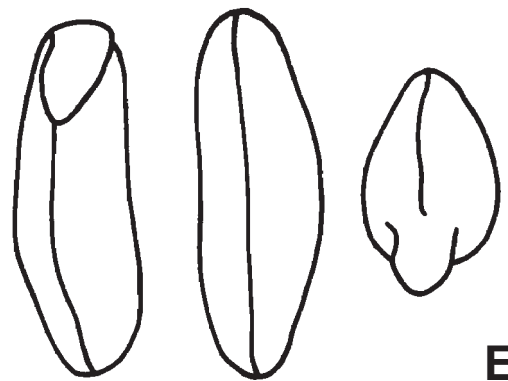
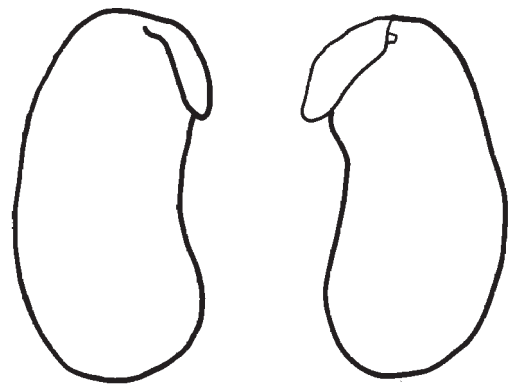
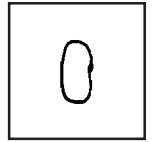
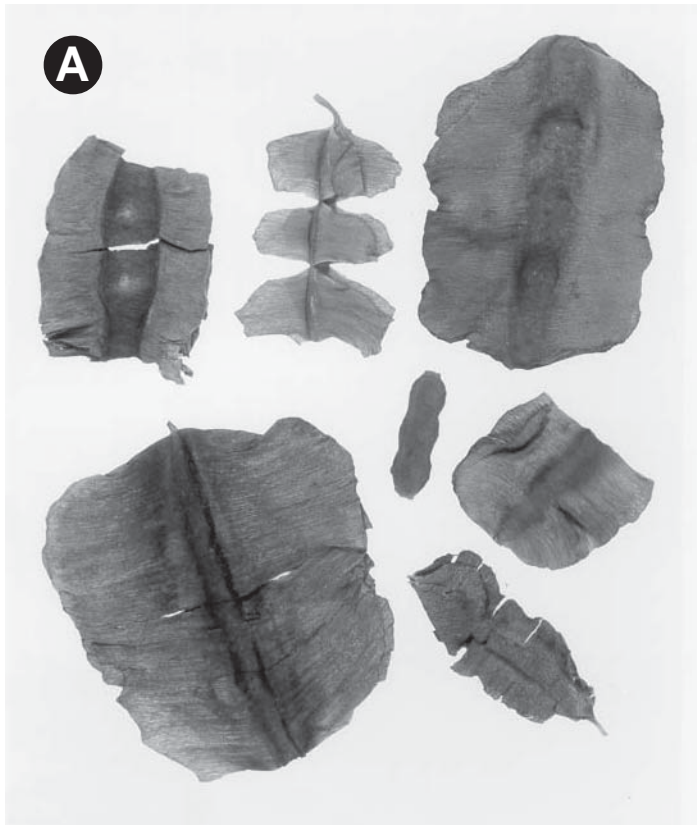
Seed 4–10 × 2.5–5 × 1.5–3.2 mm; not overgrown; not angular; symmetrical; elliptic or reniform; compressed;

with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus or without hilar sinus; with or without umbo on seed faces; with umbo on both faces of seed; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; chartaceous. Fracture lines absent or present; transverse. Rim absent. Wings absent. Raphe from hilum through lens and terminating before base of seed; not bifurcating; darker than testa; brown; flush. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1–1.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 0.8 mm long; with margins curved; circular; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; brown; 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; not concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan; inner face flat or wrinkled; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous to linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Florida, West Indies, and Central America.

Notes: Rudd (1969) summarized the genus.

Piscidia: *P. mollis* J.N. Rose (C–E), *P. spp.* (A–B). A, Fruits (× 0.8); B, seeds (× 4.8); C–D, testa (× 50, × 1000); E, embryos (× 5).



Genus: *Platycyamus* G. Bentham

Tribe: Millettieae.

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

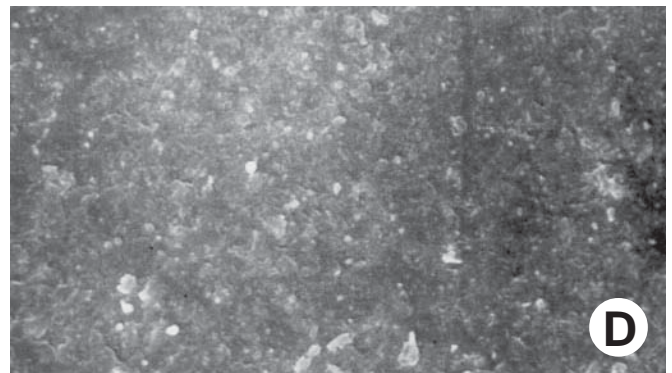
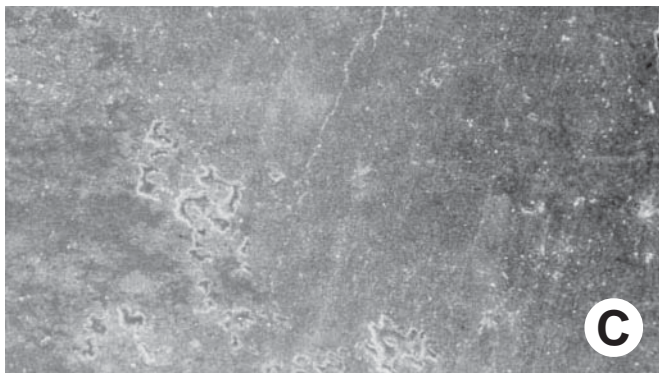
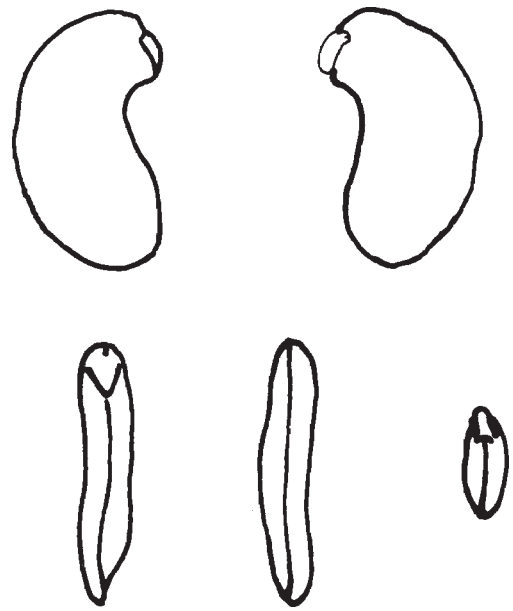
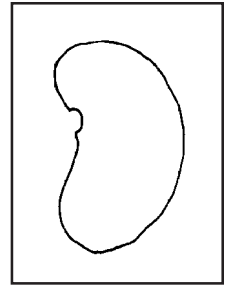
Fruit a legume; unilocular; 15–20 × 3.5–4 × 0.4–0.5 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; falcate to fusiform; when asymmetrical with both sutures parallelly curved; not inflated; flattened; without beak; tapered at apex; apex oblique with longitudinal axis of fruit; rounded to tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished; with ridges and wing. Fruit wing 1; 5–8 mm wide; sutural; on 1 suture. Fruit nonstipitate. Fruit indehiscent. Epicarp dull; monochrome; orange-brown or orangish brown; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with vitreous layer over solid layer; chartaceous. Endocarp dull; translucent; monochrome; yellow; smooth; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–3; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 4 mm long; of 1 length only; flattened and thick; straight. Aril dry; hippocrepiform rim-aril; entire; covering less than 1/2 of seed; brown.

Seed 22–23 × 13–14 × 2–4 mm; not overgrown; not angular; asymmetrical; reniform; flattened; with surface smooth; without visible radicle and cotyledon lobes; with deep hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle absent. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; not smooth; with recessed features; pitted with small separate pits; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril; with faboid split;

with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; ca. 3 mm long; with curved outline; elliptic to circular; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 3 mm long; with margins straight; linear; not in groove of raphe; adjacent to hilum; ca. 1 mm from hilum; flush; same color as testa; brown; 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; partially concealing radicle; notched at 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 oblique; oblique to perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip slightly curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Brazil (1 sp.) and Peru (1 sp.).

Platycyamus: *P. regnellii* G. Bentham (A–E). A, Fruits (× 0.6); B, seed (× 2.5); C–D, testa (× 50, × 1000); E, embryos (× 1.2).



Genus: *Platysepalum* F.M.J. Welwitsch ex J.G. Baker

Tribe: Millettieae.

Species Studied—Species in Genus: 3 spp.—ca. 12 spp.

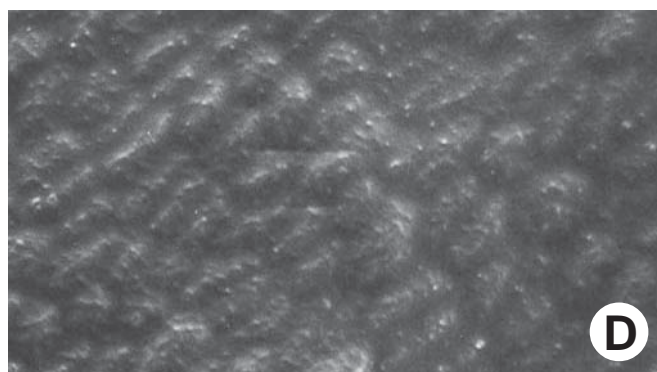
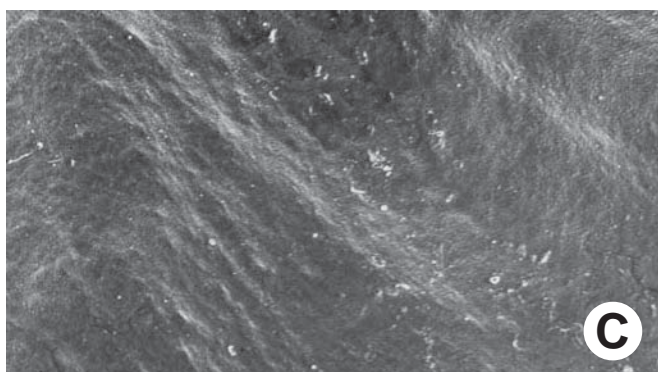
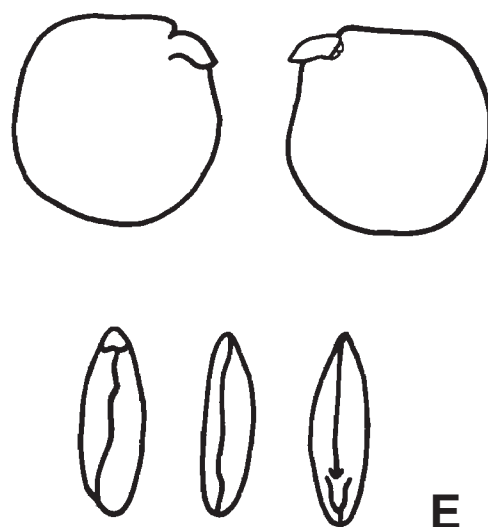
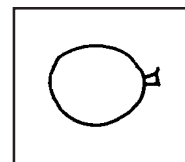
Fruit a legume; unilocular; $10-17 \times 2-4 \times 0.5-1$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; falcate or fusiform; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without or with beak; straight; with solid beak the same color and texture as fruit; rounded or tapered at apex; apex aligned or oblique with longitudinal axis of fruit; long tapered to tapered to rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous to ligneous; seed chambers externally invisible or visible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins; without sulcus; embellished or plain; with ridges. Fruit nonstipitate. Fruit with all layers dehiscing (tardily); splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; with surface texture uniform; pubescent and indurate; with hairs erect; with 1 or 2 types of pubescence; densely velutinous; with pubescence brown to golden; with long and short golden to brown hairs intermixed; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; transversely veined relative to fruit length; not tuberculate; not exfoliating; without cracks. Mesocarp thick; surface not veined; 2- or 3-layered; without balsamic vesicles; without fibers; with solid layer over solid layer or spongy layer over solid layer or with solid layer over 2 distinct solid layers; ligneous. Endocarp dull; opaque; monochrome or mottled; brown or white; with mottling (dark); with brown overlay; floury-filamentous; without adhering pieces of testa; subseptate or nonseptate; with septa eglandular; chartaceous; exfoliating in part or not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 3–5; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–4 mm long; of 1 length only; flattened or thick; curved or straight. Aril fleshy or dry; when fleshy annular; crenate; covering less than 1/2 of seed; when dry rim-aril and tongue-aril; tan.

Seed $11-27 \times 10-13 \times 3-5$ mm; not overgrown; not angular; symmetrical or asymmetrical; nearly circular or ovate (irregularly); compressed to flattened; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle absent. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; black to brown (dark); glabrous; not smooth; with elevated or recessed features; finely, transversely ridged; pitted with small separate pits; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially or fully concealed; concealed by aril or funicular remnant; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 1.5–5 mm long; with curved outline; elliptic to fusiform; apical at apex of radicle tip or apical according to radicle tip but marginal according to seed length; recessed; within rim or not within corona, halo, or rim. Hilum rim color of testa. Lens barely discernible; equal to or greater than 0.5 mm in length; 1–4 mm long; with margins straight; linear or oblong; not in groove of raphe; confluent with hilum; mounded or flush; same color as testa; black to brown; not within corona, halo, or rim. Endosperm absent. Cotyledons smooth or 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; entire over radicle; without lobes; with the interface division terminating at base of radicle; with 1 margin recessed; recessed on same side as radicle; tan; inner face flat; glabrous around base of radicle. Embryonic axis oblique to right angled; oblique to perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical Africa.

Notes: Gillett (1960a) provided a key to the species.

Platysepalum: *P. hirsutum* (S.T. Dunn) F.N. Hepper (C–E), *P. spp.* (A–B). A, Fruits ($\times 1.1$); B, seeds ($\times 2.6$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2$).



Genus: *Poecilanthe* G. Bentham

Tribe: Millettieae.

Species Studied—Species in Genus: 4 spp.—9 spp.

Fruit a legume; unilocular; $3.7\text{--}7 \times 1.5\text{--}3 \times 1$ cm; with deciduous corolla; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped or widest near apex; not inflated; compressed; without beak; rounded at apex; apex aligned or oblique 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 chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate to nonstipitate; with the stipe up to 4.5 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down (assumed); passive or active; with valves (mature valves tend to fracture at right angles to sutures (Lewis 1988)) breaking. Replum invisible. Fruit entire. Epicarp dull; monochrome; dark reddish brown; glabrous; eglandular; without or with (on some seed chambers) spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without or with cracks (if dehisced); cracking oblique to fruit length. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; ligneous. 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 1–4; length parallel with or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.1–0.5 mm long; of 1 length only; flattened; straight. Aril absent.

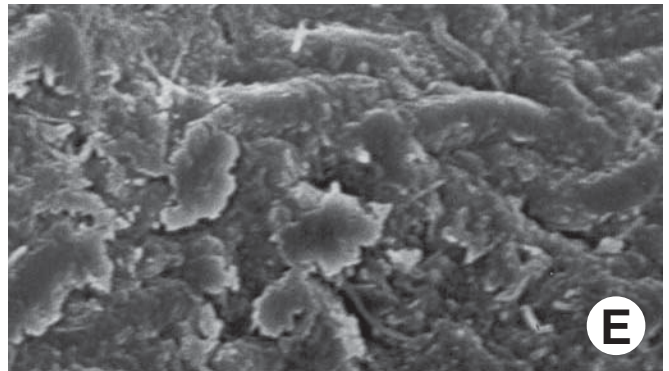
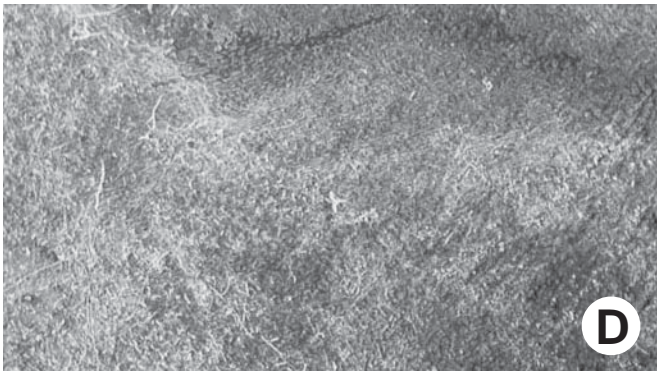
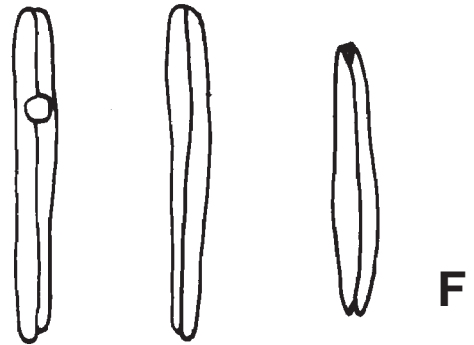
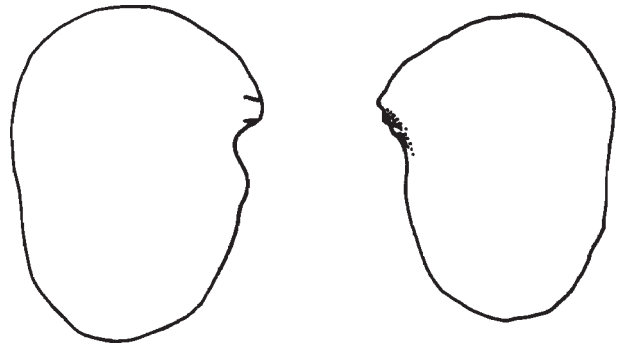
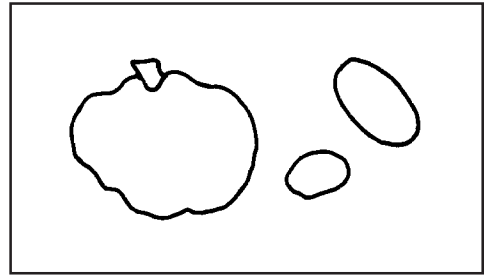
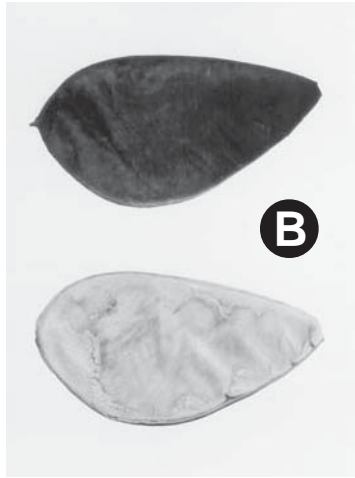
Seed 10–22 × 9–20 × 2.5 mm; not overgrown or overgrown, 1 seed filling entire fruit cavity (*P. amazonica*); not angular; asymmetrical or symmetrical; elliptic, ovate, or reniform (somewhat); compressed or flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; with umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; dark brown; glabrous; not smooth or smooth; with elevated features; wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by funicular remnant;

without faboid split; punctiform; between cotyledon and radicle lobe; flush; not within corona, halo, or rim. Lens not discernible. Endosperm absent. Cotyledons not smooth (slightly 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; 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 linear; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical South America.

Notes: Geesink (1981) had placed *Poecilanthe* in the Tephrosieae (now Millettieae), but later (1984) transferred the genus to the Robineae without relating *Poecilanthe* to other genera in the Robineae. Lavin (1987) and Lavin and Sousa (1995), however, convincingly demonstrated that *Poecilanthe* does not belong to Robineae and has close affinity to Dalbergieae. Our species count includes *P. itapuana* G.P. Lewis (1989). Based on published seed and fruit data about the genus and the lack of a monograph or a résumé of this genus, we have omitted from our study fruit and seed data of *P. falcata* (J. Velloso de Miranda) A. Ducke (including *P. grandiflora* G. Bentham). Even with this arbitrary decision, we are still faced with a genus having similar fruits but two distinct seed types: (1) Glossy with hard testa, straight embryonic axis, and seed length at right angles to fruit length as in *P. effusa* (J.E. Huber) W.A. Ducke, *P. itapuana*, and, by inference of Lewis, *P. subcordata* G. Bentham and (2) dull with thin testa, curved embryonic axis, and seed and fruit length parallel as in *P. amazonica*.

Poecilanthe: *P. amazonica* (W.A. Ducke) W.A. Ducke (*B*, *D–F*), *P. effusa* (J.E. Huber) W.A. Ducke (*A*); *P.* spp. (*C*). *A*, Valve (× 0.9); *B*, fruit and valve (× 0.8); *C*, seeds (× 1.7); *D–E*, testa (× 50, × 1000); *F*, embryos (× 2).



Genus: *Pongamia* E.P. Ventenat

Tribe: Millettieae.

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

Fruit a legume; unilocular; $3.9-7 \times 1.7-3.5 \times 0.3-1.2$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; obliquely obovate or elliptic (flattened); when asymmetrical with both sutures unequally curved; inflated or not inflated (when immature); compressed; without beak; blunt at apex; apex aligned to oblique with longitudinal axis of fruit; tapered at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; leathery or ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate or stipitate, 2–7 mm long. Fruit indehiscent or with all layers dehiscent (pods not spontaneously dehiscent, but only during seed imbibition; Adema, personal communication, 1998); splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown to green; with brown overlay; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thick; surface not veined; 3-layered; without balsamic vesicles; without fibers; without reniform canals; with solid layer over vitreous layer over solid layer; coriaceous. Endocarp dull; opaque; mottled; tan; with mottling; with brown overlay; scurfy and smooth; without adhering pieces of testa; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; ca. 1 mm long; triangular; straight. Aril present or absent; dry; partial rim-aril; cream.

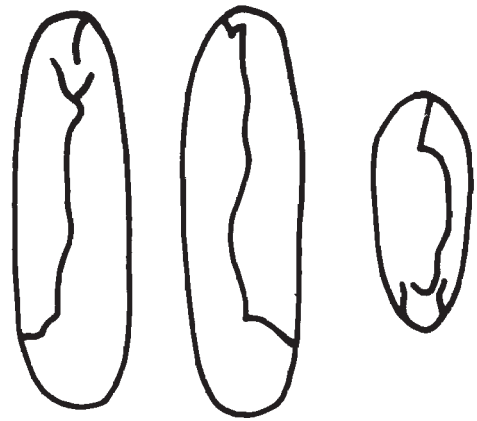
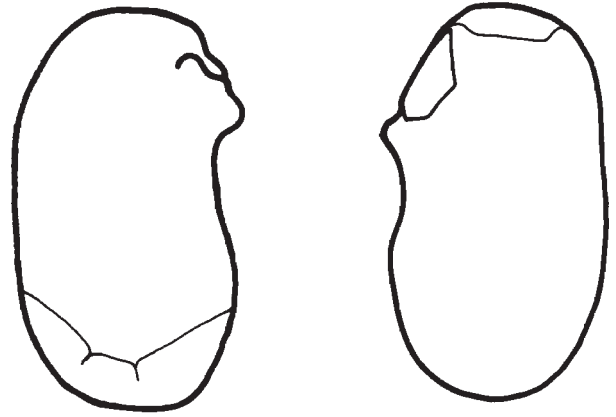
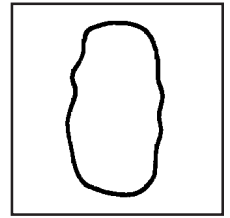
Seed $12-35 \times 12-21 \times 4-11$ mm; not overgrown; not angular; symmetrical; ovate to reniform; compressed or flattened; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; black to brown or yellow; glabrous; not smooth; with elevated

features; wrinkled; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1(–2) mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim (small). Hilum rim color darker than testa. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; confluent with hilum; recessed; same color as testa; black to brown; within rim. Lens rim color of testa. Endosperm trace; not pluglike and not resembling tip of radicle; restricted to region of embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded or with both folded (with short portions folded over the other cotyledon); 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 at or split over radicle; with or without 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 oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

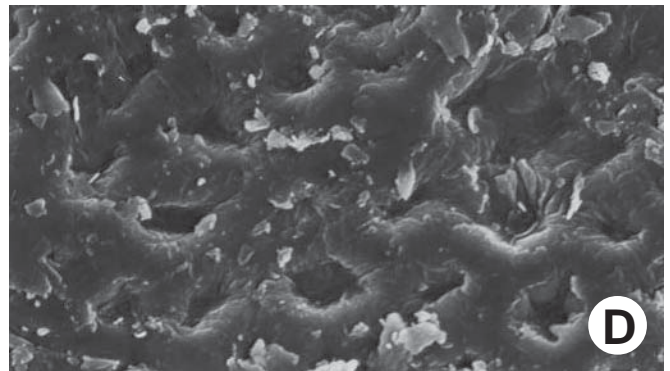
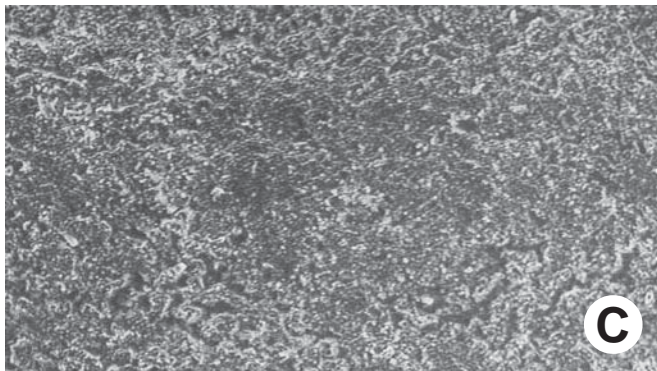
Distribution: Coastal southeastern Asia to western Pacific and northern Australia.

Notes: Thothathri (1961) treated this genus as distinct from *Millettia*, and it was included in *Millettia* by Geesink (1984). We have recognized *Pongamia* because Geesink did not make any combinations for its species in *Millettia* and there has not been a recent treatment of the group. Only immature fruits were seen.

Pongamia: *P. pinnata* (C. Linnaeus) J.B. Pierre (A–E). A, Fruit ($\times 1.3$); B, seeds ($\times 2.4$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2$).



E



Genus: *Pongamiopsis* R. Viguier

Tribe: Millettieae.

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

Fruit a legume; unilocular; $2.6\text{--}4.5 \times 1.3\text{--}3 \times 0.9\text{--}2.3$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; obliquely obovate or irregularly fusiform; when asymmetrical with both sutures unequally curved; inflated; terete; with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; rounded or short tapered at base; base aligned or oblique 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 ridges. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Epicarp dull; monochrome; tan; with surface texture uniform; pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; puberulent or sericeous; with pubescence white; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thick or thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; ligneous or coriaceous. Endocarp dull; opaque; monochrome; tan; smooth; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 2 mm long; of 1 length only; thick; straight. Aril dry; very thin rim-aril; tan.

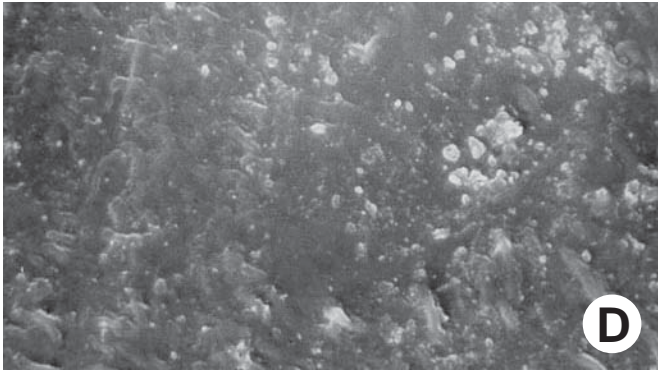
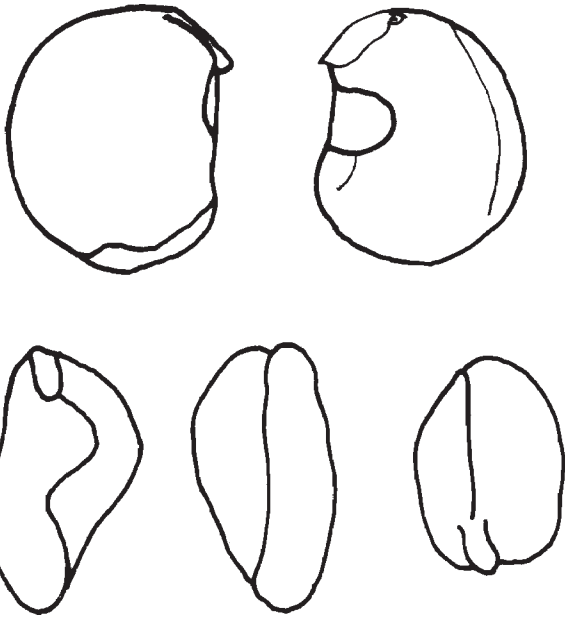
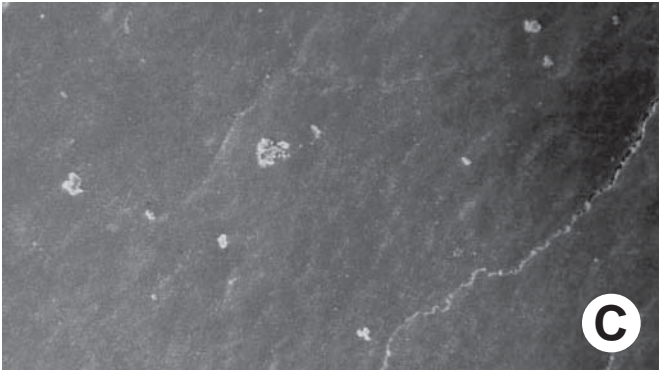
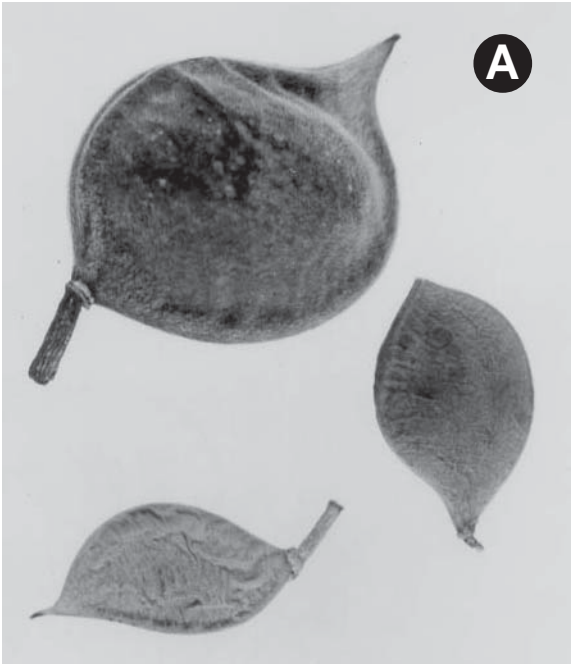
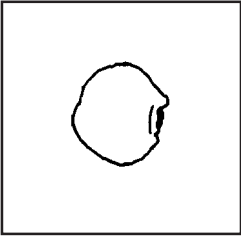
Seed $10\text{--}15 \times 10\text{--}12 \times 6\text{--}7$ mm; not overgrown; not angular; asymmetrical; irregular; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle absent. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; not smooth; with elevated features; transversely ridged; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous;

larger than punctiform; ca. 2.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; raised; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7–1 mm long; with margins curved; ovate; not in groove of raphe; adjacent to hilum; 1 mm from hilum; mounded; same color as testa; dark brown; 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; with both folded (one more than the other); 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 at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face wavy; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Madagascar.

Notes: Little material was available for study. Only one seed was studied internally, and the fruit of only one species was studied internally.

Pongamiopsis: *P. pervilleana* (H.E. Baillon) R. Viguier (C–E), *P. spp.* (A–B). A, Fruits ($\times 1.4$); B, seed ($\times 4.4$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 2.8$).



Genus: *Ptycholobium* H.A.T. Harms

Tribe: Millettieae.

Species Studied—Species in Genus: 2 spp.—3 spp.

Fruit a legume; unilocular; $1.3\text{--}2.3 \times 0.9\text{--}1.1 \times 0.1\text{--}0.2$ cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; elliptic or obliquely obovate; when asymmetrical with both sutures unequally curved; not inflated; flattened; with beak; declined; with solid beak the same color and texture as fruit; rounded at apex; apex oblique with longitudinal axis of fruit; rounded to short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible or invisible. Fruit margin not constricted; without sulcus; embellished or plain; with ridges. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Epicarp dull; monochrome; tan; with surface texture uniform; pubescent and indurate; with hairs erect; with 1 type of pubescence; puberulent; with pubescence white; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Seeds 1–6; length parallel or oblique to fruit length; neither overlapping nor touching; in 1 series. Aril dry; very small rim-aril; tan.

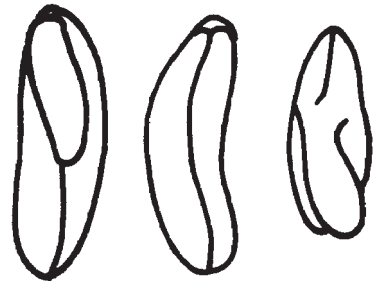
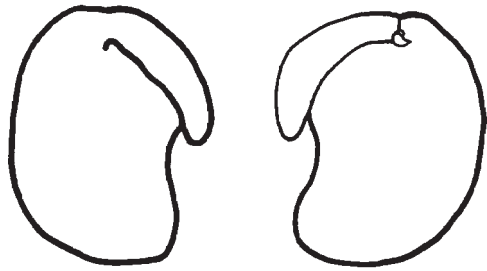
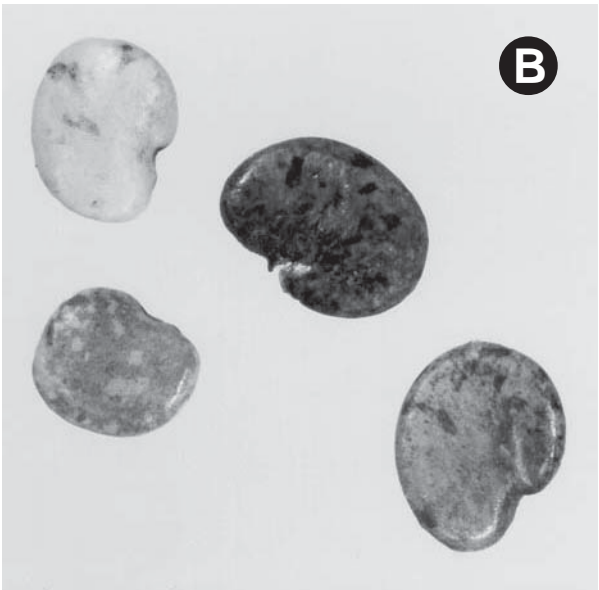
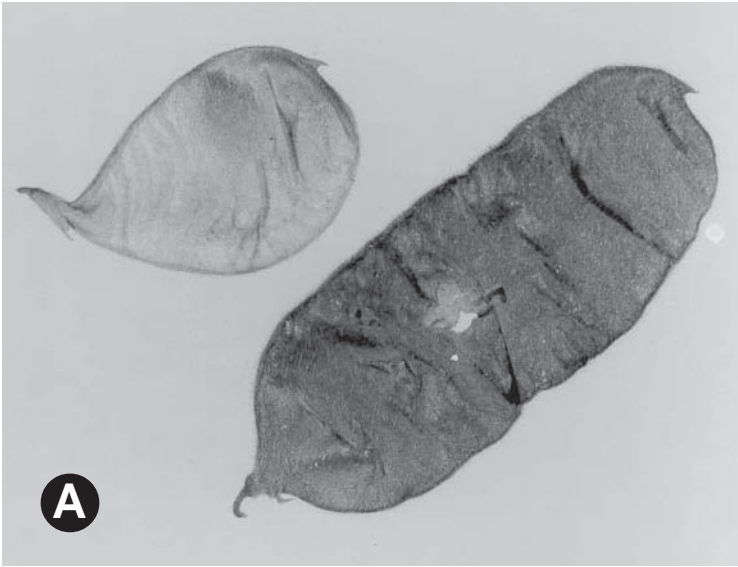
Seed $2.5\text{--}3.5 \times 2\text{--}3 \times 1\text{--}1.2$ mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; with deep or shallow hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle absent. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull to glossy; not modified by a bloom; colored; mottled; with frequent mottles; tan; with brown and gray overlay; glabrous; smooth; chartaceous. 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; 0.5 mm long; with curved outline; elliptic or oval; apical according to radicle tip but marginal according to seed length; recessed; within halo. Hilum halo color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 1 mm long; with margins straight; narrowly triangular; not in groove of raphe; confluent with hilum; flush;

same color as testa; tan; not within corona, halo, or rim. Endosperm present or absent; 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 lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique to parallel (nearly); oblique to perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous or linear; lobe tip curved; with 90-degree turn; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

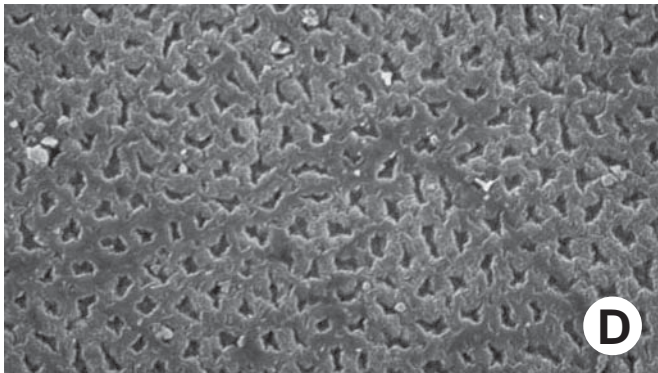
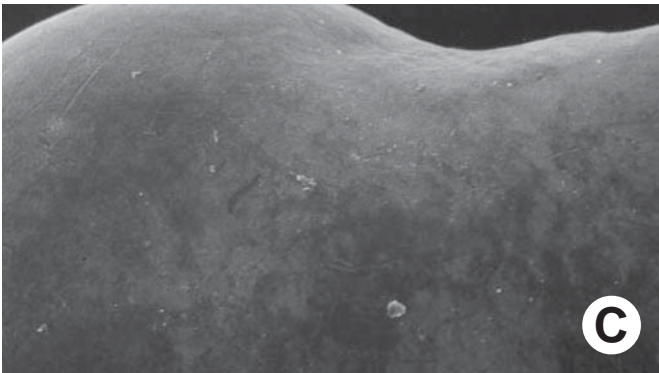
Distribution: Africa and southern Arabia.

Notes: Little material was available for study.

Ptycholobium: *P. biflorum* (E.H.F. Meyer) R.K. Brummitt (A), *P. contortum* (N.E. Brown) R.K. Brummitt (C–E), *P. spp.* (B). A, Fruits ($\times 2.9$); B, seeds ($\times 8$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 10$).



E



Genus: *Pyranthus* D.J. Du Puy & J.-N. Labat

Tribe: Millettieae.

Species Studied—Species in Genus: 3 spp.—6 spp.

Fruit a legume; unilocular; 6–11 × 0.5–0.9 × 0.2–0.3 cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; falcate or irregularly fusiform; when asymmetrical with both sutures parallelly or unequally curved; not inflated; compressed to flattened; without or with beak; declined; with solid beak the same color and texture as fruit; long tapered at apex; apex oblique with longitudinal axis of fruit; long tapered to tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible or invisible. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; plain. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown or gray; with surface texture uniform; pubescent and indurate; with hairs erect; with 1 or 2 types of pubescence; pilose to velutinous to villous; with pubescence brown, tan, or white; with long white and short golden hairs intermixed or contiguous areas of golden and white hairs; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thick; surface not veined; 2-layered; without balsamic vesicles; without fibers; with vitreous layer over solid layer or spongy layer over solid layer; coriaceous. Endocarp dull; opaque; monochrome or mottled; tan; with mottling over seed chambers; with brown overlay; smooth and floury-filamentous; without adhering pieces of testa; subseptate; with septa eglandular; chartaceous; exfoliating in part or not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 6–10; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–2 mm long; of 1 length only; flattened; straight. Aril dry; very small rim-aril; white.

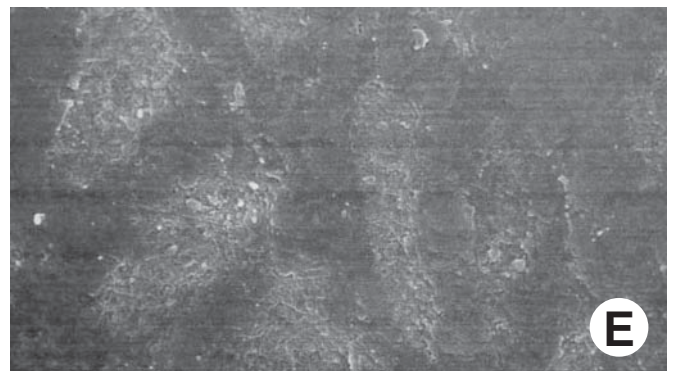
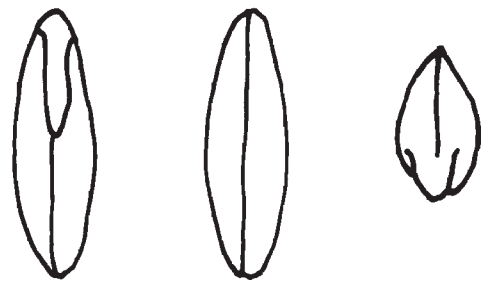
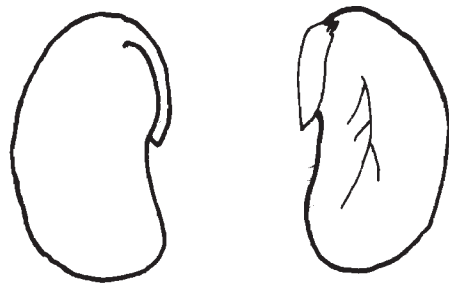
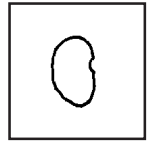
Seed 4–6 × 2.5–3 × 2–2.5 mm; not overgrown; not angular; symmetrical; reniform; compressed to terete

(nearly); with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle absent. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with infrequent mottles; brown; with brown (darker) overlay; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; 0.5–0.8 mm long; with curved outline; oval; apical according to radicle tip but marginal according to seed length; recessed; within halo. Hilum halo color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 1 mm long; with margins straight or curved; linear; hourglass or dumbbell-shaped; not in groove of raphe; confluent with hilum; slightly mounded; similar color as testa; darker than testa; brown; 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; partially concealing radicle; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; white; inner face flat or wrinkled; glabrous around base of radicle. Embryonic axis oblique; parallel to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons to with 180-degree turn (nearly); centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Madagascar.

Notes: This genus was described and monographed by Du Puy and Labat (1995). They stated, “this genus appears to be somewhat intermediate between *Mundulea* and *Chadsia*, with *P. ambatoana* forming the closest link to the latter.”

Pyranthus: *P. alasoia* D.J. Du Puy & J.-N. Labat (A, C-F), *P. ambatoana* (H.E. Baillon) D.J. Du Puy & J.-N. Labat (B). A–B, Fruits (× 0.7); C, seeds (× 4.5); D–E, testa (× 50, × 1000); F, embryos (× 4.5).



Genus: *Requienia* A.-P. de Candolle

Tribe: Millettieae.

Species Studied—Species in Genus: 2 spp.—3 spp.

Fruit a legume; unilocular; $0.7\text{--}1.1 \times 0.25\text{--}0.35 \times 0.12\text{--}0.17$ cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; obliquely obovate; when asymmetrical with both sutures unequally curved; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex oblique with longitudinal axis of fruit; short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; creamy yellow; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; puberulent; with pubescence white; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp present or absent; trace; surface not veined; 1-layered; without balsamic vesicles; without fibers; without reniform canals; solid; chartaceous. Endocarp dull; opaque; monochrome; creamy yellow; smooth; without adhering pieces of testa; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; ca. 0.8 mm long; flattened; curved. Aril dry; rim-aril; cream.

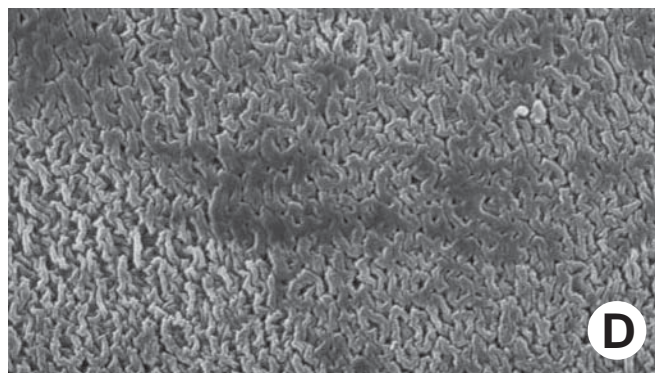
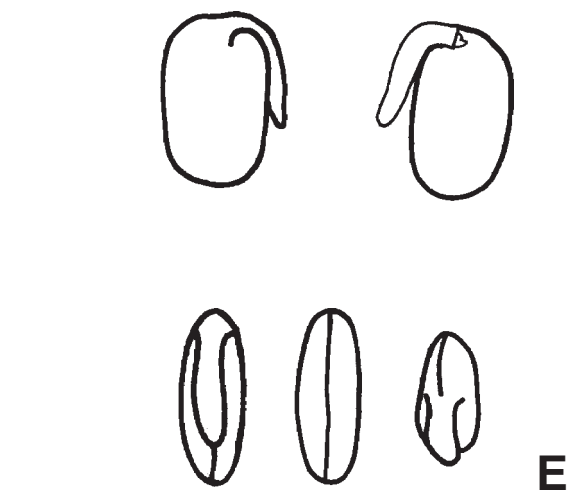
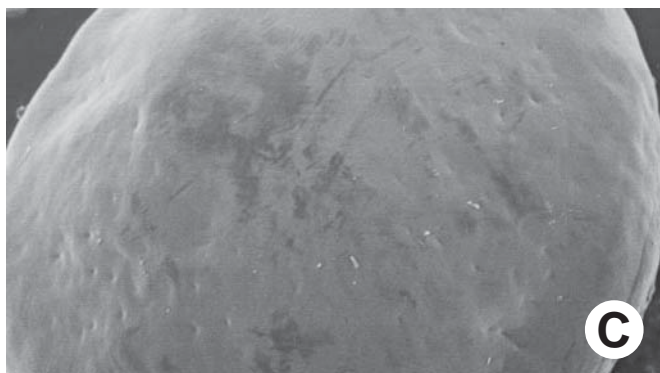
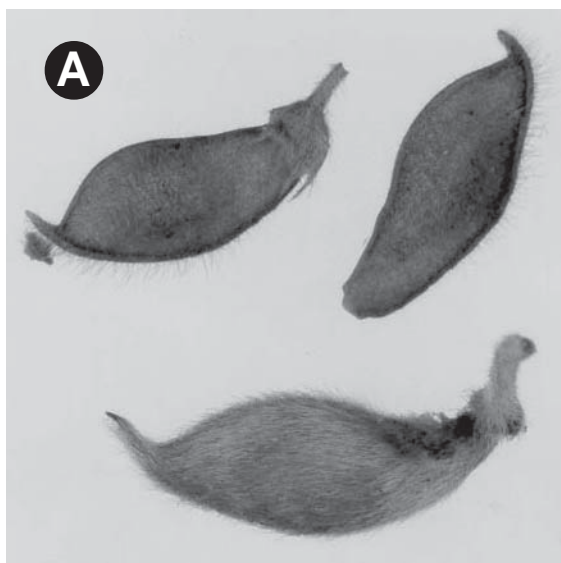
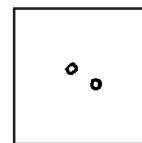
Seed $1.8\text{--}2.2 \times 1.5\text{--}2 \times 1.5\text{--}1.8$ mm; not overgrown; not angular; symmetrical; circular; terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; brown; glabrous; smooth; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by aril; with faboid split; with the lips of the

faboid split the same color as the rest of the hilum; larger than punctiform; ca. 0.5 mm long; with curved outline; circular; apical according to radicle tip but marginal according to seed length; recessed; within halo. Hilum halo color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 0.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; brown; within halo. Lens halo color darker than testa. 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; notched at 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 right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip curved; with 90-degree turn; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Tropical and southern Africa.

Notes: Geesink (1984) noted that *Requienia* is closely related to *Tephrosia*. Our fruit and seed data neither support nor reject Geesink's contention. Brummitt (1980) illustrated the seeds and fruits of *R. sphaerosperma*.

Requienia: *R. sphaerosperma* A.-P. de Candolle (B–E), *R.* spp. (A). A, Fruits ($\times 5.9$); B, seeds ($\times 10$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 10$).



Genus: *Sarcodum* J. de Loureiro

Tribe: Millettieae.

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

Fruit a legume; unilocular; $6.2-9 \times 0.8-1.3 \times 0.5-0.7$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; linear or falcate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with or without beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; tapered at base; base aligned to 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. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; embellished; with ridges. Fruit wings absent. Fruit substipitate; ca. 5 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; dark brown; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled; exfoliating or exfoliating in part; without or with cracks; cracking oblique to fruit length. Mesocarp present or absent; trace; surface uniformly veined; 1-layered; without balsamic vesicles; without fibers; without reniform canals; spongy; chartaceous. Endocarp dull; opaque; monochrome; tan; smooth and scurfy; without adhering pieces of testa; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating, exfoliating in part, or not exfoliating; separating from mesocarp; entire. Seeds 4–8; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 2.5–3 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril; brown.

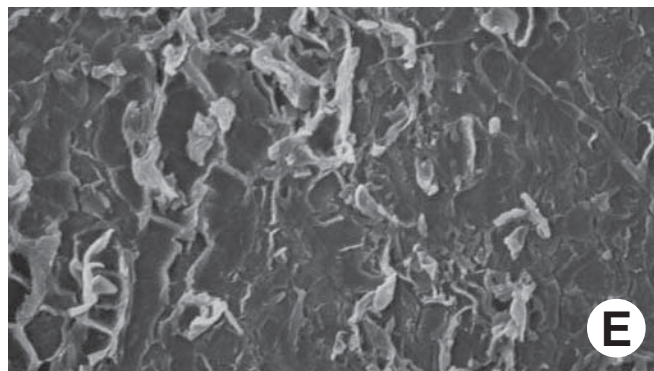
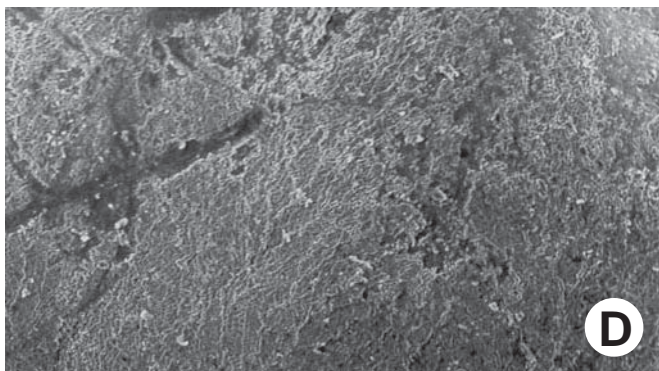
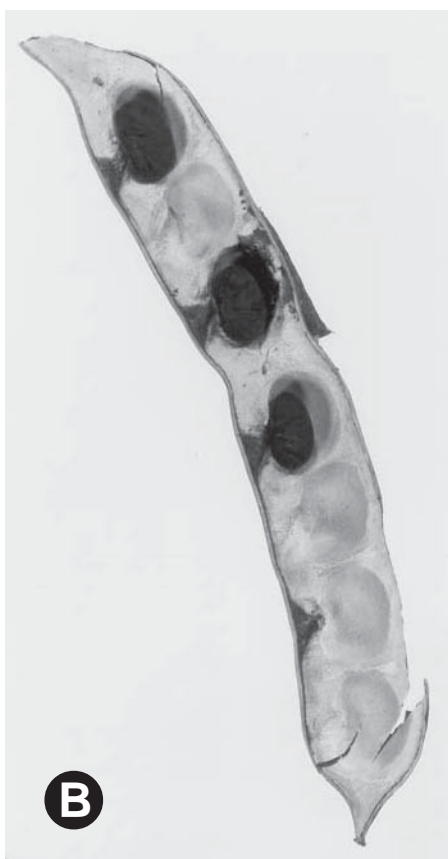
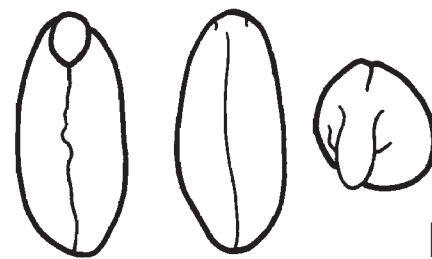
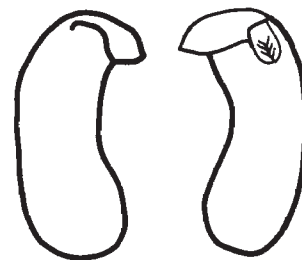
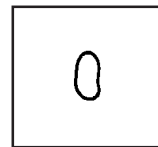
Seed 5–7.5 \times 3.5–5(–7) \times 2.5–4.5 mm; not angular; symmetrical or asymmetrical; elliptic to reniform; terete; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with shallow hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not

modified by a bloom; colored; monochrome; dark brown; glabrous; smooth; chartaceous. Fracture lines present or absent; irregular. Rim absent. Wings absent. Raphe from hilum through lens and terminating before base of seed; not bifurcating; color of testa; brown; raised. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 2–2.5 mm long; with curved outline; elliptic; apical according to radicle tip but marginal according to seed length; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; same color as testa; brown; not within corona, halo, or rim. Endosperm thin; not pluglike and not resembling tip of radicle; covering at least 1/2 of embryo, but not 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 lobes; with the interface division terminating at base of radicle; without margins recessed; tan to yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or well developed; glabrous.

Distribution: Indochina, Indonesia to the Philippines (1 sp.); and Solomon Islands (1 sp.).

Notes: Geesink (1981) noted that the species from the Solomon Islands is the “genus unknown” in Verdcourt (1979, page 589).

Sarcodum: *S. binnendyckianum* (W.S. Kurz) R. Geesink (*D–F*), *S. scandens* J. de Loureiro (*A–C*). *A–B*, Fruit ($\times 1.4$, $\times 1.5$); *C*, seed ($\times 11.3$); *D–E*, testa ($\times 50$, $\times 1000$); *F*, embryos ($\times 5$).



Genus: *Schefflerodendron* H.A.T. Harms

Tribe: Millettieae.

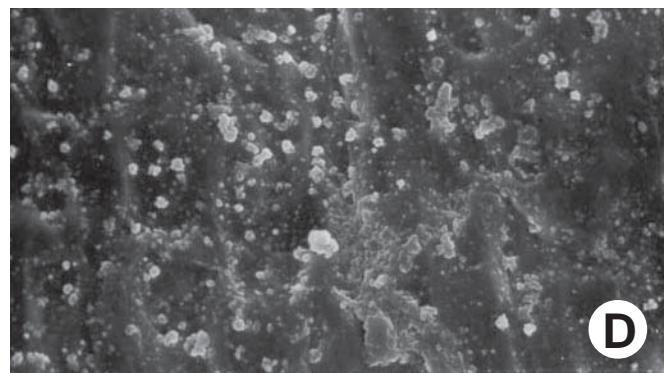
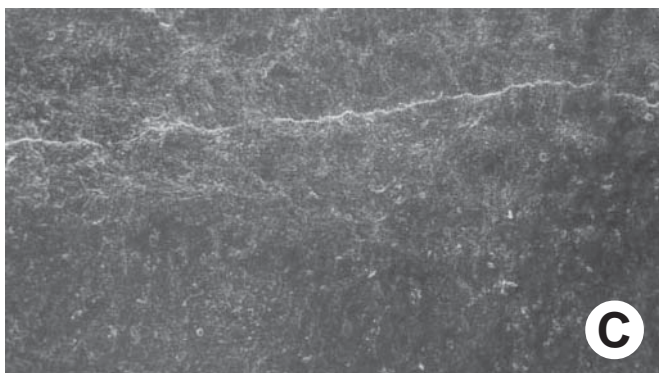
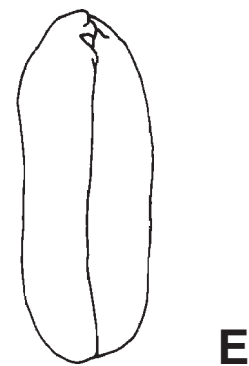
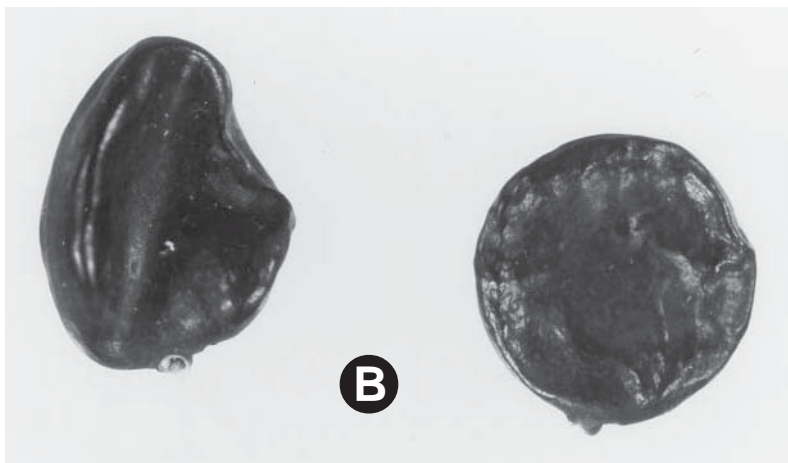
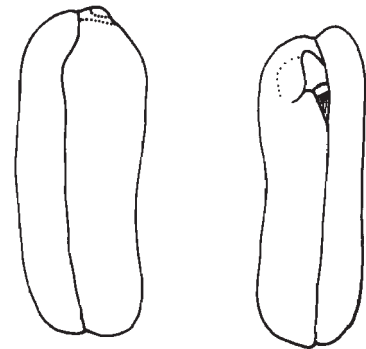
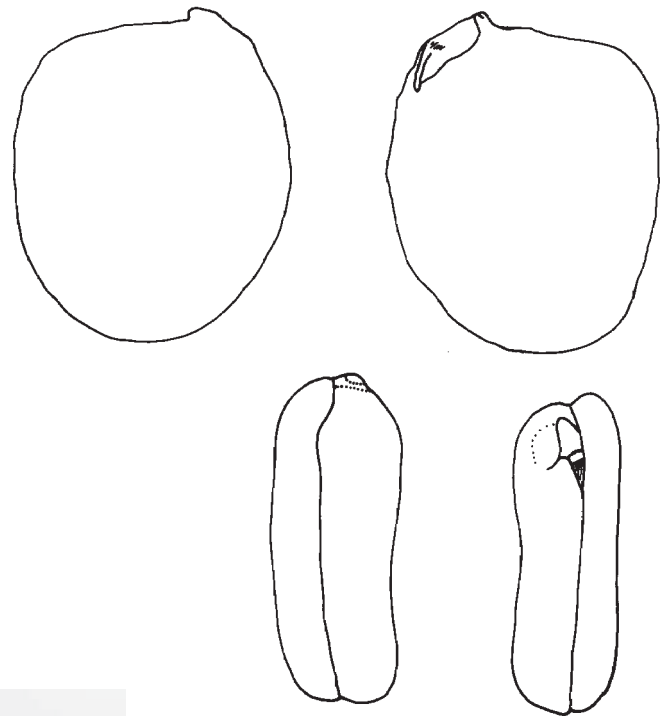
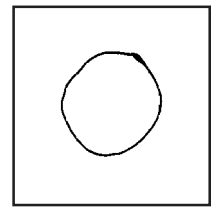
Species Studied—Species in Genus: 4 spp.—6 spp.

Fruit a legume; unilocular; 5–11 × 2–3.5 × 2–3 cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; irregular or obliquely obovate; when asymmetrical with 1 straight and 1 curved suture or both sutures unequally curved; widest near apex; not inflated; terete; with beak; straight; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; tapered at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; leathery to ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate or nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown; with brown overlay; with surface texture uniform; pubescent and indurate; with hairs appressed; with 1 type of pubescence; villous; with pubescence brown; with pubescence uniformly distributed or denser near sutures, sparse centrally; with simple hairs; stiff; with hair bases plain; glandular or eglandular; with glandular dots; distributed over entire fruit; without spines; not smooth; with elevated and recessed features, elevated features, or recessed features; veined or not veined; reticulately veined; not tuberculate; pustulate; grooved; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thick; surface uniformly veined; 2-layered; without balsamic vesicles; without fibers; without reniform canals; with solid layer over solid layer; ligneous to coriaceous. Endocarp dull; opaque; streaked; brown; with streaking; with black to brown overlay; hairy; without adhering pieces of testa; with hairs scattered over endocarp; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1(–2); length oblique to parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 3 mm long; of 1 length only; thick; straight. Aril dry; hippocrepiform rim-aril or rim-aril and tongue-aril; brown to cream.

Seed 11–18 × 11–15 × 5–10 mm; not overgrown; angular or not angular; symmetrical or asymmetrical; circular, irregular, or ovate; terete or flattened; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome; dark brown; glabrous; not smooth; with elevated and recessed features, just elevated features, or just recessed features; wrinkled; pitted with small separate pits; chartaceous. 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; ca. 2 mm long; with curved outline; circular; subapical to radicle tip; recessed; within rim. Hilum rim color lighter than testa. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; confluent with hilum; recessed; same color as testa; brown; not within corona, halo, or rim. Endosperm thin; not pluglike and not resembling tip of radicle; covering at least 1/2 of embryo, but not entire embryo; adnate to testa. Cotyledons smooth or not smooth; sulcate; 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; with lobes; with lobes touching (auriculate); without basal groin formed by lobes; with the interface division terminating at base of radicle; without margins recessed; creamy white; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; linear; lobe tip straight; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Tropical Africa.

Schefflerodendron: *S. usambarense* H.A.T. Harms (B–E), *S.* spp. (A). A, Fruits (× 1.1); B, seed (× 2.3); C–D, testa (× 50, × 1000); E, embryos (× 3).



Genus: *Tephrosia* C.H. Persoon

Tribe: Millettieae.

Species Studied—Species in Genus: 50 spp.—ca. 400 spp.

Fruit a legume; unilocular; 0.7–14 × 0.25–1 × 0.2–0.4 cm; with persistent or deciduous calyx; with calyx shorter than fruit; without or with orifice formed by curving of fruit or fruit segments or 1-coiled; straight; not plicate; not twisted; symmetrical or asymmetrical; falcate, fusiform, or linear; when asymmetrical with both sutures nearly straight; not inflated or inflated (rarely); compressed, flattened, or terete; with or without beak; straight or hooked; with solid beak the same color and texture as fruit; blunt, tapered, or short tapered at apex; apex aligned to oblique with longitudinal axis of fruit; tapered or truncate at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; embellished or plain; with ridges or thickened sutural areas. Fruit wings absent. Fruit nonstipitate or stipitate (in literature). Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown, tan, or yellow; with brown overlay; with surface texture uniform; pubescent and indurate or pubescent but soon deciduous; with hairs erect or appressed; with 1 type of pubescence; puberulent, sericeous, tomentose, or velutinous; with pubescence golden or white; with pubescence uniformly distributed; with simple hairs; stiff or pliable; with hair bases plain or swollen; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; with or without cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without fibers; without reniform canals; solid or with solid layer over solid layer; chartaceous to coriaceous. Endocarp dull; opaque or translucent; monochrome; tan or yellow; scurfy and smooth, scurfy, smooth, or hairy and smooth; without adhering pieces of testa; with hairs surrounding seed chambers; subseptate or nonseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; exfoliating in part or not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–20; length parallel with, oblique to, or transverse to fruit length; touching or neither overlapping nor touching; in 1 series. Funiculus measured or

less than 0.5 mm long; 0.5–2 mm long; of 1 length only; flattened; triangular. Aril dry; rim-aril, rim-aril and tongue-aril, or 2-lipped rim-aril; with tongues (or flap-like) on lips of 2-lipped rim-aril; with 1 tongue or flap on 1 lip of 2-lipped rim-aril; cream.

Seed 3–10 × 2–6 × 1.5–3 mm; not overgrown; angular or not angular; symmetrical; ovate, rectangular, or reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; with shallow hilar sinus or without hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; black, brown, or tan; with brown overlay; glabrous; smooth or not smooth; with elevated features; reticulate; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.8–2.2 mm long; with curved outline; circular, elliptic, or oval; apical according to radicle tip but marginal according to seed length; flush or recessed; within corona. Hilum corona color lighter and darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; ca. 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; same color as testa; brown; within halo. Lens halo color darker than testa. Endosperm present or absent; thin; not pluglike and not resembling tip of radicle; 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 lobes; with the interface division terminating at base of radicle; without margins recessed; white to yellow or green; inner face wrinkled; glabrous around base of radicle. Embryonic axis right angled; perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous to linear; lobe tip straight or curved; oblique to cotyledons to with 90-degree turn; centered between cotyledons; less than 1/2 or 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Pantropics (mainly Africa).

Notes: Bosman and Haas (1983) revised the species in Malesia. Geesink (1984) noted that "*Mundulea* is strikingly similar to *Tephrosia*" and also noted that *Requienia* is closely related to *Tephrosia*. Our fruit and seed data neither confirm nor reject Geesink's ideas. We reject *Caulocarpus* E.G. Baker, recognized by Geesink (1984) as a genus, and instead treat it as part of *Tephrosia*, following Geesink's suggestion that "it may represent a section or subgenus of *Tephrosia*." Species of *Tephrosia* are used worldwide for folk medicine, fish poison, insecticides, fodder, and dyes.

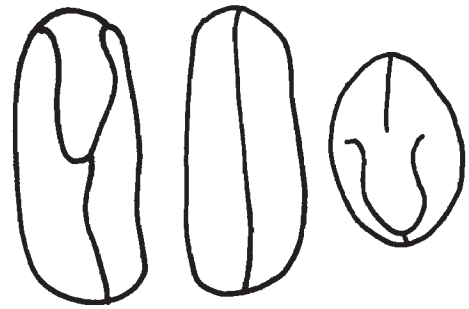
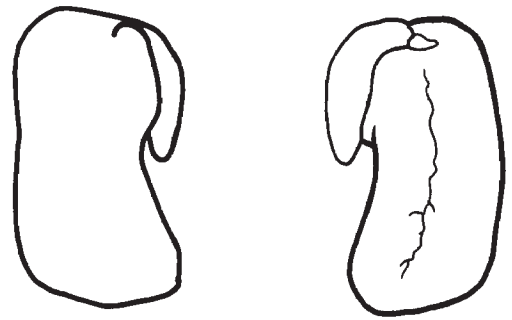
Tephrosia: *T. purpurea* (C. Linnaeus) C.H. Persoon (C–E),
T. spp. (A–B). A, Fruits ($\times 0.6$); B, seeds ($\times 3.7$); C–D,
testa ($\times 50$, $\times 1000$); E, embryos ($\times 8$).



A



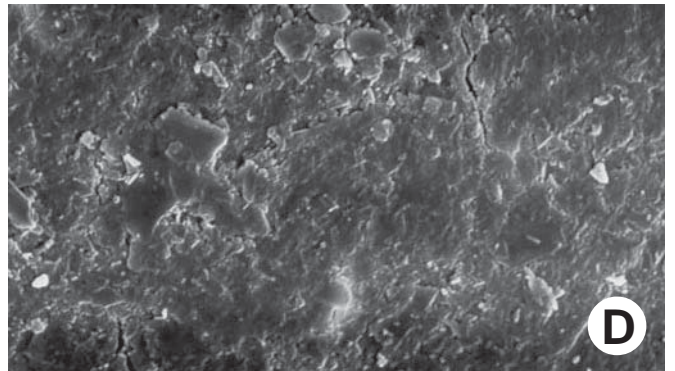
B



E



C



D

Genus: *Wisteria* T. Nuttall

Tribe: Millettieae.

Species Studied—Species in Genus: 6 spp.—6 spp.

Fruit a legume; unilocular; $7-20 \times 0.8-1.6 \times 0.6-1$ cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; linear, oblanceolate, or obliquely oblanceolate; when asymmetrical with both sutures nearly straight or parallelly curved; not inflated; compressed; with or without beak; straight; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned with longitudinal axis of fruit; long tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin constricted or not constricted; slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; with surface texture uniform; glabrous or pubescent and indurate; with hairs appressed; with 1 type of pubescence; velutinous; with pubescence brown; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; minutely rugose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 3-layered; without balsamic vesicles; without fibers; without reniform canals; with spongy layer over vitreous over solid layer or solid layer over vitreous layer over solid layer; coriaceous or chartaceous. Endocarp dull; opaque; mottled; white; with brown overlay; pithy or smooth; without adhering pieces of testa; septate or nonseptate; with septa thicker than paper, firm; with septa eglandular; chartaceous or pulpy; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1–1.5 mm long; of 1 length only; thick; straight or triangular. Aril dry; rim-aril and tongue-aril or partial rim-aril; tan or white.

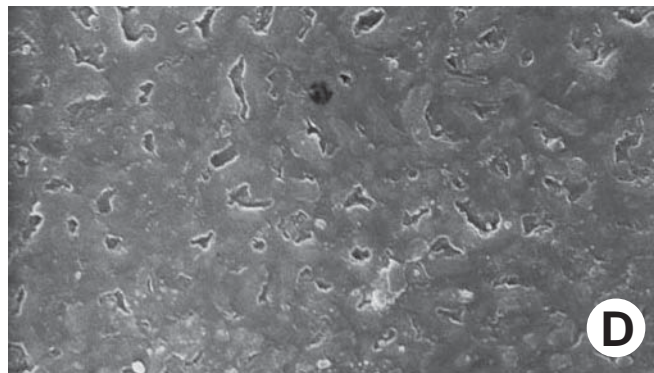
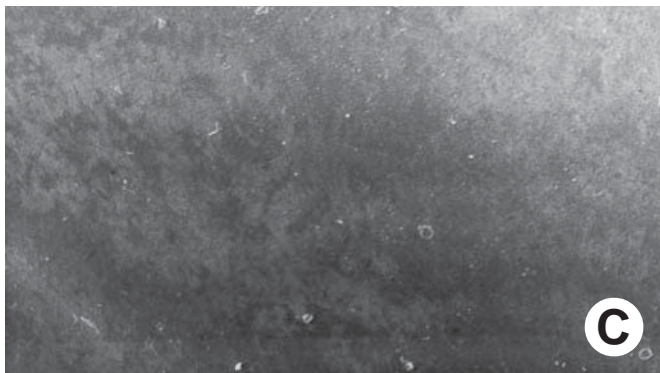
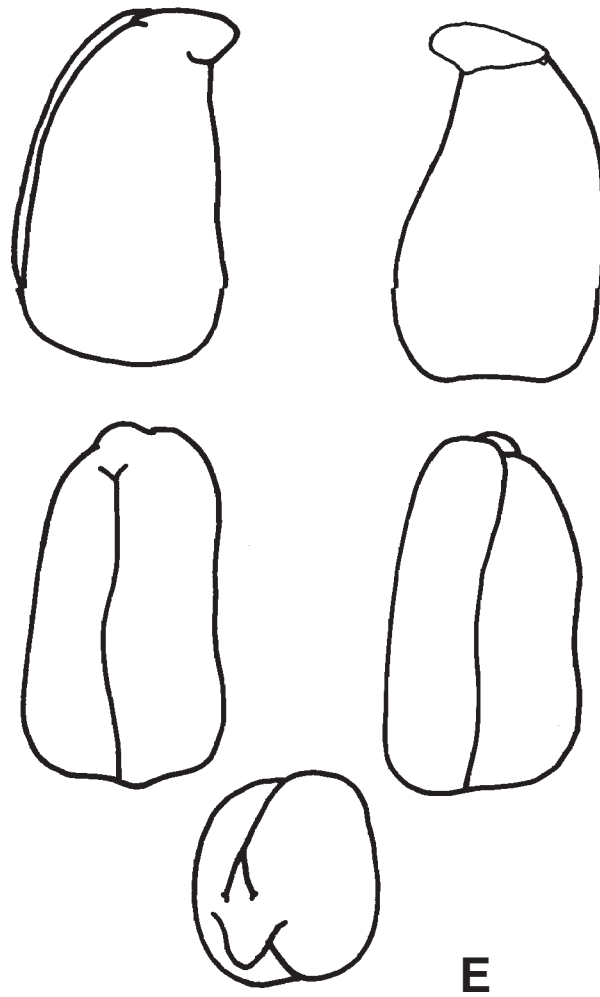
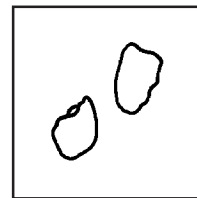
Seed $7-20 \times 5-19 \times 2.5-7$ mm; not overgrown; not angular; symmetrical or asymmetrical; oblong, obovate, or reniform; terete, compressed, or flattened; with

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; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull or glossy; not modified by a bloom; colored; mottled; with frequent mottles; brown; with brown (darker) overlay; glabrous; smooth or not smooth; with elevated features; rugose; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe visible or not visible; from hilum through lens and terminating before base of seed; not bifurcating; darker than testa; raised. Hilum partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 1.2–4 mm long; with curved or straight outline; elliptic or oblong; apical according to radicle tip but marginal according to seed length; recessed; within halo or rim. Hilum halo color darker than testa. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–1.5 mm long; with margins straight or curved; triangular or ovate; not in groove of raphe; confluent with or adjacent to hilum; 0.5 mm from hilum; mounded; similar color as testa; darker than testa; brown; within rim or not within corona, halo, or rim. Lens rim color of testa. 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; notched at radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan to yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique to right angled; oblique to parallel to perpendicular to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous to linear; lobe tip straight; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

Distribution: North America, China, and Japan.

Notes: *Rehsonia* L.R. Stritch (1984) is included in *Wisteria* because Geesink (1984) maintained its type species in *Wisteria*.

Wisteria: *W. frutescens* (C. Linnaeus) J.L.M. Poir (C–E), *W. spp.* (A–B). A, Fruits ($\times 0.7$); B, seeds ($\times 2.1$); C–D, testa ($\times 50$, $\times 1000$); E, embryos ($\times 5$).



Genus: *Xeroderris* G.E. Roberty

Tribe: Millettieae.

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

Fruit a legume; unilocular; 10–13.5 × 3–4.2 × 0.6–0.9 cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; elliptic or linear; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; 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; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; very slightly constricted along both margins; without sulcus; embellished. Fruit wings 2; 5.5–11 mm wide; sutural; on both sutures. Fruit substipitate; with the stipe 2–3 mm long. Fruit indehiscent. Replum invisible. Epicarp dull; multicolored; mottled; tan; with brown overlay; with surface texture uniform; glabrous; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface uniformly veined; 2-layered; without balsamic vesicles; without fibers; without reniform canals; with spongy layer over solid layer; coriaceous to chartaceous. Endocarp dull; opaque; monochrome; greenish tan; scurfy and smooth; without adhering pieces of testa; septate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; ca. 2 mm long; of 1 length only; filiform; straight. Aril fleshy; marginal hilar; entire; covering less than 1/2 of seed; tan.

Seed 16–20 × 12–13 × 3–6 mm; not overgrown; not angular; asymmetrical; irregular; flattened; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; with deep hilar sinus; without umbo on seed faces; without medial ridge on each face. Cuticle not exfoliating; not inflated; not wrinkled. Testa without pieces of adhering epicarp; not adhering to endocarp; free from endocarp; dull; not modified by a bloom; colored; mottled; with infrequent mottles; reddish brown; with brown (darker) overlay; glabrous; not

smooth; with elevated and recessed features, elevated features, or recessed features; wrinkled; pitted with small separate pits; chartaceous. Fracture lines absent. Rim absent. Wings absent. Raphe from hilum through lens and terminating before base of seed; not bifurcating; color of testa; slightly raised. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; ca. 1.5 mm long; with curved outline; circular to oval; apical according to radicle tip but marginal according to seed length; recessed; not within corona, halo, or rim. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; confluent with hilum; recessed; same color as testa; brown; not within corona, halo, or rim. Endosperm absent. Cotyledons not smooth; dimpled once (below embryo); 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; yellow; inner face flat; glabrous around base of radicle. Embryonic axis oblique; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle differentiated from cotyledon; bulbous; lobe tip curved; oblique to cotyledons; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Africa.

Xeroderris: *X. stuhlmannii* (P.H.W. Taubert) F. de A. Mendonça & E.P. Sousa (A–E). A, Fruits (× 1.1); B, seeds (× 1.8); C–D, testa (× 50, × 1000); E, embryos (× 1.7).

