**Amaranthus spp.** (*Amaranthaceae*)
Seed.

### General shape
Lens-shaped, lenticular or slightly elongated disc.

### Normal size
0.8 - 1.2 mm L x 0.8 - 1.1 mm W x 0.3 - 0.5 mm D

### Color
Black to dark reddish brown testa

### Texture
Shiny, smooth with minimal surface cellular structure evident.

### Distinguishing features
Hilum on disc margin or basal end of elongated disc. Distinct marginal rim. Margins winged, wings minutely granular or striate. *Amaranthus* spp. are difficult to distinguish at the species level.

### Embryo
Embryo lies around the entire margin of the seed and is detectable around the perimeter of the seed. The embryo is curved around firm, starchy white endosperm.

---

Seeds of *Amaranthus powelli*

Seed and fruit of *Amaranthus rudis*

Seed Cross Section of *Amaranthus blitoides*
Ammi majus L. (Apiaceae)

Mericarp.

**General shape:** Obovate with one flattened side and one curved side.

**Normal size:** 2.0 – 3.0 mm L x 0.8 – 1.0 mm W

**Color:** Dark brown with 3 prominent light brown ridges on the curved side.

**Texture:** Granular surface between the ridges.

**Distinguishing features:** 3 strong ridges with 2 weak intermediate ridges. The side opposite the ridges is flat with a rounded apex and pointed base. Mericarp is smaller than other Apiaceae.

**Embryo:** Small, basal in fleshy, firm, abundant endosperm.

Seed of *Ammi majus.*

Seed of *Ammi majus.*
**Bifora spp.** (*Apiaceae*)
Mericarp.

<table>
<thead>
<tr>
<th><strong>General shape</strong></th>
<th>Globose with a flat to deeply hollowed face where mericarps are joined.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal size</strong></td>
<td>2.5-3.5 mm L x 4.5-7.0 mm W x 2.0 mm D</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>Pale to yellow ochre.</td>
</tr>
<tr>
<td><strong>Texture</strong></td>
<td>Finely rugose to serrated ridges.</td>
</tr>
<tr>
<td><strong>Distinguishing features</strong></td>
<td>Sometimes purplish tinged, short beak present or absent depending upon species.</td>
</tr>
<tr>
<td><strong>Embryo</strong></td>
<td>Small, basal in firm endosperm.</td>
</tr>
</tbody>
</table>

*Seed of Bifora testisculata*

*Seeds of Bifora testisculata*
**Daucus carota** L. (*Apiaceae*)
Mericarp.

<table>
<thead>
<tr>
<th>General shape:</th>
<th>Ovate to oval in outline, elliptic flattish plano-convex.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal size:</td>
<td>2.5 – 3.5 mm L x 1.3 – 2.0 mm W</td>
</tr>
<tr>
<td>Color:</td>
<td>Greyish-yellow to yellow-brown.</td>
</tr>
<tr>
<td>Texture:</td>
<td>Longitudinal ridges or ribs with long, narrow spine-like hairs.</td>
</tr>
<tr>
<td>Distinguishing features:</td>
<td>Four prominent ribs with spines on the convex side with a lesser rib between each main rib which has smaller spines. The flattened side has a slight, central, spineless rib.</td>
</tr>
<tr>
<td>Embryo:</td>
<td>Small, basal in fleshy, firm endosperm.</td>
</tr>
</tbody>
</table>

![Seeds of Daucus carota](image1)

![Seed of Daucus carota](image2)
Ageratum houstonianum Mill. (Asteraceae)

Achene.

**General shape:** Sharply 5-sided.

**Normal size:** 1.5-2 mm L x 0.2-0.5 mm W x 0.1 mm D

**Color:** Black or grey.

**Texture:** Longitudinal ribs with fine reticulations. Surface scattered with sparse, coarse hairs.

**Distinguishing features.** Base white, angled and enlarged. 5-6 wide, fringed chaffy pappus scales.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
**Ambrosia artemisiifolia** L. (*Asteraceae*)

Achene.

<table>
<thead>
<tr>
<th>General shape:</th>
<th>Obovoid to oblanceolate, with a ring of spines near the top, urn shaped.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal size:</td>
<td>3.0–4.0 mm L x 1.8-2.5 mm W</td>
</tr>
<tr>
<td>Color:</td>
<td>Yellowish-brown to reddish-brown sometimes with a purplish tinge near the crown.</td>
</tr>
<tr>
<td>Texture:</td>
<td>Woody outer coat enclosing a shiny brown inner coat.</td>
</tr>
<tr>
<td>Distinguishing features:</td>
<td>Central apical protuberance which is surrounded by a circle of five to eight shorter, slender projections appearing like a crown.</td>
</tr>
<tr>
<td>Embryo:</td>
<td>Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.</td>
</tr>
</tbody>
</table>
**Anthemis cotula** L. (*Asteraceae*)

Achene.

**General shape:** Obovate, tapered from the apex to the base with knobby, longitudinal ridges. Circular in cross-section.

**Normal size:** 1.3 – 1.8 mm L x 0.8 – 1.0 mm W

**Color:** Yellowish-brown to greyish-brown.

**Texture:** Longitudinal ridges with wart-like tubercles.

**Distinguishing features:** Apex has a short, stout, style remnant. Scar is surrounded by a collar.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.

<table>
<thead>
<tr>
<th><img src="image1.png" alt="Seeds of Anthemis cotula" /></th>
<th><img src="image2.png" alt="Seed of Anthemis cotula" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seeds of Anthemis cotula</strong></td>
<td><strong>Seed of Anthemis cotula</strong></td>
</tr>
</tbody>
</table>
**Bidens pilosa L.** *(Asteraceae)*  
Achene.

**General shape:** Flattened, 4 angled with ridged edges, tapering at each end. Sometimes curved.

**Normal size:** 6.0 - 9.0 mm L x 0.5 - 1.0 mm W

**Color:** Black to blackish brown, lighter near the base and apex.

**Texture:** Slightly warty, tubercles on edges. Stiff, slightly curved hairs down length of seed.

**Distinguishing features:** Faces slightly depressed on one side. Obscure 2-grooved faces. Apex has 3-4 barbed, sharp spines. Base is enlarged, oblique and lighter in colour.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
**Centaurea cyanus** L. (*Asteraceae*)

Achene.

**General shape:** Oblong with a notched large scar about 1/3 the length of the achene.

**Normal size:** 3.0-3.5 mm L x 1.5-2.0 mm W

**Color:** Bluish grey with a yellow collar and scar rim. Yellow longitudinal lines.

**Texture:** Glossy, smooth.

**Distinguishing features:** Pappus present and dense, brush-like. The bristles are uneven, stiff and light reddish brown. Scar slightly oblique.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
**Cichorium intybus** L. (*Asteraceae*)

Achene.

<table>
<thead>
<tr>
<th>General shape:</th>
<th>Wedge-shaped, truncated at the base.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal size:</td>
<td>2.0-2.7 mm L x 1.0-1.5 mm W x 1.0-1.5 mm D</td>
</tr>
<tr>
<td>Color:</td>
<td>Pale brown often with darker mottling.</td>
</tr>
<tr>
<td>Texture:</td>
<td>Minute lateral ridges with various longitudinal ribs.</td>
</tr>
<tr>
<td>Distinguishing features:</td>
<td>Pappus of short scales in a single row. Centre of apex raised above the level of crown. Small apical rim.</td>
</tr>
<tr>
<td>Embryo:</td>
<td>Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.</td>
</tr>
</tbody>
</table>
**Cirsium arvense** (L.) Scop. *(Asteraceae)*

Achene.

**General shape:** Obovate, curved.

**Normal size:** 2.5-3.0 mm L x 0.8-1.0 mm W

**Color:** Brown with a yellow collar, some longitudinal yellow lines.

**Texture:** Dullish, fairly smooth surface.

**Distinguishing features:** Small stylar knob. Apical rim lighter in colour. Pappus is composed of long, plumose bristles but is readily detached. Narrow, truncated base.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
**Cirsium vulgare (Savi) Ten. (Asteraceae)**

Achene.

<table>
<thead>
<tr>
<th>General shape: Obovate, curved.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal size: 3.5-4.0 mm L x 1.2-1.7 mm W</td>
</tr>
<tr>
<td>Color: Yellowish-brown and streaked with black or purple.</td>
</tr>
<tr>
<td>Texture: Dullish, fairly smooth surface.</td>
</tr>
</tbody>
</table>

**Distinguishing features:** Large styal knob. Apical rim lighter in colour. Pappus is composed of long, plumose bristles but is readily detached. Narrow, truncated base. Broadest above the middle of the achene.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
**Helianthus annuus** L. (*Asteraceae*)

Achene.

<table>
<thead>
<tr>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General shape</strong>: Flattish oblong, truncate at the apex with a narrowed base.</td>
<td><img src="image1" alt="Seeds of Helianthus annuus" /></td>
</tr>
<tr>
<td><strong>Normal size</strong>: 4.0-5.0 mm L x 2.0-3.0 mm W x 1.0-2.0 mm D (cultivated form is much larger)</td>
<td><img src="image2" alt="Seed of Helianthus annuus" /></td>
</tr>
<tr>
<td><strong>Color</strong>: Greyish to brown with dark lengthwise streaks and mottling.</td>
<td></td>
</tr>
<tr>
<td><strong>Texture</strong>: Smooth surface with appressed silky hairs and pubescence near the apex.</td>
<td></td>
</tr>
<tr>
<td><strong>Distinguishing features</strong>: Hairs at the apex are stiff and upward-directed. Small apical rim. Attachment area notched and smooth.</td>
<td></td>
</tr>
<tr>
<td><strong>Embryo</strong>: Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.</td>
<td></td>
</tr>
</tbody>
</table>

---

Page 13 of 32
**Hypochaeris radicata** L. *(Asteraceae)*

Achene.

<table>
<thead>
<tr>
<th>General shape:</th>
<th>Elongated, narrowly elliptical with a long, roughened awn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal size:</td>
<td>4.5-5.5 mm L x 0.5-0.7 mm W</td>
</tr>
<tr>
<td>Color:</td>
<td>Dark brown to reddish brown.</td>
</tr>
<tr>
<td>Texture:</td>
<td>Many longitudinal vertical, toothed or warty ribs.</td>
</tr>
<tr>
<td>Distinguishing features:</td>
<td>Tapers to a long, spiny awn at the apex. Tapers to a truncate base with a rimmed collar.</td>
</tr>
<tr>
<td>Embryo:</td>
<td>Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.</td>
</tr>
</tbody>
</table>

Seeds of *Hypochaeris radicata*

Seed of *Hypochaeris radicata*
*Lapsana communis* L. (*Asteraceae*)

Achene.

**General shape:** Obliquely obovate, curved.

**Normal size:** 3.5-4.0 mm L x 0.8 – 1.0 mm W x 0.8 mm D

**Color:** Silvery brown to light brown.

**Texture:** Glossy with large longitudinal ribs with smaller ribs in between.

**Distinguishing features:** Prominent central and marginal ribs. Tapered apex with a broad, rimmed base.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
**Picris echioioides L.** *(Asteraceae)*
Achene.

**General shape:** Narrowly obovate with a slender stalk.

**Normal size:** 2.5-3.5 mm L x 0.4-1.0 mm W x 0.8 mm D

**Color:** Yellowish brown to dark brown.

**Texture:** Glossy with irregular, transverse ridges.

**Distinguishing features:** Broadest near the rounded apex, gradually tapers to a rounded base. Sometimes curved. Transverse ridges are narrow and crowded at the base and become wider and deeper near the apex. Outer seeds may be enclosed in a hairy bract.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
Sonchus asper (L.) Hill (Asteraceae)

Achene.

**General shape:** Obovate, compressed with one edge often more curved.

**Normal size:** 2.5-3.0 mm L x 1.0-1.5 mm W x 0.4-0.5 mm D

**Color:** Yellowish-brown to light reddish-brown.

**Texture:** Wide marginal ridges and three longitudinal ridges with very slightly roughened interspaces.

**Distinguishing features:** Flat areas between ridges. Ridges are not transversely rugulose. Seed wider towards the apex.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
Tagetes minuta L. (Asteraceae)

Achene.

**General shape:** Linear.

**Normal size:** 8.0-9.0 mm L x 0.4-0.7 mm W x 0.4-0.7 mm D

**Color:** Dark grey to black.

**Texture:** Covered with appressed short, light yellow coloured hairs and angular longitudinal ridges.

**Distinguishing features:** Achenes are very long and thin. Remnants of pappus scales often present. The basal scar is pointed, light yellow, angled and has a thick collar.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
Tripluerospermum perforatum (Merat) M. Lanz (Asteraceae).

Achene.

**General shape:** Oblong.

**Normal size:** 1.5-2.0 mm L x 0.5-1.0 mm W x 0.5-1.0 mm D

**Color:** Brown with pale yellow ribs.

**Texture:** Strong longitudinal raised ribs with wrinkled interspaces.

**Distinguishing features:** Central rib on one side only and two small dark eye-like spots visible on the other side at the apex. Strong marginal ribs. Base slightly rounded and apex quite blunt.

**Embryo:** Embryo with well-developed cotyledons and a broad stalk having a truncate top, no endosperm.
**Echium plantagineum** L. (*Boraginaceae*)
Nutlet.

<table>
<thead>
<tr>
<th><strong>General shape:</strong></th>
<th>Ovoid-truncate.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal size:</strong></td>
<td>3.0-3.5 mm L x 2.0-3.0 mm W</td>
</tr>
<tr>
<td><strong>Color:</strong></td>
<td>Pale ochre to light brown.</td>
</tr>
<tr>
<td><strong>Texture:</strong></td>
<td>Very tubercled and warty.</td>
</tr>
<tr>
<td><strong>Distinguishing features:</strong></td>
<td>Three sided with one convex face and two flat faces. Prominent mid-ridge extends around the entire seed. Flattened base and pointed apex.</td>
</tr>
<tr>
<td><strong>Embryo:</strong></td>
<td>Slightly curved embryo with prominent radicle, scant endosperm.</td>
</tr>
</tbody>
</table>

---

Seeds of *Echium plantagineum*

Seed of *Echium plantagineum*
Myosotis arvensis (L.) Hill (Boraginaceae)
Nutlet.

General shape: Ovate.

Normal size: 1.7-2.0 mm L x 1.0-1.5 mm W x 0.5-0.7 mm D

Color: Dark brown to black.

Texture: Smooth and glossy. Finely reticulate.

Distinguishing features: Tear dropped shape with pointed apex. Rimmed margin. Three sided with outer side curved and a mid-ridge between the two inner sides. Whitish oval, basal scar.

Embryo: Prominent radicle, endosperm scant.

Seeds of Myosotis arvensis

Seed of Myosotis arvensis
**Brassica napus** L. (*Brassicaceae*)

Seed.

**General shape:** Wide slightly flattened sphere.

**Normal size:** 2.0-3.0 mm L

**Color:** Grey to grey-black.

**Texture:** Fine reticulations with stippled over complete surface appearing as pin-points of light.

**Distinguishing features:** Prominent embryo indentation in the seed coat. Scar area has a distinct dark circle resembling a horse shoe shape. Squared off look to the scar end when viewed from the side.

**Embryo:** Folded embryo with minimal endosperm present.
**Brassica rapa** L. (*Brassicaceae*)

Seed.

**General shape:** Flattened oval.

**Normal size:** 1.5-2.0 mm L

**Color:** Yellow to mottled yellow, dark reddish-brown to dark grey.

**Texture:** Distinct reticulations with small interspaces and small stippled.

**Distinguishing features:** Reticulations peter out towards the scar end. Reticulations are sometimes quite prominent. Scar and chalaza sometimes appear blackened and raised with a distinct ring around them. Often a prominent embryo indentation in the seed coat.

**Embryo:** Folded embryo with minimal endosperm present.

---

*Seeds of Brassica rapa*

*Seed of Brassica rapa*

*Cross-section of Brassica rapa seed*
Brassica tournefortii Gouan (Brassicaceae)
Seed.

General shape: Spherical.

Normal size: 1.0-1.5 mm W

Color: Light reddish-brown to black.

Texture: Deeply reticulated.

Distinguishing features: Interspaces very small, lines of reticulum whitish, minute stipples. The hilum, chalaza area is very neat and compact and often has a ridge of whitish tissue. Reticulum extends up to scar area.

Embryo: Folded embryo with minimal endosperm present.
**Capsella bursa-pastoris (L.) Medik.** (*Brassicaceae*)

Seed.

<table>
<thead>
<tr>
<th><strong>General shape:</strong></th>
<th>Compressed oval.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal size:</strong></td>
<td>0.9-1.2 mm L x 0.4-0.6 mm W x 0.2 mm D</td>
</tr>
<tr>
<td><strong>Color:</strong></td>
<td>Golden brown to reddish brown.</td>
</tr>
<tr>
<td><strong>Texture:</strong></td>
<td>Fine, raised reticulations.</td>
</tr>
</tbody>
</table>

**Distinguishing features:** Distinct indentation separating radicle and cotyledon lobes. Darker at the base frequently with slight, white seed stalk remnant attached.

**Embryo:** Folded embryo with minimal endosperm present.
**Raphanus raphanistrum** L. *Brassicaceae*

One-seeded segment of pod, seed.

**General shape:** Segment: long, cylindrical.
Seed: ovate.

**Normal size:** Segment: 4.0-6.0 mm L x 3.0-4.0 mm W
Seed: 2.0-4.0 mm L x 1.7-2.3 mm W

**Color:** Segment: Light straw colour to tan.
Seed: Brown to reddish brown.

**Texture:** Segment: Longitudinal ridges or ribs, woody appearance.
Seed: Fine reticulations with shallow interspaces.

**Distinguishing features:** Pods are long and constricted between seeds, splitting readily into one-seeded segments. Seed can be slightly flattened. Seed scar is darker than the rest of the seed often with white tissue present. Scar can have a slightly pinched appearance. Fine reticulations cover the entire seed surface. Prominent embryo indentation.

**Embryo:** Folded embryo with minimal endosperm present.
**Raphanus sativus** L. (*Brassicaceae*)
Seed.

**General shape:** Ovate.

**Normal size:** 3.0-4.5 mm L x 2.5-3.0 mm W x 2.5-3.5 mm D

**Color:** Light brown to reddish brown.

**Texture:** Fine reticulations with shallow interspaces.

**Distinguishing features:** Slightly flattened. Often a silvery glaze over seed surface. Scar area darker and has a pinched appearance. Pods are not ribbed and readily break open during processing.

**Embryo:** Folded embryo with minimal endosperm present.
**Rapistrum rugosum** (L.) All. (*Brassicaceae*)

One-seeded segment of a pod, seed.

**General shape:** Pod: globose.  
Seed: obovate.

**Normal size:** Pod: 3.0-4.0 mm L x 2.5-2.7 mm W  
Seed: 1.7-2.0 mm L x 0.8-1.1 mm W

**Color:** Pod: Light yellow to straw colour.  
Seed: Light brown to reddish brown.

**Texture:** Pod: Strong cross-wrinkled longitudinal ribs.  
Seed: Fine stippling with no definite reticulations.

**Distinguishing features:** Pod is one-seeded. Whitish tissue remnant at the seed scar. Radicle lobe extends beyond the cotyledon lobes.

**Embryo:** Folded embryo with minimal endosperm present.
*Sinapis alba* L. (*Brassicaceae*)

Seed.

<table>
<thead>
<tr>
<th>General shape:</th>
<th>Spherical to flat-sided oval.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal size:</td>
<td>2.0-3.0 mm L x 2.0-2.5 mm W</td>
</tr>
<tr>
<td>Color:</td>
<td>Yellow, creamy or pale straw colour.</td>
</tr>
<tr>
<td>Texture:</td>
<td>Fine reticulum with very small interspaces obscured by a waxy layer. Stipples not evident.</td>
</tr>
<tr>
<td>Distinguishing features:</td>
<td>Scar area a small whitish hilum with a small, deep yellow or tan circle. Often a prominent embryo indentation in the seed coat. When moistened exudes a sticky mucilage.</td>
</tr>
<tr>
<td>Embryo:</td>
<td>Folded embryo with minimal endosperm present.</td>
</tr>
</tbody>
</table>

Seeds of *Sinapis alba*

Seed of *Sinapis alba*

Cross-section of *Sinapis alba* seed
*Sinapis arvensis* L. (*Brassicaceae*)
Seed.

**General shape:** Spherical.

**Normal size:** 1.5-2.0 mm L

**Color:** Black, reddish black to tan.

**Texture:** Reticulum fine, indistinct, interspaces very small. Smooth and velvety appearing like orange peel. Sometimes obscured by a waxy layer.

**Distinguishing features:** Scar very neat and small with a sunburst affect from the hilum. A short raised line indicates the position of the chalaza. When moistened exudes a sticky mucilage. If rubbed the surface becomes quite shiny. Usually no embryo indentation in the seed coat.

**Embryo:** Folded embryo with minimal endosperm present.
**Sisymbrium officinale** (L.) Scop. *(Brassicaceae)*

Seed.

<table>
<thead>
<tr>
<th>General shape:</th>
<th>Oblong to ovate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal size:</td>
<td>1.3 – 1.5 mm L x 0.7 mm W x 0.3-0.5 mm D</td>
</tr>
<tr>
<td>Color:</td>
<td>Reddish brown to dark greenish brown.</td>
</tr>
<tr>
<td>Texture:</td>
<td>Reticulations small and irregular.</td>
</tr>
<tr>
<td>Distinguishing features:</td>
<td>Distinct groove between radicle and cotyledon lobes. Seed flattened on one side. In side view ventral side humped. Apex usually rounded.</td>
</tr>
<tr>
<td>Embryo:</td>
<td>Folded embryo with minimal endosperm present.</td>
</tr>
</tbody>
</table>

![Seeds of Sisymbrium officinale](image1)

![Seed of Sisymbrium officinale](image2)
**Thlaspi arvense** L. *(Brassicaceae)*

Seed.

**General shape:** Oval to ovate.

**Normal size:** 1.6-2.0 mm L x 1.1-1.4 mm W

**Color:** Dark reddish-brown to shiny purple-black.

**Texture:** Roughened ridges which are transversely grooved.

**Distinguishing features:** Surface has concentric ridges similar to a human fingerprint. Each face has a groove which runs from the hilum to the middle of the seed. Slightly elongated, blunt base which often has a white, seed stalk remnant.

**Embryo:** Folded embryo with minimal endosperm present.