Plantago afra L., *P. arenaria* Waldst. & Kit., *P. asiatica* L., *P. ovata* Forssk.

Standardized Common Name: Psyllium

Other Common Names: Black Psyllium (*P. afra, P. arenaria*), Blonde Psyllium (*P. ovata*), Ispaghula (*P. ovata*)

Family: Plantaginaceae

Taxonomy: The genus *Plantago* includes over 200 species, distributed worldwide. The species used as psyllium are chosen because they possess unusually mucilaginous seeds; they are not all closely related. *Plantago asiatica* belongs to Subg. *Plantago*. *Plantago afra* and *P. arenaria* belong to Subg. *Psyllium*, which is the source of much taxonomic confusion. As traditionally defined, it includes fewer than twenty species characterized by branched stems with opposite leaves, while other species have alternate leaves or only basal leavea. *Plantago ovata* was until recently classified within Subg. *Albicans*, but recent molecular studies have suggested that that subgenus should be combined with Subg. *Psyllium*.

Both *P. afra* and *P. arenaria* have *P. psyllium* L. as a synonym, because Linnaeus applied that name at various times to different plants (the reason why use of the name is now avoided, although it has not at this date been formally rejected). *Plantago arenaria* is often referred to in literature as *P. indica* L., but that name is illegitimate. *Plantago afra* is not listed in *Herbs of Commerce*, although it is one of the major official species in Europe and elsewhere, perhaps due to the confusion engendered by *P. psyllium*. It is very similar to *P. arenaria*, but is a distinct species. The best-known synonym for *P. ovata* is *P. ispaghula* Roxb. ex Fleming.

Description (species of Subg. *Psyllium*): Herbaceous; leaves opposite on stems up to 80 cm high (in basal rosettes in *P. ovata*); stems usually pubescent. Leaves linear, usually <10 cm long, pubescent; primary venation reduced to a single midrib; margins entire or slightly and irregularly toothed. Inflorescences spicate, axillary or borne on long basal scapes in *P. ovata*; peduncle more or less pubescent; fertile portion dense, bracteate, <3.5 cm long. Flowers small, whitish to greenish; sepals 4, with green central stripe and apex, scarious margins; petals 4, fused, dry, pale; stamens 4, basally fused to corolla, longer than corolla; ovary 2-loculed. Fruit a circumscissile capsule; seeds 2.

Plantago asiatica is most closely related to ***P. major* L.** (q.v.) and is very similar in appearance.

Parts in Commerce: Seed

Identification:

- 1.5–3.5 mm long
- More or less flattened, breadth exceeding depth; "boat-shaped" except in *P. asiatica*, with one side convex and one side strongly concave with uprolled margins
- Concave side bears a pale circular scar (hilum) near the center
- Variable in color, not black
- Swell and produce mucilage when put in water
- Taste weak, mucilaginous

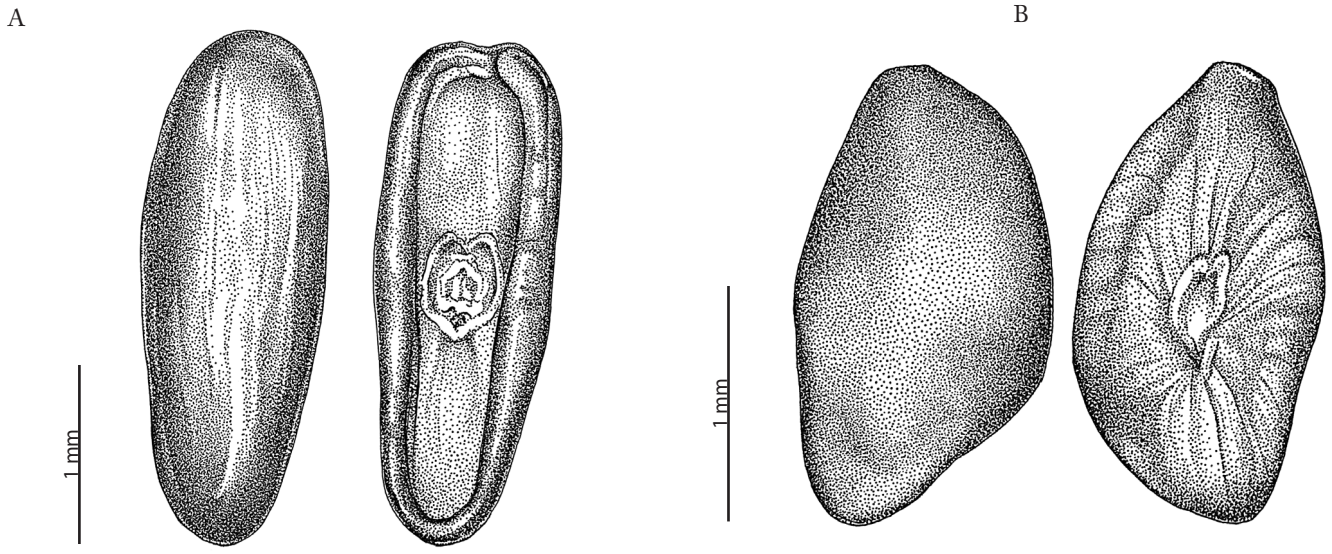

Figure 56: a, *Plantago afra* seed; b, seed of *P. major* misidentified as *P. asiatica*.

The official species have several morphological differences:

	P. afra	P. arenaria	P. asiatica	P. ovata
Shape	Boat-shaped, ovate to narrowly ovate or oblong	Boat-shaped, oblong to ovate or elliptical	Elliptical, flattened, often somewhat irregular	Boat-shaped, ovate to elliptical
Length	1.3–3.0 mm	(1.6–)2.0–3.0(–3.3) mm	1.4–2.3 mm	2.0–2.6 mm
Color	Light brown to brown	Dark brown, often reddish; convex surface usually with paler longitudinal streak in center	Yellowish to brown	Variable, brown to pinkish, reddish or gray-brown, often with darker spot towards one end of convex surface
Surface	Smooth, glossy	Irregular, glossy to dull	Smooth, glossy	Smooth, shiny or dull

Adulterants: The best way to distinguish adulteration by cultivated or weedy *Plantago* species having inferior mucilage content is to determine the swelling index. This test is conducted by soaking 1 gram (g) of seeds in a 25 milliliter (ml) graduated cylinder full of water. In the basic procedure as described by the World Health Organization, a mixture of plant matter and water is shaken several times over an hour, then left to stand for a minimum of three hours. However, Youngken recommended that psyllium should be shaken occasionally over a 24-hour period, followed by 12 hours left to stand. The volume of the mass of mucilage then present at the bottom of the cylinder, in ml, is equivalent to the swelling index. For example, if 1 g of seeds produces 9 ml of mucilage, since 1 ml of water weighs 1 g, the mucilage weighs roughly 9 g, or nine times the original weight of the seeds; the swelling index would therefore be 9. Minimum swelling indices specified by various authorities for the official species range from 8–10, but higher-quality cultivated material has higher values, especially in *P. afra*, for which Wichtl reports 14–19 as a typical range.

Accurate description of *P. asiatica* presents special problems due to lack of adequate taxonomic study and information in literature. Western pharmacognostic references state that *P. asiatica* has flattened, pale brown seeds up to 2 mm long. However, some Asian botanical literature indicates that P. asiatica has blackish seeds, which are occasionally described as multiangled or as little as 1 mm long. A variety of seed shapes and colors are observed in herbarium material labeled as *P. asiatica*. This appears to be due in part to misidentification of *P. major*, which can appear extremely similar to *P. asiatica*. Seeds of *P. major* are small, irregularly shaped and dark-colored, sometimes with a pattern of thin dark striations. Seeds of that appearance are probably not genuine *P. asiatica*. Substitution of *P. major* can be detected by determination of the swelling index.

A historical adulterant reported by Youngken is the seed of *Lallemantia royleana* Benth. (a member of the mint family), which had a swelling index of 40, or 47–50 after 48 hours, higher than would be expected of intact psyllium seeds. The seeds of *Lallemantia* can also be recognized morphologically by their shape. One side is flat, while the other side has a very prominent longitudinal ridge (so that the seeds are T-shaped in cross-section). They are glossy dark brown with a whitish bump (hilum) at one end of the longitudinal ridge; the margins may be transparent.

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