

Identification Guide to Large-seeded Members of the Subfamily Faboideae (Fabaceae)



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The 2021 edition contains new information, revised common names as they appear in the AOSA Rules for Testing Seeds (AOSA 2019a, AOSA 2019b), and scientific nomenclature updates in accordance with the USDA GRIN Database (USDA-GRIN 2021). Photographs are by D. J. Lionakis Meyer. Ms. Meyer is retired from the CDFA/PPDC Seed Science Laboratory.

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Identification of Large-seeded Members of the Subfamily Faboideae (Fabaceae)

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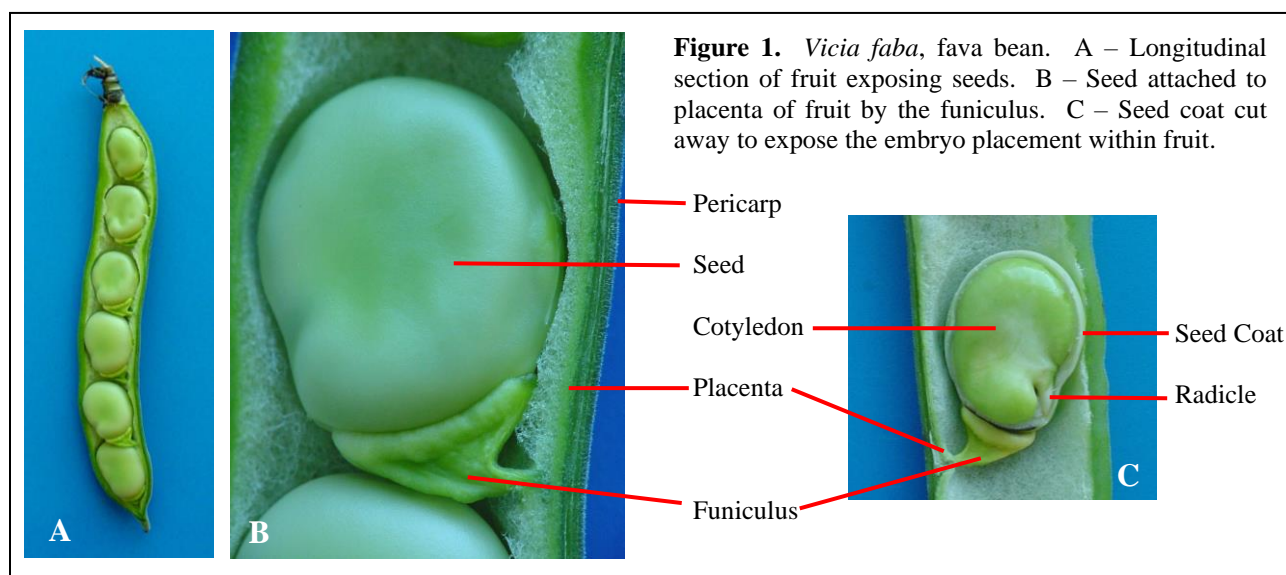
California Department of Food & Agriculture
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Cover photographs: *Phaseolus vulgaris* (upper left), *Lens culinaris* (lower left), *Lablab purpureus* (center), *Cicer arietinum* (upper right), and *Glycine max* (lower right).

Identification of Large-seeded Members of the Subfamily Faboideae (Fabaceae)

The Fabaceae is considered to be the third largest plant family (Kirkbride et al. 2003), with estimates of 741 to 770 genera and 19,500 to 20,200 species (LPWG 2017; Mabberley 2017). The family is currently divided into six subfamilies, Caesalpinioideae, Cercidoideae, Detarioideae, Dialioideae, Duparquetioideae, and Faboideae (LPWG 2017; USDA-GRIN 2021). Some authors prefer the family name Leguminosae to Fabaceae and the subfamily name Papilionoideae rather than Faboideae (Isley and Polhill 1980; LPWG 2017). The mimosoid group of genera (subfamily Mimosoideae of Gunn, 1974) are currently included within a broader subfamily Caesalpinioideae based upon recent molecular phylogenies of the family (LPWG 2017). Morphological features important to the identification of large-seeded Faboideae species are described by Delorit and Gunn (1986), Gunn (1971, 1981, 1984, and 1991), Kirkbride et al. (2003), Kopooshian and Isley (1966), Lersten and Gunn (1982), and Musil (1963).

In the world of seed testing, the seed unit for large-seeded species in Faboideae consists primarily of the true seed, therefore fruit characters will only be briefly considered here. The number of ovules developing into seeds within the fruit can range from one to many depending on the species. Within the fruit, the hilum of the seed is connected to the placenta by a stalk called the funiculus (Figure 1). The funiculus acts like an “umbilical cord” with its vascular tissue supplying the developing seed with water and nutrients. The funiculus length (0.1 to 70 mm), thickness, and shape (e.g., straight, triangular, S-curved, hooked, etc.) is species specific (Kirkbride et al. 2003). For some species included in this identification guide, the hilum and sometimes remnants of the funiculus remaining attached to the seed (in some cases becoming an aril) are of great diagnostic value.



Diagnostic features within the seed can include the structures of the embryo (Figure 2), such as the shape of the radicle (bulbose, linear, triangular, or truncate), radicle length relative to cotyledon length, alignment of radicle to cotyledons, development stage of the epicotyl (rudimentary, moderately developed, or well developed), cotyledon thickness and length, etc. (Kirkbride et al. 2003). Such features are useful when identifying broken seeds or seeds with the seed coat removed. For more details on internal structures of Faboideae seeds refer to Kirkbride et al. (2003).

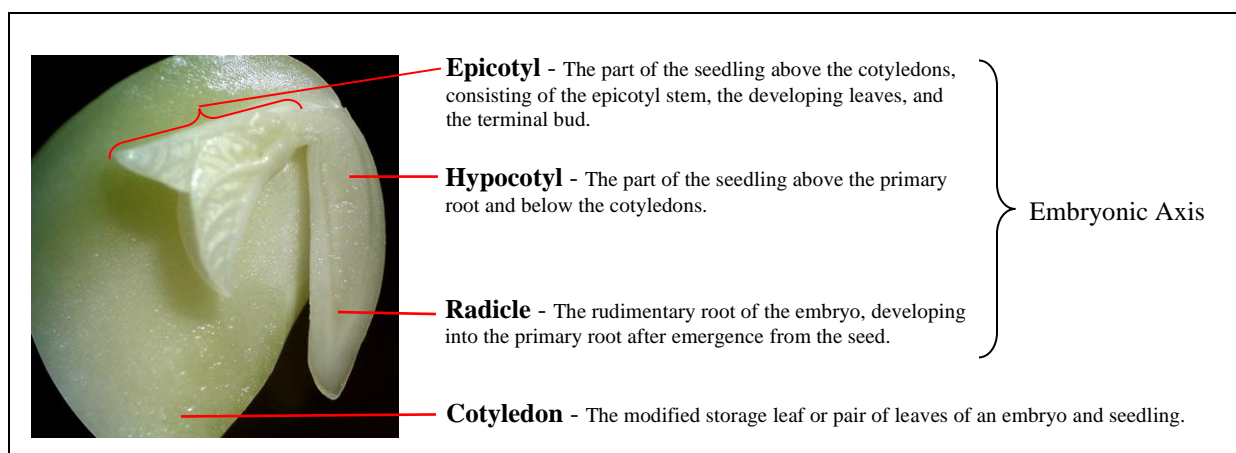


Figure 2. *Phaseolus vulgaris* (bean) – Longitudinal section of the seed exposing the parts of the embryo. In this species the epicotyl is well developed. Definitions are from the AOSA Rules for Testing Seeds (2019a).

External features of a legume seed include the hilum, lens, micropyle, radicle lobe, and cotyledon lobe (Figure 3). The micropyle is located on the end of the hilum closest to the radicle lobe. In many species the lens is located near the hilum but at the end of the hilum opposite from the micropyle. In some species the lens can be located some distance from the hilum and in rare cases on the opposite side of the seed from the hilum (e.g., *Vicia hybrida*, *V. lutea*, *V. pannonica*; Gunn 1971).

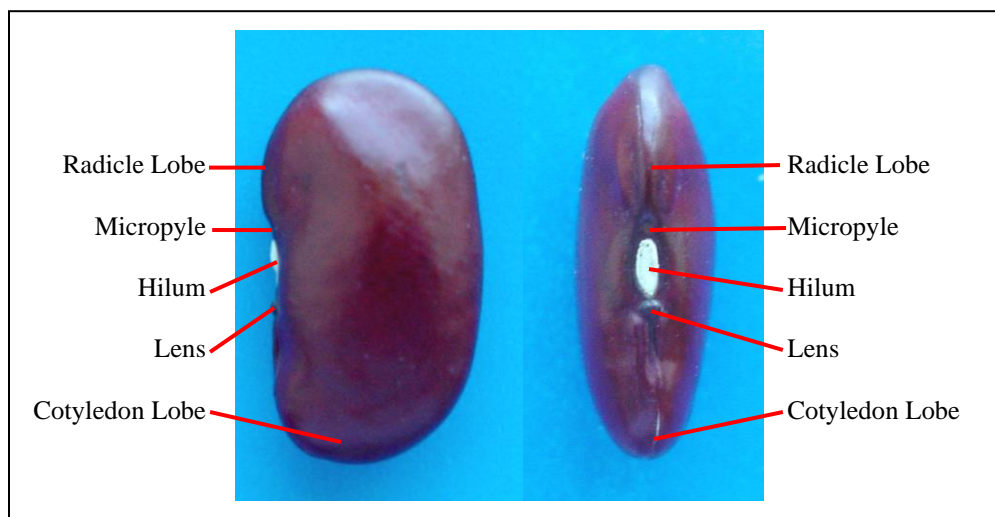


Figure 3. External features of a *Phaseolus vulgaris* (bean) seed including the hilum, lens, micropyle, radicle lobe, and cotyledon lobe.

External seed characteristics important to identification of large-seeded species in the Faboideae include general seed outline (Figure 4a), cross-sectional shape (Figure 4b), seed coat texture, hilum shape, visibility of the lens and hilar groove, and presence of funicular/aril tissue (Figure 5). For the purpose of this paper, descriptions of the hilum shape are based on seeds orientated with the radicle above the hilum (not necessarily as shown in the photographs).

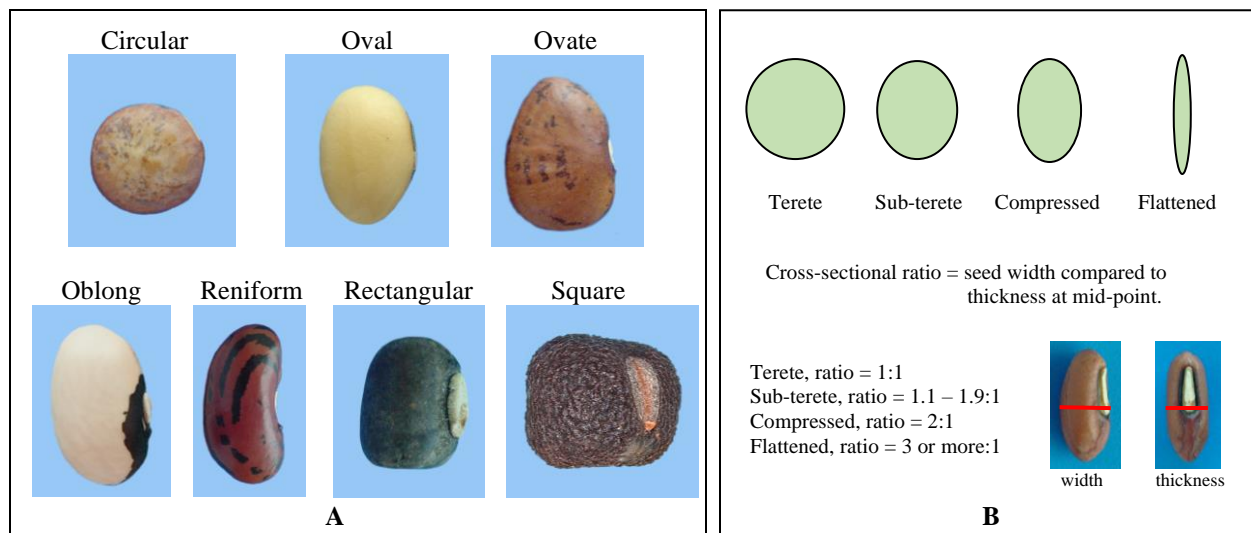


Figure 4. A – General seed shapes in lateral view. B – Cross-sectional seed shapes.

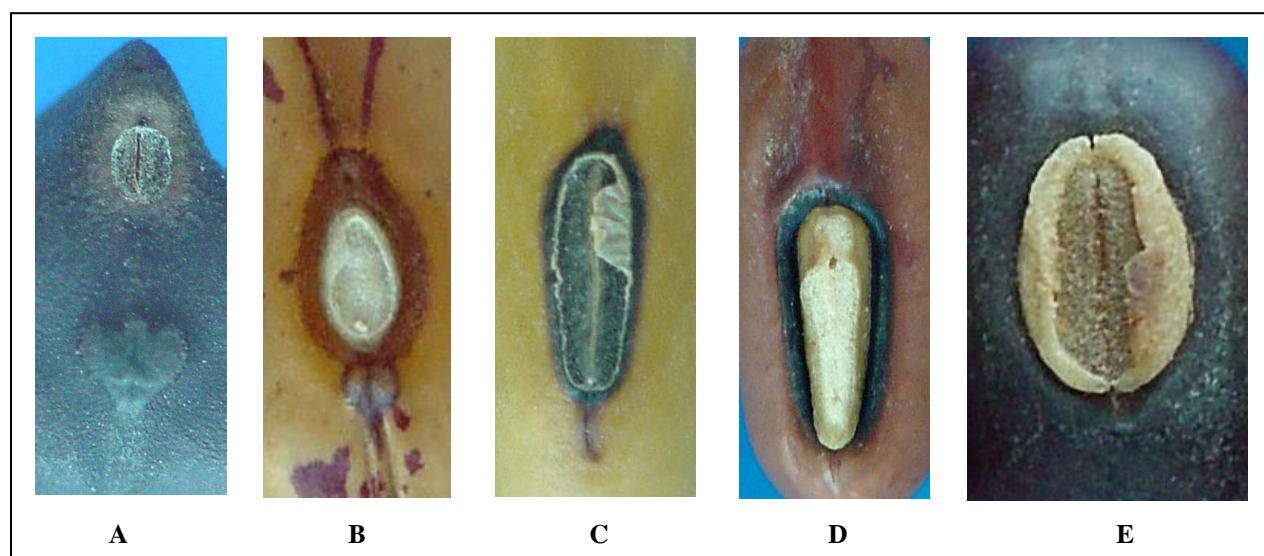


Figure 5. Examples of hilum, aril, and lens features. A - *Cicer arietinum* (chickpea) round hilum with evident hilar groove; lens prominently raised above seed surface but not adjacent to hilum. B - *Phaseolus vulgaris* (bean) hilum concealed by funicular tissue remnant; lens prominently raised above seed surface and adjacent to hilum. C - *Glycine max* (soybean) oblong hilum with evident hilar groove; hilum partially concealed by tongue aril; lens adjacent to hilum but not prominently raised on seed surface. D - *Vigna unguiculata* subsp. *unguiculata* Sesquipedalis Group (yard-long-bean) with hilum concealed by funicular tissue remnant, lens adjacent to hilum but not prominent. E - *Psophocarpus tetragonolobus* (winged-bean) oval hilum with partially visible hilar groove surrounded by rim aril, lens not prominent.

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Large-seeded Fabaceae General External Features

Cicer arietinum L., chickpea, garbanzo

Outline shape: irregularly ovate, bilobate, angular

Cross-sectional shape: terete to sub-terete

Hilum shape and color: circular to oval; same color or darker than seed coat

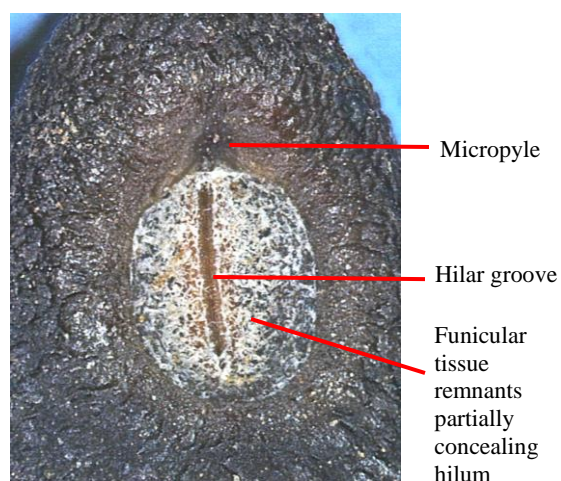
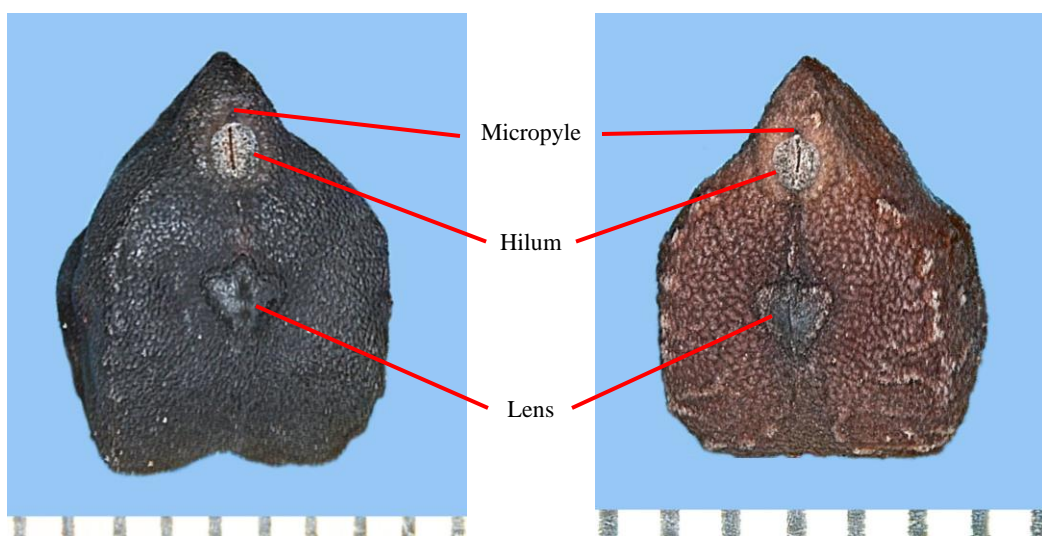
Hilar groove: evident

Lens: prominently raised above the seed surface; not adjacent to hilum

Funicular/aril tissue: none or scruffy remnants attached and concealing portions of the hilum excluding the hilar groove

Surface texture: rugose to tuberculate; dull

Seed coat color: pale buff, yellow with orange tint, brown, black, or green



Glycine max (L.) Merr., soybean

Outline shape: oblong, oval, ovate, rectangular, reniform, or square

Cross-sectional shape: sub-terete to compressed

Hilum shape and color: oval to oblong; same color as seed coat or darker

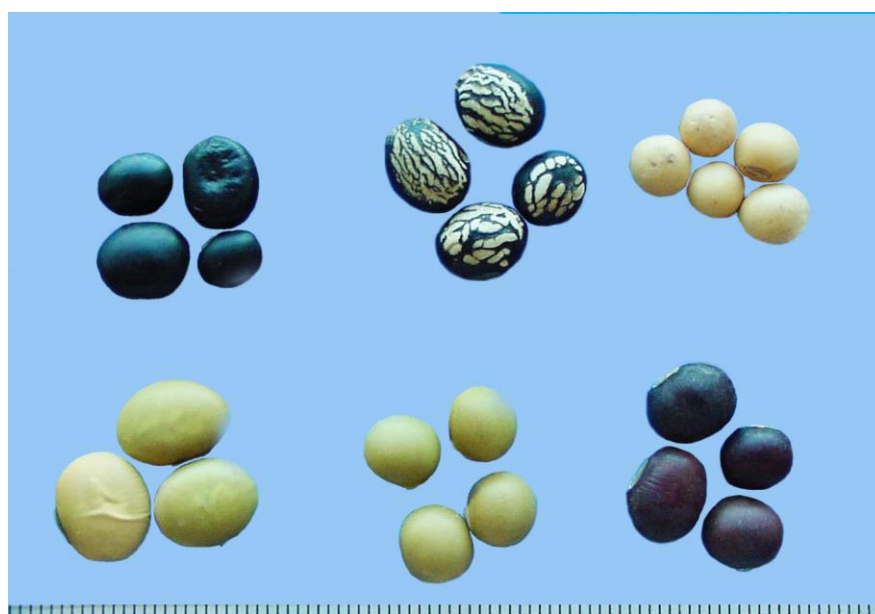
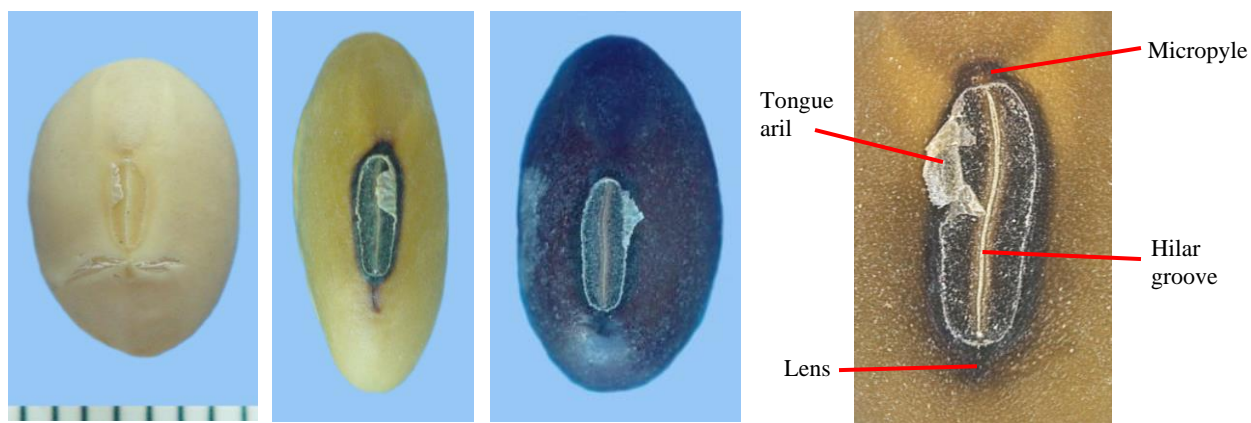
Hilar groove: evident

Lens: not prominently raised above seed surface; adjacent to hilum, sometime indicated by slightly depressed and/or dark line

Funicular/aryl tissue: tongue aril usually attached

Surface texture: +/- smooth; dull to semi-glossy

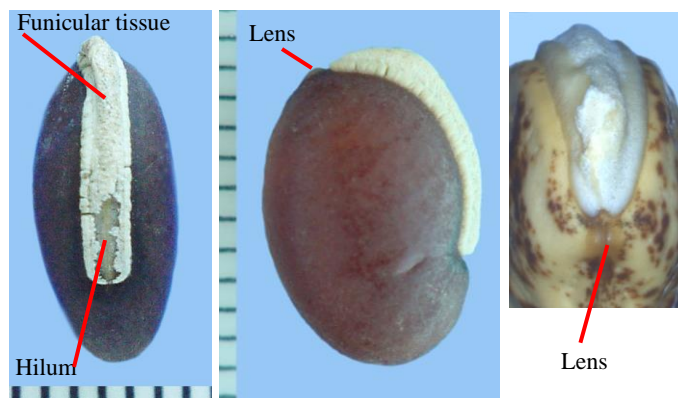
Seed coat color: buff, yellow, yellow with green tinge, green with brown or red tinge; red-brown; brown; black; black with buff mottling, or other colors; area around hilum may be darker in color than remaining seed coat



Comparison of a few different types of soybeans.

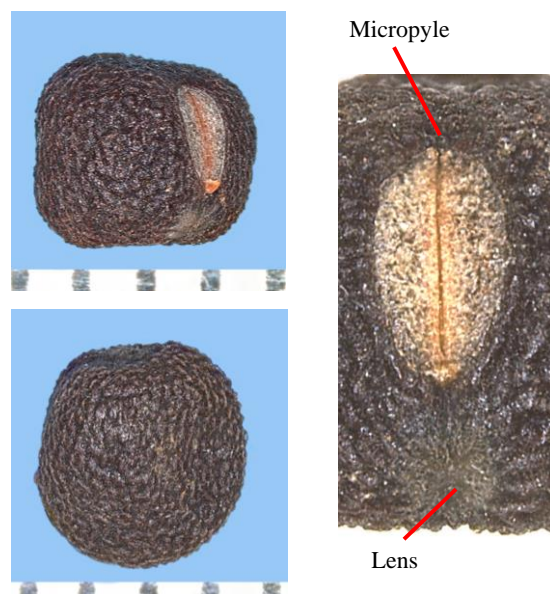
Lablab purpureus (L.) Sweet subsp. *purpureus*, hyacinth-bean

- Outline shape:** oval to oblong
Cross-sectional shape: terete to compressed
Hilum shape: narrowly oblong to linear
Hilar groove: not evident
Lens: prominently raised above seed surface; adjacent to hilum
Funicular/aryl tissue: present, completely concealing hilum unless milled off
Surface texture: smooth; dull
Seed coat color: yellow to reddish brown; some seeds with mottling



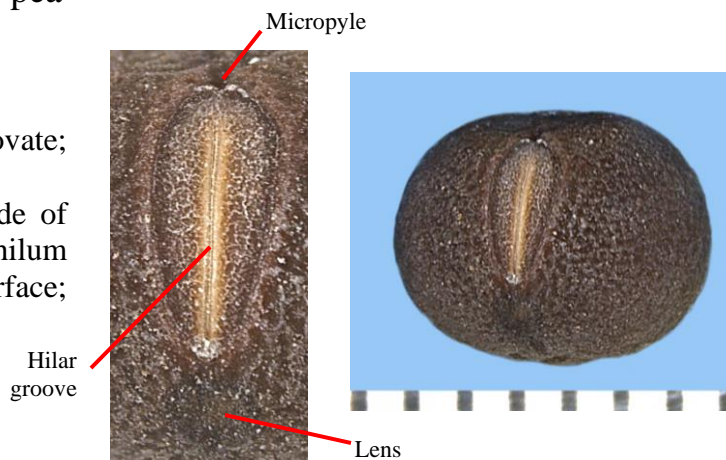
Lathyrus hirsutus L., rough pea

- Outline shape:** circular, oblong, square, triangular
Cross-sectional shape: sub-terete to terete
Hilum shape and color: oval to obovate; same color or lighter than seed coat
Hilar groove: evident; lips on either side of groove lighter in color than remaining hilum
Lens: prominently raised above seed surface; not adjacent to hilum
Funicular/aryl tissue: none or scruffy remnants attached and concealing portions of the hilum excluding the hilar lips and groove
Surface texture: tuberculate; dull
Seed coat color: dark reddish-brown



Lathyrus odoratus L., annual sweet-pea

- Outline shape:** circular, square, irregular
Cross-sectional shape: terete
Hilum shape and color: oblong to obovate; color same as seed coat
Hilar groove: evident; lips on either side of groove lighter in color than remaining hilum
Lens: prominently raised above seed surface; near to hilum but not adjacent
Funicular/aryl tissue: none
Surface texture: rugose; dull
Seed coat color: reddish-brown



Lathyrus sylvestris L., flat-pea

Outline shape: circular, circular to oblong

Cross-sectional shape: sub-terete to terete

Hilum shape and color: linear; color same as seed coat

Hilar groove: evident; lips on either side of groove lighter in color than remaining hilum

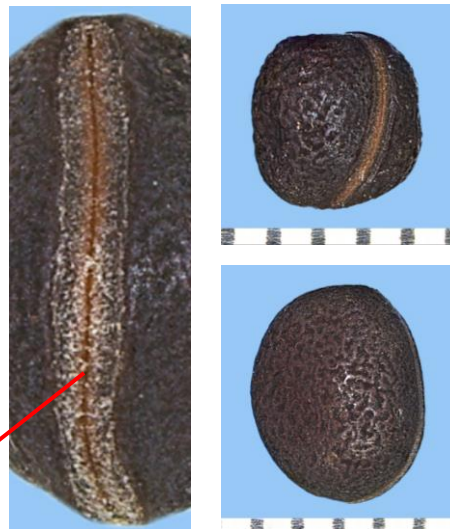
Lens: not prominently raised above seed surface; near hilum but not adjacent

Funicular/aril tissue: none or scruffy remnants attached and concealing portions of the hilum excluding the hilar lips and groove

Surface texture: rugose; dull

Seed coat color: dark reddish-brown

Hilar groove



Lens culinaris Medik. subsp. *culinaris*, lentil

Outline shape: circular

Cross-sectional shape: compressed

Hilum shape and color: narrowly oblong; lighter in color than seed coat

Hilar groove: evident

Lens: prominently raised above seed surface; not adjacent to hilum

Funicular/aril tissue: none

Surface texture: smooth; dull to semi-glossy

Seed coat color: light brown to reddish-brown, green, orangish, some seeds with dark mottling, or black



Size comparison of five varieties of lentil seeds.

Lupinus albus L., white lupine

Outline shape: sub-circular to square

Cross-sectional shape: compressed

Hilum shape: oval; surrounded by raised rim

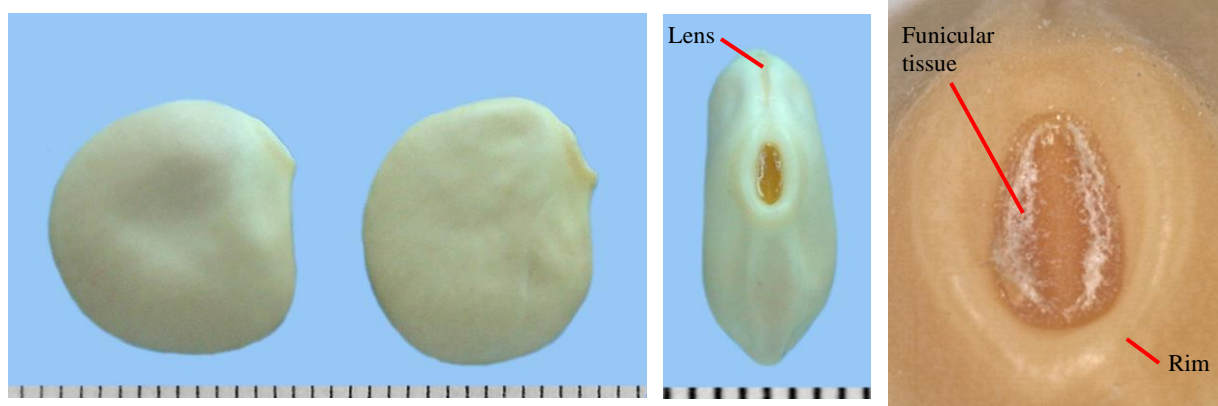
Hilar groove: very faintly evident

Lens: not prominently raised above seed surface, indicated by dark line; not adjacent to hilum

Funicular/aril tissue: present, fringe-like at margin of hilum

Surface texture: smooth; dull to semi-glossy

Seed coat color: ivory



Pachyrhizus erosus (L.) Urb., jicama, yam-bean

Outline shape: oblong, sub-circular, square

Cross-sectional shape: compressed

Hilum shape: oval to oblong; surrounded by raised rim; tilted in relation to long axis of seed

Hilar groove: evident

Lens: not prominently raised above seed surface, incorporated in raised rim around hilum, indicated by split depression in rim

Funicular/aril tissue: present, tongue aril

Surface texture: smooth; semi-glossy

Seed coat color: reddish-brown



Phaseolus coccineus L., scarlet runner bean

Outline shape: oblong to reniform

Cross-sectional shape: compressed

Hilum shape: oval to obovate

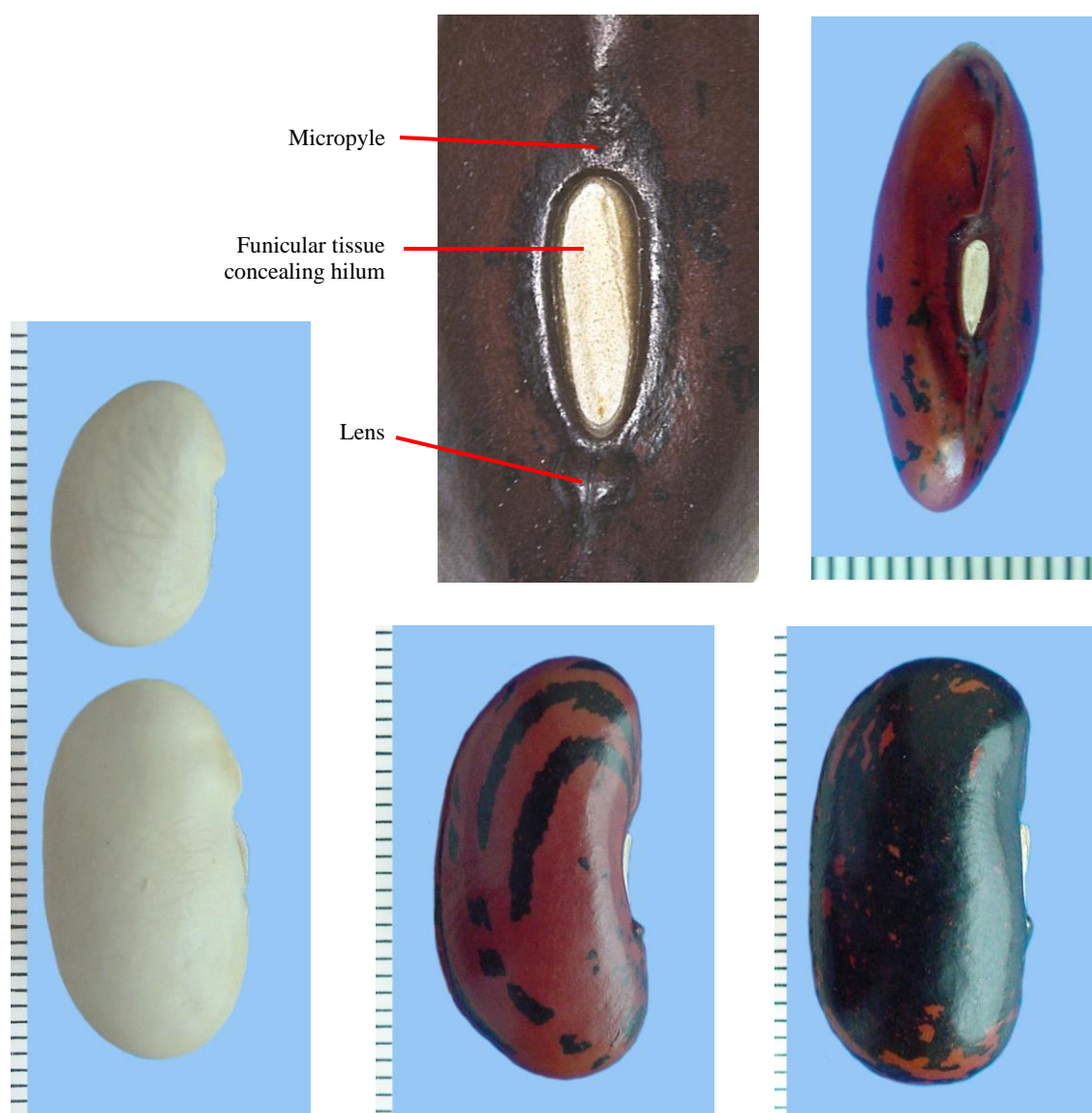
Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present and persistent, concealing hilum

Surface texture: smooth; semi-glossy

Seed coat color: ivory, ivory with dark mottling and ring around hilum, reddish-brown with black mottling and streaking, black with reddish-brown mottling and streaking



Comparison of different varieties of scarlet runner bean.

Phaseolus lunatus L., lima bean

Outline shape: sub-circular, oblong, oval, ovate, reniform

Cross-sectional shape: compressed

Hilum shape: obovate to oblong

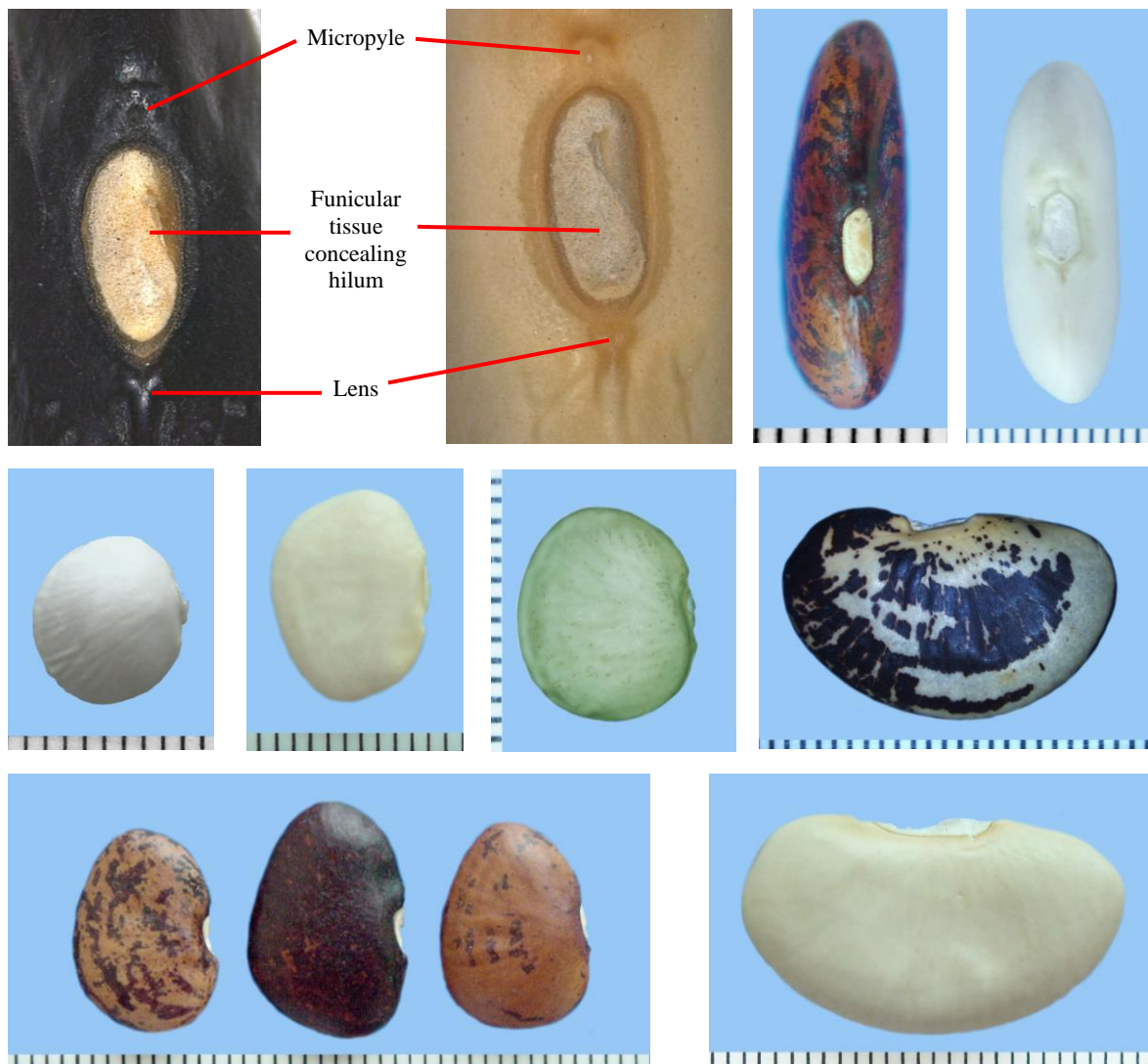
Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present and persistent, concealing hilum

Surface texture: smooth with +/- conspicuous fan-like striations or wrinkles on each side; dull to semi-glossy

Seed coat color: variable depending on the cultivar; base colors can include pale green, ivory, reddish-brown, tan, or black; seeds of some cultivars can have various amounts of dark- or light-colored mottling or streaking or both



Comparison of a few different varieties of lima beans.

Phaseolus vulgaris L., field bean, garden bean

Outline shape: oblong, ovate, reniform

Cross-sectional shape: terete to compressed

Hilum shape: oval to oblong

Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present and persistent, concealing hilum

Surface texture: smooth; semi-glossy to glossy

Seed coat color: variable depending on the cultivar; base colors can include white, ivory, red, reddish-brown, pink, tan, or black; seeds of some cultivars can have various amounts of dark- or light-colored blotching, mottling, streaking and/or dark colored halo around hilum



Comparison of a few different varieties of beans.

Pisum sativum L., field pea; garden pea

Outline shape: circular, irregularly dimpled (the more sugar-rich garden peas tend to partially collapse into irregular wrinkling upon drying, as compared to the more starch-rich field peas)

Cross-sectional shape: terete

Hilum shape and color: oval to obovate; same color as seed coat or darker

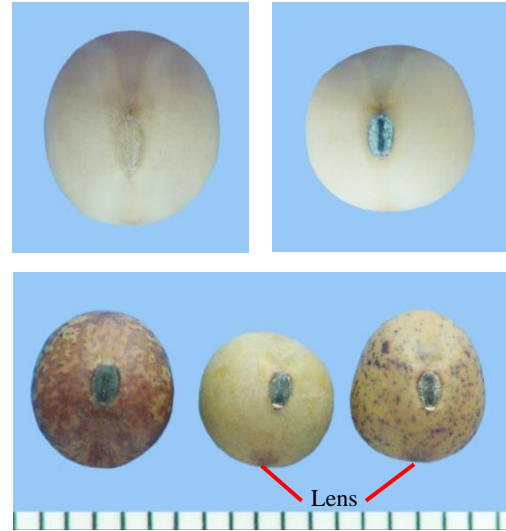
Hilar groove: evident

Lens: slightly darker in color than base seed coat color and +/- slightly raised above seed surface; not adjacent to hilum

Funicular/aril tissue: None or scruffy remnants attached concealing portions of the hilum excluding the hilar groove

Surface texture: smooth; dull

Seed coat color: white, ivory, tan, green, or light to dark reddish-brown; seeds of some varieties with dark mottling or streaking or both



Psophocarpus tetragonolobus (L.) DC., asparagus-pea, winged-bean

Outline shape: sub-circular to oblong

Cross-sectional shape: terete

Hilum shape and color: circular to oval; appearing lighter than seed coat color due to attached funicular tissue

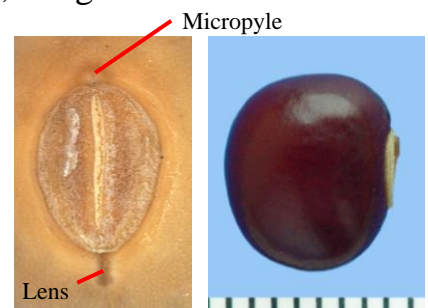
Hilar groove: mostly evident

Lens: not prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present, rim aril with slight tongue protrusion, scruffy remnants of funicular tissue conceal hilum surface except for hilar groove

Surface texture: smooth; semi-glossy to glossy

Seed coat color: ivory to dark reddish-brown



Vicia benghalensis L., purple vetch

Outline shape: sub-circular to oblong

Cross-sectional shape: sub-terete to compressed

Hilum shape: linear

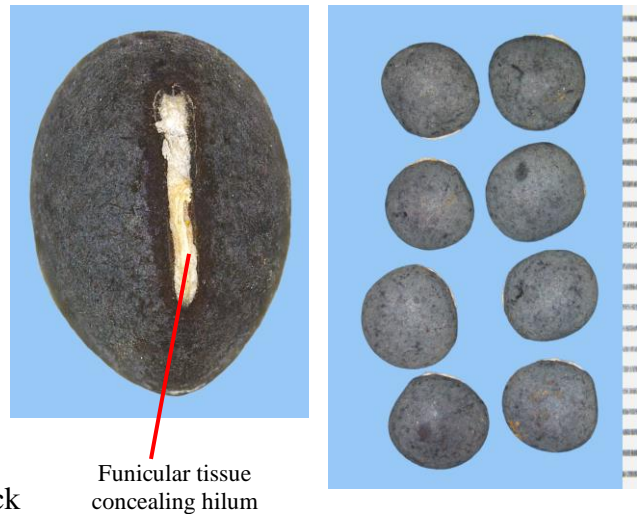
Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: not prominently raised above seed surface but visible; not adjacent to hilum

Funicular/aril tissue: present and persistent; firmly attached white funicular remnant completely concealing hilum

Surface texture: smooth; dull

Seed coat color: brownish gray with dense black mottling over entire surface



Funicular tissue concealing hilum

Vicia faba L., broadbean, fava-bean, horsebean, (bell bean – used for small seeded types)

Outline shape: oblong to oval

Cross-sectional shape: terete to compressed

Hilum shape and color: narrowly to broadly oval or linear; brownish black to black

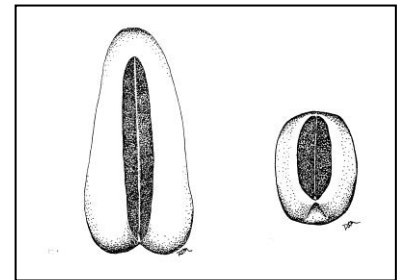
Hilar groove: evident; lips on either side of hilar groove black or tan

Lens: +/- slightly raised above seed surface; usually darker in color than seed coat; not adjacent to hilum

Funicular/aril tissue: None or scruffy remnants attached concealing portions of the hilum excluding the hilar groove

Surface texture: smooth; dull to semi-glossy

Seed coat color: light to dark brown, reddish brown, or greenish brown



Hilum comparison – fava bean (left) and bell bean (right).



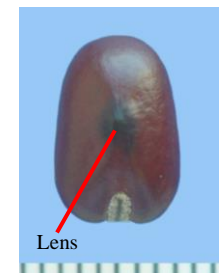
Size comparison – bell bean (left) and fava bean or broadbean (right).

Micropyle



Lens

Bell bean – hilum



Lens

Bell bean – lens view

Scale = 1 mm

Vicia sativa* L. subsp. *sativa, common vetch

Outline shape: circular to square

Cross-sectional shape: sub-terete to compressed

Hilum shape and color: narrowly lanceolate; same color as seed coat

Hilar groove: evident, lips on either side of groove usually lighter in color than rest of hilum and seed coat

Lens: not prominently raised above seed surface but visible, usually darker than seed coat; not adjacent to hilum

Funicular/aril tissue: None

Surface texture: smooth; dull

Seed coat color: yellowish brown, reddish brown, greenish brown, most seeds with dense dark mottling over entire surface such that some seeds appear almost dark brown or black



***Vigna angularis* (Willd.) Ohwi & H. Ohashi**, adzuki bean

Outline shape: oblong to rectangular

Cross-sectional shape: sub-terete

Hilum shape: narrowly oblong

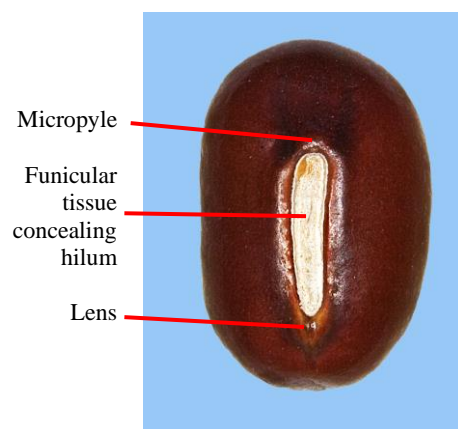
Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present and persistent; firmly attached white funicular remnant completely concealing hilum

Surface texture: smooth; dull to semi-glossy

Seed coat color: tan with green or purple tinge, reddish brown, some seeds with dense dark mottling



Vigna mungo* (L.) Hepper var. *mungo, black gram, urd-bean

Outline shape: oblong to rectangular

Cross-sectional shape: sub-terete

Hilum shape: oval to oblong

Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present and persistent; firmly attached white funicular remnant completely concealing hilum

Surface texture: smooth; dull

Seed coat color: reddish brown with dense black mottling to black with grayish bloom



Vigna radiata* (L.) R. Wilczek var. *radiata, mung bean

Outline shape: rectangular

Cross-sectional shape: terete

Hilum shape: narrowly oval to obovate

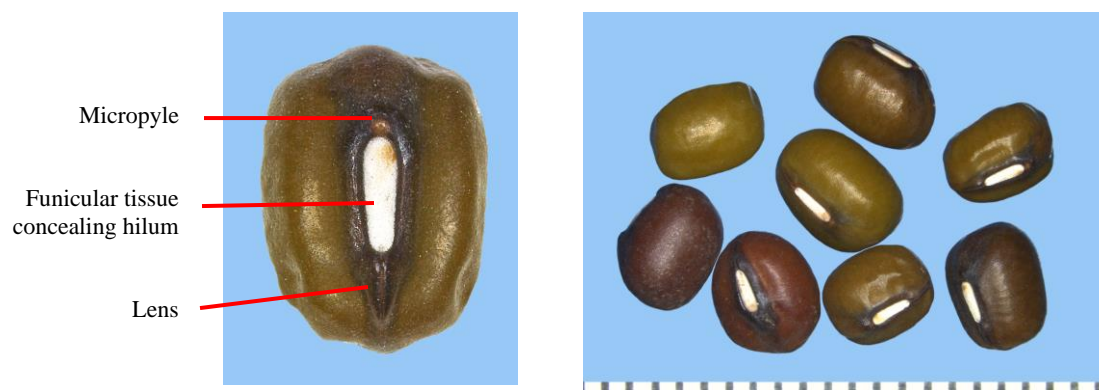
Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present and persistent; firmly attached white funicular remnant completely concealing hilum

Surface texture: smooth; dull to glossy

Seed coat color: tan, green to reddish brown, some seeds with purplish tinge, some seeds with dark mottling



***Vigna unguiculata* (L.) Walp. subsp. *unguiculata* Sesquipedalis Group,**
asparagus-bean, yard-long-bean

Outline shape: oblong to oval

Cross-sectional shape: sub-terete to compressed

Hilum shape: oval, oblong, or narrowly obovate

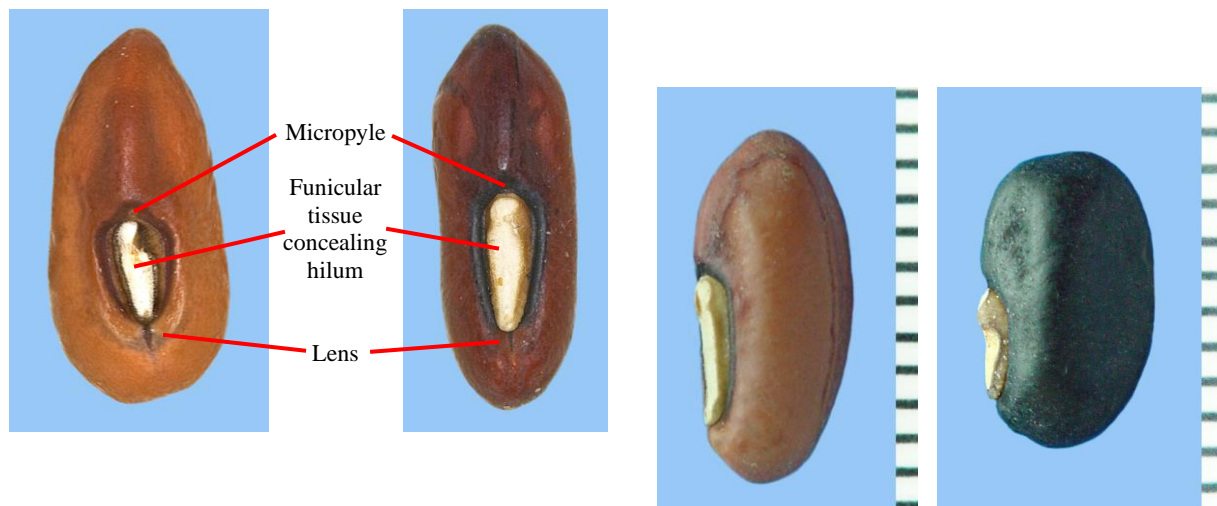
Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: not prominently raised above seed surface; adjacent to hilum

Funicular/aryl tissue: present and persistent; firmly attached white funicular remnant completely concealing hilum

Surface texture: smooth; dull

Seed coat color: variable depending on cultivar; black, tan, purple, bicolored ivory and reddish brown; some cultivars with dark blotches or streaks; some cultivars with dark halo around hilum



Comparison of three types of asparagus-bean or yard-long-bean.

***Vigna unguiculata* (L.) Walp. subsp. *unguiculata* Unguiculata Group, cowpea, black-eyed-pea, southern-pea**

Outline shape: oblong to oval

Cross-sectional shape: sub-terete to compressed

Hilum shape: oval, oblong to narrowly obovate

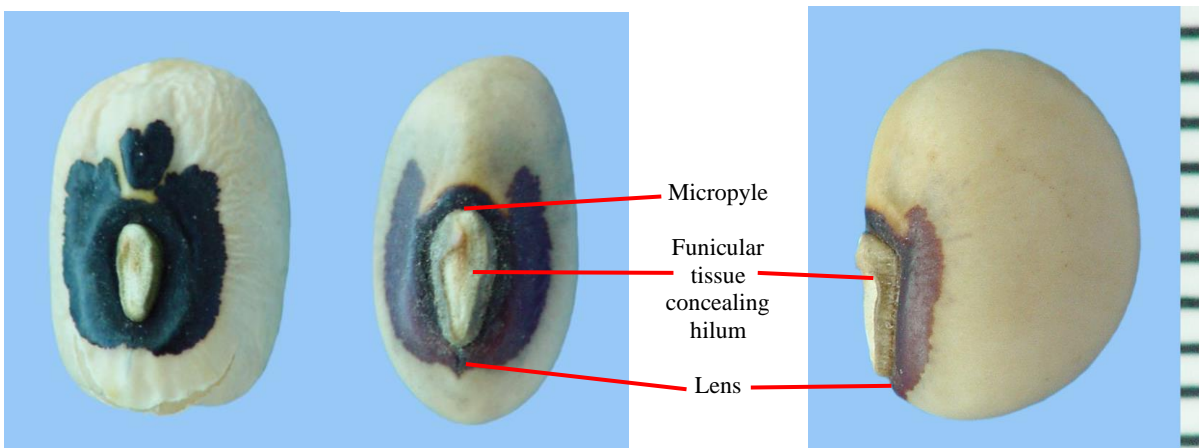
Hilar groove: not evident, obscured by thick layer of funicular tissue

Lens: not prominently raised above seed surface; adjacent to hilum

Funicular/aril tissue: present and persistent; firmly attached white funicular remnant completely concealing hilum

Surface texture: smooth to wrinkled; dull

Seed coat color: variable depending on cultivar; black, ivory, purple, reddish brown, tan, bicolored ivory and black or ivory and purple; some cultivars with dark blotches or streaks; some cultivars with dark halo around hilum



Comparison of four varieties of cowpea.