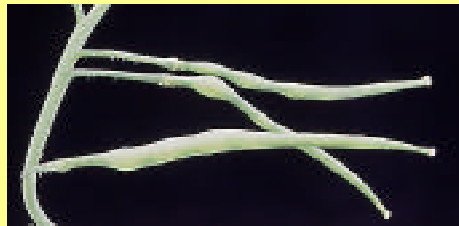


Mustards *in* *Mustards*



Bob Callihan, Jeff Brennan,
Tim Miller, Jack Brown, &
Mary Moore



Guide to
Identification of



Canola *Mustard* *Rapeseed* *and* *Related Weeds*



Mustards Mustardsⁱⁿ

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Using this information

Mustards can be difficult to distinguish from other plants, particularly in early stages of development such as seedling or rosette stages. This publication will help you learn the mustard species and to distinguish one from another. If you are not sure if a particular plant belongs to the mustard family, this booklet will help answer that question if the plant is in the flowering or post-flowering stage.

The color illustrations in this publication will help you learn to recognize a specific mustard species, but they alone are not sufficient for identifying a specific plant. You will find the descriptions in the text very useful. Use both the text and the pictures to learn to recognize these plants.

How do you recognize a plant's species? Look for the easy answers first. Often it is helpful to taste the cotyledons or leaves, or crush the plant between thumb and fingers and smell it. If it has a mustard-like flavor or odor, it is likely a mustard. If you don't detect a mustard odor, however, that doesn't mean it is not a mustard.

Height and leaf shape of these species are often highly variable among locations with different growing conditions. Weeds often exceed their normal height and have larger leaves when they grow in fertile cropland. For the same reason, crowded, competitive conditions often cause weeds to assume less typical growth habits. The effect of growing conditions on a weed's appearance depends on

whether the seedlings emerge before, during or after crop emergence.

The form, size, shape and color of flowers, pods and seeds are usually the best characteristics to use for plant identification, as these remain fairly constant across different environmental conditions. In some cases, key identifying features, such as branched hairs, can be best seen under magnification, such as with a 10x hand lens.

An industry as specialized as canola, rapeseed and mustard production requires producers to be specialists. Producers need to learn detailed basic biology of the crop as well as its associated weeds. This bulletin will provide a quick lesson in taxonomy, or systematic identification, of the plants in the mustard family. Definition of technical terms and metric conversions are in the glossary. The photos will help you become acquainted with these species. If you still cannot identify a plant, get help from the experts. This booklet will help you discuss your questions with the experts.

The first listed Latin name (in bold italics) is the name designated by the Weed Science Society of America, or the most widely accepted name; synonyms may be found in older literature. The common names designated by the Weed Science Society of America are in non-italicized bold type.

For more information

Detailed technical descriptions with drawings of plant species in this booklet can be found in *The Cruciferae of North America*. Limited descriptions are in *Gray's Manual of Botany*. Most are described in regional floral manuals such as *Flora of the Pacific Northwest*, *The Jepson Manual: Higher Plants of California*, and *Flora of the Great Plains*. Photographs of some are in fine

color-illustrated weed guides such as *Weeds of the West*, the *Southern Weed ID Guide*, and the *California Growers Guide*. Tactics for management of weeds in crop and noncrop sites are published in commercially available books, herbicide labels, and Extension publications such as the annually revised *Pacific Northwest Weed Control Handbook*.

Mustards Mustardsⁱⁿ

**Mustardsⁱⁿ
Mustards** This package illustrates and describes 17 species closely related to canola, mustard, and rapeseed that are important to that industry. It is a guide to detection and recognition, and an aid to identification of both weed and crop species uniquely important to the cruciferous oilseed industry.

Quality Crops Demand Clean Fields

Weeds competitively suppress growth and productivity of crops, including crops of the mustard family, such as rapeseed, canola, and mustard. Weeds of the mustard family, however, pose special problems for production of crops in the mustard family. Many fields have volunteer crop mustards from previous years' production, along with one to five weed species of the mustard family.

Available herbicides do not selectively remove mustard weeds or volunteers from mustard crops in most cases.

Weeds and volunteer crops of the mustard family reduce oil and meal quality by contaminating the product harvested. The oilseed industry's success requires that growers consistently produce optimum yields of high-quality oil.

These weeds and volunteer plants are especially difficult to remove from rapeseed, canola, and mustard because they are nearly identical to those crops in physiology and growth. Cultivation and hand removal is not feasible and, with few exceptions, herbicides cannot selectively kill the unwanted species without damage to the crop. Few herbicides are registered for use in these crops, and those that are registered control only some of the weeds common in the crops. Consequently, producers must carefully assess the weeds in any field before planting it to rapeseed, canola, or mustard.

Identification, recognition, and detection of weeds are important to crop management. Plant identification is the association of individual plants with categories of plants. Plant recognition, on the other hand, is to know its identity upon seeing it, based on experience or knowledge. Once a species has been identified, members of that species can be easily recognized. Detection, or spotting a species, is readily done only when one has enough experience to recognize members of that species. Weeds cannot be managed properly if they are not identified. They cannot be managed at all if they are not detected. Weed recognition is the link between the

science of identifying weeds and the practice of finding, or detecting them.

The Mustard Family

"Mustard" is the common name of the plant family known as *Brassicaceae* (also called *Cruciferae*). Any species within that family, including canola, rapeseed, and condiment mustard crops, as well as a great many weeds, native plant species, and several garden vegetable species, is commonly, but loosely, called a "mustard" or "crucifer." "Mustard" is also the common household and food industry term for the yellow or brown table condiment itself and is the agricultural term for the plant from which table mustard is made. Three characteristics separate the mustard family from all other plant families:

1. The stamens are tetradynamous, meaning there are four long stamens and two short stamens in each flower.
2. The flowers have four petals that form a cross, hence the alternate family name *Cruciferae*.
3. The seed pods have a thin translucent, frame-like inner membrane, the replum, that separates the two sides of the pod and to which the seeds are attached.

How are Canola, Rapeseed, and Mustard Related?

The mustard family (*Brassicaceae*) is larger than most. Over 40 genera, including more than 200 wild and cultivated species, are in the U.S. and Canada alone. *Brassica* is the genus from which current varieties of rapeseed and canola have been developed. Rapeseed, canola, and mustard cannot be categorized into distinct, well-characterized species for two reasons: first, the weeds and the crops in *Brassica* have close genetic relationships, so intercrossing among them is common; second, the names of the crops (rapeseed, canola, and mustard) are not specific to any single species.

Current rapeseed and canola varieties of North America come from either the *Brassica napus* or the *Brassica rapa* (formerly *B. campestris*) species. Both *B. napus* and *B. rapa* include spring- and fall-planted varieties and both edible and industrial oil types. "Rapeseed" may refer to both the edible and high erucic acid industrial types. Since "canola" is used only for the edible types, common agricultural use of the words "rape" and "rapeseed" has come to mean the non-canola types.

Origin of the agricultural term "rape" is not clear, but it likely comes from "*rapa*," the Latin word for turnip.

“Canola” is a term used in commerce, not science. Commerce has established standards only for the chemical composition of the seed oil and meal, not for the plant description. The word “canola” originated in Canada from the English word “Canada” and the Latin word “*oleum*” which means “oil.”

Canola is rapeseed that meets food quality standards. Canola has less than 2 percent erucic acid in the oil and less than 30 micromoles of total glucosinolate per gram of defatted meal (30 micromoles per gram is about 1 percent of the meal dry weight, depending on the type of glucosinolate). Erucic acid is desirable in rapeseed because it is a valuable industrial oil, but it is undesirable in canola because high concentrations in food are suspected to cause heart and liver damage to humans. Glucosinolates give the distinctive mustard flavor to plants and seeds of the mustard family, but in large quantities they are goiterogenic, and can cause dietary disorders when fed to livestock.

Although canola, rapeseed, and mustard are not botanical terms, currently they are all selections from species and varieties of *Brassica*. Those species and varieties are mostly quite distinct botanical groups. Seeds of several other species of the mustard family may contain oil of canola or rapeseed quality. Future research and development may add other species to this oilseed group.

Recognizing the Brassicas

Brassicas, whether weeds, vegetables, or agronomic crops, are those members of the mustard family that have:

1. Lower leaves deeply cleft and with petioles.
2. Yellow or white flowers.
3. Pods more than three times longer than wide, many-seeded, with prominent, sharp tips or beaks.
4. Seeds generally round.
5. Plants glabrous (hairless) or with unbranched hairs.
6. Cotyledons have a curving notch at the tip that makes them somewhat heart-shaped or kidney-shaped.

Many species within the genus *Brassica* appear different from one another, but seem to have close genetic relationships. They hybridize with each other readily, so some taxonomists say they are a group of hybrid selections, not distinct species. The combination of characteristics within the Brassicas and their varieties has been altered through variety development. Natural or artificial hybrids could resemble either parent or a combination of both parental types. Certain plant characteristics are useful to the layperson for identification of Brassicas currently used for canola and rapeseed, as well as weeds associated with their production. Nonetheless, certain wild or cultivated hybrids of *Brassica* do not fit any sort of categorization at the species level.

Current rapeseed and canola varieties in the U.S. are one of two species:

1. *Brassica rapa*
2. *Brassica napus*

Brassicas grown elsewhere in the world for oilseed include *B. hirta*, *B. juncea* and *B. carinata*. Nearly all of our *Brassica* species are either generally weedy or have weedy strains or subspecies. Many commercial *Brassica* varieties are somewhat weedy and often volunteer for several years after a *Brassica* crop has been grown. They also persist along roadsides, field borders, and waste areas.

Species Associated with the Oilseed Brassicas

In addition to the *Brassica* species that are often confused with crops, several related species belong to other genera within the mustard family and are particularly undesirable in *Brassica* crops. This package illustrates the cruciferous, or mustard family, weeds most commonly found in association with production of these crops.

Spotting Mustard Weeds in Canola, Rapeseed, and Mustard Fields

Examine the crop for plants that develop or reach noticeable stages at a different time than the majority of plants in the field, especially if the different plants are not in the drill rows. Differences among crop and weed to watch for are:

1. Plants that emerge much before or after the crop.
2. Plants between drill rows.
3. Plants that bolt (send up stalks) before or after the crop.
4. Plants that flower much before or after the crop.
5. Pubescent (hairy) plants in a glabrous (hairless) crop.
6. Glabrous plants in a pubescent crop.
7. Differences in leaf shape and size.
8. Differences in color of flowers or leaves.
9. Different pod shapes.
10. Different seed size and color of seeds to be planted.
11. Different seed size and color of harvested seeds.
12. Differences in plant height.
13. Branch proliferation and density.

These are main features that are used to distinguish the species listed in this booklet. Examine for these differences especially during times when dramatic changes occur in the crop development, such as emergence, pre-bolt stage, and pre-flowering stage.

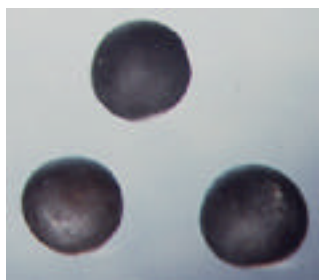
Mustards in Mustards — Brassica Species — Mustards in Mustards



1A Wild Mustard

Brassica kaber Ktze.; syn. *Sinapis arvensis*, *B. arvensis*, *S. kaber*; wild mustard, charlock

This annual is one of the most commonly found weeds of the mustard family in North America, a serious weed in all crops, particularly in spring-sown oilseed crops like rapeseed and canola. Petals are about 10 mm long and are bright yellow, which enables wild mustard to be detected in a crop with paler flowers. *Brassica kaber* can be distinguished from other Brassicas because it has sparse, rough hairs, especially on the leaf veins and at the stem base. It has stalked, lobed lower leaves and broad, toothed upper leaves that have no petioles but do not clasp the stem. The pod is 2 to 3.5 cm long with 5 to 12 seeds. It is smooth, on a stout pedicel (the stalk of one flower or fruit) 3 to 5 mm long, and spreads away from the flowering stem. The beak of the pod is 1 to 1.2 cm long, straight and conical, angular or flattened, with 1 to 3 prominent nerves, and often contains a seed. The pod is slightly constricted between the seeds. The stem joints are often somewhat purple. The cotyledons are distinctly heart- or kidney-shaped, each with a prominent wide, rounded notch at the tip, and with a mustard flavor. Wild mustard often continues to flower nearly all summer long. It produces 2 mm spherical black or purplish seeds that have reticulate exteriors that become clear and mucilaginous after a few minutes of soaking in water. It is considered native and is found throughout temperate North America.



1B The round seeds are black to purplish.



1C Cotyledons are kidney-shaped with a shallow notch.



1E Lower leaves are coarsely toothed and lobed.



1F Flowers are bright yellow.



1D Leaves are sparsely haired.



1G Siliques are slightly constricted, with a flat, angular beak which often bears a seed.



1H The sparsely haired stems are often purplish at the branches.

Mustards in Mustards — Brassica Species — Mustards in Mustards



2A White Mustard

Brassica hirta Moench; syn. *Sinapis alba*;
white mustard

White mustard is only occasionally found as a weed in our region, but is well adapted to the northern U.S., where it is widespread but sporadic. It is an annual occasionally cultivated for greens, and is currently grown for condiment mustard seed in the U.S. Stems and leaves nearly always have coarse, stiff, downward-pointing, unbranched hairs. In noncrop sites it often matures from 20 to 60 cm tall. The leaves are petiolate, with large, coarsely toothed terminal lobes; those on the upper stem are sessile (no petiole) and entire (not cleft). Its flowers are vanilla-scented and bear 8 to 11 mm long petals which are pale yellow. *Brassica hirta* can be distinguished by its distinctively hairy pod tipped with a hairless, strongly flattened, curved beak that is longer than the rest of the pod. The pod is 2 to 4.5 cm long, on a spreading pedicel 5 to 12 mm long. The beak is 1.5 to 3 cm long, angular and flattened, with 1 to 3 prominent, parallel nerves, and may contain a seed. The pod is held at a right angle to the branch, or slightly ascending. The pods have 3 to 8 seeds about 3 mm in diameter and may be constricted between seeds. The cotyledons are 10 to 30 mm long, 8 to 16 mm wide, distinctly heart- or kidney-shaped, with a sharp mustard flavor. Its seeds are round, and vary from yellowish or pale brown to gray-brown, and are sometimes mucilaginous when wet.



2B The round seeds are cream-colored to grayish brown.



2C Cotyledons are heart-shaped, distinctly notched, and borne on a hairy stem.



2D Leaves are generally sparsely haired.



2E Lower leaves are distinctly lobed and coarsely toothed.



2F Pale yellow flowers are vanilla-scented.



2G Siliques are short and hairy, with a curved, flattened beak which often bears a seed.

Mustards in *Mustards* — *Brassica Species* — *Mustards in Mustards*



3A Indian Mustard

Brassica juncea L.; syn. *Sinapis juncea*; Indian mustard

Indian mustard is also known in commerce as brown mustard, or oriental mustard. Though considered a weed, it is often grown for edible leaves, or greens, and has been grown as an oilseed crop. Several commercial varieties are grown for condiment mustard, mostly in other countries. Indian mustard is less common in the northwestern U.S. than *B. kaber*, but grows under similar conditions. It is a widespread annual weed in temperate North America. It grows to 1 m tall, is hairless or nearly so. Its flowers are pale yellow; petals are 6 to 10 mm long. Leaves grade from petiolate and deeply cleft at the base to sessile (without petioles) on the upper stem. No leaves clasp the stem. It has many erect branches. Unlike *B. rapa*, its pods are rough, showing the outline of the seeds. The pod is 2 to 4 cm long on a pedicel 1 to 1.5 cm long, and is ascending or erect but not pressed against the branch. The beak is slender and conical, tapering to a slender style, and is 5 to 10 mm long and seedless. Seeds are about 2 mm in diameter, with a reticulate (netlike), brownish red surface.



3B Seeds are brownish-red with a roughened, netlike surface.



3C Cotyledons are deeply notched and kidney-shaped.



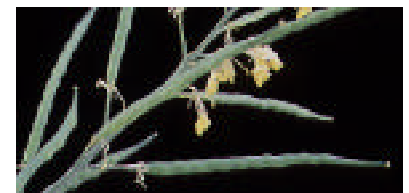
3E Leaves are deeply cut, with narrowly spaced lobes.



3D Leaves are usually hairless.



3F Flowers are pale yellow.



3G Siliques are constricted around the seeds.

Mustards in Mustards — Brassica Species — Mustards in Mustards

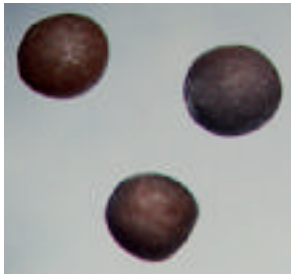


4A Canola

Brassica napus L.; canola, rapeseed

This species has become weedy in many areas as a volunteer as it tends to escape from cultivation. It is not yet considered to be a weed of great consequence. The species includes both annual and biennial types. *Brassica napus* is thought to be the result of natural crosses in Europe between birdsrape mustard (*B. rapa*) and wild cabbage (*B. oleracea*). Various cultivated races or varieties of *B. napus* are grown in addition to rapeseed and canola, including the *rapifera* subspecies types called rutabaga (also known as Swedish turnip or Swede), both of which are biennials with enlarged roots and stem bases.

Brassica napus can be distinguished from *B. rapa* in that *B. napus* has hairless, smooth, fleshy, bluish-green leaves, and the inflorescence, or flowering part, lengthens so the buds are above the opened flowers. The species grows to 1.5 m tall. Like *B. rapa*, it has medium-yellow flowers, and its lowest leaves are stalked, i.e., they have petioles, while the upper leaves have no petioles and clasp the stem of the plant. Petals are 7 to 11 mm long. The pods are 5 to 10 cm long on pedicels 1 to 3 cm long. The beak is 6 to 11 mm long, conical, slender, and seedless. The seeds are round, 1.5 to 3 mm in diameter, and bluish-black to reddish-brown with a reticulate surface texture.



4B Seeds are reddish-brown to blue-black and round.



4C Cotyledons are kidney-shaped and shallowly notched.



4E Lower leaves have a few small lobes and loosely clasp the stem.



4D Leaves are bluish-green with a waxy bloom.

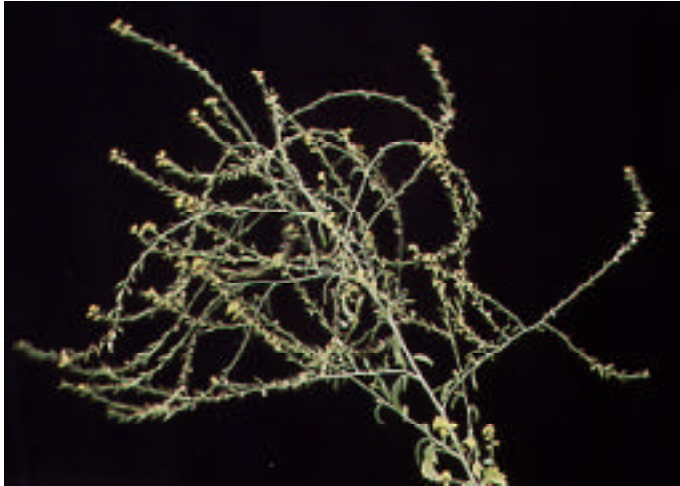


4F Buds are above the flowers, with blossoms spread for some distance at the top of the raceme.

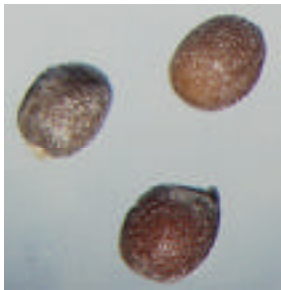


4G Siliques are spreading with a short, conical beak.

Mustards in Mustards — Brassica Species — Mustards in Mustards



5A Black Mustard



5B Round seeds are dark red-brown with a honeycombed surface.



5C Cotyledons are heart-shaped and deeply notched.



5D Leaves are sparsely haired.



5E Lower leaves are deeply lobed and coarsely toothed.



5F Flowers are bright yellow.



5G Siliques are short and tightly appressed to the stem.

Brassica nigra (L.) Koch; syn. *Sinapis nigra*; black mustard

This species is a widespread weed of crop and noncrop lands in temperate North America. It has been cultivated for its seeds, which yield the pungent yellow condiment mustard of commerce as well as a medicinal and soap-making oil. Although it is frequently mistaken for an oilseed crop plant, it is not difficult to distinguish from crop types because the leaves and stems have prominent sparse unbranched hairs that stand on a conical base and tend to be stiff near the stem base. Its upper leaves are sessile but do not clasp the stem, while the lower leaves have petioles. The leaf surface is puckered between the veins. Black mustard has long flower stems with bright yellow flowers. Petals are 7 to 11 mm long. The pods grow to 1 to 2.5 cm long on pedicels 2 to 5 mm long, are erect, somewhat four-sided, and closely appressed against the stem, a noticeable distinguishing feature of *B. nigra*. The beak of the pod is 1 to 3 mm long, conical, without seeds. It is one of the taller mustards, normally maturing from 0.5 to 2 m tall. The cotyledons are 4 to 16 mm long, heart-shaped, hairless, with a distinct mustard taste. The seeds are about 2 mm in diameter, with a finely reticulate, dark brown surface.

Mustards in Mustards — Brassica Species — Mustards in Mustards

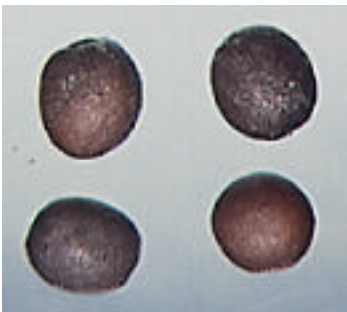


6A Birdsrape Mustard

Brassica rapa L.; syn. *B. campestris*; birdsrape mustard, wild turnip, Polish rapeseed

Weeds and vegetable crops are included in this species, along with rapeseed and canola. A subspecies, *B. rapa* ssp. *rapa*, is the common turnip. Spinach mustard, Chinese cabbage, and Chinese mustard belong to *B. rapa* also. It may be annual or biennial, depending on variety. Since this is a species in which many rapeseed and canola varieties have been developed, distinguishing the weed from the crop, based on conventional taxonomy, is not currently possible. *Brassica rapa* is very much like *B. napus* (canola and rapeseed). The two species can be distinguished from each other because *B. rapa* has yellowish-green leaves, and the flower-bearing part of its stem does not lengthen during flowering. Consequently, the opened flowers are above the buds. Flowers of *B. rapa* are slightly smaller and darker than those of *B. napus*. Mature birdsrape mustard plants are taller and more branched than canola or rapeseed.

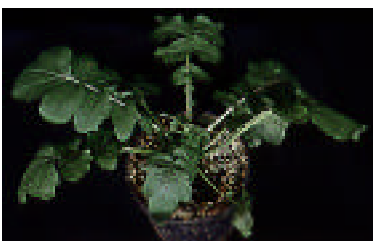
Weedy forms of *B. rapa* are distinguished from some of the other common weeds by their undivided, stalkless upper leaves which clasp the stem, their spreading, slender, stalked pods, their generally nonhairy surfaces (leaves of cultivated turnip, however, are rough and hairy), and the medium hue of their yellow flowers. Petals are 6 to 11 mm long. Lower leaves are stalked. The weedy wild types generally belong to the subspecies *B. rapa* ssp. *sylvestris*, which does not have enlarged roots. The pods are 3 to 7 cm long, spreading horizontally or ascending. The beak is 8 to 15 mm long, conical, slender, and seedless. Cotyledons have a prominent, wide, rounded notch at the end, and are distinctly heart-shaped or kidney-shaped. The seeds are 1 to 1.5 mm in diameter and blackish, reddish-brown or mottled yellow.



6B Seeds range from reddish-brown to black to yellow.



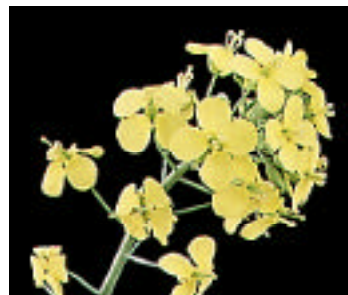
6C Cotyledons are kidney-shaped and shallowly notched.



6D Leaves are yellowish-green with a blistered surface.



6E Lower leaves are deeply lobed and clasp the stem.



6F Buds are usually overtopped by the tightly bunched, darker yellow flowers.

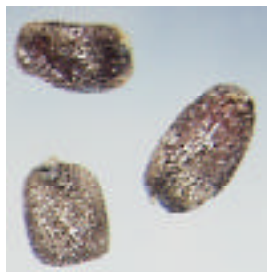


6G Silicles are spreading and tipped by long, slender beaks.

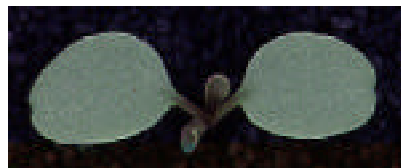
Mustards in Mustards — Associated Species — Mustards in Mustards



7A Yellow Rocket



7B Dark brown seeds are oblong to angular.



7C Cotyledons are oval and not notched at the tip.



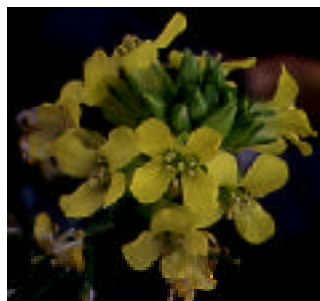
7D First leaves may lack lateral lobes.



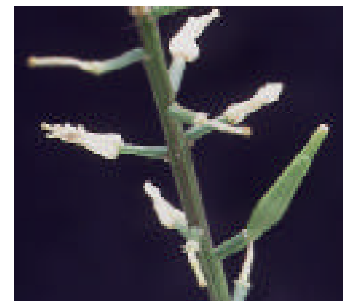
7E Leaves are smooth and generally hairless.



7F Most lower leaves have a large terminal lobe and a few smaller lateral lobes.



7G Flowers are a deep yellow.



7H Siliques are tipped by a short beak.

***Barbarea vulgaris* R. Br.; syn. *Erysimum barbarea*, *E. arcuatum*, *B. arcuata*, *B. vulgaris*, var. *arcuata*; yellow rocket**

This species is sometimes known as bitter cress or water mustard. Several variants of yellow rocket are widespread and abundant in temperate North America, sometimes as difficult garden weeds. It is normally a biennial, but has a variable lifespan and may act as an annual, biennial, or perennial. Yellow rocket is a glabrous or only slightly hairy plant, occasionally mistaken for wild mustard. It is found primarily in damp sites. Its flowers are similar to those of wild mustard, but are smaller and a brighter, deeper yellow. Petals are 6 to 8 mm long. The lower leaf shape and size is similar to that of wild radish but with green marginal flanges. The upper stem leaves are smooth-edged or toothed but not lobed, are stalkless or shortstalked, and clasp the stem, like those of rapeseed or birdsrape mustard. The leaves and stem are hairless, and the plant normally matures at a height of less than 1 meter. The pods are 1 to 3 cm long on slender pedicels 3 to 5 mm long. Beaks are 1.5 to 3 mm long, conical and tapering to a slender style. Cotyledons are round-oval, 5 to 10 mm long and half as wide, with non-hairy petioles, not notched, and with a sharp mustard flavor. First true leaves are not strongly flavored, later leaves are. Seeds are oblong to quadrangular, not mucilaginous, and 1 to 1.5 mm long.

Mustards in Mustards — Associated Species — Mustards in Mustards



8A Smallseed Falseflax

***Camelina microcarpa* (L.) Crantz;**
syn. *Camelina sativa*, subsp. *microcarpa*;
smallseed falseflax

Smallseed falseflax is an annual from Europe found on dry or well-drained, sandy sites. It is a winter-hardy annual that grows as tall as 1 m and is erect with ascending branches. It has tiny forked or stellate hairs pressed flat to the stem, but hairless individuals are occasionally found. All the leaves are hairy, lanceolate, and without petioles, and the bases of the upper leaves clasp the stem. The petals are pale yellow, fading to white, and 4 to 5 mm long, borne on long racemes. The pods are shaped like teardrops with slightly winged margins, attached at the narrow end. They are 5 to 8 mm long with beaks 2 to 2.5 mm long on pedicels that are 5 to 10 mm long. The cotyledons are round, 4 to 6 mm long and 2 to 3 mm wide, with short petioles that have 2 to 3 short, marginal hairs. Seedling leaves are lanceolate, with entire margins, a prominent midvein, and slightly mustard-flavored. The seeds are yellowish-brown, mucilaginous when wet, longer than broad, 1 to 1.5 mm long, with a finely reticulate surface texture.



8B Seeds are yellowish-brown with a curled embryo.



8C First leaves are entire to very shallowly toothed.



8E Rosettes are tightly bunched.



8D Cotyledons are round-oval with short petioles and are not notched.



8F Leaves are stellate-pubescent with prominent midveins.



8G Silicles are teardrop-shaped and narrowly wing-margined.

Mustards in Mustards — Associated Species — Mustards in Mustards



9A Shepherdspurse

Capsella bursa-pastoris L.; syn. *Thlaspi bursa-pastoris*, *Capsella rubella*; shepherdspurse.

Shepherdspurse is a somewhat winter-hardy, relatively short annual from Europe. It may germinate and flower any time of the year. Early rosette leaves are entire; later rosette leaves may be pinnatifid (toothed and divided). Rosettes closely resemble *Sisymbrium altissimum*, but are slightly smaller with stellate hairs, as compared to the simple hairs on *S. altissimum*. Basal leaves are petiolate, upper leaves sessile and clasping. This plant may grow as tall as 60 cm and is pubescent on the lower portion, but otherwise generally hairless. Under 10x magnification, the hairs on the underside of the rosette leaves can be seen to be stellate with 4 to 5 branches, while hairs elsewhere are unbranched. The petals are white, 2 to 4 mm long, and longer than the sepals. The pods, 5 to 10 mm long, are triangular or heart-shaped, beakless, strongly flattened pods, attached at the narrow end. Pods are borne on slender pedicels 7 to 15 mm long. Cotyledons are tiny (2 to 5 mm long and 1 to 2 mm wide), round, petiolate, and mustard-flavored. The first true leaves are cotyledon-like, entire or slightly toothed. The later seedling leaves are larger and deeply cleft. Seeds are slightly elongated, 1 to 1.5 mm long, rust-red, mucilaginous when wet, with a honeycombed surface texture.



9B Seeds are reddish-brown with a curled embryo.



9C Cotyledons are oval with a long petiole.



9F Lower leaves are long-petiolate; upper leaves are sessile and clasp the stem.



9D First leaves are entire to very shallowly toothed.



9E Later leaves are pinnately lobed with stellate and simple hairs.



9G Flower clusters are flat-topped with small, white petals.



9H Silicles are triangular to heart-shaped.

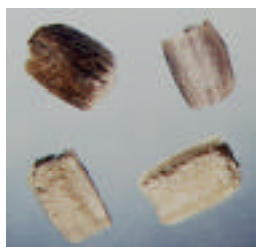
Mustards in Mustards — Associated Species — Mustards in Mustards



10A Blue Mustard

Chorispora tenella (Willd.) DC.; blue mustard

Native to Asia, blue mustard is a winter-hardy annual that grows as tall as 70 cm. It is sparsely pubescent, with minute, stiff hairs. The cotyledons are oval, with petioles. The first true leaves are deeply toothed, with coarse hairs. The lower leaves are deeply and irregularly cleft; the middle and upper leaves are petiolate, and are lanceolate or oblong, with wavy, shallow-toothed margins. Blue mustard flowers in early spring, April or earlier in mid-latitudes. The flower petals are magenta or purple, and 7 to 10 mm long, with sepals slightly longer. The pods are 3 to 4.5 cm long, borne on stout, 2 to 4 mm long pedicels. The pods curve upwards, with slender, needle-like beaks 7 to 20 mm long. When pods are mature, they break apart crosswise rather than lengthwise as most mustards do. Seeds remain inside the pod, so look for off-white to coffee-colored pod sections in crop seed samples. The species is an abundant weed on arid and semiarid crop and range land of central Canada and the western U.S.



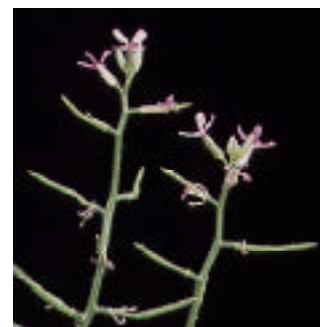
10B Seeds are borne in cross-sections of the broken silique.



10C Cotyledons are elongated ovals with a long petiole.



10E Later leaves are deeply cleft with simple or glandular hairs.



10F Flowers are purple with narrow petals.



10D First leaves are shallowly to deeply toothed.



10G Siliques are sparsely haired and tipped by needle-like, curved beaks.

Mustards in Mustards — Associated Species — Mustards in Mustards



11A Pinnate Tansymustard: The uniseriate siliques are slightly club-shaped and contain fewer than 20 seeds.



11B Seeds are orange-red with a curled embryo.



11C Cotyledons are elliptical to oval with long petioles.



11D Leaves are once- to twice-pinnate with gland-tipped, simple hairs.

Descurainia spp., including *D. sophia* (L.) Webb. (flixweed) and *D. pinnata* (Walt.) Britt. (pinnate tansymustard); tansymustards

The tansymustards are found throughout western North America, particularly on arid or semiarid land. Tansymustards are primarily winter annuals but will grow in spring-planted rapeseed as well. They can grow to 1 m or more in cropland and are prolific and competitive.

Flixweed was introduced from Europe, but the other tansymustards are native to the western U.S. The predominating tansymustards are *D. sophia* and *D. pinnata* spp. *brachycarpa* (green tansymustard). *Descurainia sophia* does not include recognized varieties; however *D. pinnata* includes six varieties, and *D. richardsonii* (Richardson tansymustard) includes four. *Descurainia sophia* is mostly in the western U.S. and southwestern plains provinces of Canada; the others are in most of the U.S. and southern Canada. About 10 species of *Descurainia* are north of Mexico; about seven are found south of the U.S. in Mexico and Central America. These are easily identified to the genus level as tansymustards, but are not simple to identify to the species level.

(plant description on next page)



11E Leaves of pinnate tansymustard are usually less divided than flixweed.



11F Foliage is lacy and usually green in color, not especially grayish.

Mustards in Mustards — Associated Species — Mustards in Mustards



12A Flixweed

Descurainia (cont)

Descurainia spp., including *D. sophia* (L.) Webb. (flixweed) and *D. pinnata* (Walt.) Britt. (pinnate tansymustard); tansymustards

The flowers are tiny, bright yellow or greenish yellow to almost white, in dense clusters at the ends of the branches. The petals are as long as the calyx. The flower stalks elongate as flowers mature through the season, until the inflorescence may comprise half of the plant's height. The seeds are orange, and about 1 mm long. The leaves of *D. sophia* are divided bipinnately or tripinnately (divided 2 to 3 times), whereas those of the other tansymustards are divided only bipinnately. The pods of flixweed are usually 5 to 10 cm long, while the pods of other tansymustards are less than 12 mm long, and have proportionately fewer seeds per pod. Pods of *D. sophia* are uniseriate (one row of seeds in each of the two chambers), whereas *D. pinnata* and *D. richardsonii* are biseriate (two rows of seeds in each of the two chambers). Seeds of all species are about 1 mm long, and are mucilaginous when wet. Foliage of *D. sophia* and *D. richardsonii* appears grayish-green due to very tiny stellate-branched hairs, whereas hairs on *D. pinnata* spp. *brachycarpa* are not branched but glandular. Hairs may have up to 6 branches. Cotyledons are oblong, 4 to 12 mm long, with hairs on the petiole. The first true leaves are 3-lobed; later leaves are divided into lobed segments. While aromatic, the plant does not have a typical mustard taste or odor.



12B Seeds are red-brown with a curled embryo.



12C The elliptical to oval cotyledons have long petioles.



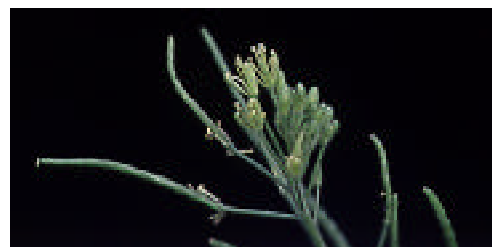
12D First true leaves are 3-lobed.



12E Leaves are bi- to tri-pinnate with stellate hairs.



12F Foliage is lacy and green to gray-green in color.



12G The biseriate siliques are linear and contain more than 20 seeds.

Mustards in Mustards — Associated Species — Mustards in Mustards



13A Wallflower Mustard

Erysimum cheiranthoides L.; wormseed mustard

This species is a winter-hardy annual, green or slightly grayish, and native to Europe. The plant grows to 60 cm tall. The cotyledons are 2 to 5 mm long and half as wide, oval to elongate and may be somewhat rectangular, with a slightly notched tip. Cotyledons have no mustard flavor, but have a very bitter taste, though the true leaves do not have a strong taste. The first true leaves have entire margins. The leaves are lanceolate, the edges nearly smooth, and the surfaces bear fine, trifid (three-branched) hairs that can be seen with a 10x hand lens. The flowers are on spreading, thin pedicels, with yellow petals 2.5 to 5 mm long. The pods are 5 to 40 mm long and usually hairless, becoming distinctly flattened when dry. The seeds are brown, oblong and slightly twisted, about 1 mm long, and are not mucilaginous. *Erysimum cheiranthoides* is found throughout the cooler part of temperate North America in moist habitats.



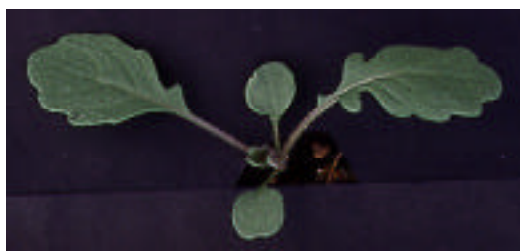
13B The red-brown seeds are slightly teardrop-shaped and twisted.



13C Cotyledons are nearly rectangular and are slightly notched.



13G Flowers are pale yellow.



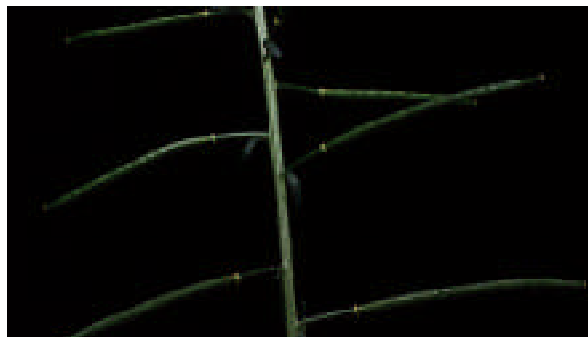
13D First leaves are entire to shallowly toothed.



13E Later leaves are pinnately lobed.



13F Leaves are petiolate with many slightly toothed lobes.



13H Siliques are long, slender, and distinctly flattened when mature.

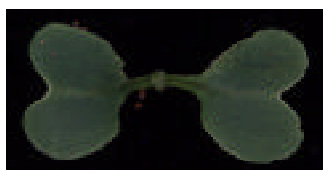
Mustards in Mustards — Associated Species — Mustards in Mustards



14A Wild Radish



14B Seeds are dark yellow-brown, but often remain in cross-sections of the broken silique.



14C Cotyledons are distinctly heart-shaped and deeply notched.



14D Leaves normally have simple hairs.



14E Leaves are shallowly toothed to lobed.

Raphanus raphanistrum L.; wild radish, jointed charlock

This weed is similar to cultivated radish (*R. sativus*) but normally has pale yellow flowers, or—less commonly—white or purple flowers as in cultivated radish. Petals are 15 to 20 mm long. It grows as an annual or biennial. Wild radish is characterized by hairless, pithy pods that are 3 to 6 cm long (including the 1 to 2 cm beak), 3 to 6 mm broad, grooved lengthwise, bulging at each seed position, and divided into distinct joints that break up into 4 to 12 one-seeded pod segments. The pods are borne on ascending pedicels 1 to 2.5 cm long. The stems have scattered, short, stiff hairs. Wild radish can grow more than 1.6 m tall. The leaves all have petioles, and the lower leaves are pinnately lobed with a large, toothed, pointed, terminal lobe. The cotyledons are distinctly heart- or kidney-shaped, on a petiole. The first true leaves are hairy, toothed, with noticeably sunken veins. The seeds are 2 to 4 mm long, egg-shaped, reddish brown, and not mucilaginous, but are rarely seen since they remain inside the pod segments. It is widely distributed in temperate North America and hybridizes readily with *R. sativus* to form a diversity of types.



14F Flowers are pale yellow to white or purplish.



14G Silicles are pithy and strongly constricted at maturity.

Mustards in Mustards — Associated Species — Mustards in Mustards



15A Tumble Mustard

Sisymbrium altissimum L.; syn. *Hesperis altissima*, *Norta altissima*; tumble mustard

Tumble mustard is an annual species that normally germinates in the spring, but is winter-hardy enough to survive and grow during mild winters. It is common from arid to subhumid regions of western North America. It is easily identified at maturity by its long, thin pods. It is densely hairy at the stem base, but the upper stem is glabrous. Before flowering, the rosettes can be identified by the hairy leaves that are pinnately lobed, with the terminal lobe about the same length and size as the lateral lobes. The upper stem leaves are deeply divided to form very slender, pinnate lobes. This plant grows as tall as 1.5 m and branches to form a somewhat spherical shape. Tumble mustard becomes dry and woody at maturity, when the stem breaks at ground level and moves with the wind as a tumbleweed. The flowers are borne in compact clusters at the end of the branches and have pale yellow petals 6 to 8 mm long. The pods are cylindrical, 5 to 10 cm long, and contain many seeds. Pods are borne on pedicels 4 to 10 mm long, spreading, branchlike and rigid at maturity, with prominent midveins and lateral veins. The cotyledons are oblong, 2 to 6 mm long and 0.8 to 2 mm wide, on petioles, and have a mustard taste. The first leaves are round, with sinuate margins. The seeds are about 1 mm long and slightly mucilaginous when moist. The species is abundant in temperate North America, particularly in arid and semiarid zones.



15B Seeds are orange-red and blocky.



15C Cotyledons are round to oblong with a slight notch at the tip.



15D First leaves are entire to shallowly toothed.



15E Later leaves are pinnately lobed with simple hairs.



15F Leaves are long petiolate and pinnately lobed.



15G Flowers are pale yellow and overtop the siliques.



15H Siliques are very long, very slender, and not beaked.

Mustards in Mustards — Associated Species — Mustards in Mustards



16A London Rocket

Sisymbrium irio L.; syn. *Norta irio*, *Descurainia irio*, *Erysimum irio*; London rocket

This species is a serious annual weed originating in Europe and introduced in California and the eastern U.S. The plant grows to 0.5 m tall, with petiolate lower leaves and sessile upper leaves that are often entire (without teeth clefts or lobes). The plant is hairless or has a few short, sharp, curving hairs. The flower petals are pale yellow, 2.5 to 4 mm long, and slightly longer than the sepals. Pod development usually overtops the clusters of flowers on branch tips. Pods are cylindrical, curved upward, 3 to 4 cm long, hairless, and borne on slender pedicels 5 to 11 mm long. The beak is about 0.5 mm long. The cotyledons are oblong, on petioles, and have a mustard taste. The first true leaves are round with sinuate margins. The seeds are oblong, about 1 mm long, and covered with short, blunt knobs seen under 10x magnification.



16E Later leaves are pinnately lobed.



16B Seeds are orange-red and oval.



16C Cotyledons are round to oblong with a shallow notch at the tip.



16D First leaves are entire and hairless.



16F Flowers are pale yellow and are overtopped by developing siliques. Siliques are slender and not beaked.

Mustards in Mustards — Associated Species — Mustards in Mustards

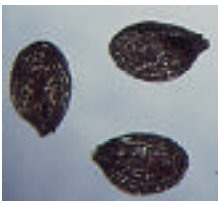


17A Field Pennycreess

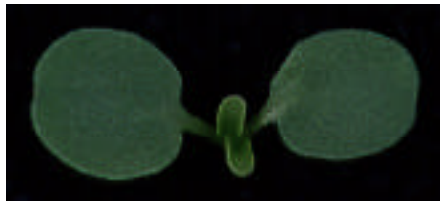
Thlaspi arvense L.; field pennycress

Often called fanweed, French weed, or stinkweed, field pennycress is one of the most widespread and serious weeds in the mustard family. It is normally a spring-germinating annual, but is winter-hardy enough to survive in northern climates when it germinates late in the season.

The cotyledons are round to oval, 4 to 10 mm long, 2 to 4 mm broad, on a 5- to 6-mm petiole, and mustard-flavored. The first true leaves are similar to the cotyledons but larger. Its leaves are normally about two inches long, shallowly and sharply toothed. Lower leaves have a short petiole, but upper stem leaves are sessile with a slightly clasping base. Field pennycress is always glabrous and is not difficult to identify after pods begin to form. The pod is 8 to 15 mm long and flattened to the shape of a palm-fan, with a prominent thin wing-like margin that is notched at the top. The pedicels are slender, widely spreading, and abruptly bent to hold the pods in a nearly vertical position. The seeds are about 2 mm long, slightly flattened, not mucilaginous, and uniquely lined with concentrically ringed corrugations resembling a fingerprint when viewed under 5x magnification. The flowers are white, on terminal branching clusters, and about 3 mm in diameter (much smaller than flowers of cruciferous oilseed crop plants). The plant has a strong, fetid, onionlike odor. *Thlaspi arvense* grows normally to a height of 60 cm, but can become taller in highly fertilized soils and in competition with a crop. Field pennycress is an abundant weed of crops and waste areas within the cool regions of temperate North America.



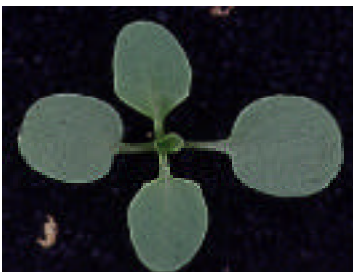
17B The black seeds have a fingerprint-like pattern on the surface.



17C Cotyledons are oval and long-petioled.



17F Lower leaves are petiolate; upper leaves are sessile and clasping.



17D First leaves are shallowly and sharply toothed.



17E Later leaves have a prominent midvein and sharp, shallow teeth.



17G Flower clusters are flat-topped with small white petals.



17H Silicles are oval, flattened, and wing margined with a distinct notch at the tip.

COMPARISON CHART OF BRASSICAS AND ASSOCIATED MUSTARD SPECIES

Mustards *Mustards* in

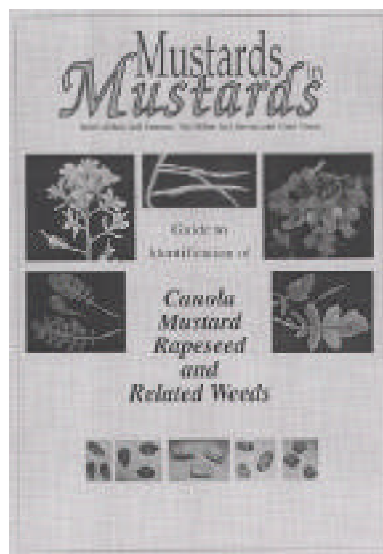
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Glossary

Annual – Germinates, seeds and dies in 12 months or less, producing flowering stems in one season only.

Appressed – Pressed flat against another plant part.

Ascending – Growing obliquely upward.

Beak – Distinct tip, narrowed at the end of the pod.

Biennial – Germinates and produces a rosette in one growing season, produces seed and dies during the second growing season.

Bipinnate – Twice pinnate, with each lobe also being pinnately divided.

Biseriate – Pod bearing two rows of seeds in each of the two chambers.

Cleft margin – Leaf margin is deeply cleft to form branchlike leaf blade segments.

Cotyledon – Seed leaf.

Entire margin – Leaf edge is smooth with no teeth or irregularities.

Erect – Vertical.

Glabrous – Without hairs.

Hispid – With coarse, firm, hairs.

Inflorescence – The flower groups on a plant.

Lanceolate – Shaped like a lance tip.

Leaf base – Where the leaf is attached to the stem.

Mucilaginous – Forming a glue-like substance when moistened.

Pedicel – Stalk by which a single flower is attached to the plant.

Perennial – Lives for an indeterminate number of years, often producing flowering stems each year after germination.

Petiolate – With a leaf stalk.

Petiole – Leaf stalk.

Pinnate – Leaf blade divided into two rows of deeply cut lobes.

Pod – A dry fruit, or ripened ovary. In *Brassicaceae* it is longitudinally divided by a thin membrane into two halves, and dry on maturity.

Pubescent – With short, dense, soft hairs.

Raceme – A kind of flower group in which the pedicel is attached directly to the main longitudinal axis.

Reticulate – Forming a network, as veins in a leaf or surface of a honeycomb.

Rosette – An apparently stemless cluster of leaves at ground level.

Sepal – Green flower bract immediately below petals.

Sessile – Leaf attached to the stem directly; having no petiole.

Silicle – Seed pod less than 3 times longer than broad.

Silique – Seed pod greater than 3 times longer than broad.

Sinuate – With a strongly wavy margin.

Spreading – Growing at nearly right angles to the main axis.

Stellate – Three or more branches form a star shape.

Toothed margin – Margin has teeth or tooth-like irregularities.

Tripinnate – Three times pinnate, with each lobe also being pinnately divided.

Uniseriate – Pod bearing one row of seeds in each of the two chambers.

Abbreviations:

m = meter (39.4 inches)

mm = millimeter, 1/1000 m (25.4 per inch)

cm = centimeter; 1/100 m (2.54 per inch)

spp. = species

ssp. = subspecies

syn. = synonym



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