

## Genisteae (30.01–30.25)

Genus: *Melolobium* C.F. Ecklon & J.M. Zeyher

Phylogenetic Number: 30.01.

Tribe: Genisteae.

Species Studied—Species in Genus: 8 spp.—ca. 20 spp.

Fruit a legume; unilocular;  $0.8\text{--}2 \times 0.3\text{--}0.5 \times 0.08\text{--}0.2$  cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight or curved; not plicate; not twisted; asymmetrical or symmetrical; linear or oblong (narrowly) to ovate; when asymmetrical with both sutures nearly straight; not inflated; compressed; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers torulose. Fruit margin slightly constricted along both margins; 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 slightly twisting. Replum invisible. Epicarp dull; monochrome or multicolored; mottled; brown or tan; with brown (reddish) overlay; with mottling over seed chambers; pubescent and indurate; with 1 type of pubescence; tomentose; with pubescence golden or gray; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; warty; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; reddish brown; smooth; subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; straight. Aril present (so tiny that it can be missed) or absent; dry; tiny tongue-aril; white.

Seed  $2\text{--}2.5 \times 2\text{--}2.5 \times 1.5$  mm; not overgrown; not angular; asymmetrical; ovate to circular (sub); compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; reddish to dark reddish brown; 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; punctiform; between cotyledon and radicle lobe; recessed; within rim. Hilum rim color of, lighter than, or darker than testa. Lens discernible; less than 0.5 mm in length; with margins straight or curved; irregular; irregular or key-hole shaped; not in groove of raphe; adjacent to hilum; up to 0.2 mm from hilum; mounded; dissimilar color from testa; darker than testa; black (at least center); 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; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow or green; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

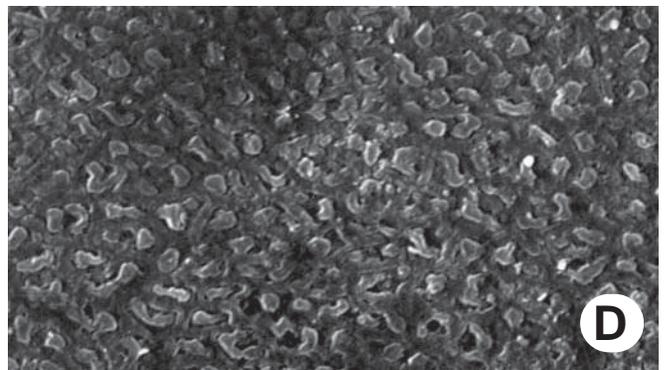
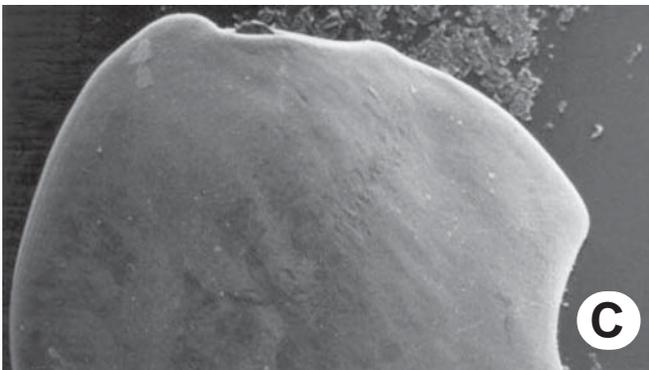
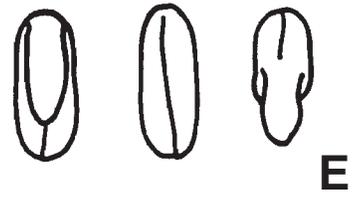
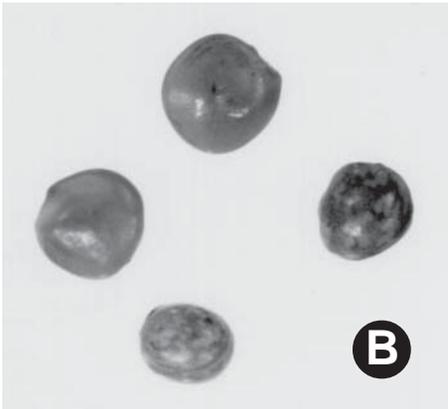
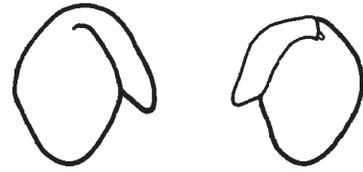
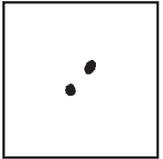
Distribution: Southern Africa.

Notes: Traditionally this tribe has been called Genisteae.

Reveal (1997) reported that the name Cytiseae was published before the name Genisteae. In accordance with the International Code of Botanical Nomenclature (Greuter et al. 1994), the oldest name for a taxon must be used, so Reveal suggested that this tribe should be called Cytiseae. In 1999, however, Reveal (1999) reversed himself, so this tribe remains the Genisteae. Bisby (1981) summarized the tribe Genisteae, following the excellent study by Polhill (1976). Bisby correctly noted that “many species have been moved from one genus to another several times and the *Cytisus-Genista* complex has gained a reputation as a critical group.” He continued with an in-depth analysis of the tribe. Using chemical and morphological characters, Polhill (1994a,b) and Wyk and Schutte (1995) transferred the following five genera from Crotalariaeae (27) to Genisteae: *Anarthrophyllum* (30.06), *Argyrolobium* (30.03), *Dichilus* (30.02), *Melolobium*, and *Sellocharis* (30.07). Cristofolini (1997) carried out a cladistic study of the tribe’s biogeography and discussed its early evolutionary history. Polhill (1981q) and Wyk (1991) had *Melobium* in Crotalariaeae but later transferred it to the beginning of the Genisteae (Polhill 1994a,b, Wyk and Schutte 1995).



*Melolobium*: *M. decumbens* (E.H.F. Meyer) J. Burtt Davy  
(C-E), *M. spp.* (A-B). A, Fruits ( $\times 2.2$ ); B, seeds  
( $\times 7.5$ ); C-D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



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

Phylogenetic Number: 30.02.

Tribe: Genisteae.

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

Fruit a legume; unilocular;  $0.25\text{--}0.55 \times 0.4 \times 0.14\text{--}0.15$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; oblong to linear (or narrowly so) or oblong (narrowly); when asymmetrical with both sutures nearly straight; not inflated; compressed; without beak; short tapered at apex; apex oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin slightly constricted along both margins; 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. Replum invisible. Epicarp dull; monochrome; brown; glabrous, pubescent and indurate, or pubescent but soon deciduous; with 1 type of pubescence; puberulent (especially along sutures); with pubescence gray; with simple hairs; pliable; with hair bases plain; 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; brown; spongy; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–9; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick; straight. Aril absent.

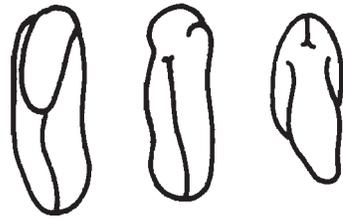
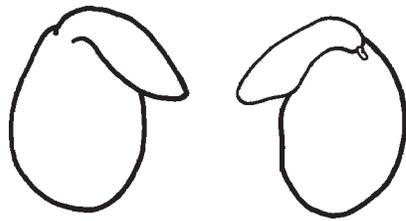
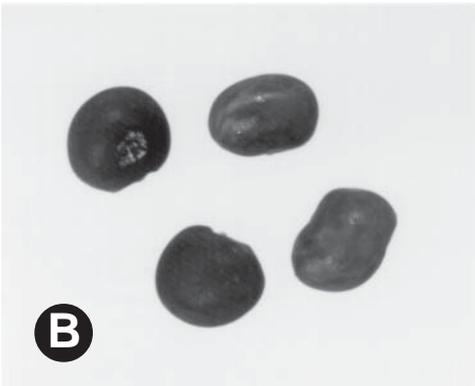
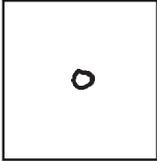
Seed  $2.5\text{--}3 \times 2\text{--}2.8 \times 1.5\text{--}1.7$  mm; not overgrown; not angular; asymmetrical; circular or oblong; compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent or infrequent mottles; with frequent or infrequent streaks; black, brown (pale yellow to brown), green (dark to olive), or orange; with black (restricted to black seeds), brown,

green (restricted to green seeds), or yellow (restricted to green seeds) overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum partially concealed; concealed by funicular remnant; without faboid split; larger than punctiform; 0.5 mm long; with curved outline; circular; marginal according to radicle tip or between cotyledon and radicle lobe; flush; within rim or not within corona, halo, or rim. Hilum rim color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.6–0.9 mm long; with margins straight or curved; wedge-shaped (to hourglass-shaped and surrounded by tan circular patch, when circular tan with reddish-brown and hourglass-shaped to wedge-shaped interior) or circular; not in groove of raphe; adjacent to hilum; 0.1 mm from hilum; mounded; dissimilar color from testa; lighter than testa; tan and brown (reddish); not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to embryo. Cotyledons not smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; completely concealing radicle; entire over radicle; without lobes; with the interface division terminating at base of radicle; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed. Radicle bulbous; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

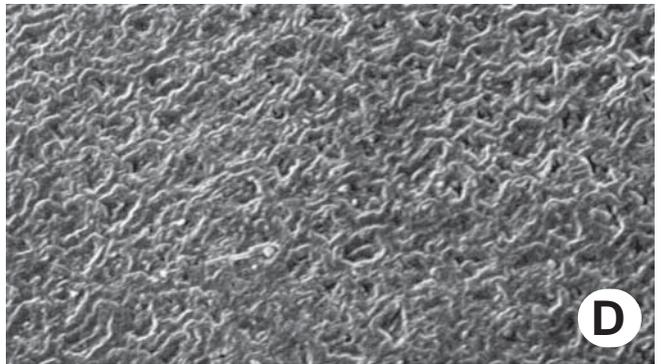
Distribution: Southern Africa.

Notes: Schutte and Wyk (1988) monographed the genus and illustrated its seeds and fruits. They also analyzed the taxonomic relationships of the species (Schutte and Wyk 1990). Polhill (1981*q*) and Wyk (1991) placed this genus in Crotalariaeae but later transferred it to the beginning of the Genisteae (30) (Polhill 1994*a,b*, Wyk and Schutte 1995).

*Dichilus*: *D. lebeckioides* A.-P. de Candolle (C–E), *D.* spp. (A–B). A, Fruits ( $\times 1.8$ ); B, seeds ( $\times 6.8$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 8$ ).



E



Genus: *Argyrolobium* C.F. Ecklon & J.M. Zeyher

Phylogenetic Number: 30.03.

Tribe: Genisteae.

Species Studied—Species in Genus: 19 spp.—ca. 70 spp.

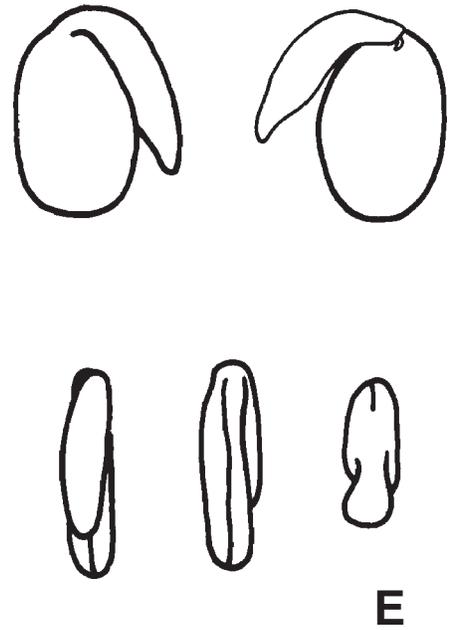
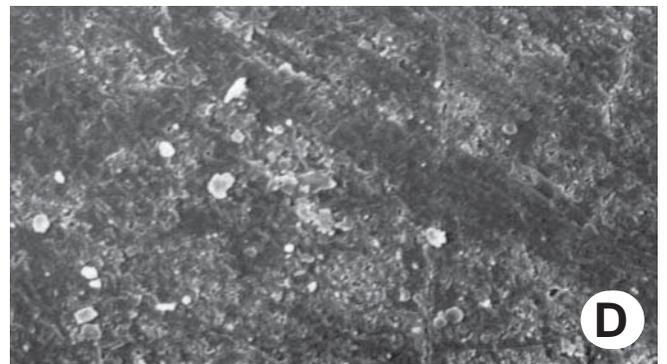
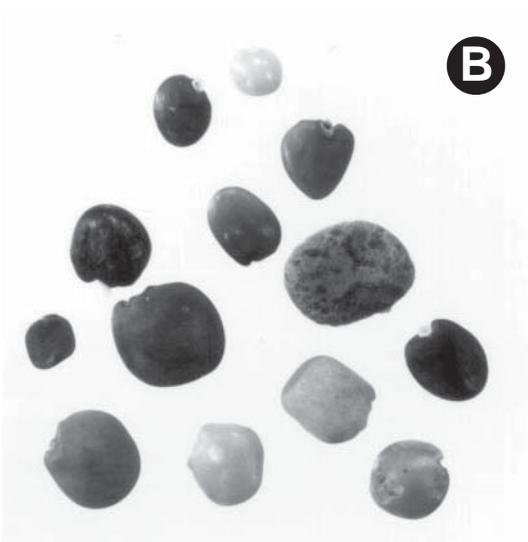
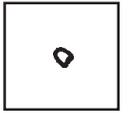
Fruit a legume; unilocular;  $0.6\text{--}8.5 \times 0.3\text{--}0.6 \times 0.13\text{--}0.25$  cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (or slightly curved); not plicate; not twisted; asymmetrical or symmetrical; linear, oblong, ovate, lanceolate, or C-shaped; when asymmetrical with both sutures nearly straight or parallelly curved; not inflated; compressed or flattened; with or without beak; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex aligned 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; membranous or coriaceous; seed chambers externally visible; with the raised seed chambers torulose or not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown or tan; pubescent and indurate or glabrous; with hairs erect or appressed; with 1 or 2 types of pubescence; pilose, villous, or sericeous; with pubescence gray or golden; with gray hairs on valves and golden hairs on sutures; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth or not smooth; with elevated features; not veined; not tuberculate; faintly wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown or tan; smooth and scurfy; nonseptate (with slight to well developed scurfy lines between seeds) or subseptate (because of regular intrusion of fruit); with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–14; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured or less than 0.5 mm long; up to 1.5 mm long; of 1 length only; flattened or thick; straight or curved. Aril dry; rim-aril or tongue-aril; tan, white, or black.

Seed  $1.4\text{--}4 \times 1.2\text{--}2.8 \times 1\text{--}1.3$  mm; not overgrown; not angular or angular; asymmetrical; oblong, ovate, quadrangular, reniform, triangular, circular, or mitaform; compressed or terete; with surface smooth; with or without 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; glossy or dull; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent or infrequent mottles; with frequent streaks; reddish to greenish brown, tan (to greenish), green, olive, yellow, or black; with brown (dark), purple (definite marks to “clouds”), or black overlay; glabrous; smooth or not smooth; with elevated features; reticulate or wrinkled; 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 or larger than punctiform; up to 0.5 mm long; with curved outline; circular; between cotyledon and radicle lobe, apical at apex of radicle tip, subapical to radicle tip, or marginal according to radicle tip; recessed; within rim. Hilum rim color of or lighter than testa. Lens discernible or not discernible; less than or equal to or greater than 0.5 mm in length; up to 0.5 mm long; with margins straight or curved; triangular or oblong; circular or oblong; not in groove of raphe; adjacent to hilum; 0.2–0.5 mm from hilum; flush or mounded; dissimilar color from or similar color as testa; darker or lighter than testa; brown or tan; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to embryo. Cotyledons not smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; tan, yellow, or white; 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 or equaling length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Mediterranean region to India, highlands tropical Africa, South Africa, and Madagascar (1 sp.).

Notes: Polhill (1968) monographed the taxa of tropical Africa, Chaudhary (1997) revised the Indian taxa, and Edwards (1997) revised the species of series *Racemosae* sensu W.H. Harvey (Harvey 1962). Wyk and Schutte (1990) compared *Argyrobium* with several *Crotalariaeae* genera of South Africa and concluded that *Argyrobium* should be part of *Crotalariaeae*, but they never made the change. Polhill noted that the endocarp often breaks down to form internal partitions.

*Argyrolobium*: *A. biebersteinii* P.W. Ball (C–E), *A. spp.* (A–B). A, Fruits (closed and dehisced) ( $\times 1.2$ ); B, seeds ( $\times 4.7$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



Genus: *Polhillia* C.H. Stirton

Phylogenetic Number: 30.04.

Tribe: Genisteae.

Species Studied—Species in Genus: 3 spp.—7 spp.

Fruit a legume; unilocular;  $1.5-4 \times 0.3-0.6 \times 0.2-0.3$  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 or plicate; not twisted; asymmetrical or symmetrical; nearly oblong or linear; when asymmetrical with both sutures nearly straight; not inflated; flattened; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; with the apex and base uniform in texture; chartaceous or ligneous (according to Stirton (1986b)); seed chambers externally visible; with the raised seed chambers torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate. Fruit indehiscent. Replum invisible. Epicarp dull; dark brown to black (but appearing gray because of hairs); pubescent and indurate; with 1 type of pubescence; villous; with pubescence gray; with simple hairs; pliable; with hair bases plain; eglandular; 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 dull; monochrome; grayish brown; smooth; nonseptate (but fruit impressed between seeds); chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 4–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; triangular or thick; straight or curved (slightly). Aril dry; rim-aril; reddish brown.

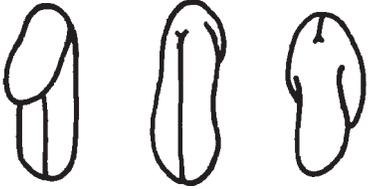
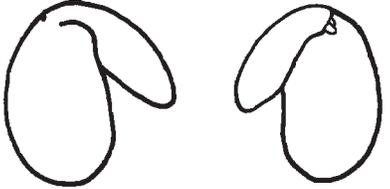
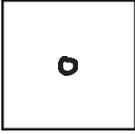
Seed  $2.3-3 \times 2.3-3 \times 2-2.2$  mm; not overgrown; not angular; asymmetrical; obliquely cordate or mitaform; compressed; with visible radicle and cotyledon lobes; with umbo (nearly) on seed faces; with umbo on both faces of seed. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome (if green may be blotchy purple but not mottled and streaked greenish to dark brown or tan); glabrous; smooth or not smooth; with elevated features; wrinkled (based on seed and not testa characters); 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; punctiform; between cotyledon and radicle lobe; recessed; within rim. Hilum rim color darker than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7 mm long; with margins straight; wedge-shaped; not in groove of raphe; adjacent to hilum; mounded; dissimilar color from testa; lighter than or darker than testa; black or tan; 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; yellow; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons;  $1/2$  to nearly length of cotyledons. Plumule moderately developed; glabrous.

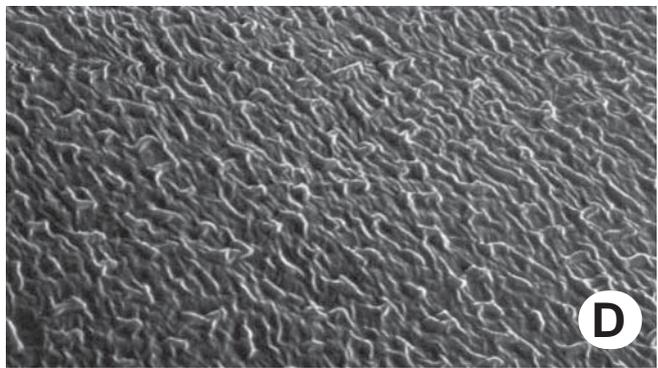
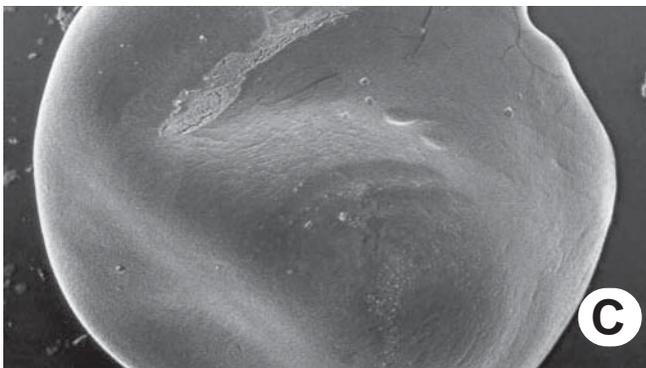
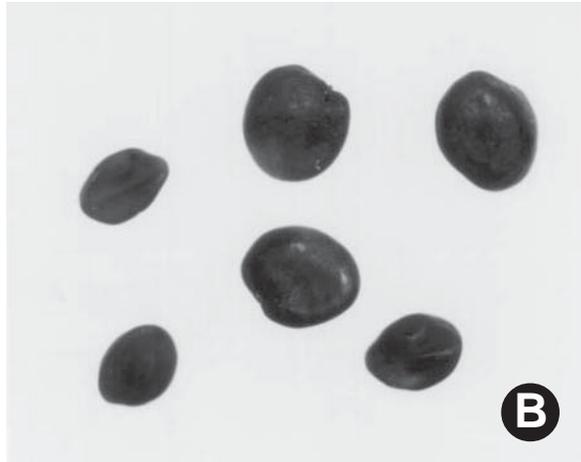
Distribution: South Africa (southwestern Cape Province).

Notes: When he founded the genus, Stirton (1986b) noted that *Polhillia* “has a natural affinity with *Melolobium* and *Dichilus*,” (30.01) and (30.02) respectively. Polhill (1981p) and Wyk (1991) placed this genus in Crotalariaeae but later transferred it to the beginning of the Genisteae (30) (Polhill 1994a,b, Wyk and Schutte 1995). Its number of species and distribution were taken from Wyk (1991) and Wyk and Schutte (1995).

*Polhillia*: *P. pallens* C.H. Stirton (C–E), *P* spp. (A–B). A, Fruits ( $\times 2.2$ ); B, seeds ( $\times 7$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).



E



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

Phylogenetic Number: 30.05.

Tribe: Genisteae.

Species Studied—Species in Genus: 12 spp.—15 spp.

Fruit a legume; unilocular;  $1.5-6 \times 0.4-1 \times 0.03-0.1$  cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; slightly curved or straight; not plicate; not twisted; asymmetrical or symmetrical; oblong, linear, or C-shaped; when asymmetrical with both sutures parallelly curved or nearly straight; not inflated; compressed or flattened; without or with beak; 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; short tapered or rounded at base; base aligned or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin 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 (loosely). Replum invisible. Epicarp glossy or dull; monochrome (though conspicuous glandular tuberculae may be darker colored); brown to light or dark reddish brown; glabrous or pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; puberulent, villous, or sericeous; with pubescence gray or golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular; with glandular papillae (long to short); without spines; not smooth; with elevated features; reticulately veined; not tuberculate; papillose; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown; smooth; nonseptate (but may be slightly scurfy between seeds); chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1 mm long; of 1 length only; thick; straight or curved. Aril dry; rim-aril or tongue-aril (somewhat); tan.

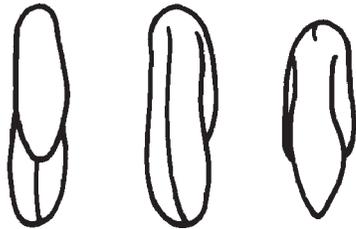
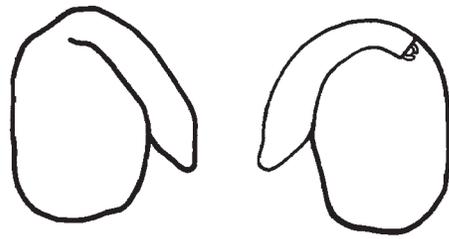
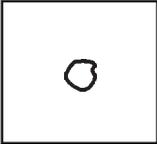
Seed  $2-5.5 \times 2-5.5 \times 1.2-2.5$  mm; not overgrown; not angular; asymmetrical; quadrangular, mitaform, oblong, ovate, circular (more or less), rectangular, or reniform;

compressed or terete; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified by a bloom; colored; monochrome or mottled and streaked; with frequent mottles; with frequent streaks; reddish to greenish brown, green, olive, or black; with purple or 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 or punctiform; 0.3–0.4 mm long; with curved outline; circular; between cotyledon and radicle lobe, apical at apex of radicle tip, or subapical to radicle tip; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight or curved; triangular; circular; not in groove of raphe; confluent with or adjacent to hilum; up to 0.4 mm from hilum; mounded or flush; similar color as or 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; white 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 bulbous or linear; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; equaling length of cotyledons. Plumule rudimentary; glabrous.

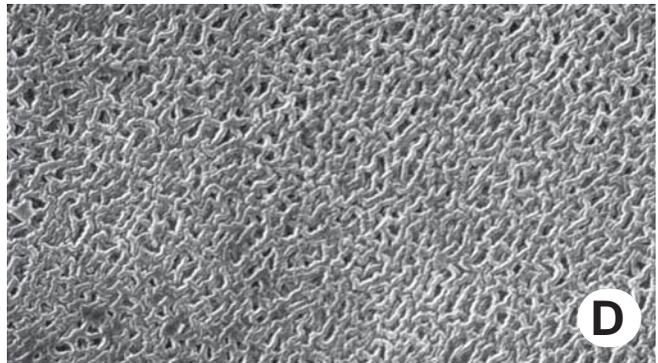
Distribution: Mediterranean region, Canary Islands, highest mountains of tropical Africa, and Syria.

Notes: Gibbs (1967) monographed the genus, and Luaces (1972) reported on the seed germination and chromosome counts of the Iberian species. Greinwald et al. (1992) reported on the taxonomic significance of alkaloids in *Adenocarpus*, and Veen et al. (1992) reported on the alkaloids of *A. hispanicus* (J.P.A.P.M. de Lamarck) A.-P. de Candolle.

*Adenocarpus*: *A. decorticans* P.E. Boissier (C–E), *A.* spp. (A–B). A, Fruits (closed and dehiscent) ( $\times 1.4$ ); B, seeds ( $\times 4.7$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 6$ ).



E



Genus: *Anarthrophyllum* G. Bentham

Phylogenetic Number: 30.06.

Tribe: Genisteae.

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

Fruit a legume; unilocular;  $0.7\text{--}4 \times 0.4\text{--}0.9 \times 0.2\text{--}0.8$  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 or symmetrical; lanceolate, linear, oblong, ovate, or rhombic; when asymmetrical with both sutures parallelly to unequally curved; not inflated; compressed; without or with beak; with solid beak the same color and texture as fruit; tapered or short tapered at apex; apex oblique with longitudinal axis of fruit; long tapered or tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate or nonstipitate. Fruit with all layers dehiscing; splitting along suture. Dehiscence of valves along 1 suture; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate or glabrous to glabrate; with 1 type of pubescence; tomentose or 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; brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1.5 mm long; of 1 length only; thick; straight. Aril absent.

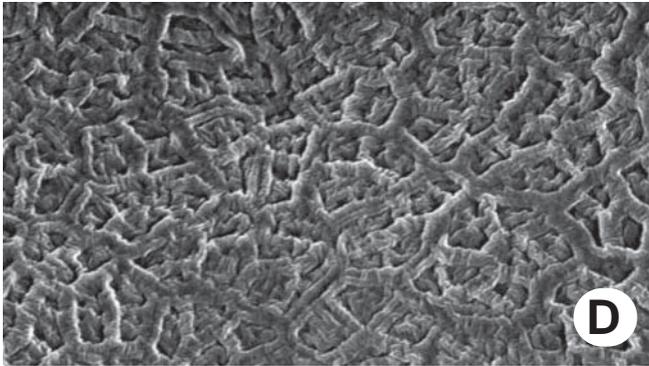
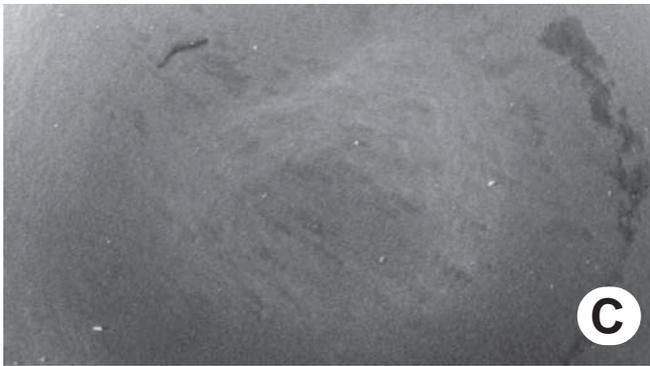
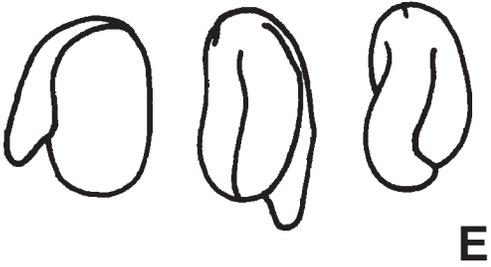
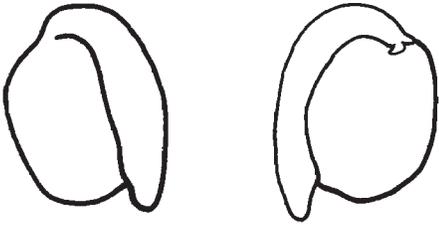
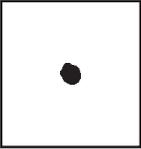
Seed  $2.5\text{--}5 \times 1.5\text{--}4 \times 1.5\text{--}1.7$  mm; not overgrown; not angular; symmetrical (except for hilum); circular, oblong, or ovate; compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; reddish brown to brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum

partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform; apical according to radicle tip but marginal according to seed length; recessed; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; 0.9 mm long; with margins straight; wedge-shaped; not in groove of raphe; adjacent to hilum; 0.1 mm from hilum; flush; similar color as testa; darker than 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; tan; inner face flat; glabrous around base of radicle. Embryonic axis parallel (radicle length parallel to cotyledon length); parallel to length of seed. Radicle linear; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; exceeding length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Chile and Argentina (Andes).

Notes: Soraru (1974) monographed the genus and illustrated the external characters of its fruits and seeds. Polhill (1981q) and Soraru both noted that *Anarthrophyllum* seeds often bulge on the side opposite the hilum (or radicle tip). This bulge is a normal legume seed with its axis parallel to the hilum length shorter than the axis at right angles to the hilum length, that is, the seeds are wider than they are long. Polhill continued that *Anarthrophyllum* is a “very remarkable genus of uncertain affinities, apart from its probable relationship with *Sellocharis*” (30.07). Polhill (1981q) and Wyk (1991) had this genus in Crotalariaeae but later transferred it to the beginning of the Genisteae (30) (Polhill 1994a,b, Wyk and Schutte 1995).

*Anarthrophyllum*: *A. rigidum* (J. Gilles ex W.J. Hooker & G.A.W. Arnott) G.H.E.W. Hieronymus (C–E), *A.* spp. (A–B). A, Fruits and valve ( $\times 1.9$ ); B, seeds ( $\times 4.8$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 8$ ).



Genus: *Lupinus* C. Linnaeus

Phylogenetic Number: 30.08.

Tribe: Genisteae.

Species Studied—Species in Genus: 75 spp.—200 spp.

Fruit a legume; unilocular;  $2-9 \times 0.3-2 \times 0.18-0.8$  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; oblong or ovate; when asymmetrical with both sutures nearly straight; not inflated; compressed, terete, or flattened; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; long tapered or short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous, membranous, chartaceous, or ligneous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate or nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull or glossy; monochrome or multicolored; mottled; brown to dark reddish brown; with black overlay; pubescent and indurate, glabrous, or pubescent but soon deciduous; with 1 type of pubescence; tomentose, villous, or puberulent; 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, ligneous (sub), or chartaceous. Endocarp dull or glossy; monochrome; brown or tan; spongy; septate, subseptate, or nonseptate; with septa thicker than paper, firm; with septa eglandular; chartaceous; not exfoliating or exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 1–15; length parallel with or transverse to fruit length; neither overlapping nor touching or touching; in 2 or more series. Funiculus less than 0.5 mm long; of 1 length only; thick or triangular; straight or curved. Aril absent or present; dry; rim-aril; white.

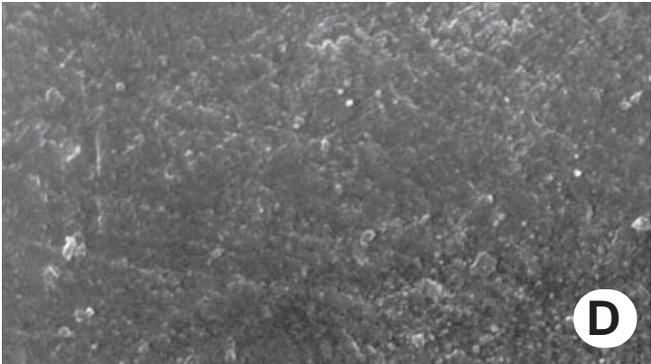
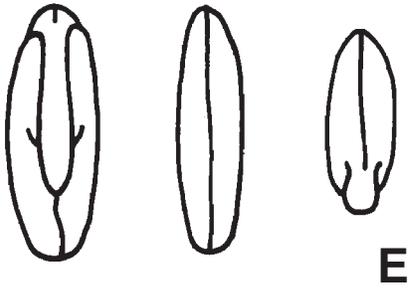
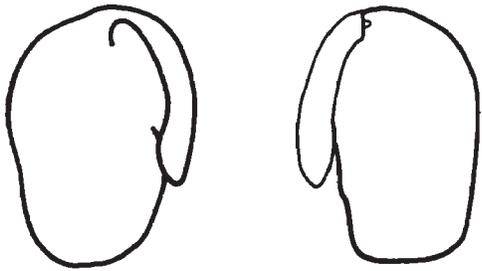
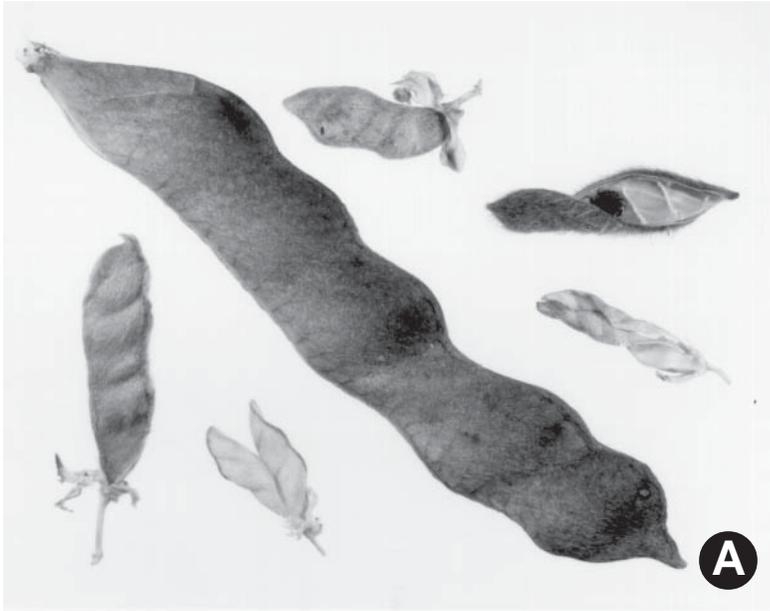
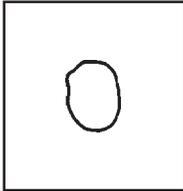
Seed  $1.5-9 \times 1.5-8 \times 1-5$  mm; not overgrown; not angular or angular; asymmetrical; ovate, circular, oblong, or

quadrangular; compressed; with surface smooth; without visible 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 or clear; monochrome, mottled and streaked, or bichrome (ivory and reddish-brown); with frequent mottles; with frequent streaks; dark reddish brown, cream, tan, white, gray (to bluish), pink, or blue; with brown, gray (to bluish), red, or black overlay; glabrous; smooth or not smooth; with elevated or recessed features; wrinkled, shagreen, or rugose; concave; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible or visible; from hilum to lens or through lens and terminating before base of seed; not bifurcating; color of or darker than testa; reddish brown; recessed. Hilum visible or partially concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as or lighter than the rest of the hilum and therefore conspicuous; larger than punctiform; up to 2 mm long; with angular, curved, or straight outline; circular, oval, wedge-shaped, triangular (more or less), or oblong; subapical or marginal according to radicle tip; recessed; not within corona, halo, or rim or within rim or halo. Hilum halo color of or lighter than testa. Hilum rim color of testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; up to 3 mm long; with margins curved; circular (often with linear center) or elliptic; not in or in groove of raphe; adjacent to hilum; up to 3 mm from hilum; mounded; dissimilar color from testa; lighter or darker than testa; reddish tan or black; not within corona, halo, or rim or within rim (its own). Lens rim color of testa. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with lobes not touching; with the interface division terminating at base of radicle or in radicle tissue; without margins recessed; tan; inner face flat or wrinkled; 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 triangular; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2, 1/2 to nearly, or equaling length of cotyledons. Plumule rudimentary, moderately developed, or well developed; glabrous.

Distribution: New World, Mediterranean region, tropical highlands of Africa, and naturalized elsewhere.

Notes: Cristofolini and Chiapella (1977) studied the water-soluble seed proteins of 45 species of *Lupinus*. Phillips (1955) monographed the perennial lupine species of North America, and Dunn and Gillett (1966) monographed the taxa in Canada. Heyn and Herrnstadt (1977) studied the testae of Old World species. Lawson (1982) edited an overview of the agronomic value, liability, and problems in growing *Lupinus* species in Australia. Summerfield and Roberts (1985b) also reported on the economic value of the genus. Plitmann (1981) traced the evolutionary history of the Old World lupines.

*Lupinus*: *L. tauris* G. Bentham (C–E), *L. spp.* (A–B). A,  
Fruits (closed and dehisced) ( $\times 1.1$ ); B, seeds ( $\times 1.8$ );  
C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 2$ ).



Genus: *Laburnum* P.C. Fabricius

Phylogenetic Number: 30.09.

Tribe: Genisteae.

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

Fruit a legume; unilocular;  $2-6 \times 0.7-1 \times 0.15-0.4$  cm; with deciduous or persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (or slightly curved); not plicate; not twisted; symmetrical or asymmetrical; linear or oblong (narrowly); when asymmetrical with both sutures nearly straight; not inflated; flattened or compressed; without beak; long tapered, tapered, or short tapered at apex; apex aligned or oblique (slightly) with longitudinal axis of fruit; long tapered or tapered at base; base aligned or oblique (slightly) with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous, membranous, or ligneous; seed chambers externally visible; with the raised seed chambers not torulose or torulose. Fruit margin not constricted or constricted; slightly constricted (hardly) along both margins; without sulcus; plain. Fruit wings absent. Fruit substipitate. Fruit with all layers dehiscing (tardily); splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp dull; monochrome; dark to reddish brown 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; longitudinally veined relative to fruit length; not tuberculate; longitudinally and irregularly wrinkled; exfoliating in part or not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; subligneous or coriaceous. Endocarp dull; monochrome; reddish brown or tan; smooth; nonseptate or subseptate (because of intrusion of fruit); with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–8; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1.5 mm long; of 1 length only; thick; curved. Aril absent.

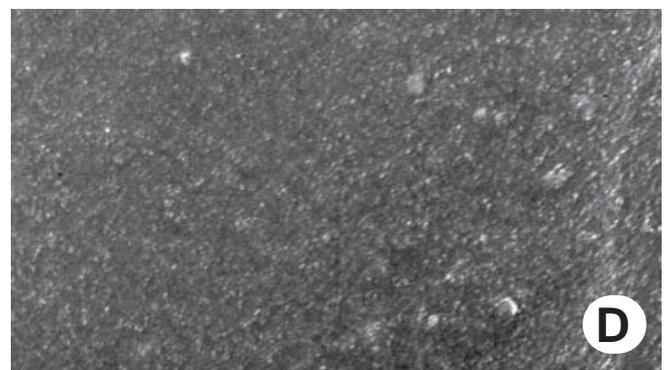
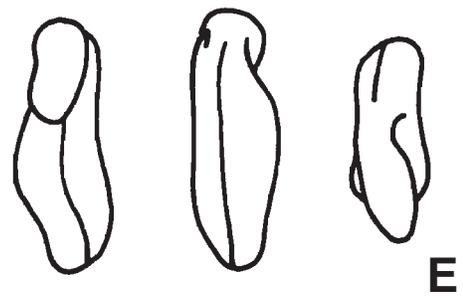
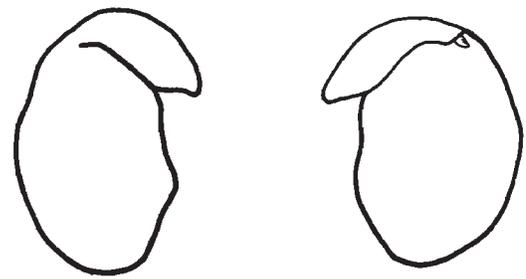
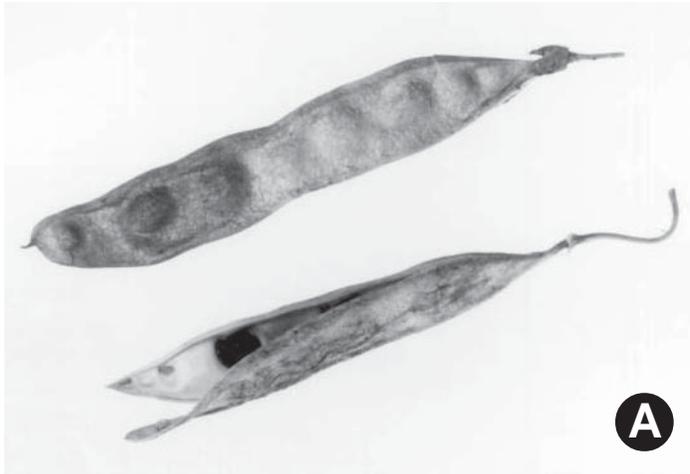
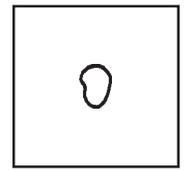
Seed  $4-5 \times 3.5-4 \times 2.5-2.8$  mm; not overgrown; not angular or angular (somewhat); asymmetrical; oblong, reniform, triangular (more or less), or mitaform; compressed; with surface smooth; with visible radicle

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 or glossy (somewhat); not modified by a bloom; colored; monochrome; dark to bright reddish brown or orange; 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; up to 0.5 mm long; with curved outline; circular; between cotyledon and radicle lobe; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5–1 mm long; with margins straight or curved; wedge-shaped or elliptic; not in groove of raphe; adjacent to or confluent with hilum; 0.2 mm from hilum; barely mounded; similar color as 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; with both folded (barely) or not folded; not sufficiently folded for inner face to touch itself; portions of inner folded face unequal; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with the interface division terminating at base of radicle; without margins recessed; red; 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 rudimentary; glabrous.

Distribution: Southern Europe.

Notes: Forrester (1979) stated that an average of about 3,000 children per summer are poisoned by fruits, seeds, and flowers of *Laburnum* in England.

*Laburnum*: *L. anagyroides* F.C. Medikus (C–E), *L. spp.* (A–B). A, Fruits (closed and dehiscent) ( $\times 1.4$ ); B, seeds ( $\times 4.8$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 5$ ).



Genus: *Hesperolaburnum* R.C.J.E. Maire

Phylogenetic Number: 30.10.

Tribe: Genisteae.

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

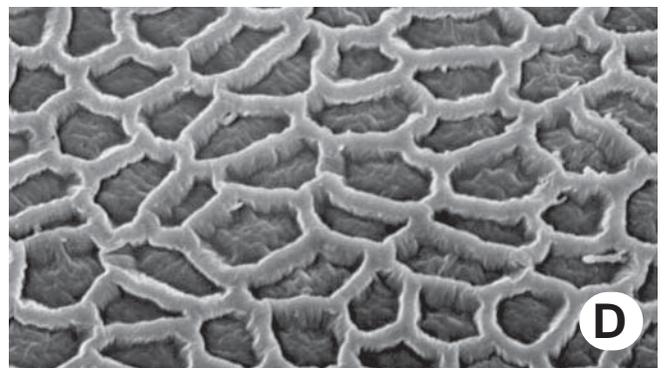
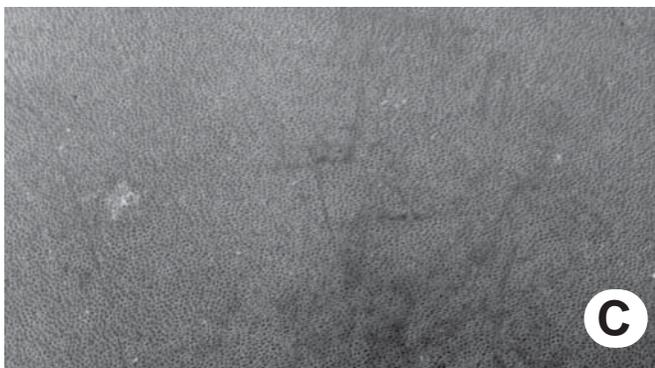
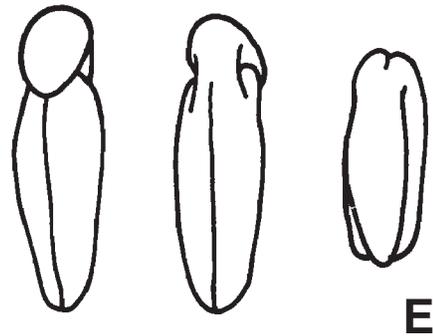
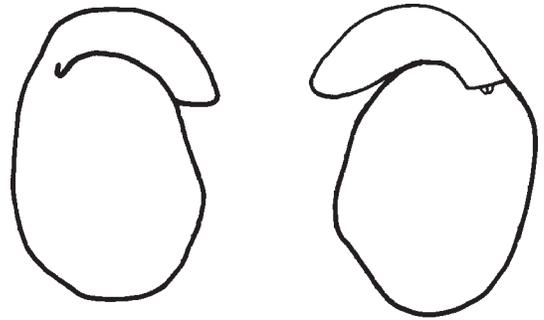
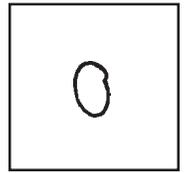
Fruit a legume; unilocular;  $4 \times 1 \times 0.5$  cm; with deciduous or persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; oblong; when asymmetrical with 1 straight and 1 curved suture, both sutures unequally curved, or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed; without beak; short tapered at apex; apex oblique with longitudinal axis of fruit; tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin slightly constricted only on 1 margin; without sulcus; embellished. Fruit wings absent. Fruit substipitate or nonstipitate. Fruit with all layers dehiscing (to tardily so); splitting along sutures. Dehiscence of valves along both sutures; apical and down; passive. Replum invisible. Epicarp glossy; monochrome; dark reddish brown; glabrous; eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; warty (tan); not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; pale brown; scurfy; septate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–3; length transverse to, oblique to, or parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened; curved. Aril absent.

Seed  $5.5\text{--}6 \times 4.5\text{--}5 \times 3\text{--}3.3$  mm; not overgrown; not angular; asymmetrical; ovate; 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; dark reddish brown; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same

color as the rest of the hilum; punctiform; apical at apex of radicle tip or between cotyledon and radicle lobe; recessed; within rim. Hilum rim color somewhat 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; oblong; not in groove of raphe; confluent with hilum (hilar rim extends out to lens); mounded; similar color as testa; lighter than testa; 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 or concave (or one concave and other convex); 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 rudimentary; glabrous.

Distribution: Morocco (Anti-Atlas mountains).

*Hesperolaburnum*: *H. platycarpum* (R.C.J.E. Maire) R.C.J.E. Maire (A–E). A, Valves showing endocarp and epicarp ( $\times 1.7$ ); B, seeds ( $\times 4.3$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 5$ ).



Genus: *Podocytisus* P.E. Boissier & T.H.H. von Heldreich

Phylogenetic Number: 30.11.

Tribe: Genisteae.

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

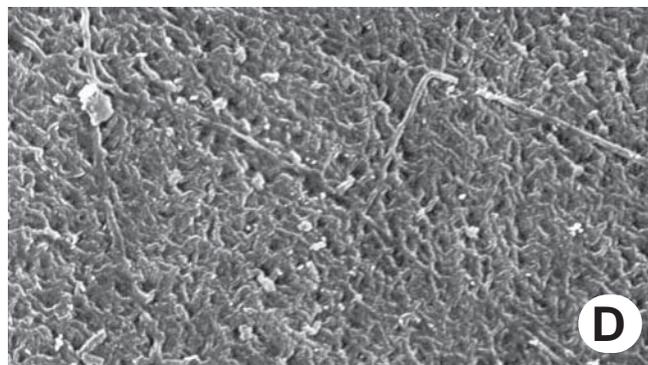
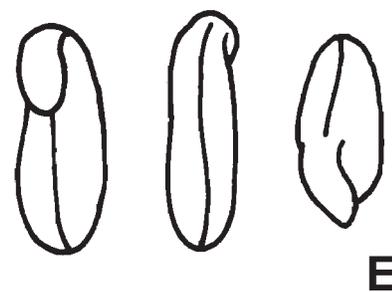
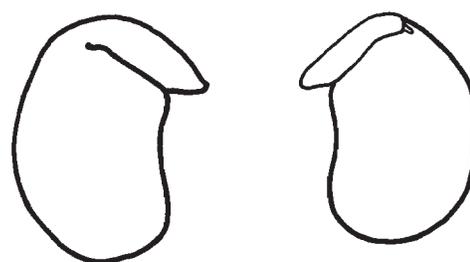
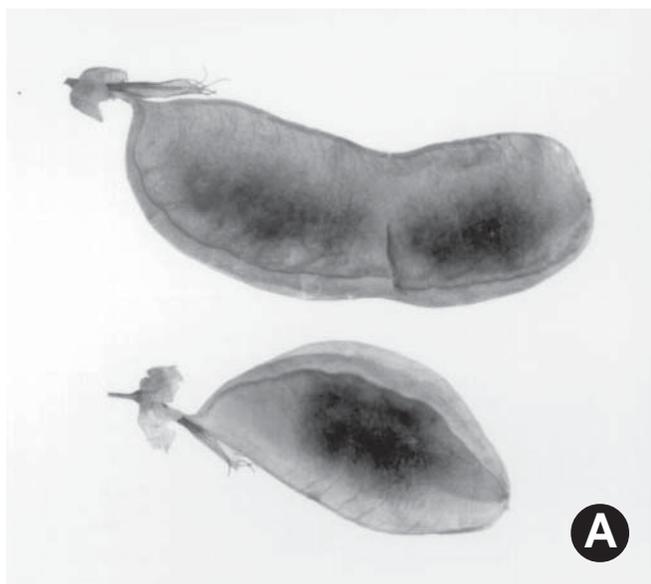
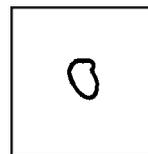
Fruit a legume; unilocular;  $2.5\text{--}4.5 \times 1\text{--}2 \times 0.03\text{--}0.05$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; curved; not plicate; not twisted; asymmetrical; oblong; when asymmetrical with both sutures nearly straight; not inflated; flattened; without beak; rounded at apex; apex oblique with longitudinal axis of fruit; rounded or short tapered at base; base oblique with longitudinal axis of fruit; with the apex and base uniform in texture; membranous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted (and irregularly) only on 1 margin; without sulcus; embellished. Fruit wing 1; 1.5 mm wide; sutural; on both valves; on 1 suture. Fruit substipitate. Fruit indehiscent or with all layers dehiscent (tardily); splitting along suture. Dehiscence of valves along 1 suture; probably medial and up and down; passive. Replum invisible. Epicarp dull; monochrome or multicolored; bichrome (irregularly, no pattern) or mottled and streaked (neither true mottling nor true streaking); brown (greenish with irregular dark-brown to purple patches), green, purple, or tan (greenish); with brown (dark brown to dark purple) overlay; glabrous; 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; chartaceous (or thinner). Endocarp dull or glossy (without “cobwebs”); monochrome; tan; cobwebby; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–6; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 3 mm long (most of length fused with valve and 1 branched); of 1 length only; flattened; curved. Aril absent.

Seed  $4.5\text{--}5 \times 4\text{--}4.5 \times 2\text{--}2.8$  mm; not overgrown; not angular or angular (somewhat); asymmetrical; oblong, circular, or reniform (more or less); 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; dark reddish brown or mixture of dark and darker 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; 0.7 mm long; with straight outline; oblong; between cotyledon and radicle lobe; slightly flush; not within corona, halo, or rim or within rim (faint). Hilum rim color of testa. Lens discernible; less than or equal to or greater than 0.5 mm in length; 0.5 mm long; with margins curved; circular (with linear center); not in groove of raphe; confluent with or adjacent to hilum; up to 0.2 mm from hilum; flush; dissimilar color from testa; lighter than testa; reddish tan; 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; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Balkans and Turkey (Anatolia).

*Podocytisus*: *P. caramanicus* P.E. Boissier & T.H.H. von Heldreich (A–E). A, Fruits ( $\times 1.7$ ); B, seeds ( $\times 4.2$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 5$ ).



Genus: *Cytisophyllum* O.F. Lang

Phylogenetic Number: 30.12.

Tribe: Genisteae.

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

Fruit a legume; unilocular; 2.5–4 × 1 cm; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical or asymmetrical; linear to oblong; when asymmetrical with both sutures nearly straight; not inflated; compressed; with the apex and base uniform in texture; coriaceous. Fruit margin without sulcus; plain. Fruit wings absent. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp glossy; monochrome; glabrous; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; reddish tan; smooth and scurfy; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seed 3–6 (Pignatti 1982); neither overlapping nor touching; in 1 series. Funiculus of 1 length only. Aril fleshy; topknotlike or cupshaped; covering less than 1/2 of seed; yellow.

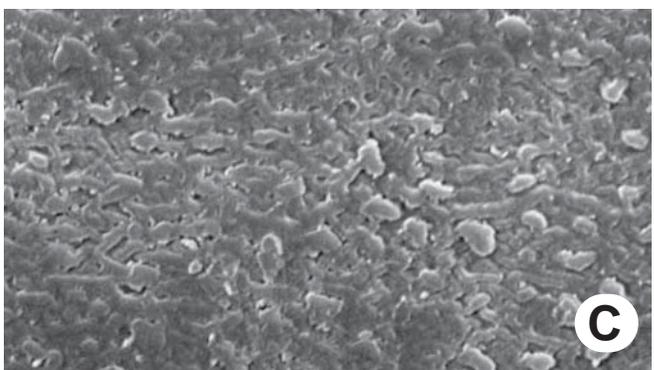
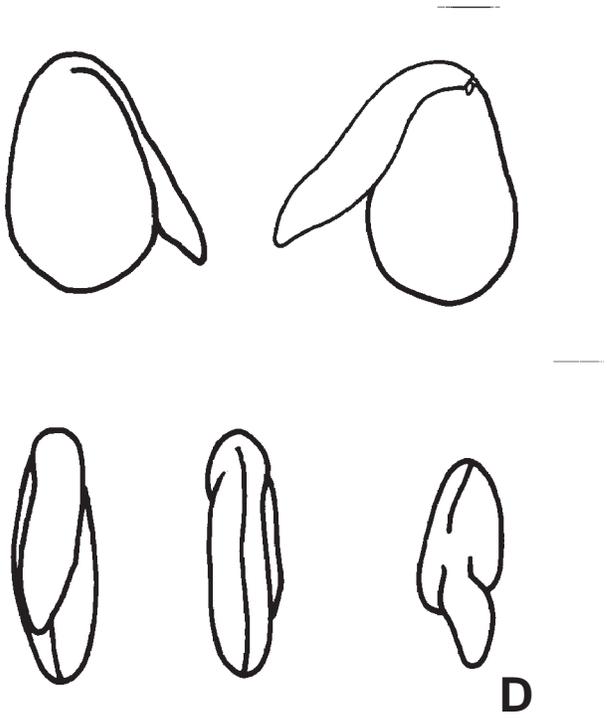
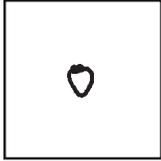
Seed 4–5 × 3–4 × 1.2–1.7 mm; not overgrown; angular or not angular; asymmetrical; oblong, ovate, circular (more or less), triangular, or irregular (somewhat); compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified by a bloom; colored; monochrome; dark reddish to greenish brown or black; 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; 0.6 mm long; with curved outline; elliptic; apical at apex of radicle tip and between cotyledon and radicle lobe; recessed; within rim (inconspicuous). 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; flush; dissimilar color from testa; lighter than testa; tan; 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; equaling length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Eastern Spain, southern France, and Italy.

Notes: No entire fruits were available for photographing.

*Cytisophyllum*: *C. sessilifolium* (C. Linnaeus) O.F. Lang (A–D). A, Seeds (× 4.4); B–C, testa (× 50, × 1000); D, embryos (× 6).



Genus: *Petteria* C.B. Presl

Phylogenetic Number: 30.13.

Tribe: Genisteae.

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

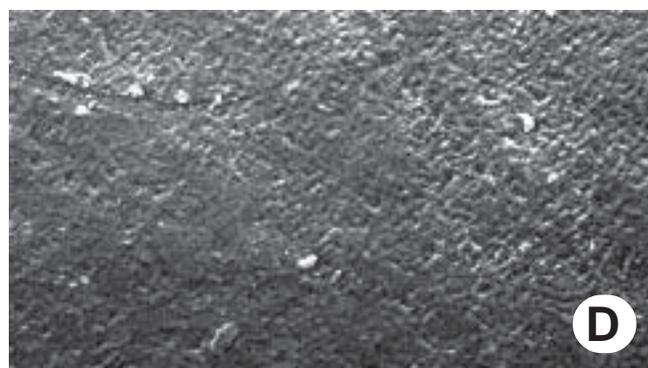
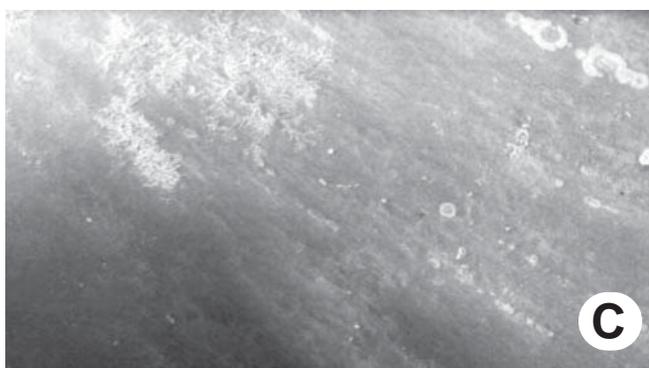
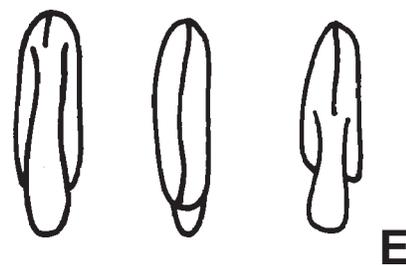
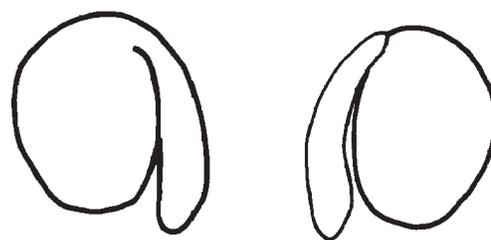
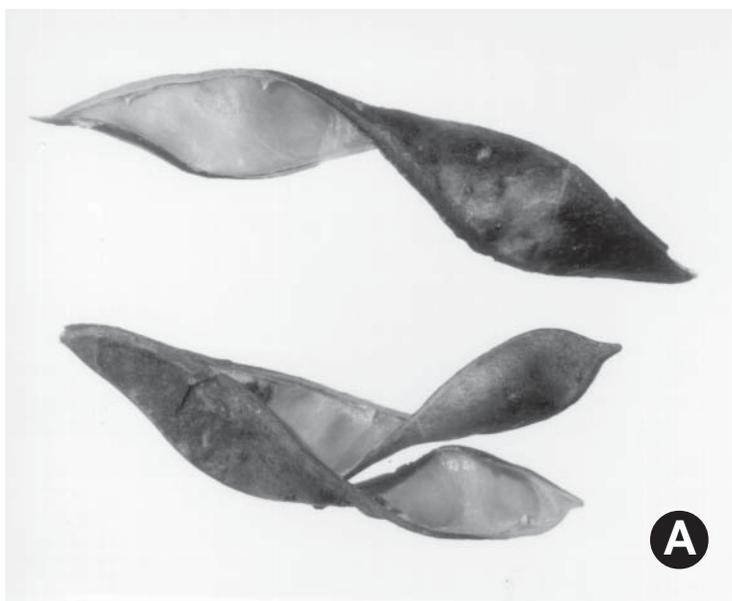
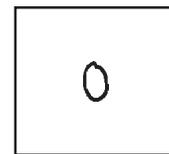
Fruit a legume; unilocular;  $2.5\text{--}5 \times 0.5\text{--}1$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; symmetrical or asymmetrical; broadly linear or falcate; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; not inflated; compressed; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. 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; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; dark reddish brown; glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; wrinkled or shagreen; not exfoliating or exfoliating in part; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown; spongy and scurfy (between seeds); nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 8; length parallel with or transverse to fruit length; neither overlapping nor touching or touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; flattened or triangular; straight. Aril dry; tongue-aril (nearly); tan.

Seed  $4.5\text{--}5 \times 2.5\text{--}4.5 \times 1.6\text{--}2.2$  mm; not overgrown; not angular or angular; symmetrical; rectangular, oblong, rhombic, or triangular; compressed or terete; with surface smooth; with 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; not modified by a bloom; colored; monochrome; orangish to greenish and reddish brown, tan (orangish), green, or orange; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent.

Wings absent. Raphe not visible. Hilum visible, partially concealed, or fully concealed; concealed by funiculus, funicular remnant, radicle lobe, or wing (somewhat); 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 (more or less) outline; oblong; apical at apex of radicle tip; recessed; within rim (which involves radicle lobe and open on lens side). Hilum rim color of testa. Lens barely discernible; less than 0.5 mm in length; with margins straight; tiny wedge-shaped or rhombic (tiny); not in groove of raphe; adjacent to hilum; 0.5 mm from hilum; barely mounded; 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; 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; 1/2 to nearly, equaling, or exceeding length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Balkans.

*Petteria*: *P. ramentacea* (F.W. Sieber) C.B. Presl (A–E). A, Fruit (dehisced) and valve ( $\times 2$ ); B, seeds ( $\times 3.7$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 5$ ).



Genus: *Argyrocytisus* (R.C.J.E. Maire) D.G. Frodin & V.H. Heywood ex C. Raynaud

Phylogenetic Number: 30.14.

Tribe: Genisteae.

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

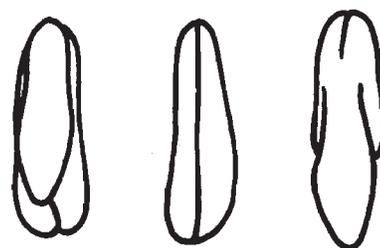
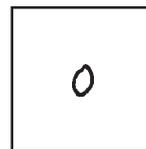
Fruit a legume; unilocular;  $5.5 \times 0.7$  cm; without orifice formed by curving of fruit or fruit segments; slightly curved; not plicate; not twisted; asymmetrical or symmetrical; linear; when asymmetrical with both sutures nearly straight; not inflated; compressed; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible or visible. Epicarp dull; monochrome; pubescent and indurate; with 1 type of pubescence; pilose; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; veined or not veined; reticulately veined (faintly near suture); not tuberculate; faintly wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; tan; smooth; nonseptate (but fringe of scurfy, light-colored material along ridges between seeds); chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 8; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 0.5 mm long; of 1 length only; thick; straight. Aril dry; tongue-aril; white.

Seed  $3.5-4 \times 3-3.5 \times 2-2.3$  mm; not overgrown; not angular; asymmetrical; oblong 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 or mottled and streaked (both faintly); dark reddish to greenish brown; with brown overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum

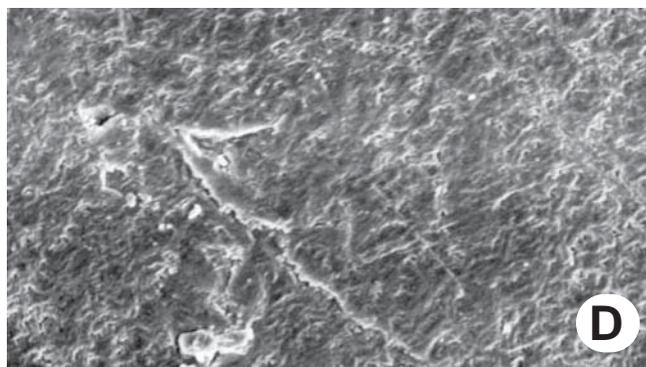
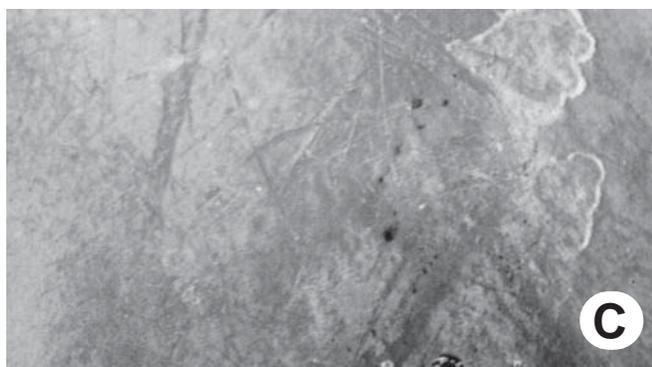
partially concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.4 mm long; with curved outline; oval; apical at apex of radicle tip and between cotyledon and radicle lobe; recessed; within rim. Hilum rim color darker than testa (slightly to black). Lens discernible; equal to or greater than 0.5 mm in length; 0.7–0.9 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; slightly mounded; dissimilar color from testa; lighter than testa; tan; 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; not sufficiently folded for inner face to touch itself; 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; equaling length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Africa (Atlas Mountains).

*Argyrocytisus*: *A. battandieri* (R.C.J.E. Maire) C. Raynaud (A–E). A, Valves ( $\times 1.5$ ); B, seeds ( $\times 4.5$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 6$ ).



E



Genus: *Cytisus* R.L. Desfontaines

Phylogenetic Number: 30.15.

Tribe: Genisteae.

Species Studied—Species in Genus: 13 spp.—35 spp.

Fruit a legume; unilocular;  $1.2-7 \times 0.4-1.3 \times 0.1-0.3$  cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear, oblong, or ovate; when asymmetrical with both sutures nearly straight; not inflated (more or less) or inflated; compressed or flattened; without beak; 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; chartaceous or coriaceous; seed chambers externally invisible or visible; with the raised seed chambers not torulose. Fruit margin not constricted or constricted; slightly constricted along both margins; without sulcus; plain. Fruit wings absent. Fruit nonstipitate or substipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome; brown to dark reddish brown or black; pubescent and indurate, pubescent but soon deciduous, or glabrous; with hairs erect or appressed; with 1 or 2 types of pubescence; villous (to restricted to sutures), pilose, or tomentose; with pubescence gray, brown, or golden; with long and short gray plain-tipped hairs; 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; faintly wrinkled; not exfoliating or exfoliating in part; without or with cracks; cracking oblique to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown to blackish brown or tan; smooth; subseptate or nonseptate; with septa composed of minute fringe of hairs; with septa eglandular; chartaceous; not exfoliating or exfoliating in part; remaining fused to mesocarp and epicarp; entire. Seeds 8–14; length transverse to, oblique to, or parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long or measured; up to 1 mm long; of 1 length only; triangular; straight or curved. Aril fleshy or dry; when

fleshy cupshaped; covering less than 1/2 of seed; when dry rim-aril; brown to reddish brown, tan (to reddish tan), or orange.

Seed  $3-5 \times 2-4.2 \times 1.5-2.5$  mm; not overgrown; not angular; asymmetrical; oblong, ovate, rectangular, rhombic, circular, or D-shaped; 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; dull; not modified by a bloom; colored; monochrome or mottled and streaked; brown to blackish, reddish, or greenish brown, tan (to greenish or reddish tan), red, orange, olive, green, or black; with tan 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; circular; apical at apex of radicle tip and between cotyledon and radicle lobe, subapical to radicle tip, or marginal according to radicle tip; recessed; within rim. Hilum rim color of or darker than testa. Lens discernible; less 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; mounded; similar color as testa; darker than testa; 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 bulbous or linear; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; equaling, 1/2 to nearly, or exceeding length of cotyledons. Plumule rudimentary; glabrous.

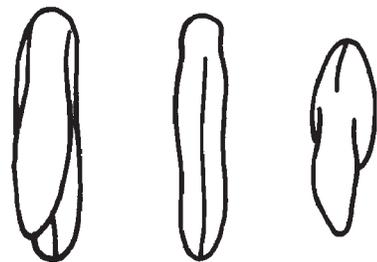
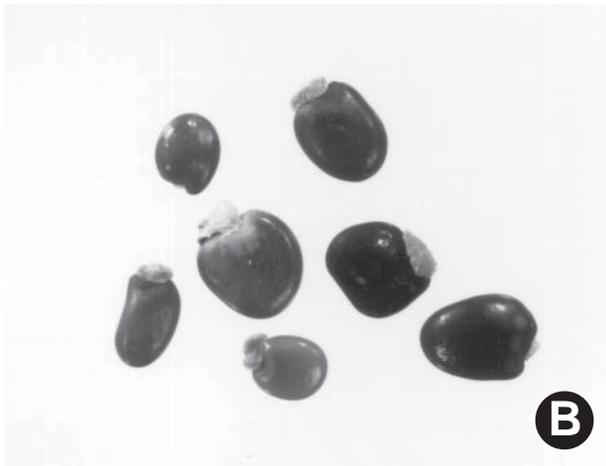
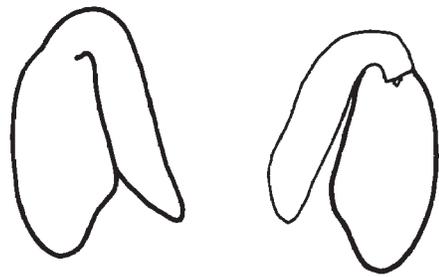
Distribution: Europe, North Africa, Canary Islands, and Asia.

Notes: Talavera and Gibbs (1997) added two species to *Cytisus*, and the species count includes them. Polhill (1994b) accepted *Lembotropis* A.H.R Grisebach

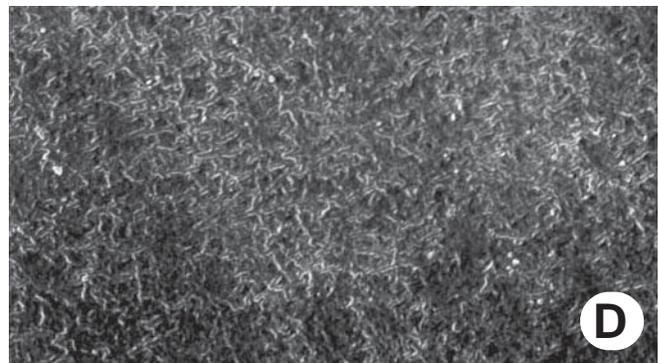
(30.16) as a genus, but we are maintaining it as a synonym of *Cytisus*.

*Cytisus*: *C. commutatus* (H.M. Willkomm) J.I. Briquet (*C–E*), *C. spp.* (*A–B*). *A*, Valves and fruit (dehisced) ( $\times 1.4$ ); *B*, seeds ( $\times 4$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 11$ ).

0



E



Genus: *Chamaecytisus* J.H.F. Link

Phylogenetic Number: 30.15A.

Tribe: Genisteae.

Species Studied—Species in Genus: 11 spp.—30 spp.

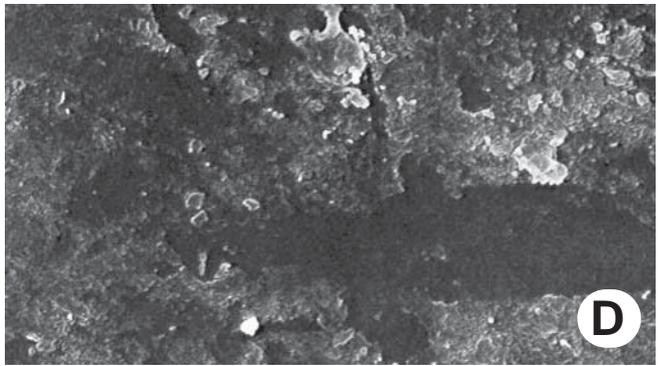
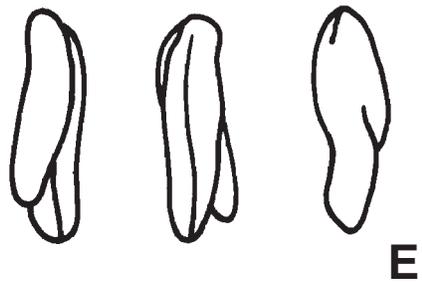
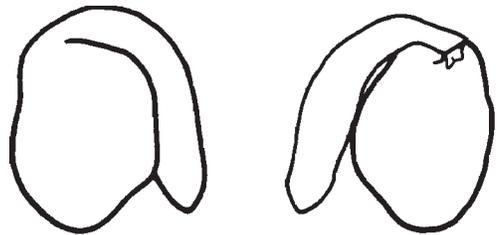
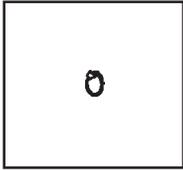
Fruit a legume; unilocular;  $2-7 \times 0.5-1.1 \times 0.2-0.4$  cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; oblong or falcate (barely); when asymmetrical with both sutures nearly straight; not inflated; flattened or compressed; without beak; tapered or short tapered at apex; apex aligned or 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; coriaceous or ligneous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. 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; brown to reddish brown; pubescent and indurate or pubescent but soon deciduous; with 1 type of pubescence; pilose or tomentose; 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; veined or not veined; reticulately veined; not tuberculate; faintly wrinkled or pustulate (minutely); not exfoliating, exfoliating, or exfoliating in part; with or without cracks; cracking oblique or transverse to fruit length. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; ligneous (or subligneous) or coriaceous. Endocarp dull; monochrome; reddish brown; smooth or scurfy; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 4–13; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; up to 1 mm long; of 1 length only; flattened or triangular; straight. Aril present or absent; fleshy; topknotlike or cupshaped; covering less than 1/2 of seed; reddish brown or tan (to reddish).

Seed  $2.7-5 \times 2.2-3.5 \times 1.5-2.7$  mm; not overgrown; angular or not angular; asymmetrical; oblong, ovate,

circular (more or less), triangular (more or less), or cordate; compressed or terete; with surface smooth; with or without visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; with umbo on seed faces. Cuticle wrinkled. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; brown to reddish or greenish brown, tan (to greenish tan), olive, or black; 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 or lighter colored than the rest of the hilum and therefore conspicuous; larger than punctiform; up to 1 mm long; with curved outline; circular or elliptic; apical at apex of radicle tip, subapical to radicle tip, or between cotyledon and radicle lobe; recessed; within rim or halo. Hilum halo color of testa (to duller). Hilum rim color of testa. Lens discernible or not discernible; less than or equal to or greater than 0.5 mm in length; up to 1 mm long; with margins straight or curved; circular (with light colored line), elliptic, or oblong; not in groove of raphe; confluent with hilum; mounded or flush; same color as or dissimilar color from testa; lighter than testa; reddish tan; 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 or bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; equaling or exceeding length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Europe, Morocco, and Canary Islands.

*Chamaecytisus*: *C. austriacus* (C. Linnaeus) J.H.F. Link (*C-E*), *C. spp.* (*A-B*). *A*, Fruits (closed and dehisced) ( $\times 1.3$ ); *B*, seeds ( $\times 4.6$ ); *C-D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 8$ ).



Genus: *Calicotome* J.H.F. Link

Phylogenetic Number: 30.17.

Tribe: Genisteae.

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

Fruit a legume; unilocular;  $3\text{--}5.5 \times 0.7\text{--}0.8 \times 0.27$  cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (slightly); not plicate; not twisted; asymmetrical or symmetrical; linear or oblong; when asymmetrical with both sutures nearly straight; not inflated; compressed; 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 short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally visible or invisible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain (though upper suture thickened and at most with 2 subwings) or embellished. Fruit wings absent or present; 2; 1 mm wide (at most); sutural; on 1 suture. Fruit nonstipitate or substipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp glossy; monochrome; dark reddish to slightly purplish brown; pubescent and indurate; with 1 type of pubescence; puberulent or 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; not veined; not tuberculate; faintly wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; subligneous. Endocarp dull; monochrome; brown to purplish brown or purple; smooth and scurfy; nonseptate (with well developed scurfy lines between seeds) or subseptate (because of regular intrusion of fruit); chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–8; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; filiform; straight. Aril present or absent; dry; rim-aril or tongue-aril; tan or white.

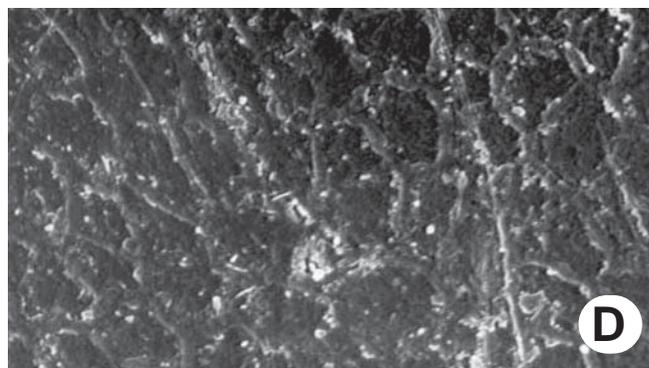
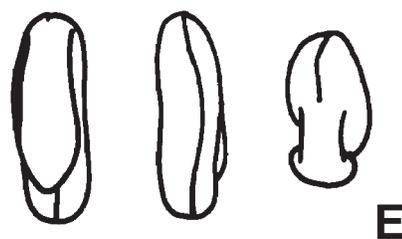
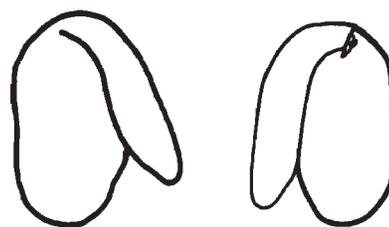
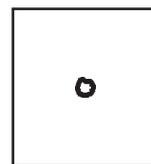
Seed  $3\text{--}4.2 \times 2.6\text{--}3.3 \times 1\text{--}3$  mm; not overgrown; not angular or angular; asymmetrical; rectangular, oblong, elliptic, or circular; compressed or terete; with surface

smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy or dull; not modified by a bloom; colored; monochrome; brown to light brown to dark reddish brown, tan (to faintly greenish tan), or yellow; 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 or larger than punctiform; 0.3 mm long; with curved outline; circular; apical at apex of radicle tip or between cotyledon and radicle lobe; recessed; within rim. Hilum rim color of testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7–0.8 mm long; with margins straight or curved; oblong or wedge-shaped; oblong; not in groove of raphe; confluent with hilum; mounded; similar color as testa; darker than testa; 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 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 bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly or equaling length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Mediterranean region.

Notes: The correct spelling of the genus is *Calicotome*, not *Calycotome* (Gunn 1983, Gunn et al. 1992).

*Calicotome*: *C. spinosa* (C. Linnaeus) J.H.F. Link (*C–E*), *C.* spp. (*A–B*). *A*, Fruit and valves ( $\times 1.5$ ); *B*, seeds ( $\times 6.1$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 8$ ).



Genus: *Erinacea* M. Adanson

Phylogenetic Number: 30.18.

Tribe: Genisteae.

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

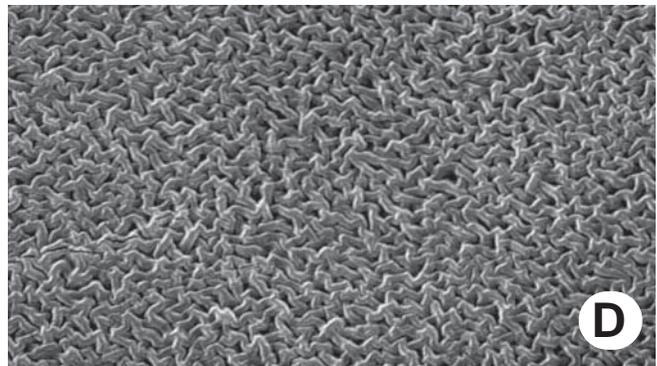
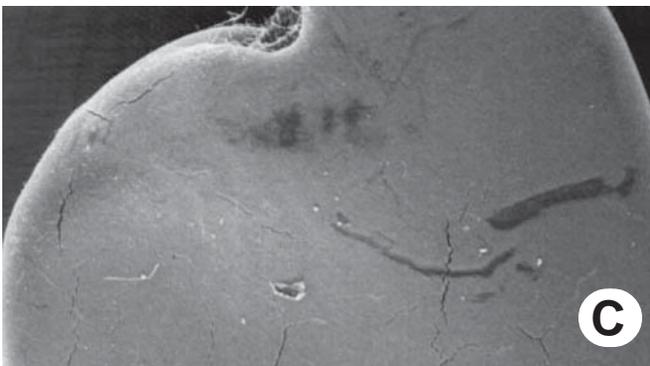
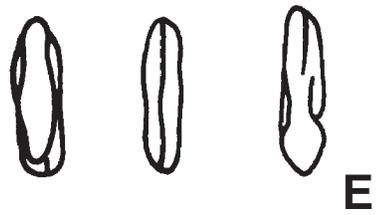
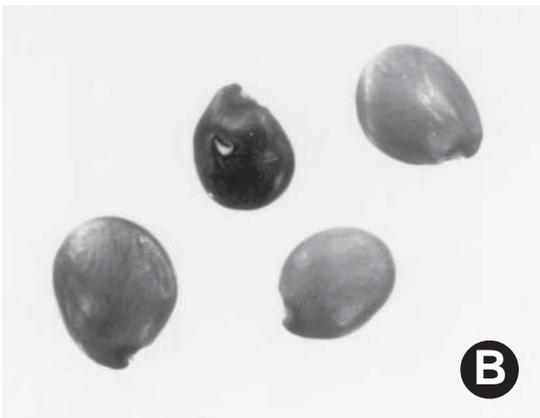
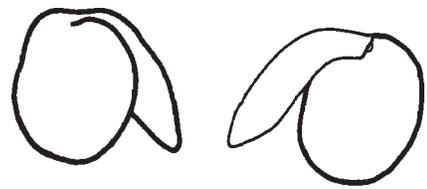
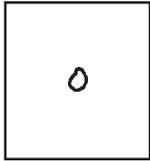
Fruit a legume; unilocular;  $1.5\text{--}1.8 \times 0.4 \times 0.1$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; narrowly oblong; when asymmetrical with both sutures nearly straight; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; 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; chartaceous; seed chambers externally visible; with the raised seed chambers torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves reflexing. Replum invisible. Epicarp dull; monochrome; reddish brown or black; pubescent and indurate; with hairs appressed or erect; with 1 type of pubescence; sericeous; with pubescence golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating or exfoliating in part; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; chartaceous. Endocarp dull; monochrome; reddish brown or gray; smooth and scurfy; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–3; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; triangular; straight. Aril dry; rim-aril; reddish tan or white.

Seed  $3.7 \times 3 \times 1.5$  mm; not overgrown; not angular; asymmetrical; oblong or triangular; compressed; with surface smooth; with visible radicle and cotyledon lobes; without external groove between radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome; dark reddish to greenish brown or olive; 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; subapical to radicle tip and between cotyledon and radicle lobe; recessed; within halo. Hilum halo color darker (greenish) than testa. Lens discernible; less than 0.5 mm in length; with margins straight or curved; oblong or linear; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; lighter than testa; tan; 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; 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 bulbous; lobe tip straight; deflexed and parallel to cotyledon length; not centered between cotyledons (radicle outside 1 cotyledon and inside other, therefore junctions for each cotyledon different); equaling length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern Europe and northwestern Africa.

*Erinacea: E. anthyllis* J.H.F. Link (*A–E*). *A*, Fruit within calyx and corolla and valve ( $\times 2.9$ ); *B*, seeds ( $\times 6.2$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos (upper two show the outside of both cotyledon-radicle junctions) ( $\times 10$ ).



Genus: *Spartium* C. Linnaeus

Phylogenetic Number: 30.19.

Tribe: Genisteae.

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

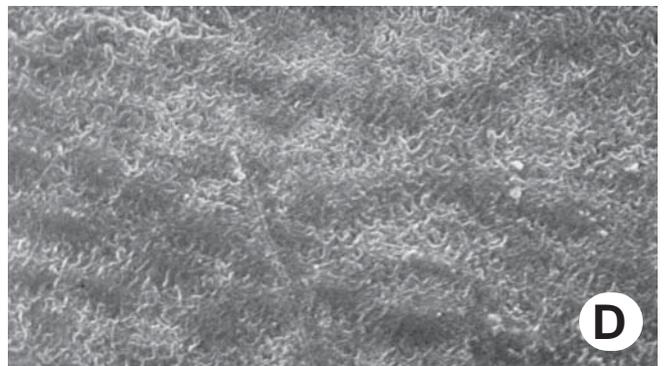
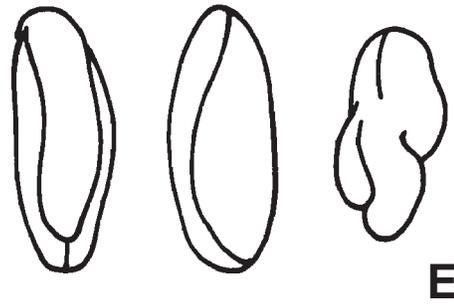
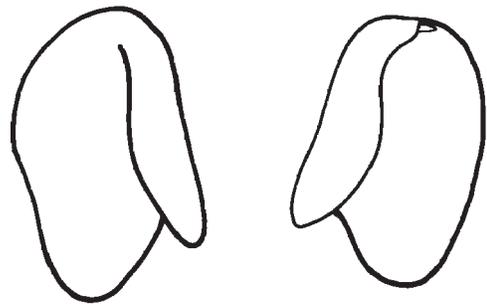
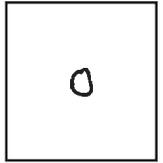
Fruit a legume; unilocular;  $5-7 \times 0.5-0.8 \times 0.2-0.3$  cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; linear; not inflated; flattened; without or with beak; with solid beak the same color and texture as fruit; short tapered at apex; apex aligned with longitudinal axis of fruit; short tapered at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp glossy; monochrome; reddish brown; glabrous; eglandular; without spines; not smooth; with elevated features; not veined; not tuberculate; faintly wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp glossy or dull; monochrome; reddish brown or tan (reddish); smooth and scurfy (somewhat between seeds); subseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 10–16; length transverse to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick; straight. Aril dry; rim-aril or tongue-aril; cream or tan.

Seed  $3.5-4 \times 2.5-3 \times 1.5-1.7$  mm; not overgrown; not angular or angular; asymmetrical; oblong, quadrangular, rectangular, circular, D-shaped, or irregular; 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 to bright reddish brown or purple (almost dark); 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; subapical to radicle tip to apical at apex of radicle tip; recessed; within rim. Hilum rim color of to darker than testa. Lens discernible; less than 0.5 mm in length; with margins straight or curved; circular or oblong; not in groove of raphe; confluent with hilum; mounded; similar color as or dissimilar color from testa; lighter or darker than testa; tan (reddish within dark reddish border) or 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; 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 bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Mediterranean region and widely cultivated.

*Spartium*: *S. junceum* C. Linnaeus (A–E). A, Dehiscent fruit and valve ( $\times 1.4$ ); B, seeds ( $\times 6$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 8$ ).



Genus: *Gonocytisus* É. Spach

Phylogenetic Number: 30.20.

Tribe: Genisteae.

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

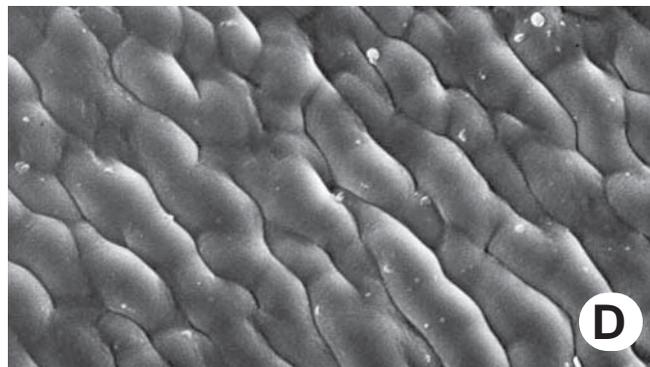
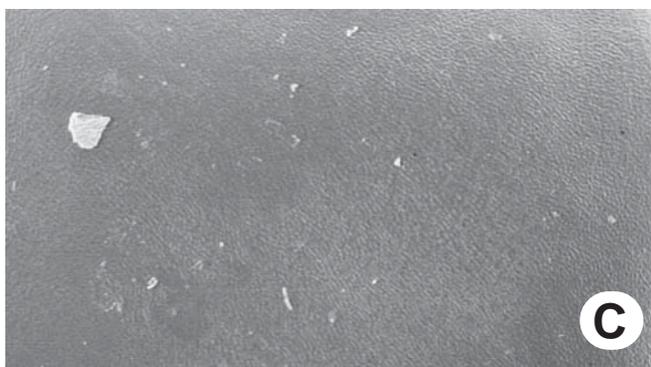
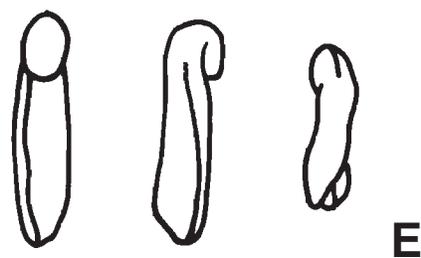
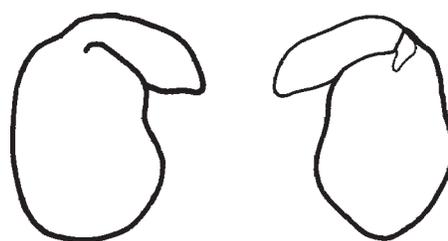
Fruit a legume; unilocular;  $1.2\text{--}1.7 \times 0.45\text{--}0.6 \times 0.075\text{--}0.18$  cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; oblong or rhombic; when asymmetrical with both sutures nearly straight; not inflated; compressed; without beak; short tapered at apex; apex aligned or oblique (slightly) with longitudinal axis of fruit; short tapered at base; base aligned (slightly) or oblique with longitudinal axis of fruit; with the apex and base uniform in texture; ligneous; seed chambers externally visible; with the raised seed chambers not torulose. 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; reddish brown; pubescent and indurate; with hairs appressed; with 1 type of pubescence; with pubescence gray; 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; faintly wrinkled; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; subligneous. Endocarp dull; monochrome; brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–2; length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; filiform or triangular; straight. Aril dry; rim-aril; tan.

Seed  $2.5\text{--}4 \times 2\text{--}3 \times 1.7\text{--}2$  mm; not overgrown; not angular or angular; asymmetrical; oblong, reniform, or circular (more or less); 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 or black; glabrous; smooth; coriaceous. Fracture lines absent.

Rim present. Wings absent. Raphe not visible. Hilum partially or fully concealed; concealed by aril or funiculus; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform; between cotyledon and radicle lobe; recessed; within rim or not within corona, halo, or rim. Hilum rim color of testa. Lens discernible; less than 0.5 mm in length; with margins straight or curved; more or less oblong or circular; not in groove of raphe; adjacent to hilum; 0.5 mm from hilum; flush or recessed; similar color as or dissimilar color from testa; lighter than testa; tan; 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; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; oblique to length of seed; with a joint evident between the radicle and the cotyledons. Radicle 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: Eastern Mediterranean.

*Gonocytisus*: *G. angulatus* (C. Linnaeus) É. Spach (*C–E*), *G. spp.* (*A–B*). *A*, Fruits (closed and dehisced) ( $\times 3.4$ ); *B*, seeds ( $\times 5.7$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 8$ ).



Genus: *Retama* C.S. Rafinesque-Schmaltz

Phylogenetic Number: 30.21.

Tribe: Genisteae.

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

Fruit a legume; unilocular;  $0.7\text{--}2 \times 0.6\text{--}1 \times 0.45\text{--}1$  cm; with deciduous calyx; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; ovate to elliptic or elliptic to ovate; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; 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; 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 nonstipitate. Fruit indehiscent (to finally incompletely dehiscent along vertical suture) or with all layers dehiscing; splitting along suture. Dehiscence of valves along 1 suture; probably apical and down; passive. Replum invisible. Epicarp glossy or dull; monochrome (though some with darker areas); brown to dark or dark reddish brown or tan; glabrous; eglandular; without spines; not smooth or smooth; with elevated features; not veined; not tuberculate; rugose or wrinkled; not exfoliating; without cracks. Mesocarp thick or thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid (tan) or vitreous (dark reddish-brown); ligneous (or subligneous). Endocarp dull or glossy; monochrome (to darker and lighter when underlain by dark mesocarp); brown or tan; spongy and cobwebby; subseptate or nonseptate; with septa thin (tissue paper-like), flexible or thicker than paper, firm; with septa eglandular; coriaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1(–2); length parallel with fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick; straight. Aril absent.

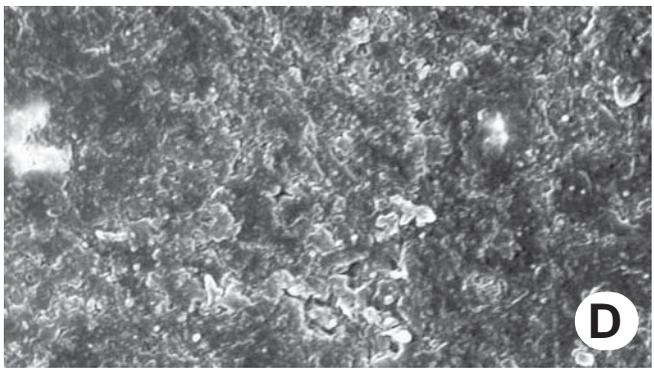
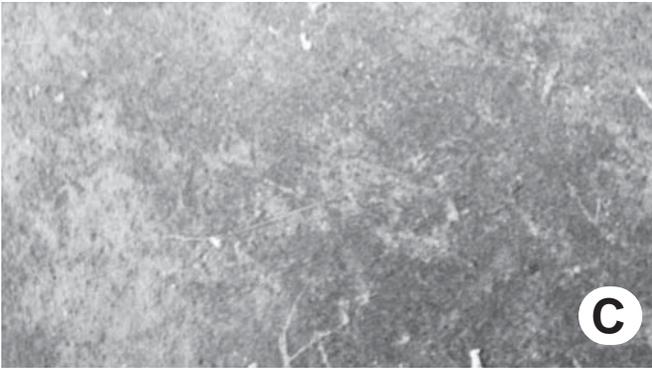
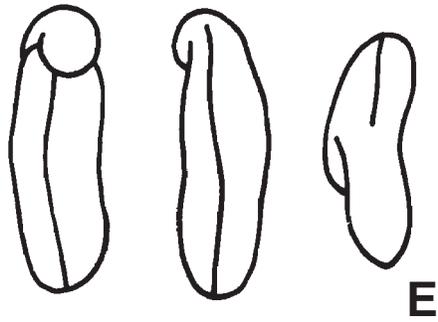
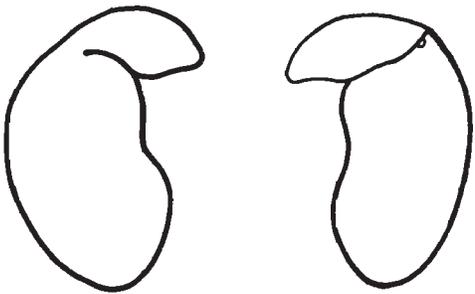
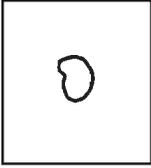
Seed  $6\text{--}7.5 \times 4\text{--}5.5 \times 3\text{--}4.5$  mm; not overgrown; not angular or angular; asymmetrical or symmetrical; oblong, reniform, triangular (more or less), D-shaped, or irregular; compressed, terete, or mounded on 1 side and straight on other side; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Testa not adhering or

partially adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent or infrequent mottles; dark reddish to greenish brown, tan (to greenish or reddish tan), green (light to dark), or black; with black overlay; glabrous; smooth; osseous. 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; up to 1 mm long; with straight outline; oblong; marginal according to radicle tip; recessed; within rim. Hilum rim color of or lighter than testa. Lens discernible or not discernible; equal to or greater than 0.5 mm in length; up to 2.5 mm long; with margins straight or curved; linear, oblong, wedge-shaped, or circular (with a small satellite); not in groove of raphe; confluent with or adjacent to hilum; up to 0.3 mm from hilum; flush or recessed; similar color as or dissimilar color from testa; lighter or darker than testa; reddish brown, tan, or black; not within corona, halo, or rim. Endosperm thick; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; 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 bulbous; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Mediterranean region, northern Africa, Canary Islands, and Asia (Middle East).

Notes: This genus is presented under the name *Lygos* M. Adanson in Heywood (1968).

*Retama*: *R. sphaerocarpa* (C. Linnaeus) P.E. Boissier (*C–E*), *R. spp.* (*A–B*). *A*, Fruits ( $\times 3.4$ ); *B*, seeds ( $\times 4$ ); *C–D*, testa ( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 5$ ).



Genus: *Genista* C. Linnaeus

Phylogenetic Number: 30.22.

Tribe: Genisteae.

Species Studied—Species in Genus: 33 spp.—87 spp.

Fruit a legume; unilocular;  $0.8\text{--}3 \times 0.35\text{--}0.4 \times 0.15\text{--}0.3$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight or curved (or slightly curved); not plicate; not twisted; asymmetrical or symmetrical; oblong, linear, ovate, rhombic, or falcate; when asymmetrical with both sutures parallelly curved; not inflated or inflated; compressed, flattened (rarely), or terete; without beak; tapered or short tapered at apex; apex aligned, oblique, or right-angled with longitudinal axis of fruit; tapered or short tapered at base; base aligned, oblique, or right angled with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally visible or invisible; with the raised seed chambers not torulose or torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate or nonstipitate. Fruit with all layers dehiscing or indehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp glossy or dull; monochrome; dark to light reddish brown; glabrous or pubescent and indurate; with hairs erect or appressed; with 1 type of pubescence; tomentose or villous; with pubescence golden or gray; with pubescence uniformly distributed or with apical pubescence different from basal pubescence; with apical  $1/3\text{--}1/2$  pubescent and basal  $1/2\text{--}2/3$  glabrous (*G. cephalantha* É. Spach); with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; veined or not veined; obliquely veined relative to fruit length or reticulately veined; not tuberculate; wrinkled; exfoliating in part or not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; reddish brown; smooth and scurfy (around seeds); with hairs scattered over endocarp (minute except along sutures where much longer); subseptate or nonseptate; with septa thin (tissue paper-like), flexible; with septa eglandular; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–7; length transverse, oblique, or parallel with fruit length; neither

overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long or measured; up to 1.5 mm long; of 1 length only; filiform, thick, or triangular; straight, curved, S-curved, or hooked. Aril dry or fleshy; when fleshy topknotlike or cupshaped; covering less than  $1/2$  of seed; when dry rim-aril or tongue-aril; reddish brown, tan, white, or red (nearly).

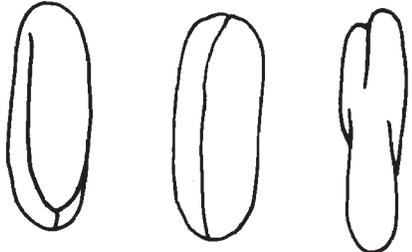
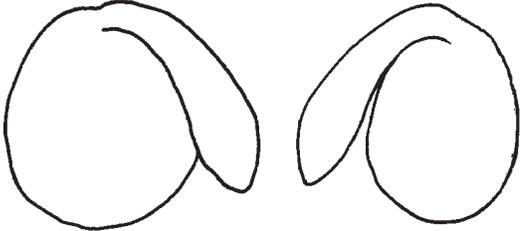
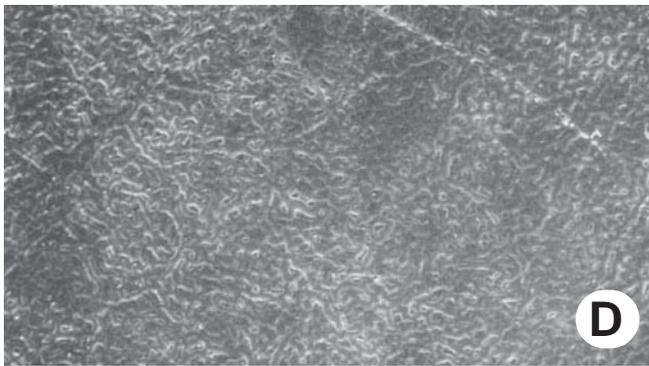
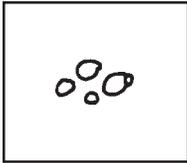
Seed  $1.8\text{--}4.2 \times 1.5\text{--}3 \times 1\text{--}2$  mm; not overgrown; not angular or angular; asymmetrical; oblong, ovate, reniform, circular (more or less), D-shaped, irregular (somewhat), quadrangular, rhombic, or triangular; compressed or terete; with surface smooth; with or without 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; not modified by a bloom; colored; monochrome or mottled and streaked (sometimes both faint); with frequent mottles; with frequent streaks; brown to yellowish, greenish or reddish brown, yellow (to brownish to greenish yellow), green, olive, or black; with brown or black overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or fully concealed (occasionally); concealed by funiculus or funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform or larger than punctiform; 0.3 mm long; with curved outline; circular; apical at apex of or subapical to radicle tip; recessed; within rim. Hilum rim color of testa. Lens discernible or not discernible; less than or equal to or greater than 0.5 mm in length; 0.5 mm long; with margins straight or curved; elliptic or oblong; not in groove of raphe; adjacent to or confluent with hilum; 0.1–0.2 mm from hilum; mounded or flush; similar color as testa; not within corona, halo, or rim. Endosperm thick or thin; 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; tan, yellow, or white; 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;  $1/2$

to nearly, equaling, or exceeding length of cotyledons.  
Plumule rudimentary; glabrous.

Distribution: Europe, Canary Islands, northern Africa, and western Asia.

Notes: Gibbs (1966) revised the genus, and Gibbs and Dingwall (1971) revised its segregate *Teline* F.K. Medikus, now recombined with *Genista*.

*Genista*: *G. germanica* C. Linnaeus (*C–E*), *G. spp.* (*A–B*). *A*,  
Fruits (dehisced) ( $\times 1.5$ ); *B*, seeds ( $\times 4$ ); *C–D*, testa  
( $\times 50$ ,  $\times 1000$ ); *E*, embryos ( $\times 10$ ).



**E**

Genus: *Echinopartum* (É. Spach) J.P. Fourreau

Phylogenetic Number: 30.23.

Tribe: Genisteae.

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

Fruit a legume; unilocular;  $1-1.5 \times 0.3-0.5 \times 0.1-0.2$  cm; with persistent calyx; with calyx longer than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; oblong; when asymmetrical with 1 straight and 1 curved suture or both sutures parallelly curved; widest near middle or D-shaped; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; 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; liginous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; embellished. Fruit wings absent. Fruit nonstipitate. Fruit with all layers dehiscing; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves enrolling. Replum invisible. Epicarp dull; monochrome; 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; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thick; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; sublignous. Endocarp glossy; monochrome; reddish tan; smooth and scurfy; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1 or 2; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick; curved. Aril dry; rim-aril; black.

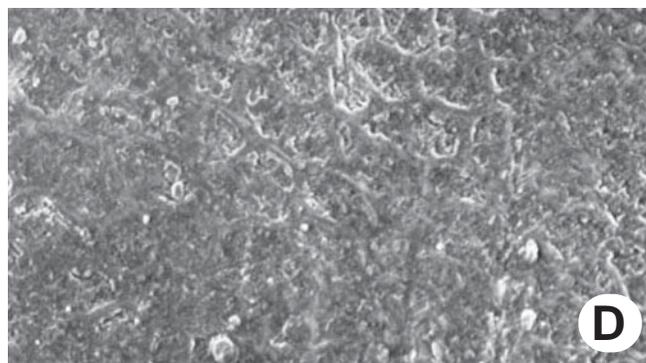
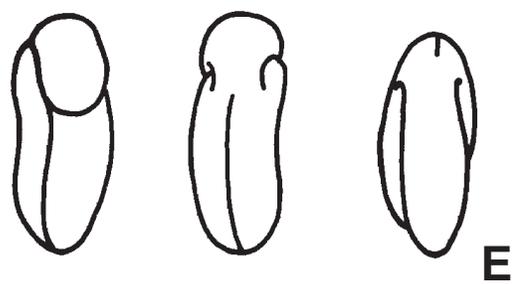
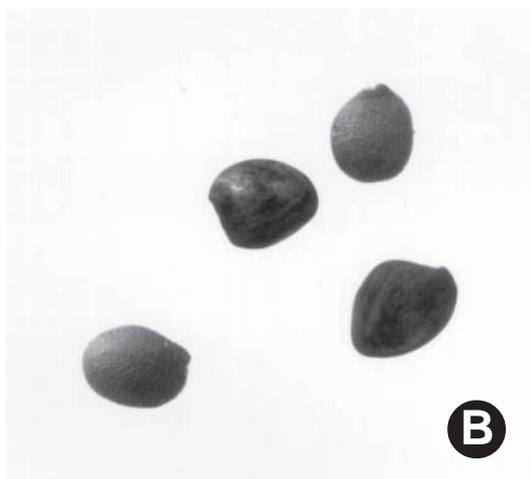
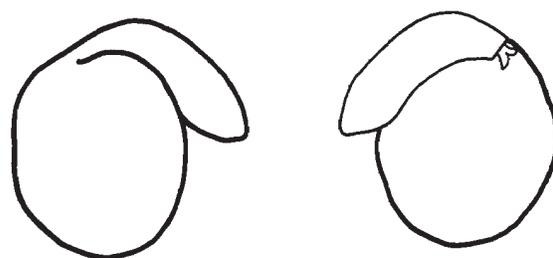
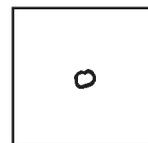
Seed  $2.5-2.7 \times 2-2.5 \times 1.7-2$  mm; not overgrown; angular or not angular; asymmetrical; oblong, ovate, or D-shaped; compressed or terete; with surface smooth; without visible radicle and cotyledon lobes; without hilar sinus; without umbo on seed faces. Cuticle wrinkled (*E. horridum* (J.L.M. Vahl) W.H.P. Rothmaler). 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 black overlay; glabrous; smooth or not smooth; with elevated features; wrinkled (because

of cuticle); 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; apical at apex of radicle tip; slightly recessed; within rim. Hilum rim color of testa. Lens not discernible. Endosperm thick; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with 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 somewhat linear; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons;  $1/2$  to nearly length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Southwestern Europe.

Notes: We are following Gunn et al. (1992) for the author of this genus rather than Bisby (1981).

*Echinopartum*: *E. lusitanicum* (C. Linnaeus) W.H.P. Rothmaler (C-E), *E. spp.* (A-B). A, Fruits (dehisced) ( $\times 2.9$ ); B, seeds ( $\times 6.6$ ); C-D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 12$ ).



Genus: *Stauracanthus* J.H.F. Link

Phylogenetic Number: 30.24.

Tribe: Genisteae.

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

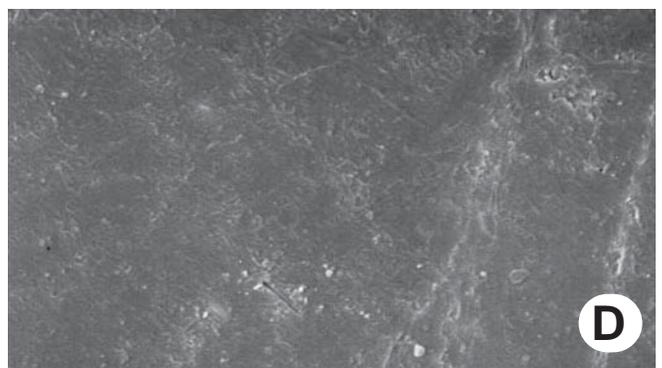
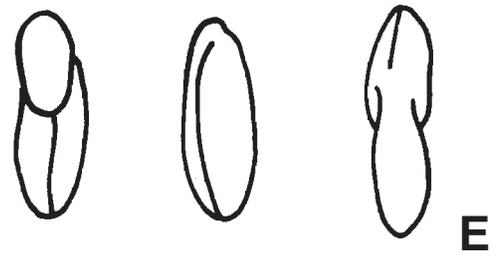
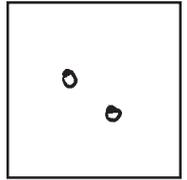
Fruit a legume; unilocular;  $0.8\text{--}2.5 \times 0.5$  cm; with persistent calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; linear or oblong (to linear); when asymmetrical with 1 straight and 1 curved suture or both sutures nearly straight; widest near middle or D-shaped (somewhat); not inflated; compressed; without beak; rounded 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; 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; assumed apical and down; passive. Replum invisible. Epicarp dull; monochrome; reddish brown; glabrous or pubescent but soon deciduous; with hairs appressed; with 1 type of pubescence; with pubescence golden (barely golden, primarily colorless); with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; reddish brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 2–6; length oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus measured; 1 mm long; of 1 length only; flattened; curved. Aril present (but apparently easily knocked off); fleshy; topknotlike; covering less than 1/2 of seed; brown or tan.

Seed  $2.8\text{--}3.5 \times 2\text{--}2.5 \times 1.2\text{--}1.8$  mm; not overgrown; not angular or angulate; asymmetrical; oblong or rectangular (more or less); 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 or streaked and mottled (large or

minute); with frequent mottles; with frequent streaks; reddish to greenish brown or green; with purple overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible or fully concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform or larger than punctiform; 0.3 mm long; with straight outline; oblong; apical at apex of radicle tip and between cotyledon and radicle lobe; recessed; within rim. Hilum rim color of testa (or nearly so). Lens discernible; equal to or greater than 0.5 mm in length; 0.8 mm long; with margins straight or curved; oblong; not in groove of raphe; confluent with hilum; mounded; 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; 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; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southwestern Europe and northwestern Africa.

*Stauracanthus*: *S. boininii* (P.B. Webb) G.A. da S.F. Sampaio (A), *S. genistoides* (F.d'A. Brotero) G.A. da S.F. Sampaio (C–E), *S. spp.* (B). A, Inner and outer valve surfaces ( $\times 5.7$ ); B, seeds ( $\times 6.3$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 14$ ).



Genus: *Ulex* C. Linnaeus

Phylogenetic Number: 30.25.

Tribe: Genisteae.

Species Studied—Species in Genus: 7 spp.—20 spp.

Fruit a legume; unilocular;  $0.8-2 \times 0.4-0.45 \times 0.14-0.15$  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; linear (oblong), oblong, ovate, or rhombic; when asymmetrical with both sutures nearly straight; not inflated; compressed or terete; without or with beak; straight; with solid beak the same color and texture as fruit; tapered 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, ligneous, or fragile, thinner than chartaceous like *Trifolium* (23.07); seed chambers externally visible or invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit substipitate or nonstipitate. Fruit with all layers dehiscent; splitting along sutures. Dehiscence of valves along both sutures; apical and down; active; with valves twisting. Replum invisible. Epicarp dull; monochrome or multicolored; bichrome (upper portion darker than lower portion); reddish brown; with surface texture uniform or not uniform, with patches of different texture not restricted to the base and apex; pubescent and indurate; with 1 type of pubescence; villous; with pubescence more or less golden or gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; smooth; not veined; not tuberculate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous or ligneous (sub). Endocarp dull; monochrome; reddish brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seeds 1–6; length parallel with or oblique to fruit length; neither overlapping nor touching; in 1 series. Funiculus less than 0.5 mm long; of 1 length only; thick; curved. Aril fleshy or dry; topknotlike; rim-aril; brown, tan, cream, or ivory.

Seed  $2-3 \times 1.3-3.5 \times 1-2.7$  mm; not overgrown; not angular or angular; asymmetrical; oblong, ovate, rectangular, triangular, circular, or irregular; compressed or terete; with surface smooth; with or without

visible radicle and cotyledon lobes; without or with (faint) 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; reddish to greenish brown, tan (greenish), or green; glabrous; smooth; 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; 0.5–1 mm long; with curved outline; elliptic or oval; apical at apex of radical tip, subapical to radicle tip, or between cotyledon and radicle lobe; recessed; within rim. Hilum rim color lighter (greenish-tan) or darker (dark brown) than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.7–1 mm long; with margins straight or curved; oblong (with or without central groove) or key-hole shaped (more or less); not in groove of raphe; confluent with hilum; flush or recessed; same or similar color as testa; lighter or darker than testa; 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 bulbous; lobe tip straight; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly or equaling length of cotyledons. Plumule rudimentary or moderately developed; glabrous.

Distribution: Native to Western Europe and northern Africa; introduced elsewhere.

*Ulex*: *U. parviflorus* P.A. Pourret de Figeac (C–E), *U.* spp. (A–B). A, Dehiscent fruits with one in calyx and bracts ( $\times 2.6$ ); B, seeds ( $\times 6$ ); C–D, testa ( $\times 50$ ,  $\times 1000$ ); E, embryos ( $\times 10$ ).

