

## Mirbelieae (24.01–24.26)

Genus: *Gompholobium* J.E. Smith

Phylogenetic Number: 24.01.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 16 spp.—ca. 35 spp.

Fruit a legume; unilocular;  $0.4\text{--}2 \times 0.4\text{--}1.3 \times 0.3\text{--}1$  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; asymmetrical or symmetrical; circular or oblong; when asymmetrical with both sutures parallelly curved or both sutures nearly straight; not inflated; terete; without beak; rounded at apex; apex 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; plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures or 1 suture; apical and down; passive. Replum invisible. Epicarp dull; monochrome; black; glabrous or glabrate (with hairs along sutures); with 1 type of pubescence; puberulent; with pubescence gray; with pubescence uniformly distributed; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull or glossy; monochrome or streaked; tan; with streaking (dark); with brown overlay; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 6–12; length transverse to fruit length; overlapping or touching; in 1 series. Funiculus measured; up to 3 mm long; of 1 length only; thick; S-curved or hooked. Aril absent or present; dry; well developed rim-aril; reddish brown.

Seed  $1.6\text{--}3 \times 1.2\text{--}2.5 \times 1\text{--}2.1$  mm; not overgrown; not angular; asymmetrical; mitaform, reniform, or circular; compressed or terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Cuticle inflated (like bubbles) or not inflated (around hilum). Testa not adhering to endocarp; dull; not modified by a bloom;

colored; monochrome or mottled; with frequent mottles; reddish brown, tan (reddish), orange, or black; with black overlay; glabrous; smooth; coriaceous. 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; 0.7 mm long; with curved outline; oval; marginal according to radicle tip; recessed; within rim. Hilum rim color of testa. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; confluent with hilum; mounded; same color as, similar color as, or dissimilar color from testa; darker than testa; reddish brown or black; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa or embryo. 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; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; pale tan or brown (reddish); 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 bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately or well developed; glabrous.

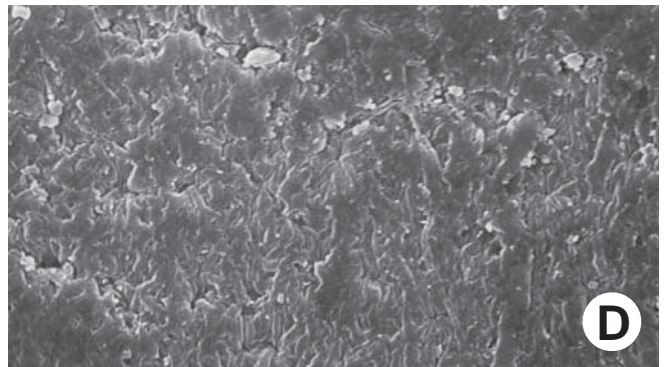
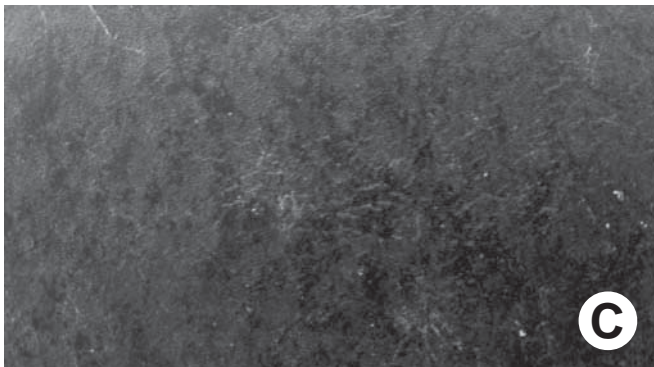
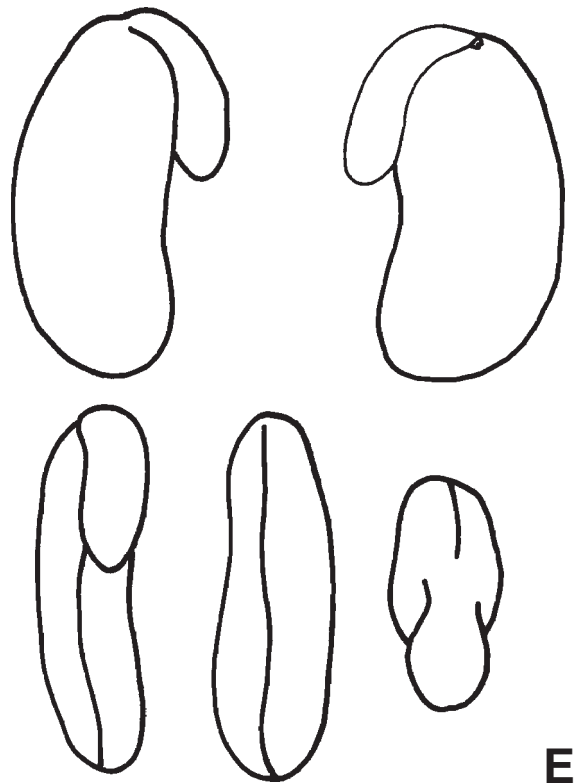
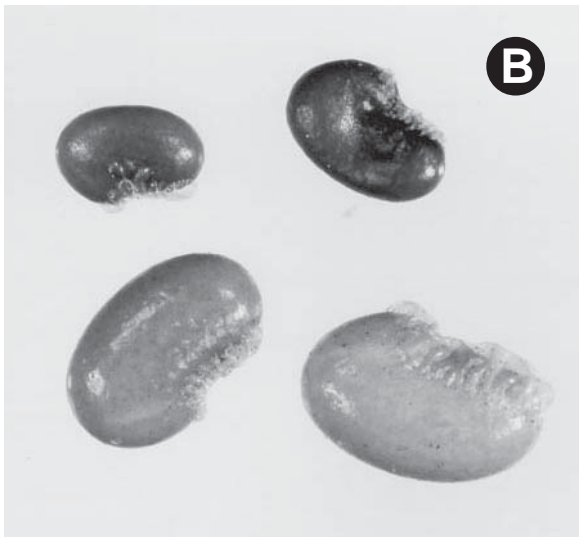
Distribution: Australia and New Guinea (*G. papuanum* E.D. Merrill & L.M. Perry).

Notes: Crisp and Weston (1987) analyzed the Mirbelieae, and we are following their species counts. We did not treat the following new taxa of Crisp and Weston: the *Pultenaea incurvata* A. Cunningham group of five species; *Pultenaea neurocalyx* P.K.N.S. Turczanivow, a single species; *Aotus phyllicoides* G. Benth, a single species; and *Oxylobium microphyllum* G. Benth, a two-species genus. The genus *Cupulanthus* J. Hutchinson is listed on page 85 of Crisp and Weston (1987) and not mentioned by them again. Crisp and Weston (1995) proposed the following two major generic changes: the resurrection of *Podolobium* R. Brown with six species of *Oxylobium* (24.09, see Notes for *Oxylobium*) and a new genus, tentatively to be named *Otion*. *Otion*, as projected, will have six species, two new ones and four from four different genera: *Aotus phyllicoides* G. Benth, *Burtonia simplicifolia* F. von Mueller & R. Tate, *Oxylobium microphyllum* G. Benth, and *Phyllota luehmannii* F. von Mueller.

Crisp and Weston (1987), in Appendix II, united *Burtonia* R. Brown with *Gompholobium* under the latter name.

*Gompholobium*: *G. latifolium* J.E. Smith (*E*), *G. scabra* R. Brown (*C–D*), *G. spp.* (*A–B*). *A*, Fruits with and without calyx and valves ( $\times 2.3$ ); *B*, seeds ( $\times 10$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 12$ ).

0



Genus: *Sphaerolobium* J.E. Smith

Phylogenetic Number: 24.02.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 7 spp.—ca. 15 spp.

Fruit a legume; unilocular;  $0.4\text{--}0.55 \times 0.3\text{--}0.4 \times 0.3\text{--}0.4$  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; asymmetrical or symmetrical; more or less circular or oblong; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; not inflated; terete; without beak; rounded at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate or stipitate; with the stipe up to 5 mm long. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; reddish brown, tan (to greenish or barely reddish tan), green, or black; glabrous; eglandular; without spines; not smooth; with elevated features; veined or not veined; reticulately veined; not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; sub ligneous. Endocarp glossy; monochrome; reddish brown, tan, or white (nearly); smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with or transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight (from a thickened suture wall). Aril dry; rim-aril; tan.

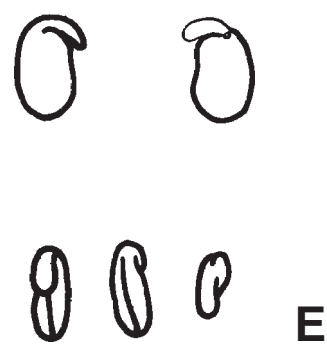
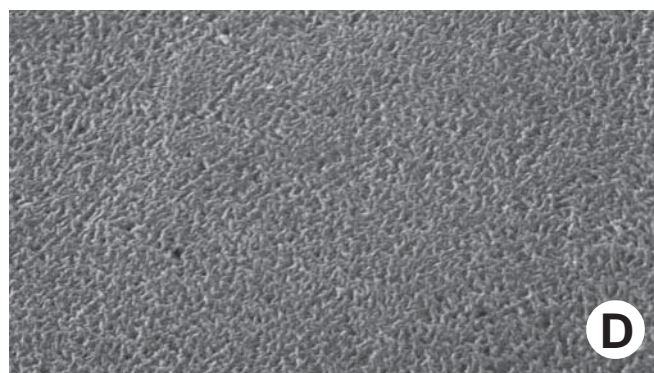
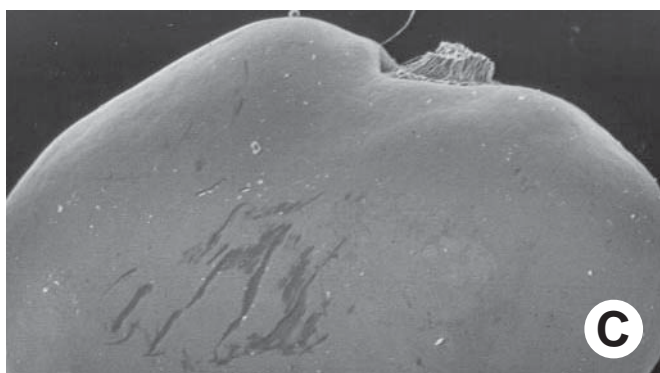
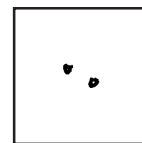
Seed  $1.2\text{--}1.8 \times 1.1\text{--}1.3 \times 0.9$  mm; not overgrown; not angular; asymmetrical; reniform, circular, or mitaform; compressed; with surface smooth; without or with visible radicle and cotyledon lobes; without or with external groove between radicle and cotyledon lobes; same color as testa; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth or not smooth; with elevated features; tuberculate; coriaceous. 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; punctiform; marginal according to radicle tip; flush; not within corona, halo, or rim or within rim. Hilum rim color of testa. Lens discernible; less than 0.5 mm in length; with margins straight or curved; circular or oblong; not in groove of raphe; adjacent to or confluent with hilum; 0.2 mm from hilum; flush; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; 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; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern and southeastern Australia.

Notes: The fruits of *Sphaerolobium* are slightly to noticeably longitudinally compressed so that the long axis is equivalent to the width of most other legume fruits. The upper fruit in fig. A (of *S. grandiflorum* G. Benth) is an example of this compression.

*Sphaerolobium*: *S. vimineum* J.E. Smith (C–E), *S.* spp. (A–B). A, Fruits with or without calyx ( $\times 6.9$ ); B, seeds ( $\times 10.5$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 13$ ).



Genus: *Viminaria* J.E. Smith

Phylogenetic Number: 24.03.

Tribe: Mirbelieae.

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

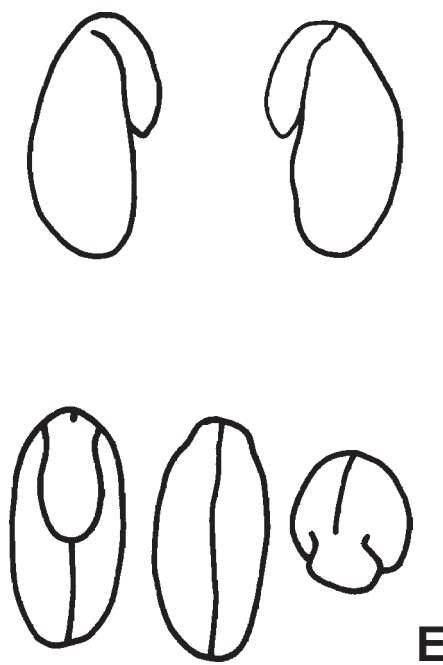
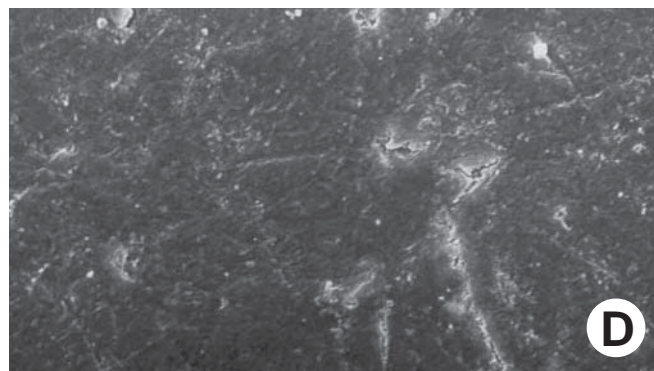
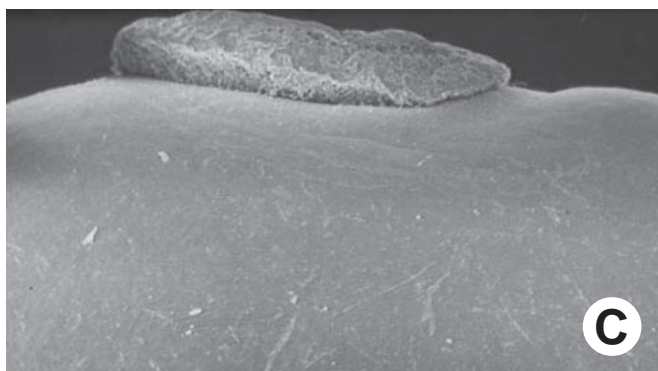
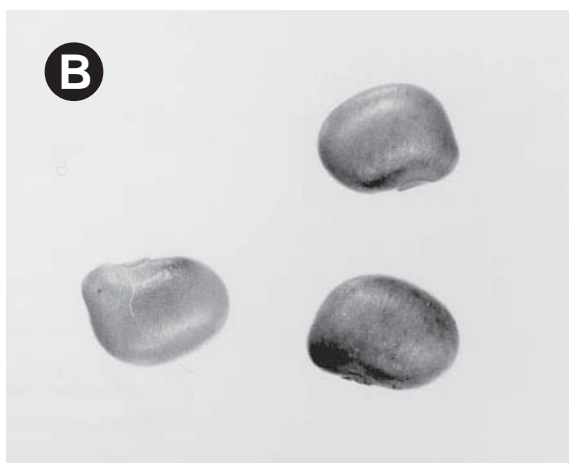
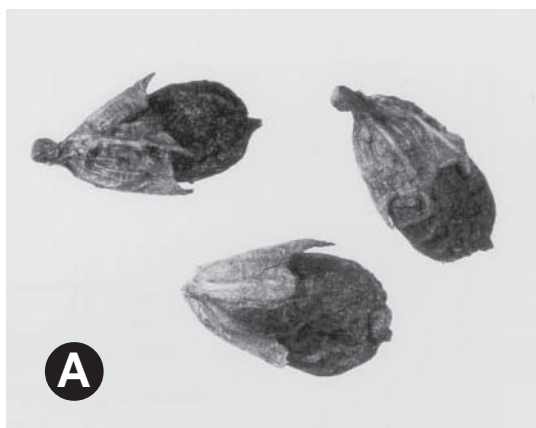
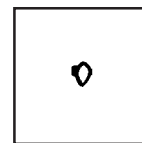
Fruit a legume; unilocular;  $0.9-1 \times 0.5-0.6 \times 0.3$  cm; with persistent calyx; with calyx shorter than fruit ( $3/4$  length of fruit); without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; oblong or ovate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without beak; rounded at apex; apex oblique with longitudinal axis of fruit; rounded at base; base slightly oblique with longitudinal axis of fruit; with the apex and base uniform in texture; membranous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; black; glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled (especially portion above calyx); not exfoliating; without cracks. Mesocarp absent. Endocarp dull; monochrome (but epicarp color is visible); tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp. Seed 1; length parallel with fruit length. Funiculus less than 0.5 mm long; flattened; straight. Aril dry; rim-aril; tan.

Seed  $2-3 \times 1.4-2 \times 1-1.8$  mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim present. 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; circular; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim. Lens discernible; less than 0.5 mm in length (0.3–0.4 mm); with margins curved; circular; not in groove of raphe; adjacent to hilum; 0.1 mm from hilum; slightly mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to embryo.

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; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; pale 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; deflexed and parallel to cotyledon width; centered between cotyledons; less than  $1/2$  length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern and southeastern Australia.

*Viminaria: V. juncea* (H.A. Schader) J.C. von Hoffmann-segg (*A-E*). *A*, Fruits with calyx ( $\times 5.6$ ); *B*, seeds ( $\times 10$ ); *C-D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 16$ ).





Genus: *Daviesia* J.E. Smith

Phylogenetic Number: 24.04.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 22 spp.—120 spp.

Fruit a legume; unilocular;  $0.5\text{--}1.5 \times 0.4\text{--}1 \times 0.3\text{--}0.5$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; more or less asymmetrical; triangular or irregular; when asymmetrical with both sutures unequally curved, 1 straight and 1 curved suture, or both sutures parallelly curved; more or less widest near middle or D-shaped; not inflated; compressed; without or with beak; with solid beak the same color and texture as fruit; tapered, short tapered, or truncate at apex; apex aligned, oblique, or right-angled 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; membranous or chartaceous. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting (each valve or both valves forming a cone). Replum invisible. Epicarp dull or glossy; monochrome or multicolored; mottled; light to dark or reddish brown, tan, green, purple, or gray; with tan overlay; glabrous or pubescent and indurate; with 1 type of pubescence; villous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; 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 not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown; smooth, hairy (crinkled and golden), or cobwebby; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; overlapping and touching or neither overlapping nor touching; in 1 series. Funiculus measured; 1 mm long; of 1 length only; thick; straight (may be bifurcate at base with seed on each stalk. Aril fleshy; cupshaped (with thicker apex); covering 1/2 to nearly all of seed; reddish brown or yellow.

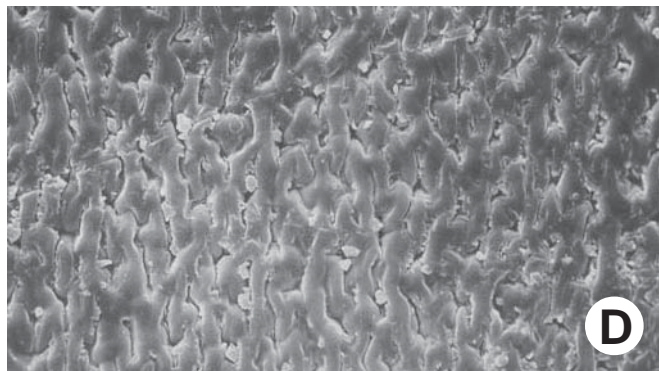
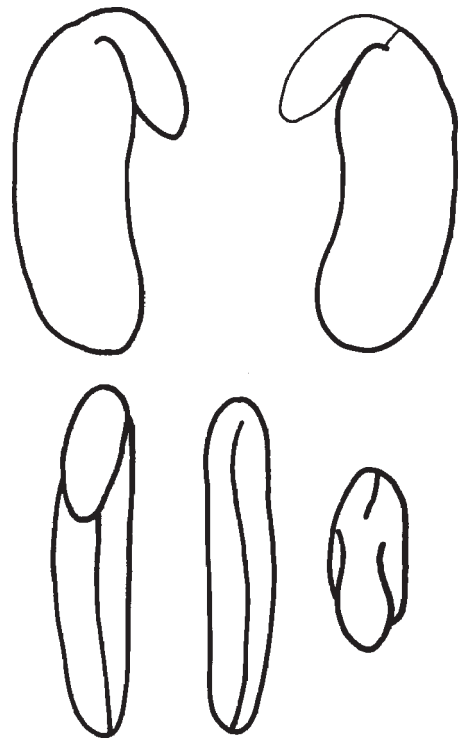
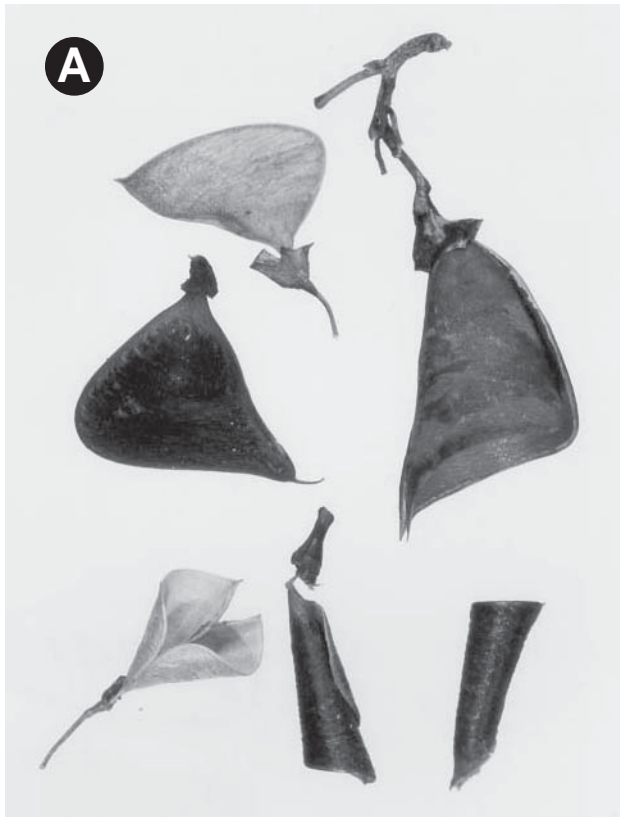
Seed  $3\text{--}6 \times 1.5\text{--}3.5 \times 0.8\text{--}2.4$  mm; overgrown, 1 seed filling entire fruit cavity; not angular; asymmetrical;

oblong or elliptic; compressed; with surface smooth; without visible radicle and cotyledon; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent mottles; with frequent streaks; brown to greenish or reddish brown, tan (to reddish tan), yellow, orange, or black; with black overlay; glabrous; smooth or not smooth; with recessed features; punctate; coriaceous. 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; 1 mm long; with straight outline; oblong; marginal according to radicle tip; recessed; not within corona, halo, or rim or within halo. Hilum halo color (black) darker than testa. Lens discernible or not discernible; less than 0.5 mm in length; with margins curved; elliptic; not in groove of raphe; confluent with hilum (at least with halo); mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa or embryo. Cotyledons smooth; both outer faces convex; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; 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 length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

Notes: Crisp and Chandler (Crisp 1980, 1982, 1984, 1985, 1991; Crisp and Chandler 1997; Chandler and Crisp 1998) have treated parts of *Daviesia*. Crisp (1985) dealt with conservation of the genus.

*Daviesia*: *D. acicularis* J.E. Smith (C–E), *D.* spp. (A–B). A, Fruits and valves with calyx ( $\times 2.9$ ); B, seeds ( $\times 5$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



Genus: *Isotropis* G. Bentham

Phylogenetic Number: 24.06.

Tribe: Mirbelieae.

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

Fruit a legume; unilocular;  $1.5-3 \times 0.35-0.7 \times 0.37$  cm; 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; falcate, oblong (linear), linear, or lanceolate; when asymmetrical with both sutures nearly straight; not inflated; terete; without or with beak; straight or declined; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned, oblique, or right-angled with longitudinal axis of fruit; 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; plain. Fruit wings absent. Fruit substipitate or 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; pubescent but soon deciduous; with 1 type of pubescence; tomentose or villous; with pubescence golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular or glandular; with glandular dots (black); without spines; not smooth; with elevated features; not veined; not tuberculate; shagreen; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds up to 11; length parallel with fruit length; overlapping and touching or neither overlapping nor touching; in 1 series. Funiculus measured; 1 mm long; of 1 length only; filiform; straight or curved. Aril dry; rim-aril; white.

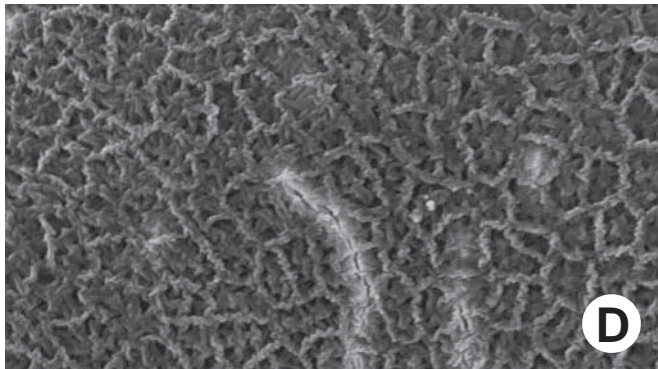
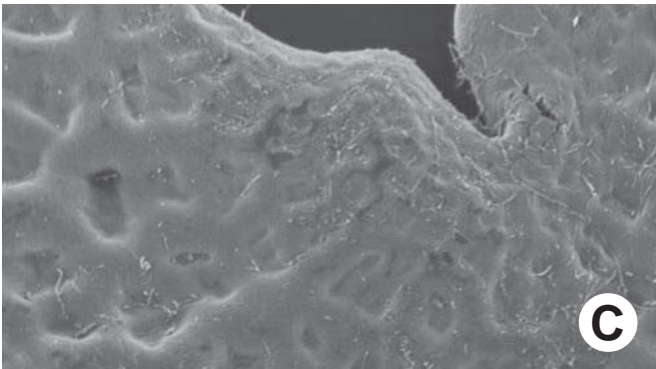
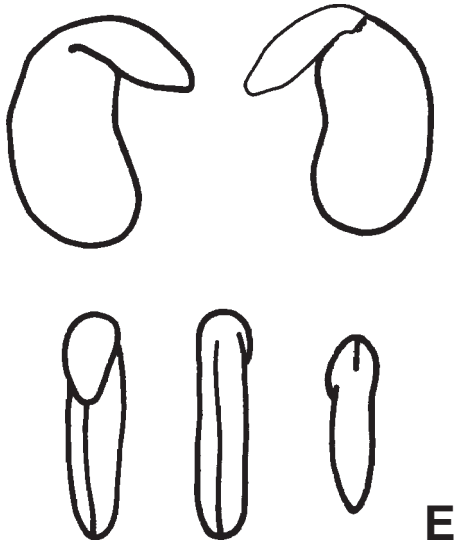
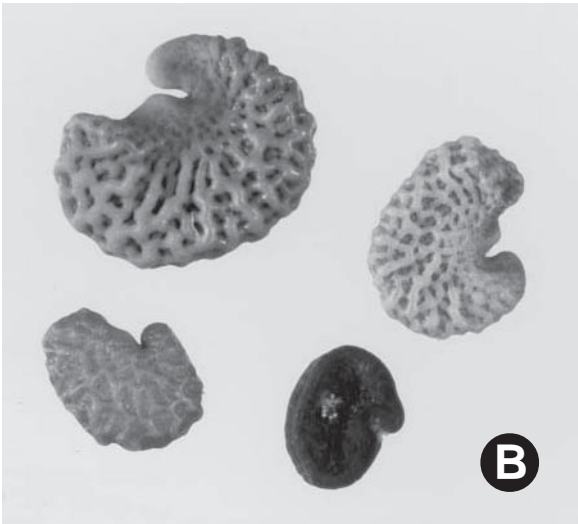
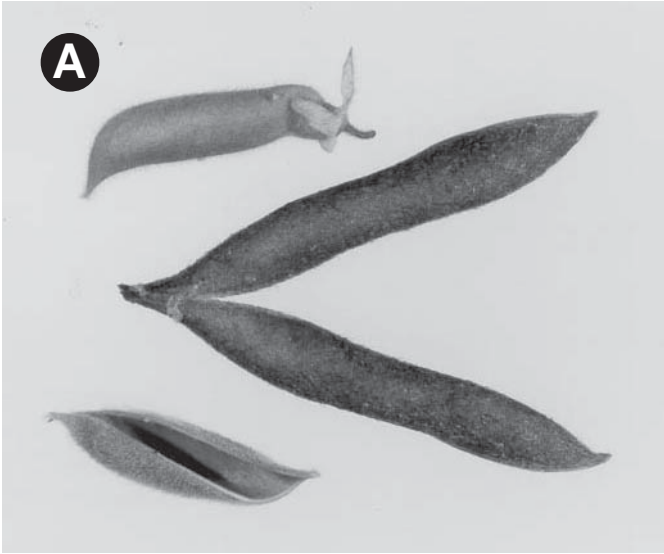
Seed  $2-3.75 \times 1.5-3 \times 0.8-1$  mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes same color as testa; with deep or shallow hilar sinus; without umbo on seed faces. Testa

not adhering to endocarp; dull; not modified by a bloom; clear; monochrome (though intertices may be darker than ridges); light to dark reddish brown or tan; glabrous; not smooth; with elevated features; reticulate; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially or fully concealed; concealed by radicle lobe or wing; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform; between cotyledon and radicle lobe; flush; within rim. Hilum rim color of testa. Lens discernible or not discernible; less than 0.5 mm in length; with margins curved; more or less circular; not in groove of raphe; confluent with hilum; mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thick; pluglike and resembling tip of radicle; covering entire embryo; adnate to testa or embryo. 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; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; green, brown (greenish), or tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; lobe tip straight, curved, or hooked; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

*Isotropis*: *I. wheeleri* G. Bentham (C-E), *I.* spp. (A-B). A, Fruits with and without calyx (closed and dehisced) and valves ( $\times 2.8$ ); B, seeds ( $\times 9.7$ ); C-D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).

D



Genus: *Jacksonia* R. Brown ex J.E. Smith

Phylogenetic Number: 24.08.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 10 spp.—ca. 50 spp.

Fruit a legume; unilocular;  $0.5-1 \times 0.3-4.5 \times 0.25-0.35$  cm; with persistent or deciduous calyx; with calyx shorter than or equal in length to fruit; without orifice formed by curving of fruit or fruit segments; straight or curved; not plicate; not twisted; symmetrical or asymmetrical; oblong, obovate, or ovate; when asymmetrical with 1 straight and 1 curved suture or both sutures nearly straight; widest near middle or D-shaped; not inflated; terete or compressed; without or with beak; straight; with solid beak the same color and texture as fruit; long tapered at apex; apex aligned or oblique with longitudinal axis of fruit; short tapered or long 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; plain. Fruit wings absent. Fruit substipitate to nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; reddish brown or tan (reddish); pubescent and indurate; with 1 type of pubescence; puberulent or tomentose; with pubescence gray or golden; 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 veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy; monochrome; reddish brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; overlapping and touching or neither overlapping nor touching; in 1 series. Funiculus measured; 0.7 mm long; of 1 length only; filiform; curved. Aril present or absent; dry; tongue-aril; reddish brown or white.

Seed  $2-3.5 \times 1-2.5 \times 0.5-1.5$  mm; not overgrown; not angular or angular; asymmetrical; oblong or reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus;

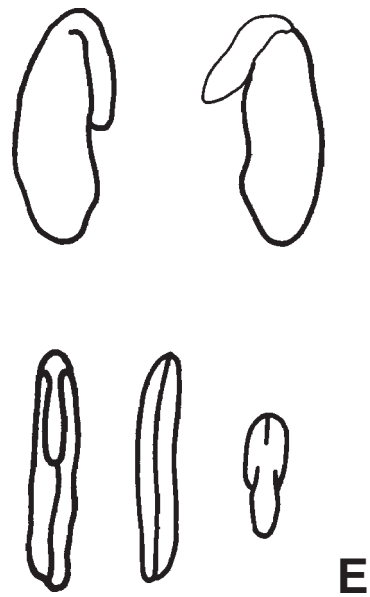
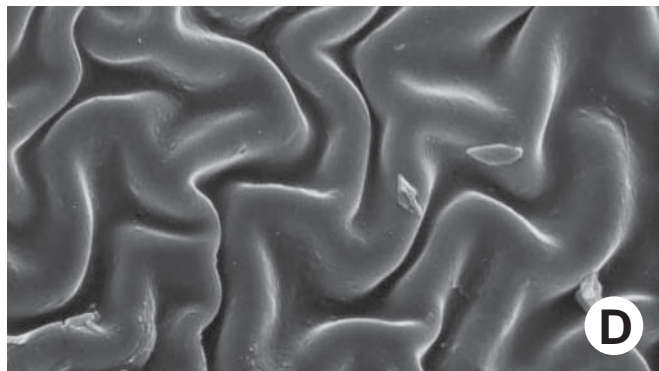
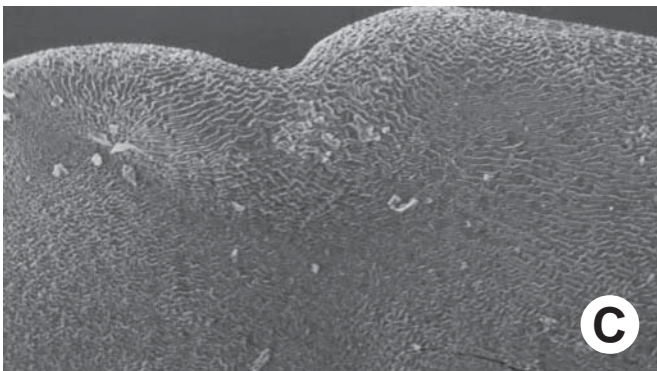
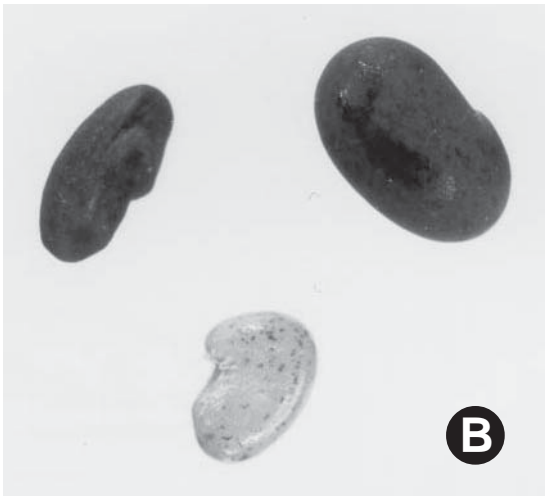
without umbo on seed faces. Cuticle wrinkled or not wrinkled. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled and streaked; reddish brown; with black overlay; glabrous; not smooth; with elevated features; wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by radicle lobe or wing; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; adjacent to hilum; 0.3 mm from hilum; mounded; same color as testa; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to testa or embryo. 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 or not concealing radicle; entire or split over radicle; without or with lobes; with lobes not touching; with the interface division terminating at base of radicle; without margins recessed; greenish tan or green; 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 or bulbous; lobe tip hooked; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

Notes: Crisp (1984) presented notes on *Jacksonia*.

*Jacksonia*: *J. ramosissima* G. Benth (C-E), *J. spp.* (A-B). A, Fruits with calyx and valve ( $\times 3.5$ ); B, seeds ( $\times 10$ ); C-D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).

0



Genus: *Oxylobium* H.C. Andrews

Phylogenetic Number: 24.09.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 13 spp.—ca. 15 spp.

Fruit a legume; unilocular;  $0.5\text{--}2 \times 0.3\text{--}0.8 \times 0.2\text{--}0.5$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved; not plicate; not twisted; asymmetrical or symmetrical; ovate or C-shaped; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed; without or 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; short tapered at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally invisible or visible (faintly). Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down (or apically only); passive. Replum invisible. Epicarp dull; monochrome; greenish brown, green, or black; pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; villous; with pubescence gray or golden; with pubescence uniformly distributed; with simple hairs; stiff or pliable; with hair bases plain; glandular; with glandular setae (short); without spines; not smooth; with elevated features; reticulately veined; not tuberculate; exfoliating in part, exfoliating, or not exfoliating; without cracks. Mesocarp thin; surface not veined; 1- or 2-layered; without balsamic vesicles; without or with fibers; solid; with fibers over solid layer; subligneous. Endocarp glossy; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–10; length parallel with or oblique to fruit length; neither overlapping nor touching or overlapping and touching; in 1 series. Funiculus measured;  $0.7\text{--}0.8$  mm long; of 1 length only; filiform; curved, S-curved, or straight. Aril dry; tongue-aril; reddish brown, tan (to reddish tan), or red.

Seed  $1\text{--}2.7 \times 1.2\text{--}2 \times 1.2\text{--}1.5$  mm; not overgrown; not angular or angular; asymmetrical; oblong, ovate, reniform, mitaform, triangular, or irregular; compressed; with surface smooth; with or without visible

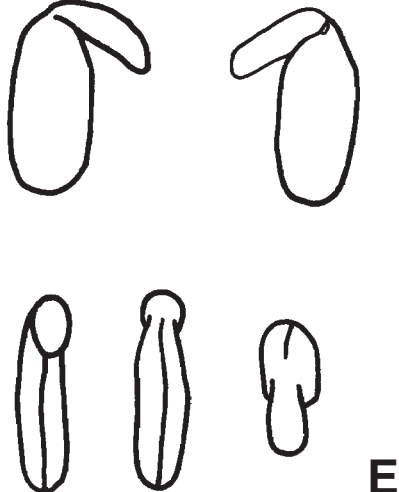
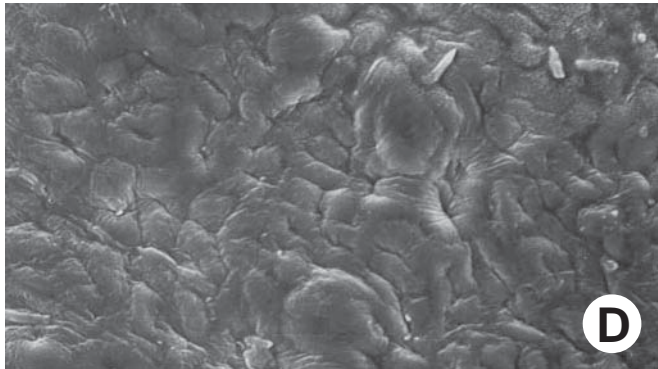
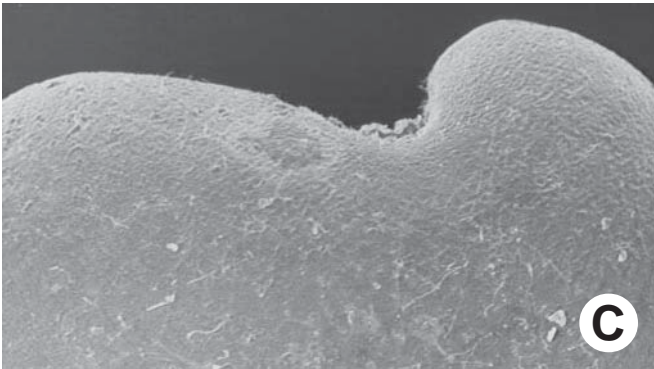
radicle and cotyledon lobes; without or with external groove between radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes same color as testa; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent mottles; with frequent streaks; brown to dark to light reddish brown or black; with brown (reddish), tan (reddish), or black 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 the same color as the rest of the hilum; larger than punctiform; 0.5 mm long; with curved outline; elliptic or oval; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim or within halo. Hilum halo color darker or lighter than testa. Lens not discernible or discernible (faintly); less than 0.5 mm or equal to or greater than 0.5 mm in length; up to 0.5 mm long; with margins curved; circular or elliptic; not in groove of raphe; adjacent to hilum; 0.3–0.5 mm from hilum; mounded; same or similar color as testa; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to embryo. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; tan to reddish tan or green; 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 length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

Notes: Crisp and Weston (1987) noted that “in its strictest sense, *Oxylobium* may include only *O. cordifolium* [H.C. Andrews] and *O. pultenaea*” A.-P. de Candolle. Lebler (1977) described the fruits and seeds of five species of *Oxylobium*, also known as shaggy-peas. The plants are poisonous to livestock.

*Oxylobium*: *O. robustum* J. Thompson (C–E), *O. spp.* (A–B). A, Fruits (dehiscid or closed) with or without calyx ( $\times 2.5$ ); B, seeds ( $\times 7$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 12$ ).

6





Genus: *Chorizema* J.J.H. de Labillardière

Phylogenetic Number: 24.10.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 21 spp.—25 spp.

Fruit a legume; unilocular;  $0.4\text{--}1.7 \times 0.3\text{--}0.8$  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; asymmetrical or symmetrical; ovate, obovate, or elliptic; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; terete or compressed; with beak; straight, declined, or hooked; with solid beak the same color and texture as fruit; short tapered or 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; coriaceous; seed chambers externally invisible or visible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit stipitate to substipitate to nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down (to somewhat down); passive. Replum invisible. Epicarp dull; monochrome; brown; glabrous or pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; subligneous. Endocarp glossy; monochrome; reddish brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds (number unknown, see Notes) length parallel with fruit length; in 1 series. Funiculus measured; 0.6 mm long; of 1 length only; filiform; curved. Aril dry; well developed rim-aril; reddish brown.

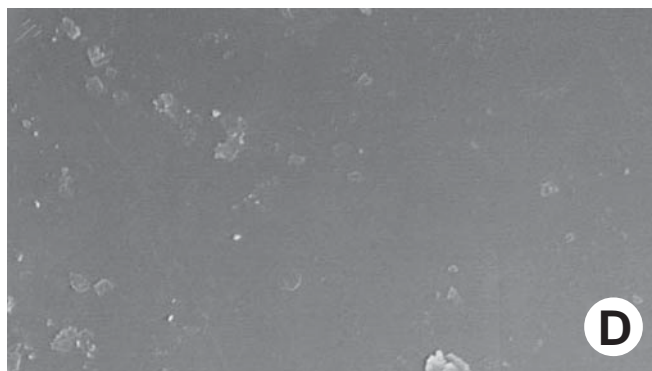
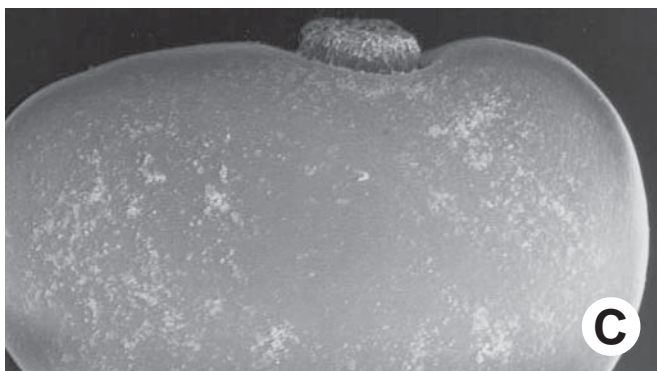
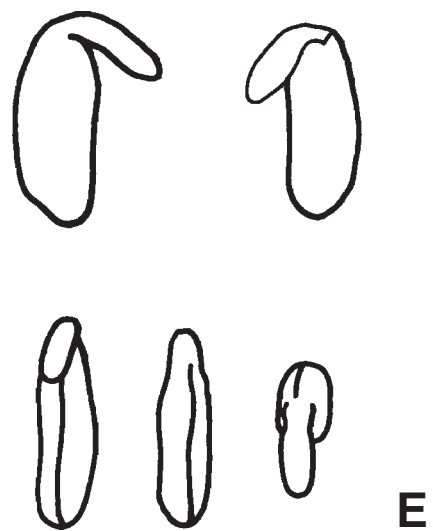
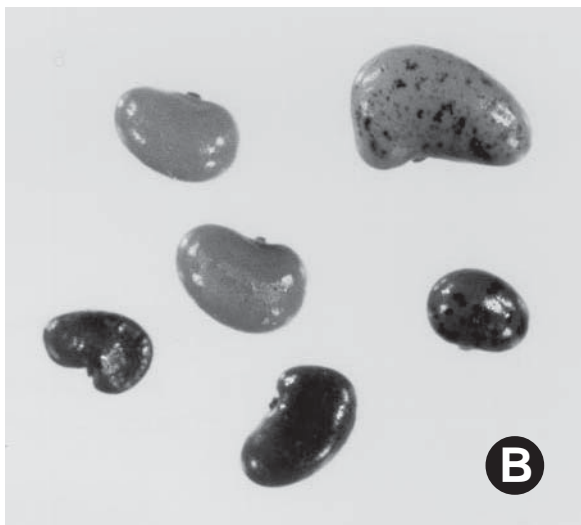
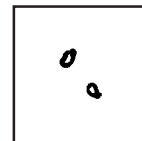
Seed  $1.5\text{--}3.5 \times 1\text{--}2 \times 1\text{--}1.3$  mm; not overgrown; not angular; asymmetrical; D-shaped, oblong, or reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified by a bloom;

colored; monochrome or mottled and streaked; with frequent mottles; with frequent streaks; brown to greenish to reddish brown, tan, or black; with black overlay; glabrous; smooth or not smooth; with elevated features; reticulate; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially or fully (nearly) 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; up to 0.5 mm long; with curved outline; oval; marginal according to radicle tip or between cotyledon and radicle lobe; recessed; within rim. Hilum rim color of testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.5 mm long; with margins straight; linear; not in groove of raphe; adjacent to hilum; 0.3 mm from hilum; flush; similar color as testa; darker than testa; reddish brown; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to embryo or testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or orange; 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 length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Western Australia.

Notes: Taylor and Crisp (1992) revised *Chorizema*, and our species count agrees with theirs. All fruiting material available to us was dehiscent, therefore we were unable to determine the number of seeds per fruit. Taylor and Crisp did not report the number of seeds per fruit, but they did report that the ovaries had 8–30 ovules and that *C. retrorsum* J.M. Taylor & M.D. Crisp had as many as 35 ovules per ovary.

*Chorizema*: *C. ilicifolium* J.J.H. de Labillardière (C–E), *C.* spp. (A–B). A, Fruits (dehiscent) with and without calyx ( $\times 5.3$ ); B, seeds ( $\times 9.2$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



Genus: *Mirbelia* J.E. Smith

Phylogenetic Number: 24.11.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 8 spp.—15–30 spp.

Fruit a legume; unilocular;  $0.8\text{--}2 \times 0.3\text{--}1 \times 0.25\text{--}0.5$  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; ovate or didymous; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; short tapered or rounded at apex; apex aligned 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; coriaceous; seed chambers externally invisible or visible. Fruit margin not constricted or constricted; constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down or basal and up; passive. Replum invisible. Epicarp dull; monochrome; black, brown (reddish), or tan; glabrous or pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; puberulent; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined or veined; reticulately veined and transversely veined relative to fruit length; not tuberculate; wrinkled and shagreen; not exfoliating or exfoliating; without cracks. Mesocarp thin; surface not veined; 1- or 2-layered; without balsamic vesicles; with fibers present or without fibers; solid; with fibers over solid layer; coriaceous. Endocarp dull or glossy; monochrome; reddish tan; smooth; with hairs restricted to sutures (some with hairs especially along funicular suture); nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 2 mm long; of 1 length only; flattened; straight or curved. Aril dry; rim-aril; reddish brown, red, or black.

Seed  $1.5\text{--}3 \times 1\text{--}2.2 \times 0.5\text{--}1.2$  mm; not overgrown; not angular or angular; asymmetrical; mitaform, oblong, reniform, rhombic, D-shaped, or irregular; compressed or mounded on 1 side and straight on other side (shape of valve with intruded lower suture); with surface

smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull or glossy; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent mottles; with frequent streaks; light reddish to dark reddish brown or black; with purple overlay; glabrous; smooth or not smooth; with elevated features; wrinkled and shagreen; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by funicular remnant, radicle lobe, or wing; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform or larger than punctiform; up to 0.5 mm long; with curved or angular outline; circular or triangular; marginal according to radicle tip or between cotyledon and radicle lobe; recessed; not within corona, halo, or rim or within halo. Hilum halo color (reddish-brown) lighter than testa or of testa. Lens not discernible or discernible (on light-colored seeds); less than 0.5 mm or equal to or greater than 0.5 mm in length; up to 0.5 mm long; with margins straight or curved; linear or irregular; not in groove of raphe; adjacent to or confluent with hilum; 0.2 mm from hilum; flush; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to testa or embryo. 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 or not concealing radicle; entire or split over radicle; without or with lobes; with lobes not touching; with the interface division terminating at base of radicle; without margins recessed; tan, brown (reddish), or yellow; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; lobe tip curved; deflexed and parallel to cotyledon width; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

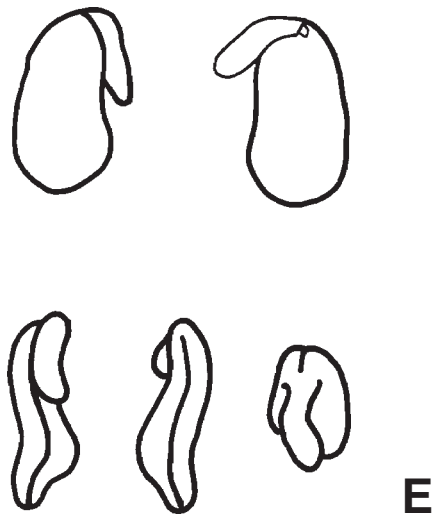
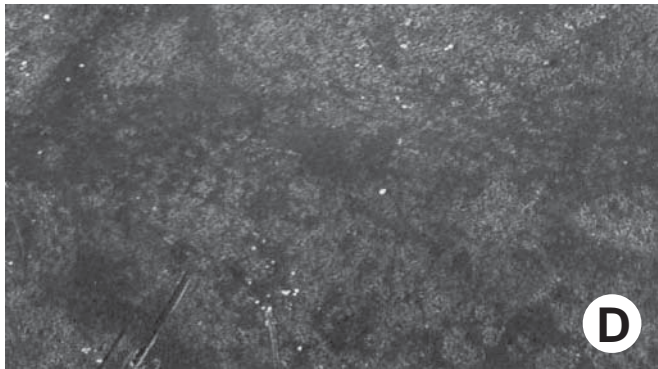
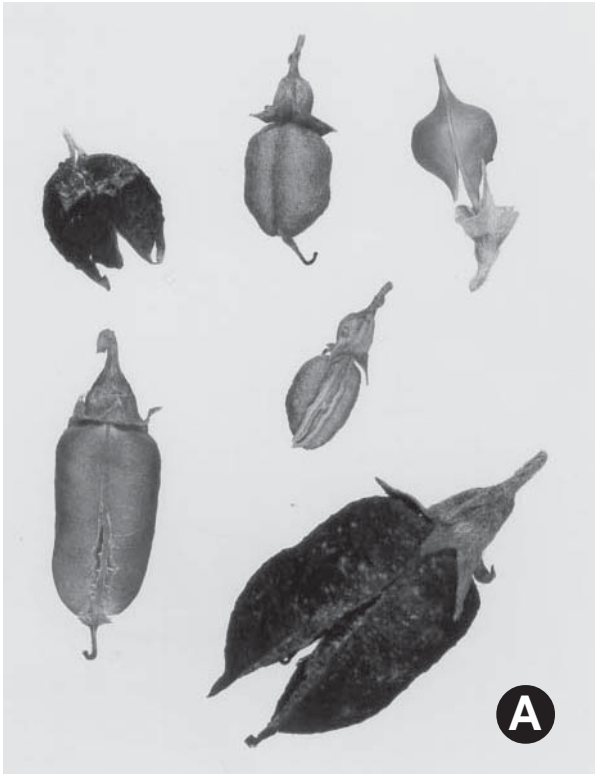
Distribution: Australia.

Notes: Crisp and Weston (1987) noted that its circumscription needs further study, especially in relation to *Chorizema* (24.10) and elements of *Oxylobium* (24.09). They (Crisp and Weston 1995) have carried out further cladistic studies and resurrected *Podolobium* R. Brown (24.14) with six species that were accepted by Wiecek (1991) as the first six species of *Oxylobium*. Pending

further evaluation by the botanical community, we have left those species in *Oxylobium*. The fruit has a spurious septum intruding from the lower suture.

*Mirbelia*: *M. grandiflora* W. Aiton (C–E), *M. spp.* (A–B). A, Fruits with calyx (closed and dehisced) ( $\times 3.2$ ); B, seeds ( $\times 10.6$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).

6



Genus: *Callistachys* É.P. Ventenat

Phylogenetic Number: 24.12.

Tribe: Mirbelieae.

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

Fruit a legume; unilocular;  $1.5-2 \times 0.5-0.6 \times 0.4-0.45$  cm; with persistent or deciduous (rarely) calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; oblong; when asymmetrical with both sutures nearly straight; not inflated; terete; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base 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 wings absent. Fruit substipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; dark reddish brown; pubescent and indurate; with 1 type of pubescence; villous; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; obliquely veined relative to fruit length; not tuberculate; ribbed; exfoliating (especially with age over and around ribs); without cracks. Mesocarp thick; surface uniformly veined; 2-layered; without balsamic vesicles; without fibers; with veins over solid layer; ligneous. Endocarp dull; monochrome; tan; scurfy or smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 7; length transverse to fruit length; overlapping or touching; in 1 series. Funiculus measured; 7–15 mm long; of 1 length only; flattened; curved. Aril dry; rim-aril; tan.

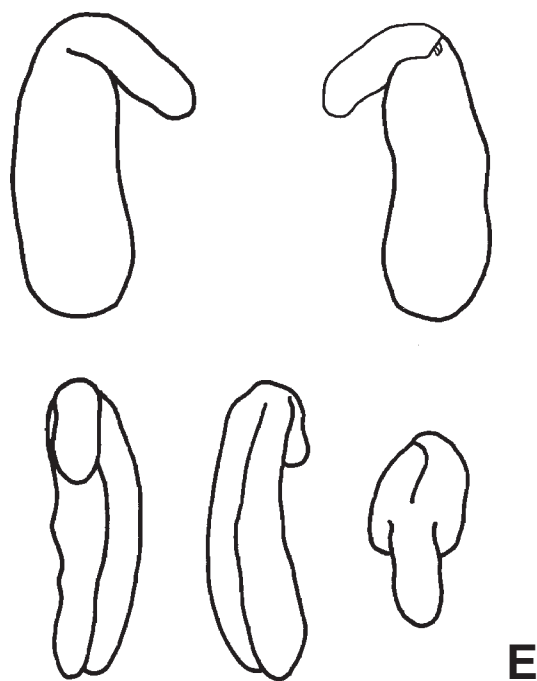
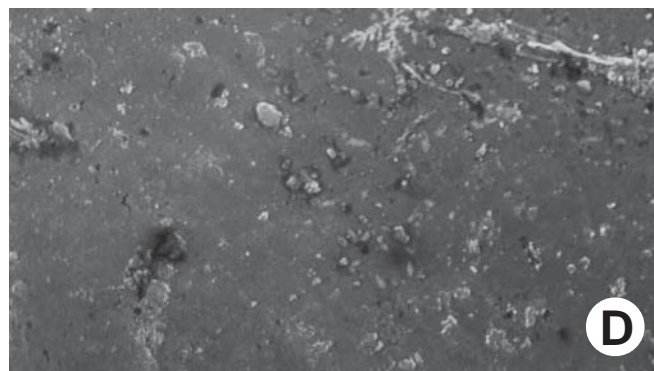
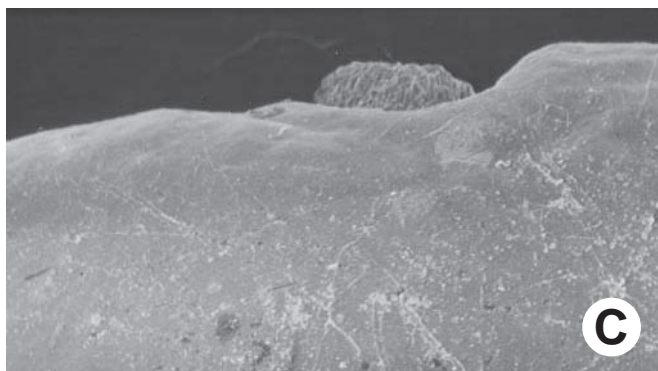
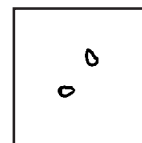
Seed  $2-2.5 \times 1.2-1.5 \times 1-1.2$  mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes same color as testa; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled and streaked; with frequent mottles; with frequent streaks; dark reddish brown; with brown (darker reddish) 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 the same color as the rest of the hilum; larger than punctiform; 0.4 mm long; with curved outline; circular; between cotyledon and radicle lobe; recessed; within halo. Hilum halo color lighter than testa. Lens not discernible or discernible (faintly); less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; adjacent to hilum; 0.3–0.4 mm from hilum; mounded or flush; similar color as testa; darker than testa; darker reddish brown; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to embryo. 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; split over radicle; with 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 length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern Australia.

Notes: *Callistachys*, a segregate of *Oxylobium* (24.09), was recognized by Crisp and Weston (1987) but not by Polhill (1981m).

*Callistachys*: *C. lanceolata* É.P. Ventenat (A–E). A, Fruits with calyx ( $\times 2.9$ ); B, seeds ( $\times 9.7$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 20$ ).





Genus: *Gastrolobium* R. Brown

Phylogenetic Number: 24.13.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 10 spp.—ca. 50 spp.

Fruit a legume; unilocular;  $0.7\text{--}2 \times 0.3\text{--}0.7 \times 0.2\text{--}0.65$  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; ovate or circular; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; terete; without beak; rounded at apex; apex aligned with longitudinal axis of fruit; 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; plain. Fruit wings absent. Fruit stipitate to substipitate; with the stipe up to 9 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; reddish brown; with purple overlay; glabrous, pubescent and indurate, or glabrate; with hairs erect or appressed; with 1 type of pubescence; villous; with pubescence gray; 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 thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; tan; smooth or scurfy; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; up to 2 mm long; thick; straight or curved (near apex). Aril present or absent; fleshy (to somewhat dry, but better developed than rim-aril); topknotlike or marginal hilar; covering 1/2 to nearly all of seed; reddish tan or cream.

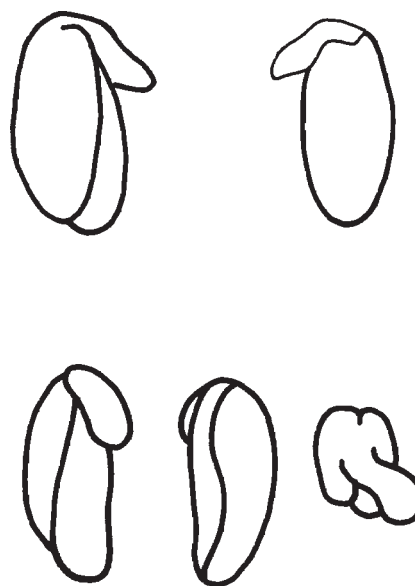
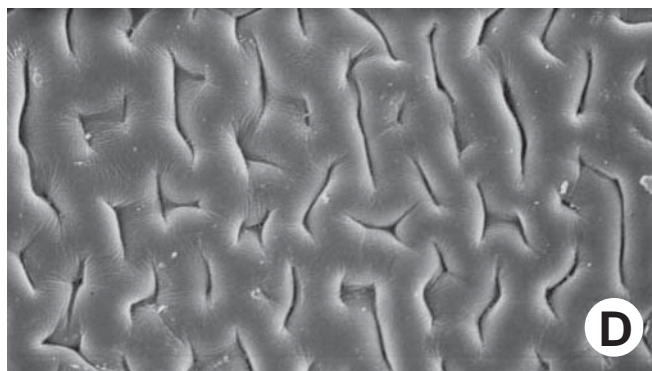
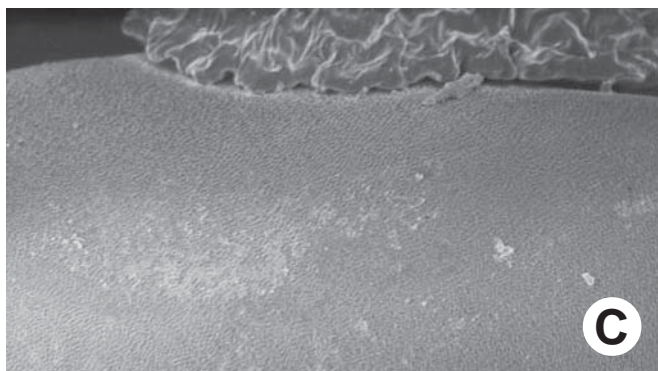
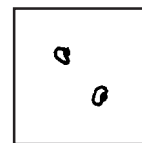
Seed  $1.7\text{--}5 \times 1.3\text{--}3 \times 1\text{--}2.3$  mm; not overgrown; angular or not angular; asymmetrical or symmetrical; mitaform, oblong, reniform, or circular; compressed; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome or mottled;

with frequent mottles; reddish brown or black; with purple overlay; glabrous; smooth; coriaceous. 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; 1 mm long; with curved outline; oval; marginal according to radicle tip; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight or curved; circular or oblong; not in groove of raphe; confluent with or adjacent to hilum; up to 0.2 mm from hilum; mounded or flush; similar color as testa; 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; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; tan or brown (reddish); 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; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

Notes: Crisp and Weston (1987) included the *Oxylobium parviflorum* J. Lindley group in *Gastrolobium*.

*Gastrolobium*: *G. bilobum* R. Brown (C–E), *G.* spp. (A–B). A, Fruits (dehiscid and closed) with and without calyx ( $\times 2.9$ ); B, seeds ( $\times 6$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



Genus: *Nemcia* K. Domin

Phylogenetic Number: 24.15.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 9 spp.—28 spp.

Fruit a legume; unilocular;  $0.8\text{--}1.5 \times 0.3\text{--}0.5 \times 0.2\text{--}0.4$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; ovate or oblong; when asymmetrical with 1 straight and 1 curved suture, both sutures unequally curved, or both sutures parallelly curved; widest near middle or D-shaped; not inflated; terete; with or without beak; straight or declined; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned 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 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 (at least 1/2 way); passive. Replum invisible. Epicarp dull; monochrome; dark to light reddish brown; pubescent and indurate; with 1 type of pubescence; villous; with pubescence golden or gray; 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 thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy; monochrome; pale tan; smooth or reticulate; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; 1 mm long; thick; curved. Aril fleshy or dry; when fleshy topknotlike; covering less than 1/2 of seed; when dry rim-aril; reddish brown.

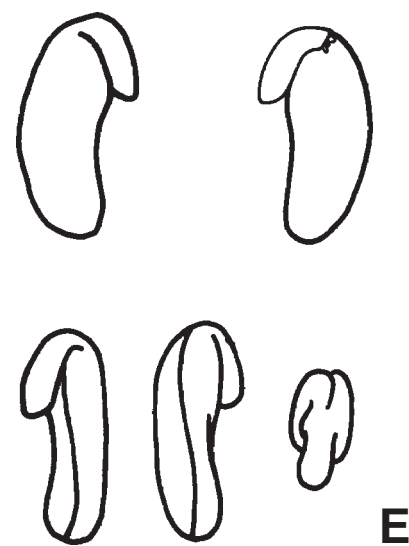
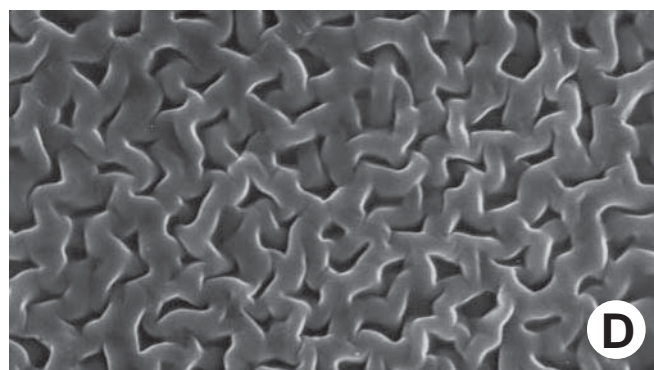
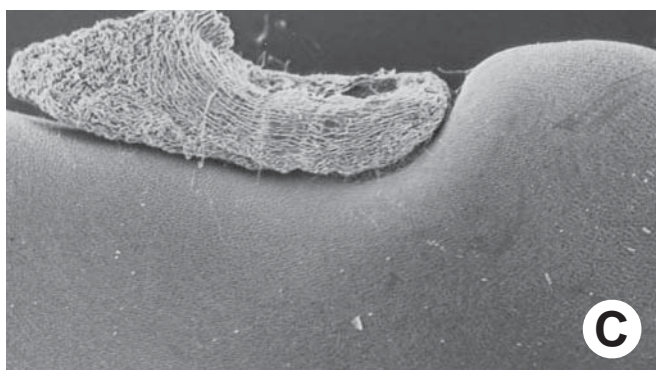
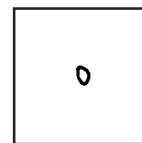
Seed  $2.3\text{--}3 \times 1.5\text{--}1.8 \times 1\text{--}1.5$  mm; not overgrown; not angular; asymmetrical; oblong, reniform, or D-shaped; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent mottles; with frequent streaks; reddish brown; with

brown overlay; glabrous; smooth; coriaceous. 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; 0.7 mm long; with straight outline; oblong; marginal according to radicle tip; recessed; not within corona, halo, or rim. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.5 mm long; with margins straight or curved; oblong; not in groove of raphe; confluent with hilum; barely mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa or embryo. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; reddish 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 or bulbous; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern Australia.

Notes: Crisp and Weston (1987) emended the generic circumscription to include series *Axillares* of *Gastrolobium* (24.13).

*Nemcia*: *N. dilatata* (G. Benth) M.D. Crisp (*C–E*), *N.* spp. (*A–B*). *A*, Fruits (dehiscent and closed) with and without calyx ( $\times 4.8$ ); *B*, seeds ( $\times 10.1$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 10$ ).



Genus: *Brachysema* R. Brown

Phylogenetic Number: 24.16.

Tribe: Mirbelieae.

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

Fruit a legume; unilocular;  $1-2.5 \times 0.5-1 \times 0.5-0.6$  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; oblong; not inflated; terete; without beak; tapered to short tapered at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate to nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome or multicolored; mottled (faintly in some species); reddish brown or tan; with gray overlay; pubescent and indurate; with 1 type of pubescence; tomentose; with pubescence gray; with pubescence uniformly distributed (or restricted to sutures); with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; shagreen or wrinkled; exfoliating in part; with or without cracks; cracking transverse to fruit length. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; ligneous. Endocarp dull; monochrome; reddish tan; transversely wrinkled; nonseptate; ligneous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 7; length parallel with fruit length; overlapping and touching; in 1 series. Funiculus measured; 1 mm long; of 1 length only; thick; straight or curved (slightly). Aril fleshy; cupshaped; covering less than 1/2 of seed; reddish brown or tan.

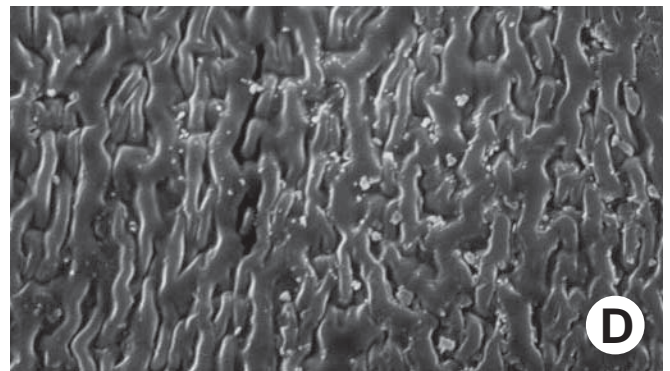
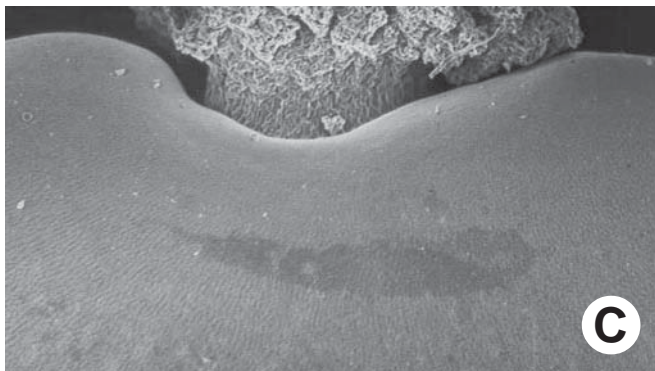
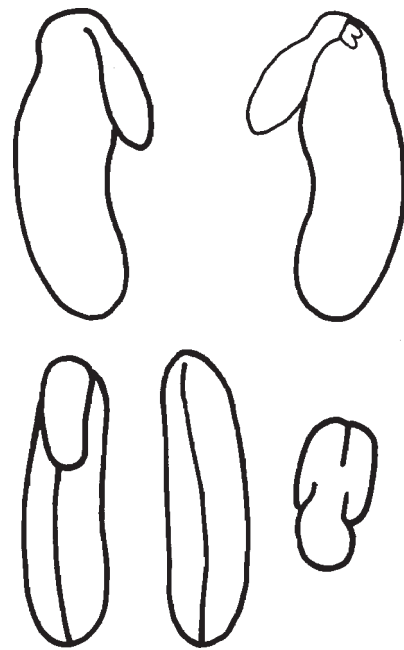
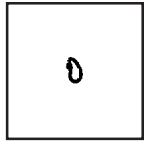
Seed  $2-3.1 \times 1.5-2 \times 1-1.5$  mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; black or brown (reddish); glabrous; smooth or not smooth; with recessed features; punctate; coriaceous. 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; 1 mm long; with curved outline; oval; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim or within halo. Hilum halo nearly color of testa. Lens discernible or not discernible; less than 0.5 mm to equal to or greater than 0.5 mm in length; up to 0.7 mm long; with margins curved; key-hole shaped; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; dark reddish brown; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to embryo. 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; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear or bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

Distribution: Australia.

Notes: *Brachysema* is "under revision by M.D. Crisp" (Crisp and Weston 1987), but Crisp and Weston (1987) did not recognize *Cupulanthus* J. Hutchinson (old phylogenetic number 25.03). *Cupulanthus bracteolus* (F.H.J. von Mueller) J. Hutchinson now is *B. bracteolus* F.H.J. von Mueller.

*Brachysema*: *B. lanceolata* C.D.F. Meissner (C-E), *B.* spp. (A-B). A, Fruits (dehiscent and closed) with and without calyx ( $\times 2.1$ ); B, seeds ( $\times 9.6$ ); C-D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 13.3$ ).



Genus: *Latrobea* C.D.F. Meissner

Phylogenetic Number: 24.18.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 2 spp.—7 spp.

Fruit a legume; unilocular;  $0.7-1 \times 0.2-0.55 \times 0.15-0.2$  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; ovate or falcate; 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; tapered or short tapered at apex; apex aligned or oblique with longitudinal axis of fruit; tapered or 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; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; reddish brown, tan (to greenish tan), purple, or green; with purple overlay; pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; villous; with pubescence golden or gray; 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 thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; vitreous (fractured); coriaceous. Endocarp dull; monochrome or mottled (somewhat because of darker mesocarp layer); grayish brown or gray; with brown (reddish) overlay; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5 mm long; of 1 length only; filiform; straight. Aril fleshy; cupshaped; covering less than 1/2 of seed; tan.

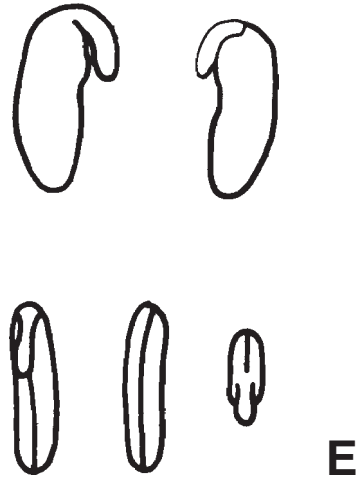
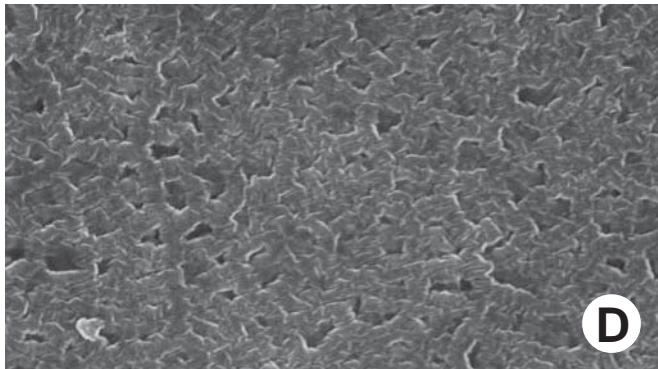
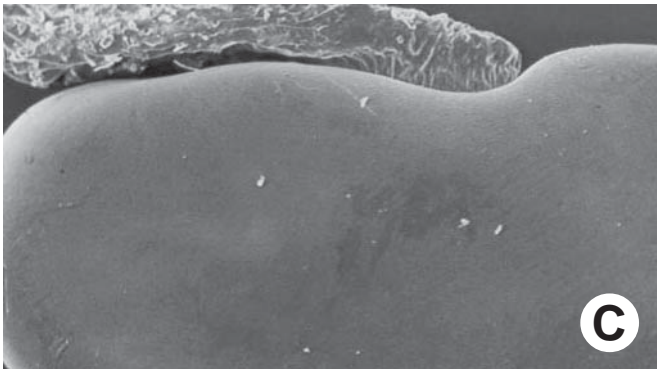
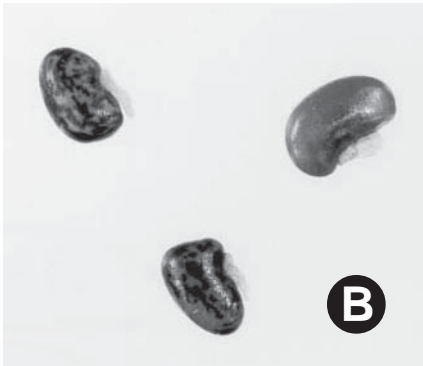
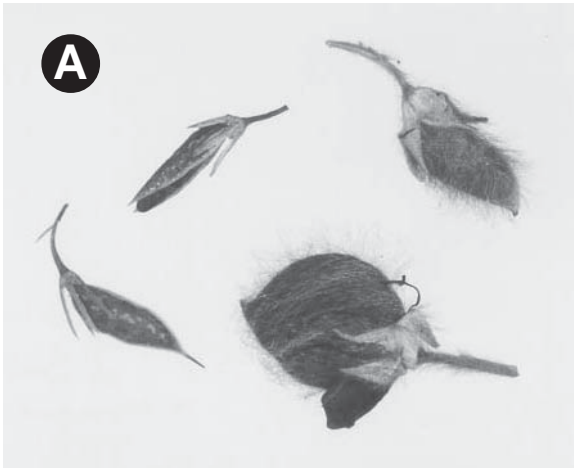
Seed  $2 \times 1.2 \times 0.8$  mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by

a bloom; colored; monochrome; dark reddish brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform; between cotyledon and radicle lobe; somewhat recessed; within rim. Hilum rim color of testa. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; adjacent to hilum; 0.5 mm from hilum; mounded; same color as testa; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; reddish brown; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern Australia.

*Latrobea*: *L. tenella* G. Bentham (C–E), *L. spp.* (A–B). A, Fruits with calyx ( $\times 2.8$ ); B, seeds ( $\times 10$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).

0





Genus: *Phyllota* (A.-P. de Candolle) G. Bentham

Phylogenetic Number: 24.19.

Tribe: Mirbelieae.

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

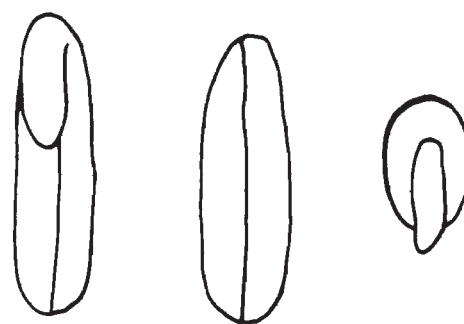
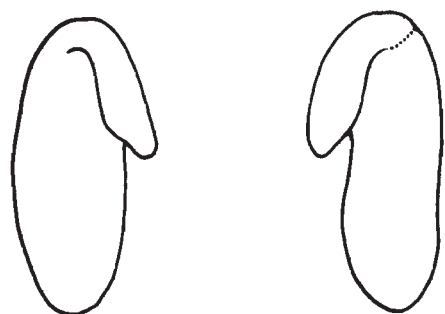
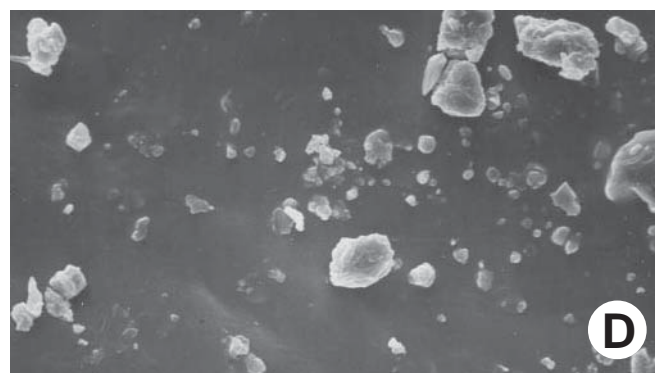
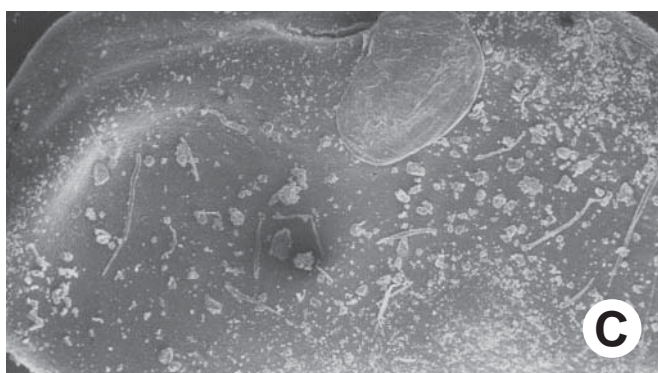
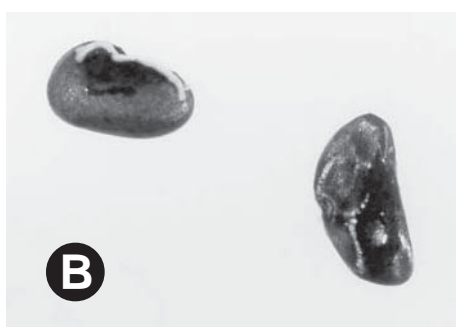
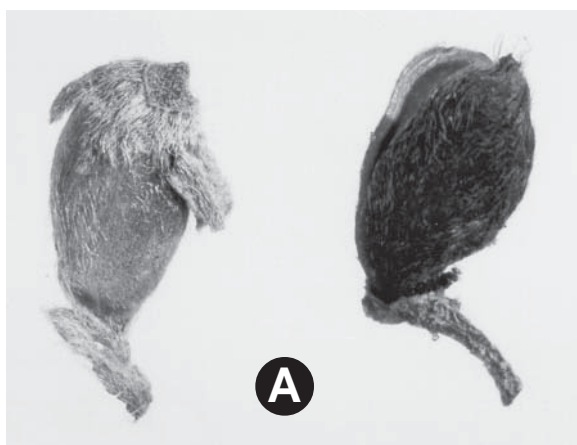
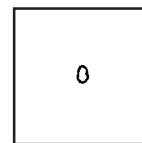
Fruit a legume; unilocular;  $0.45\text{--}0.5 \times 0.25\text{--}0.3 \times 0.15\text{--}0.2$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; obovate or ovate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; without beak; short tapered at apex; apex aligned or oblique with longitudinal axis of fruit (slightly); rounded 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 nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive or active; with valves enrolling. Replum invisible. Epicarp dull; monochrome; reddish brown or tan; pubescent and indurate; with hairs appressed or erect; with 1 type of pubescence; tomentose; with pubescence golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined or veined; reticulately veined; not tuberculate; shagreen; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy; monochrome; reddish brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril absent.

Seed  $2.3\text{--}4 \times 1.5\text{--}2 \times 1.2\text{--}1.5$  mm; not overgrown; not angular or angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Cuticle inflated; inflated around hilum. Testa not adhering to endocarp; dull; not modified by a bloom; colored; mottled and streaked; with frequent mottles; with frequent streaks; reddish brown; with black overlay; glabrous; smooth; coria-

ceous. 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; between cotyledon and radicle lobe; recessed; within halo. Hilum halo color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.8–1 mm long; with margins straight or curved; oblong or linear; not in groove of raphe; confluent with hilum; mounded; dissimilar color from testa; darker than testa; reddish 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; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; green; 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 bulbous; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

*Phyllota*: *P. pleurandroides* F.H.J. von Mueller (A–E). A, Fruits with calyx ( $\times 8.7$ ); B, seeds ( $\times 9.5$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 20$ ).



E

Genus: *Euchilopsis* F.H.J. von Mueller

Phylogenetic Number: 24.20.

Tribe: Mirbelieae.

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

Fruit a legume; unilocular;  $0.9-1 \times 0.5-0.6 \times 0.35-0.45$  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 or symmetrical; ovate; when asymmetrical with both sutures parallelly curved; not inflated; terete; without beak; rounded at apex; apex aligned or oblique (slightly) with longitudinal axis of fruit; short tapered or rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate; with the stipe 2.5–3 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; reddish brown; pubescent but soon deciduous; with 1 type of pubescence; villous; with pubescence pale 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; pitted; not exfoliating; without cracks. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with vitreous layer over solid layer (vitreous layer beadlike); ligneous (or subligneous). Endocarp glossy; monochrome; reddish brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching or overlapping and touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick or triangular; straight. Aril absent.

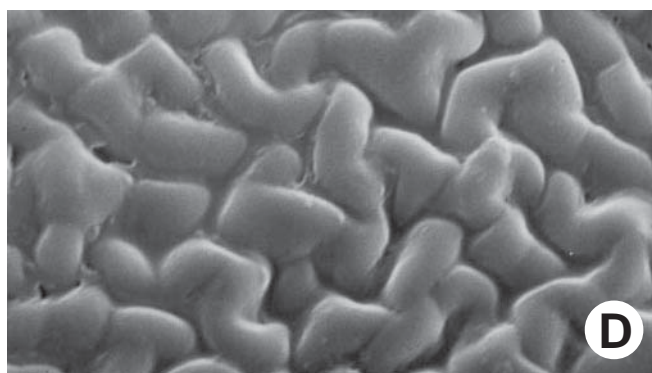
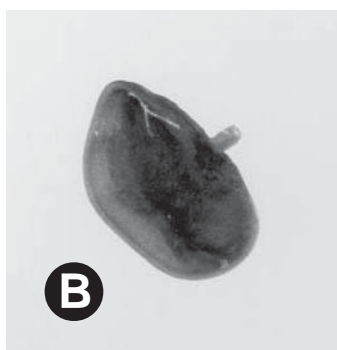
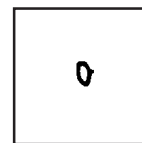
Seed  $4 \times 2.3 \times 1$  mm; not overgrown; not angular; asymmetrical; D-shaped or rectangular; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown; glabrous; smooth; coriaceous. 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 straight outline; oblong; between cotyledon and radicle lobe; flush; within rim, corona, and halo. Hilum corona color (brown) darker than testa. Hilum halo color (reddish-brown) lighter than testa. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 1 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; darker reddish brown; not within corona, halo, or rim. Endosperm thin; 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; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; green; 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; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern Australia.

Notes: Unfortunately, we were able to study only three fruit samples, each with minimal material, and only one seed.

*Euchilopsis*: *E. linearis* (G. Benth) F.H.J. von Mueller (A–E). A, Fruits and valve ( $\times 5.7$ ); B, seed ( $\times 10$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ).



Genus: *Aotus* J.E. Smith

Phylogenetic Number: 24.21.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 8 spp.—16–18 spp.

Fruit a legume; unilocular;  $0.5\text{--}0.6 \times 0.4\text{--}0.45 \times 0.3\text{--}0.45$  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; more or less circular; when asymmetrical with both sutures parallelly curved; not inflated; terete; without beak; rounded at apex; apex oblique or aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished. Fruit wings absent. Fruit stipitate or substipitate; with the stipe up to 15 mm long. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; dark reddish brown; pubescent and indurate; with 1 type of pubescence; villous; with pubescence golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular; with glandular dots; without spines; not smooth; with elevated features; not veined; not tuberculate; shagreen and subvesicular; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; ligneous. Endocarp glossy; monochrome or mottled; dark reddish brown; with mottling (dark); with brown (reddish) overlay; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching or overlapping and touching; in 1 series. Funiculus measured or less than 0.5 mm long; up to 0.5 mm long; of 1 length only; thick; straight. Aril present or absent; dry; rim-aril; white.

Seed  $2.2\text{--}3 \times 1.7\text{--}3 \times 1\text{--}2$  mm; not overgrown; not angular or angular (somewhat); asymmetrical; D-shaped or oblong (more or less); compressed; with surface smooth; with visible radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes the same color as testa; without hilar sinus; without umbo on seed faces. Testa not adhering to

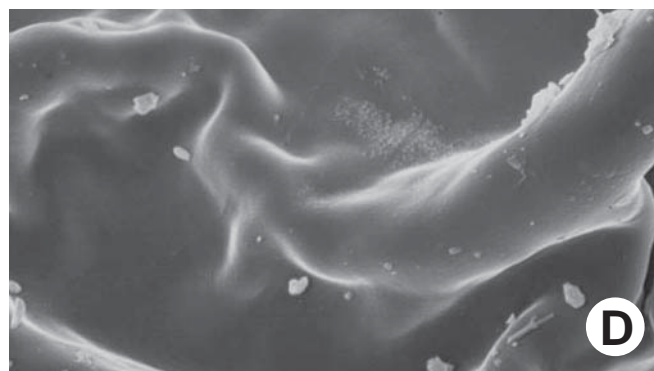
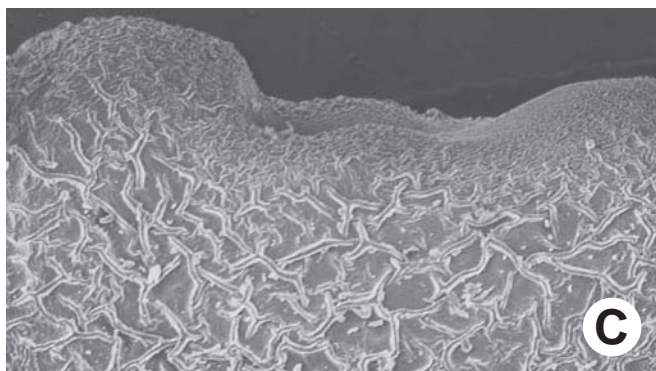
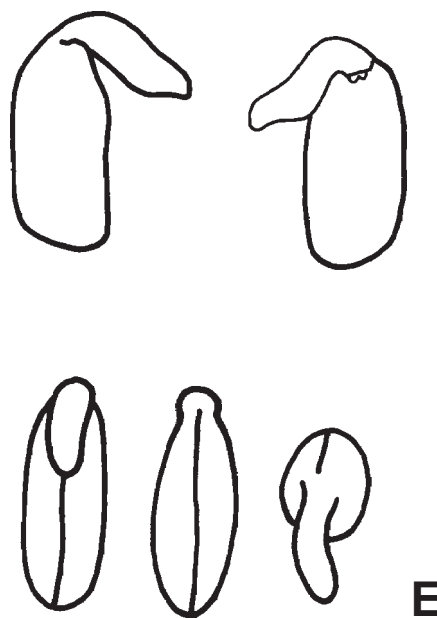
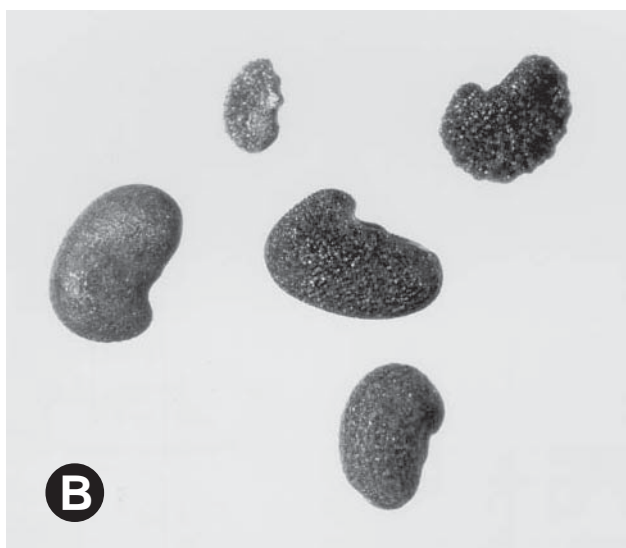
endocarp; dull; not modified by a bloom; colored; monochrome (cuticle may be raised, causing silver patches); dark to light reddish brown or black; glabrous; not smooth; with elevated features; reticulate or reticulate and shagreen; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or partially concealed; concealed by funicular remnant, radicle lobe, or wing; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform to larger than punctiform; up to 0.5 mm long; with curved outline; elliptic; marginal according to radicle tip or between cotyledon and radicle lobe; recessed; not within corona, halo, or rim or within halo. Hilum halo color lighter than testa. Lens discernible or not discernible; less than 0.5 mm long or equal to or greater than 0.5 mm; up to 0.5 mm long; with margins straight or curved; triangular or more or less circular; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; black (ish); not within corona, halo, or rim. Endosperm thick (reflecting testa reticulation); covering entire embryo; adnate to testa or embryo. 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; split over radicle; with 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 deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbous; lobe tip straight or hooked; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

Notes: The thick cuticle on the testa exfoliates during soaking of the seed.

*Aotus*: *A. ericoides* (É.P. Ventenat) G. Don (*C–E*), *A.* spp. (*A–B*). *A*, Fruits (closed and dehisced) with calyx ( $\times 3.5$ ); *B*, seeds ( $\times 9.8$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 10$ ).

0°



Genus: *Urodon* P.K.N.S. Turczaninow

Phylogenetic Number: 24.22.

Tribe: Mirbelieae.

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

Fruit a legume; unilocular;  $0.6\text{--}0.7 \times 0.3\text{--}0.35 \times 0.14\text{--}0.16$  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; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; compressed; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; membranous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along suture. Dehiscence of valves along 1 suture; apical and down; active; with valves revolute. Replum invisible. Epicarp dull; monochrome; dark reddish brown; pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence gray; with pubescence uniformly distributed; with simple hairs; stiff; with hair bases plain; eglandular; without spines; with elevated features; faintly, transversely veined relative to fruit length; not tuberculate; not exfoliating; without cracks. Mesocarp absent. Endocarp dull; monochrome; grayish brown or gray; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching or overlapping and touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril fleshy; topknotlike; fimbriate; covering less than 1/2 of seed; reddish brown.

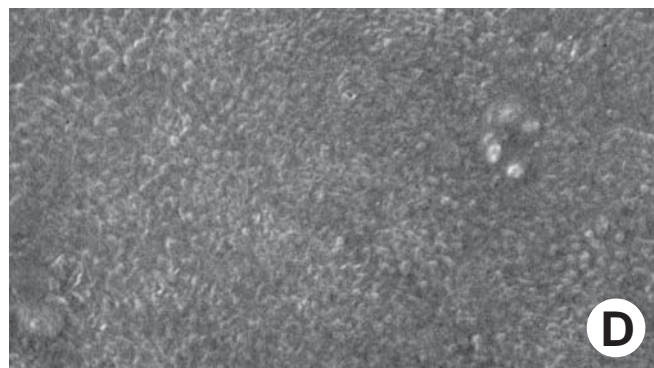
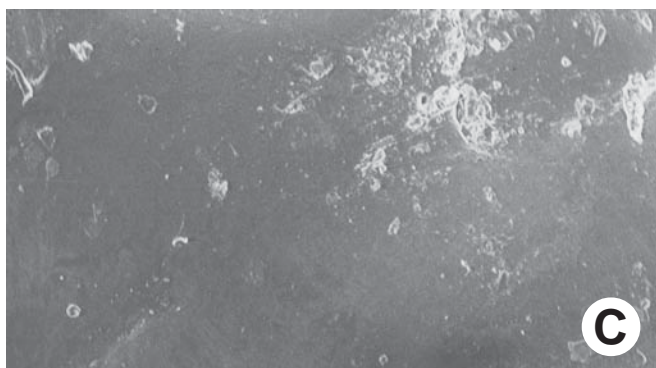
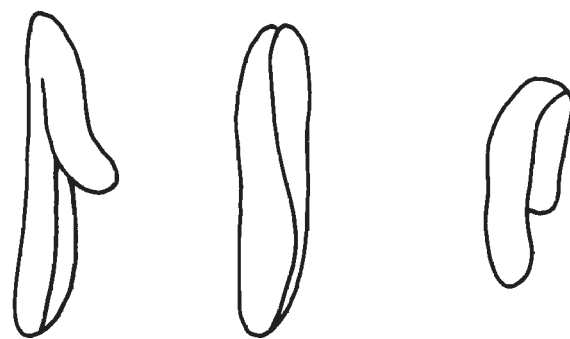
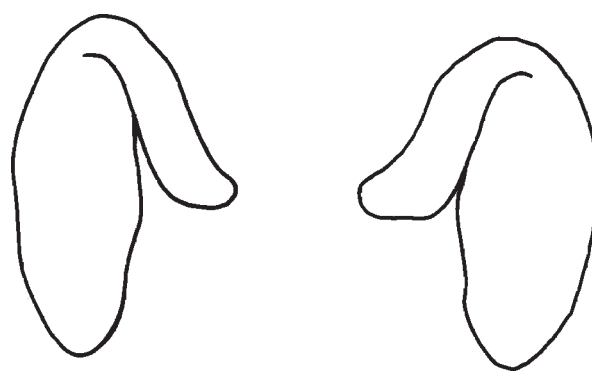
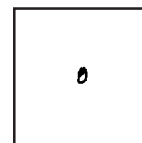
Seed  $2.7 \times 1.6 \times 0.8$  mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; dark reddish brown; glabrous; smooth or not smooth (occasionally); with recessed features; occasionally pitted with small separate pits; coriaceous. 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 mm long; with curved outline; elliptic; subapical to radicle tip; recessed; not within corona, halo, or rim or within rim (slight). Hilum rim color of testa. Lens discernible; less than 0.5 mm in length; with margins curved; circular; not in groove of raphe; adjacent to hilum; 0.3 mm from hilum; mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with 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; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern Australia.

Notes: Crisp and Weston (1987) resurrected *Urodon*. This genus has three described species, but they were uncertain whether these species were truly separate or were instead one variable species.

*Urodon*: *U. capitatus* P.K.N.S. Turczaninow (A–E). A, Fruits with calyx (closed and dehiscent) ( $\times 6$ ); B, seeds ( $\times 13$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 20$ ).





Genus: *Pultenaea* J.E. Smith

Phylogenetic Number: 24.23.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 14 spp.—ca. 150 spp.

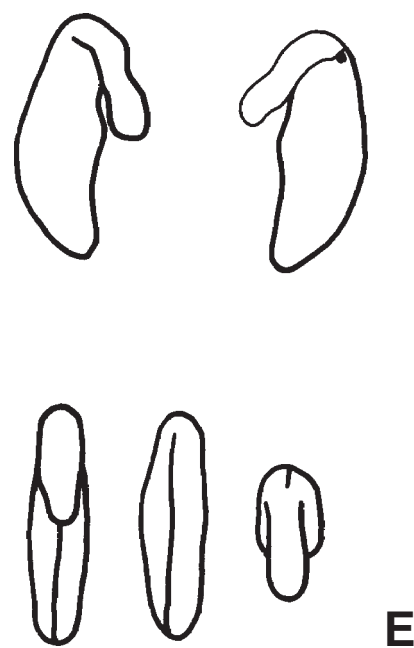
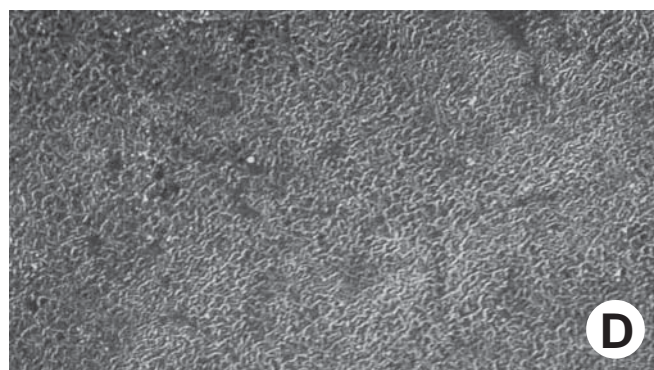
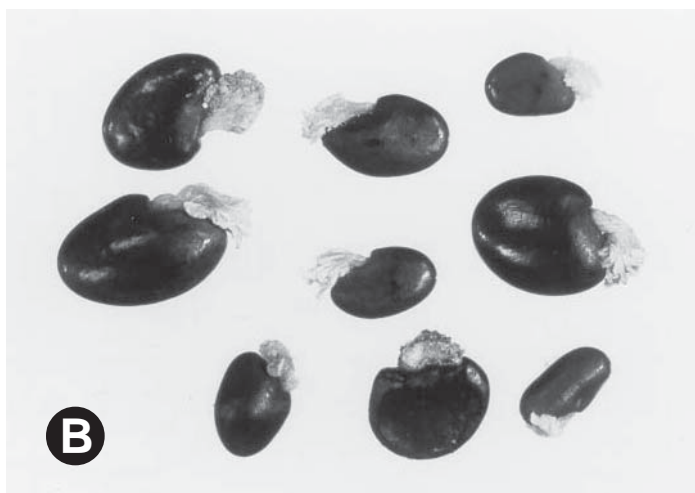
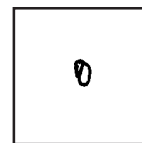
Fruit a legume; unilocular;  $0.4\text{--}0.7 \times 0.3\text{--}0.35 \times 0.2$  cm; with persistent calyx; with calyx shorter or longer than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; ovate; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed or terete; without or with beak; straight or hooked; with solid beak the same color and texture as fruit; short tapered or rounded at apex; apex aligned or oblique with longitudinal axis of fruit; rounded or truncate 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; plain. Fruit wings absent. Fruit substipitate or nonstipitate. Fruit with all layers dehiscent; splitting along suture. Dehiscence of valves along 1 suture; apical and down; passive. Replum invisible. Epicarp dull; monochrome; reddish brown or black; glabrous or pubescent but soon deciduous; with hairs appressed or erect; with 1 type of pubescence; villous; with pubescence golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; minutely warty; exfoliating in part or exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; reddish brown or black; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; overlapping or overlapping and touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril fleshy; topknotlike or cupshaped; entire or fimbriate; covering less than 1/2 of seed; tan to reddish tan.

Seed  $1.5\text{--}4 \times 0.6\text{--}2 \times 0.7\text{--}1.3$  mm; not overgrown; not angular; asymmetrical; oblong, mitaform, or reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to

endocarp; glossy or dull; not modified by a bloom; colored; mottled and streaked or monochrome; with frequent mottles; with frequent streaks; reddish brown; with black overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim present. 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;  $0.5\text{--}0.6$  mm long; with curved outline; elliptic; between cotyledon and radicle lobe; recessed; within rim. Hilum rim color lighter than testa. Lens not discernible or discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length;  $0.3\text{--}0.5$  mm long; with margins curved; circular; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; reddish 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; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; reddish brown, tan, or yellow; 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 or bulbous; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

*Pultenaea*: *P. obcordata* (R. Brown) G. Benth (C–E), *P.* spp. (A–B). A, Fruits within calyx (closed and dehiscent) ( $\times 3.3$ ); B, seeds ( $\times 6.7$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



Genus: *Almaleea* M.D. Crisp & P.H. Weston

Phylogenetic Number: 24.24.

Tribe: Mirbelieae.

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

Fruit a legume; unilocular;  $0.3\text{--}0.6 \times 0.2\text{--}0.4 \times 0.2\text{--}0.3$  cm; with persistent calyx; with calyx shorter than or equal in length to fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; ovate; when asymmetrical with both sutures parallelly curved; not inflated; terete; without beak; rounded or short tapered at apex; apex oblique or aligned 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; 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 or 1 suture; apical and down (about 1/2 way down); passive. Replum invisible. Epicarp dull; monochrome; dark reddish brown; pubescent and indurate; with 1 type of pubescence; villous; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain or swollen; eglandular; without spines; not smooth; with elevated or recessed features; reticulately veined; not tuberculate; tuberculate (base of hairs); punctate (when hair bases absent); not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy; monochrome; grayish or reddish tan or gray; smooth; nonseptate; chartaceous; exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; overlapping, touching, or neither overlapping nor touching; in 1 or 2 or more series. Funiculus measured;  $0.3\text{--}0.8$  mm long; of 1 length only; thick; straight. Aril fleshy; cupshaped; covering less than 1/2 of seed; tan.

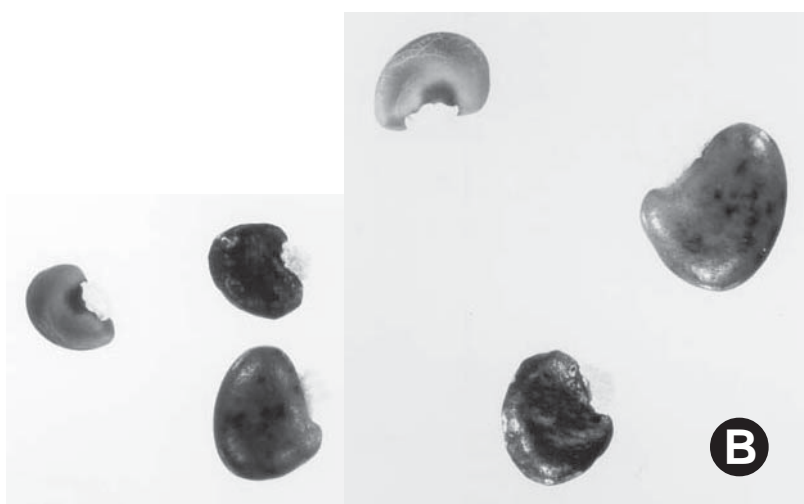
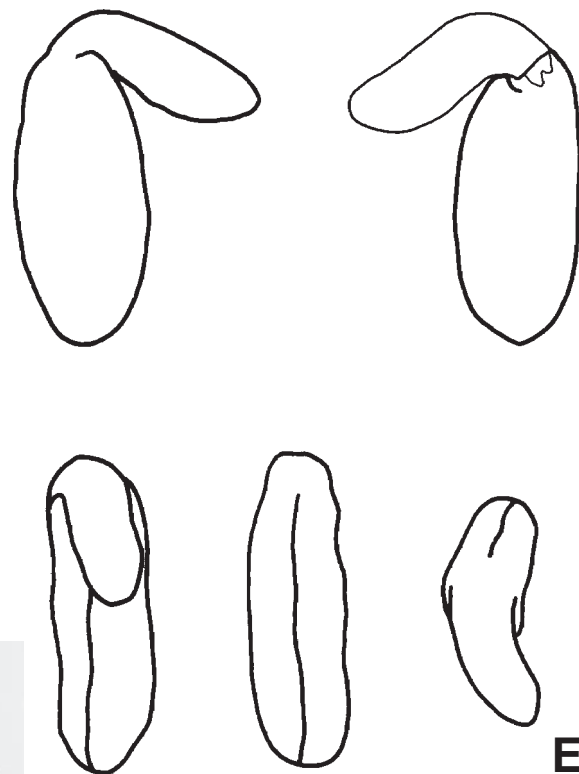
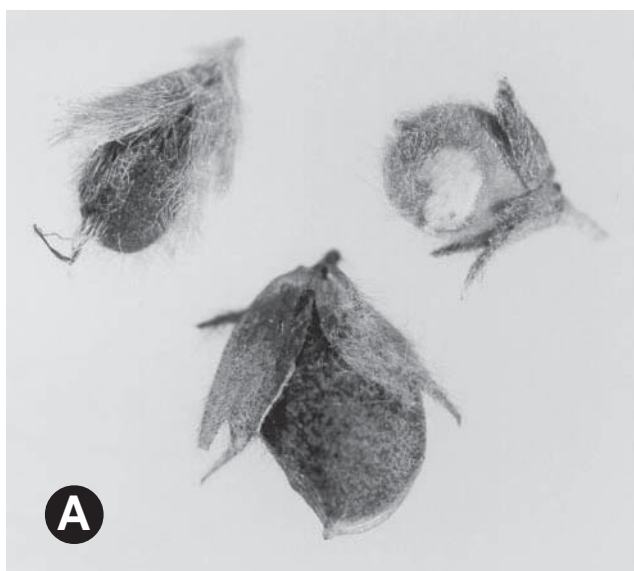
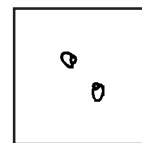
Seed  $1\text{--}2.7 \times 1\text{--}2 \times 0.6\text{--}1.2$  mm; not overgrown; not angular; asymmetrical; reniform; compressed; with surface smooth; with visible radicle and cotyledon lobes; with or without external groove between radicle and cotyledon lobes; with external groove between radicle and cotyledon lobes same color as testa; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom;

colored; mottled or monochrome; with frequent mottles; reddish brown; with brown (reddish) overlay; glabrous; smooth; coriaceous. 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 mm long; with straight outline; oblong; between cotyledon and radicle lobe; recessed; not within corona, halo, or rim or within halo. Hilum halo color lighter than testa. Lens discernible; less than 0.5 mm or equal to or greater than 0.5 mm in length; 0.5 mm long; with margins curved; more or less circular; not in groove of raphe; confluent with hilum; flush; similar color as testa; darker than testa; reddish 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; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; without a joint evident between the radicle and the cotyledons. Radicle bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Southeastern Australia.

Notes: *Almaleea* includes species formerly placed in *Pultenaea* (24.23) and *Dillwynia* (24.25) (Crisp and Weston 1991). Crisp and Weston noted that *Almaleea* was closely related to *Eutaxia* (24.26) and *Dillwynia* (24.25).

*Almaleea*: *A. subumbellata* (W.D. Hooker) M.D. Crisp & P.E. Weston (C–E), *A. spp.* (A–B). A, Fruits with calyx ( $\times 7.1$ ); B, seeds ( $\times 9.5$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 15$ ).



Genus: *Dillwynia* J.E. Smith

Phylogenetic Number: 24.25.

Tribe: Mirbelieae.

Species Studied—Species in Genus: 5 spp.—ca. 20 spp.

Fruit a legume; unilocular;  $0.4\text{--}0.7 \times 0.25\text{--}0.45 \times 0.3\text{--}0.4$  cm; with persistent or deciduous calyx; with calyx slightly shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; circular, elliptic, or ovate; when asymmetrical with both sutures parallelly curved; not inflated; terete; without or with beak; declined; with solid beak the same color and texture as fruit; rounded at apex; apex oblique with longitudinal axis of fruit; short 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. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; reddish brown; pubescent but soon deciduous; with hairs erect or appressed; with 1 type of pubescence; villous; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined or veined (rarely); reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; subligneous. Endocarp glossy; monochrome; reddish brown or purple; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching or overlapping and touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick; straight. Aril fleshy; topknotlike; covering less than 1/2 of seed; reddish tan or yellow.

Seed  $2.5\text{--}3.5 \times 2\text{--}2.5 \times 1.3\text{--}1.7$  mm; not overgrown; not angular or angular; asymmetrical; reniform, mitaform, or triangular; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom;

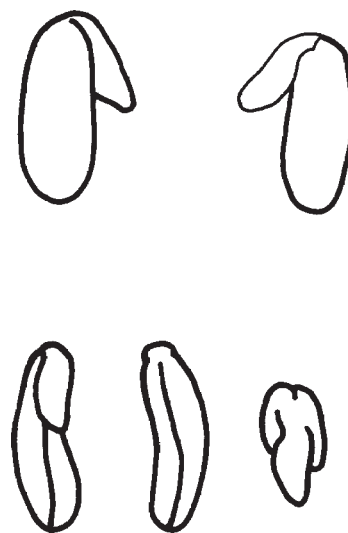
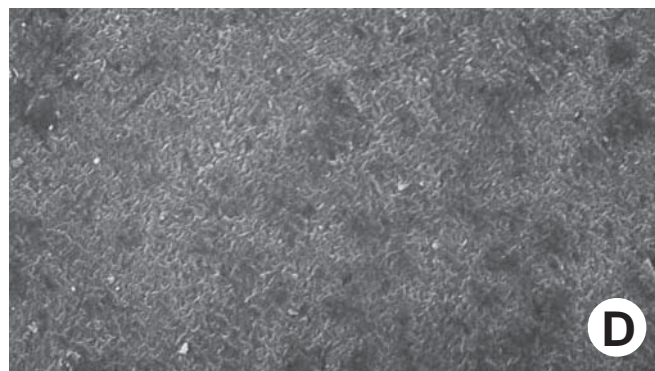
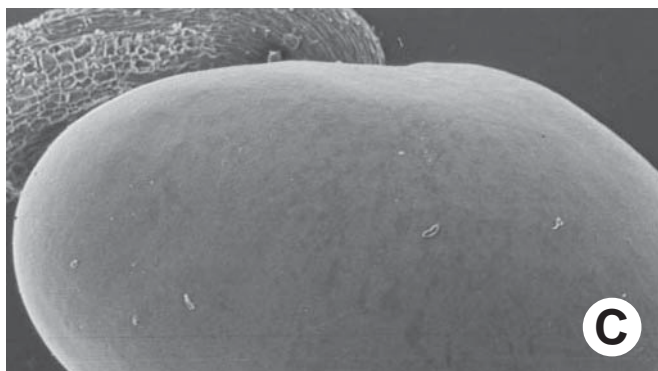
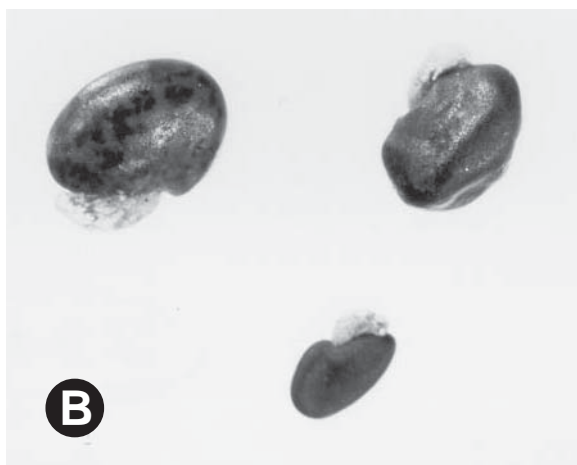
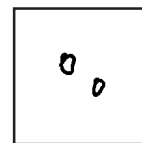
colored; streaked; with frequent streaks; dark brown or black; with brown (lighter) or purple overlay; glabrous; smooth or not smooth; with recessed features; punctate; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.5–0.6 mm long; with curved outline; circular; marginal according to radicle tip or between cotyledon and radicle lobe; recessed; within halo. Hilum halo color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.6 mm long; with margins straight or curved; oblong; not in groove of raphe; confluent with hilum (at least halo); barely mounded; similar color as testa; darker than testa; reddish brown; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to testa or embryo. 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; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or brown (reddish); 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; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 to 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Australia.

Notes: Two species of *Dillwynia*, known as parrot-pea, are Australian wildflowers and were discussed by Lebler (1976).

*Dillwynia*: *D. floribunda* J. Smith (C–E), *D. spp.* (A–B).

A, Fruits with or without calyx (closed and dehiscent) ( $\times 4.7$ ); B, seeds ( $\times 9.4$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



Genus: *Eutaxia* R. Brown

Phylogenetic Number: 24.26.

Tribe: Mirbelieae.

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

Fruit a legume; unilocular;  $0.4\text{--}0.6 \times 0.25\text{--}0.3 \times 0.1\text{--}0.25$  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; ovate; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; compressed or flattened; without or with beak; hooked; with solid beak the same color and texture as fruit; rounded 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; plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; reddish to dark reddish brown; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence gray; 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 thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; reddish tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length parallel with fruit length; neither overlapping nor touching or overlapping and touching; in 1 series. Funiculus measured; 0.5–1 mm long; of 1 length only; filiform or thick; straight. Aril fleshy; topknotlike; covering less than 1/2 of seed; yellow.

Seed  $2.2\text{--}2.7 \times 1.5\text{--}2 \times 1\text{--}1.5$  mm; not overgrown; not angular or angular (somewhat); asymmetrical; mitaform; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent mottles; with frequent streaks; brown to

reddish brown; with brown (dark reddish) or tan overlay; glabrous; smooth or not smooth; with elevated features; reticulate; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by aril and radicle lobe or wing; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform; between cotyledon and radicle lobe; flush; within rim. Hilum rim color lighter (reddish) than testa. Lens discernible; less than 0.5 mm in length; with margins straight or curved; somewhat wedge-shaped; elliptic; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; brown; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to embryo. 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; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; 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 bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southern Australia.

*Eutaxia*: *E. microphylla* (R. Brown) J.M. Black (*C–E*), *E.* spp. (*A–B*). *A*, Fruits with or without calyx (closed and dehiscent) ( $\times 6.5$ ); *B*, seeds ( $\times 9.2$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 10$ ).

