



Brassicas (*Brassicaceae*) – Family

Bok choy, Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collard, Kale, Kohlrabi, Rutabaga, Turnip

Brassicas are a group of popular vegetables including bok (pak) choy, broccoli, Brussels sprouts, cabbage, cauliflower, collard, kale, kohlrabi, rutabaga and turnip. Chinese cabbage, brown mustard, rape and radishes are also members of the *B. oleracea* family. Commonly called “cole” crops because of the stems and stalks associated with members of this family, brassicas can be found in products from condiments to salad greens. They are cool weather (60-65°F) plants that do not tolerate high temperatures. All have similar growing requirements, insect pests and diseases. Nutritionally they provide Vitamins A, C, folate, and the minerals calcium, potassium, and iron. They are also a source of fiber.



1ngb.org Broccoli var.SunKing

Growing Conditions

- To thrive, Brassicas need fertile, well-drained soil high in organic matter. A soil test of the area prior to planting (*UConn Soil Nutrient Analysis Lab*) will determine if supplemental nutrients are needed and if the soil is within the required 6.0-7.5 pH range.
- Members of this family should **not** be planted where related members have been planted within the past four growing seasons to avoid infection by pests and diseases remaining in the soil or on infected plant debris.
- Seeds can be started indoors by early March for summer harvest, or by mid-June for fall harvest. Add two or three extra weeks for days-to-maturity if plants are started from seed. Generally, greenhouse-started transplants can be set out by mid-April – (about 4 weeks before the last frost date in Connecticut) - and by September for fall harvest. Greenhouse-started plants are harder to find for fall planting.
- If starting seeds indoors:
 - use a sterile, soilless seedling mix. Plant seeds about 1/4 – 1/2 inch deep, moisten the material, and keep at temperatures around 70° F until germination. Bottom

heat is not needed as these plants will develop at 60-65°F. Once seedlings emerge, provide direct sunlight, or use overhead lights, to prevent plants from getting leggy.

- water seedlings with a diluted low nitrogen fertilizer at sprouting and once or twice a week until the plants have 2-3 sets of leaves, then reduce watering.
- around 4-6 weeks, move the plants outside to start hardening off by gradually exposing them to more sunlight. Protect the young seedlings from wind.
- For direct seeding, seeds will germinate if the soil temperature is above 45°F.

Planting Instructions

- For direct seeding, drop 3 seeds 1/2-3/4 inches deep into holes in soil that has been prepared according to soil test results.
- Water in the plants and maintain consistent moisture until germination. When plants emerge, thin to the final spacing.
- If using greenhouse transplants, dig a trench about as deep as the growth pot. Plants that form heads, such as cauliflower, should be spaced about 12-15 inches apart in rows about 24-30 inches apart.
- Fill in and firm the soil around the plant so that its final height in the trench is about at the same level as it was in the growing pot.
- A liquid starter fertilizer higher in phosphorus, such as 3-10-3, can be applied when watering in.
- Apply a row cover to protect the young plants from wind and early feeding insects.
- Plants will do well in a sunny location with some shade. They can tolerate frost but may have reduced heading if temperatures stay below 45°F.

Cultivation

Weeding

- Cultivate carefully since brassica roots are shallow.
- Use thick layers of straw or other mulch to discourage weeds and conserve moisture.

Water

- The root zones of plants in this species all need deep and regular watering to develop more flavorful and well-shaped heads. As heads develop the plants will need more frequent watering.
- Prevent roots from becoming water-logged.

Fertilizing

- Brassicas are heavy feeders. Depending on soil test results, add compost and well-aged manure at transplanting. Side dress when the plants are 4-inches tall and again in the spring or fall.
- Add 1/4 lb. of 10-10-10 per 10 ft. row fertilizer after harvesting the main head to help produce smaller side heads after the main head is removed.

Harvesting

Bok Choy: (*B. rapa subsp. chinensis*) is also sensitive to bolting if temperatures fluctuate outside its preferred range. Bok choy leaves can be harvested as they mature or wait for the head to mature. Flavor is best if plants are harvested when leaves are tender.

Broccoli: (*B. oleracea v. italica*) Harvest when the heads reach a useable size, are tight and before buds have opened. Harvest as soon as the head is mature, cutting a short stalk.

Side shoots should be harvested when they reach a good size. Harvest before individual buds become obvious or buds begin to yellow, as this gives lower taste and nutritional quality. Refrigerate or process heads immediately after harvest to maintain plant quality.

Brussels Sprouts: (*B. oleracea* var. *gemmifera*) Harvest can occur even after temperatures fall below freezing. Largest sprouts form lower on the stalk, but if the top 1-2 inches of the stalk is removed when the lowest sprouts are about 1-inch in diameter, the upper sprouts will also enlarge. Harvest when sprouts are firm, dark green and about 1-1.5 inches in size. They can be picked individually and stored in the refrigerator for 7-10 days, or when the whole stalk has matured. To harvest the whole stalk, remove the leaves and cut the stalk at the base. Store at 34-40°F and in high humidity. Best flavor is maintained the shorter the storage period but they will last 3-5 weeks under ideal conditions. Blanch and freeze soon after harvest for best quality.

Cabbage: (*B. oleracea* var. *capitata*) Harvest once heads become firm. Mature size will depend on variety and growing conditions. Reduce the potential for mature heads to split by twisting the head a quarter-to-half-turn to break part of the plant's roots. Excess water can also cause heads to split. Cabbage can be stored at 32-45°F and above 80% humidity for several months.

Chinese cabbage: (*B. rapa* subsp. *pekinensis*) If exposed to frost or night temperatures below 50°F, these plants tend to bolt prematurely when warmer weather returns. Use a cover if freezing temperature is forecast. Harvest Chinese cabbage when heads feel firm and tight. If leaves feel loose, allow more time to develop. Cut off the head above the outside leaves.

Cauliflower: (*B. oleracea* var. *botrytis*) This vegetable can be tricky to grow. When mature, it won't tolerate hard freezes. The round, compact head is called the "curd," or the flowering part of the plant. It should be harvested before the flowers open or sections begin to split. *Buttoning* (the head stops growing after it reaches about 1-1.5 inches) can occur if the plant is stressed by either high or low temperatures or the transplant was over grown. As heads form, *blanching* is needed to keep the head white. When the head is 2-3 inches in diameter, gather outer leaves around the center curd and secure them with string or rubber band. Harvest 8-12 days after tying or when head is clear white and is about 6 inches in diameter.



Bugwood.org

Collard and Kale: (*B. oleracea* subsp. *acephala*) The leaves of these greens can be harvested individually or as a whole plant. If some "baby" leaves are harvested, the plant will continue to produce for additional pickings. Flavor is best if leaves are harvested before hot, dry weather sets in when leaves can become tough and less flavorful. Harvest solid green and firm leaves; discard any leaves that start to yellow. Store leaves under very cold and humid conditions for 2-3 weeks for best flavor and nutrition. Grow these greens in the fall instead of the spring since colder temperatures tend to enhance the sugar content and flavor of the leaves. Follow the same process to harvest **mustard greens**.

Kohlrabi: (*B. oleracea var. gongylodes*) This bulbous plant is best harvested when it reaches 2-3 inches in width, otherwise it gets tough and bitter. Like its relatives, it grows best in cooler weather and with adequate moisture. Splitting is possible if harvest is delayed too long. The bulbs can be stored for months if kept in very cold and humid conditions.

Rutabagas: (*B. napobrassica*) While these root plants are often confused with turnips, rutabagas are harder, denser and sweeter than turnips. Flavor is improved if they stay in the soil until after a hard frost. Harvest them when they are about 3-4 inches in diameter and the top edges (shoulders) show above the soil. The tops can also be harvested. Both the yellow root and the greens should be cooked. Use a spading fork to loosen the soil around the root for easier harvest. Rutabagas can be stored in the ground for several weeks. If they are stored for more than 1-2 weeks in the refrigerator they will rapidly lose their moisture and they may begin to sprout roots.

Turnips: (*B. rapa subsp. rapa*) Harvest when the above-ground shoulders are about 2 inches in diameter. If they become larger before harvesting they become tough, woody and bitter. They taste best while young, and can be cooked, pickled or eaten raw. Remove the green tops from the bulb when harvested, and store the greens and bulbs separately in very cold and humid conditions. If they are stored for more than 1-2 weeks in the refrigerator they will rapidly lose their moisture, and quality is reduced.

Common Insect Pests

Many brassica pests spend their first generation on wild mustard plants and will move into brassicas crops by the second generation. Remove mustard plants to encourage cabbage pests to move on.

Imported cabbageworm - aka white cabbage butterfly - (*Pieris rapae*)

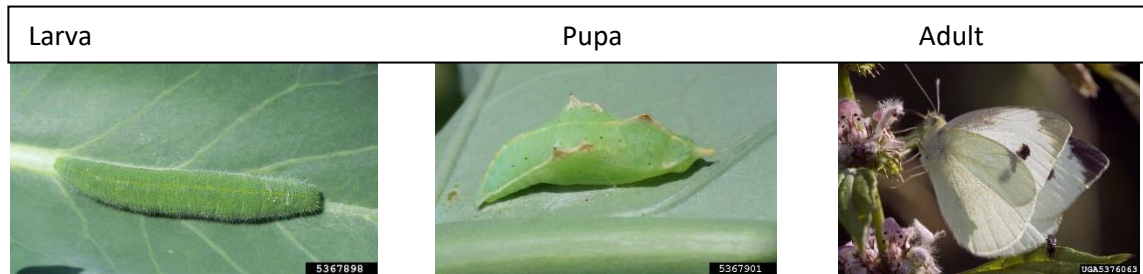


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This is the most common caterpillar in gardens. It initially makes small holes in leaves. Holes eventually enlarge until the whole leaf is eaten, leaving only the midrib. Older, larger caterpillars cause the most damage to brassica crops. Adults appear in early May and remain for the entire growing season, producing 3-5 overlapping generations. Eliminate larvae when small to avoid serious plant damage. Pupae and chrysalis overwinter in plant debris.

- **eggs** are white to pale yellow, oblong, laid singly and standing upright on the upper and lower surfaces of leaves.
- **larvae** are 1-1/2 inches long, slightly fuzzy green with yellow stripes along the sides and mid-back. They move slowly, initially produce small feeding holes which enlarge until nothing is left except the mid-rib. Large, dark green droppings are left on and under the affected plant.
- **pupae** have a unique chrysalis shape with 2 “arms” sticking out the sides and one seam running down the center back. The chrysalis usually matches its yellow, green or brown background, and is attached to a food source or nearby plant by a thin thread.

- **adults** have a 2-inch wingspan, white forewings with a black outline and a yellow underside. Females' wings have 2-3 black spots and males have one spot. Females can lay 300-400 eggs during a 3-6 week life cycle. Adults are active flyers but only feed on nectar; they do not damage plants.



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Monitor

- Be alert for small white butterflies flitting about the garden.
- Scout early plantings at least weekly for well-camouflaged larvae resting near the leaf mid-rib. Larvae are fond of areas of the plant where heads form.
- Check for accumulation of droppings.

Control

- Use floating row covers secured into the soil to prevent egg laying on young plants.
- Hand-pick larvae and deposit in soapy water.
- Spray Neem, insecticidal soap, or pyrethrum on both sides of leaves.
- ***Bacillus thuringiensis*** (Bt), an organic microbial insecticide, is effective on young larvae.
- Encourage natural predators such as parasitic wasps.
- Remove and dispose of plant residue after harvest to eliminate any potential sites for overwintering pupae or chrysalis.
- Instructions on how to make floating row covers at [\(PDF\) GE 004 Floating Row Cover.pdf](#)



<https://extension.umd.edu>

Cross-striped cabbageworm (*Evergestis rimosalis*)

Another important "worm" of New England gardens, this is the larval stage of the adult Cross-striped Cabbage Worm moth. When feeding, the larvae chew small holes in a leaf until only the veins are left. The small light brownish gray moth has black eyes with dark smudges on the forewing. The hindwing is white with a dark spot toward the back outer edge. Its appearance in the garden requires searching for eggs on late season plantings. The wingspan of adults is about 1 inch. It doesn't tolerate hot weather.



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- **eggs** are laid in groups of 3-25, are yellow, flat and overlap like fish-scales. Eggs are attached on the underside of a leaf and take about 2-12 days to develop, depending on temperature.

- **larvae** emerge in clusters and grow to 3/4-1 inch long in 2-3 weeks. They develop through 4 instars to become pale bluish-grey on top and green below. They have black and white stripes across their back with a yellow stripe along each side and a reddish head. Like other cabbage worms, they skeletonize leaves beginning with small holes until only the main vein remains. They may also damage terminal buds and burrow into developing heads.
- **pupae** develop for 9-11 days in the soil, close to the surface.
- **adult** females begin to lay eggs 3-6 days after emerging and will lay for the next 2 weeks. They have a life span of 20 days, even less under warm conditions.



Photos from bugguide.net

Monitor

- Be alert for these moths flying into the garden area.
- Check plants twice a week when plants are developing.
- Monitor for small holes in leaves and large amounts of frass (solid fecal waste material) on and around leaves.
- Look for beneficial insects like parasitic wasps.

Control

As with other cabbage worms:

- Use floating row covers secured into the soil to prevent egg laying on young plants.
- Hand-pick larvae and deposit in soapy water.
- Spray neem, insecticidal soap, or pyrethrum on both sides of leaves.
- ***Bacillus thuringiensis*** (Bt), an organic microbial insecticide, is effective on young larvae.
- Encourage natural predators such as parasitic wasps.
- Remove and dispose of plant debris after harvest to eliminate any potential sites for overwintering pupae or chrysalis.

Cabbage root maggots (*Delia radicum*)

This insect pest is particularly harmful to broccoli, cabbage, Chinese cabbage, radish, turnips and rutabagas. They can infect a crop any year but infection is more likely when springs are wet and cool. Infected plants appear stunted, wilted and discolored. Infestation may be severe enough to kill the plant. Adults overwinter as pupae in soil near roots of susceptible plants. Adults become active 1-2 weeks after forsythia start to bloom.



bugguide.net

- **eggs** are 1/8 inch long, white and bullet shaped, laid singly or in clumps in the top inch of soil or near the base of the plant stem. Soil that is wet or high in manure or compost attracts the egg-laying adults.
- **larva** Eggs hatch into maggots. Maggots are small, whitish, legless bodies with black mouth hooks. Within a week they begin to feed on germinating seeds and roots of brassica plants. Maggots produce tunnels in the bulbs or roots of the infected plants and, *after feeding for 3-4 weeks*, become oval and brown pupae.
- **pupa** develop in the soil and emerge as adults. Beginning in late June, a second generation of maggots emerges, begins to feed and pupates. If warm weather prolongs the growing season, a third generation can emerge, feed and pupate. This third pupal set overwinters and adults emerge the following spring. Often it is the second generation that overwinters as pupa.
- **adults** are an ashy gray, bristly, delicate fly that has black stripes on its thorax and resemble a small house fly. They begin flight in April and May and damage early spring plants. Another flight from mid-August to September injures fall brassica crops. Adults can lay 50-200 eggs, preferably in cool, recently tilled soil rich in organic matter.

Monitor

- check transplants for the 1/8 inch long, white eggs along stems, or carefully stir the soil near the stems of the young plants where eggs may be hidden.
- Yellow sticky cards can be used to attract flying adults.
- Once plants are damaged, it's too late for treatment.

Control

- Avoid using fresh animal manure in the spring garden. Till soil 2-3 weeks before planting.
- Wait to plant until soil temperature is above 50°F (usually early June) to encourage quick emergence of plant varieties that can be attacked by root maggots.
- Use a physical barrier, such as row covers, to prevent adult flies from getting near the plants to lay eggs. Set up the barriers before adult flies are laying eggs (usually mid-May) and keep them in place until flies are finished laying eggs (usually the end of the month) for spring crops. Cover the plants at the time of seeding or transplanting and seal the edges of the cover with soil to prevent adults from entering. Remove covers during the winter so pupae will not be trapped under them when adults emerge in the spring.
- Remove or work crop residue into the soil after harvest to eliminate or reduce areas where the cabbage maggot pupae can overwinter.
- Rotate crops between areas where plants susceptible to cabbage root maggot have been planted in the previous 2-4 years.
- Effective control depends mostly on prevention and monitoring. Placing yellow plastic bowls filled with soapy water has been suggested as a way to monitor the population of adults.
- An effective pre-plant treatment has not been established.

Flea beetles:



crucifer flea beetle damage
insectimages.org

Two types of flea beetles cause damage to brassicas: the crucifer flea beetle (*Phyllotreta cruciferae*) and the striped flea beetle (*P. striolata*). The crucifer flea beetle is about 1-1/4 inch long and is shiny black. The striped flea beetle is about 1-1.5- 2 inches long, is black and has 2 yellow stripes on its back. Records in New England show that populations of both species of flea beetles have increased in the past 25 years making them a leading pest of brassicas. Adult feeding is mostly limited to stems and leaves producing small round “shot” holes. Feeding on mature waxy leaved plants is usually limited to leaf margins. Damage is more

extensive on glossy leaved plants such as Nappa cabbage, mustards and bok choy. Severe feeding causes wilting and stunted growth.

- **eggs** are tiny, white and laid singly or in clusters in small holes in leaves or in soil near the plants.
- **larvae** are tiny white grubs that feed below the surface on plant root hairs and usually don't do much damage to the plants. They pupate under soil. There can be 1-2 generations a year.
- **adults** over-winter away from planted fields, in shrubby or woody borders or in plant debris. In early spring, they find host plants and feed on leaves and stems making small holes across the leaf surface. These spring adults damage summer plants while emerging summer adults damage fall crops. Seedlings can be killed by heavy feeding. Damage to older plants can stunt growth, reduce yield by slowing plant maturity and make plants unmarketable. Feeding usually declines by late September as adults look for overwintering areas.



larva insectimages.org



adult beetles insectimages.org

Monitor

- Hang yellow sticky cards above the growing area or observe feeding damage to monitor beetle populations.

Control

- Rotate crops away from areas where brassica were previously planted.
- Use well-secured row covers when seeding or transplanting.
- Plant late season crops to avoid early season infestation.
- Spray heavy infestations with neem oil or pyrethrum. Dust plants with diatomaceous earth or wood ash to discourage feeding.
- Remove and discard garden debris to reduce overwintering sites for adult beetles.

Cabbage looper (*Trichoplusia ni*)

A tiny “inchworm”- type larva that produces round holes and wet, brownish frass as it feeds on the leaves of cole (brassicas or crucifers) crops. They may also damage potato, tomato, pea, and some leafy green crops as well as flower and field crops, and many broadleaf weeds. The cabbage looper does not overwinter in New England but arrives with migrations from southern areas or with southern-originating storms. There are 3-4 generations per year beginning with adults that arrive in mid-May. Feeding usually begins in mid-summer when the first generation becomes active. A second generation can appear before the first generation pupates.



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- **Eggs** are single, tiny, white-to-yellow-to-greenish, half-spheres that appear in groups of 6-7, usually laid on the underside of leaves.
- **Larvae** (caterpillars) are initially white but become light green and have 4 white stripes down the back and a distinctive broader white stripe down the sides. It has 5-7 instars finally reaching 1.5 inches long when mature. If disturbed, the caterpillars actively wriggle and may drop off the plant on a strand of silk.
- **Pupae** start as green but turn dark brown within a thin, white cocoon on the underside of leaves, in plant debris or loose soil.
- **Adults** emerge as 3/4 inch long, mottled grey-brown moths that have a silvery-white mark near the center of the wing. They are mostly active at dusk.

The larval stages cause plant damage; adults feed on nectar. Feeding at each larval stage advances from making patterned holes on leaf undersides to boring into the plant heads, preventing heads from forming. The ravenous feeding can cause serious damage to the plant.

larva



pupa



adult



insectimages.org

Monitor

- top and bottom of leaves for all stages of feeding beginning with early plant growth.
- Continue scouting plants as larval stages grow and droppings increase.

Control

- practice crop rotation
- plant resistant varieties
- inspect plants regularly and carefully to spot camouflaged caterpillars.
- try an organic pesticide *Bacillus thuringiensis* (Bt) against established colonies of larvae. Neem is effective against larvae.

- plants growing during cool weather are less susceptible to larval feeding, which prefer warmer weather.

Cutworm – black (*Agrotis ipsilon*)



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So named because they cut off plants at their stems, these insects come in a variety of colors but all are destructive to their host plant. The black cutworm is associated with brassicas. Adult moths with a wingspan of 1-1/2 inches migrate from southern areas between March and June and lay eggs in weedy or grassy areas. Larvae curl into a C-shape when disturbed and are found at or near the soil surface or on lower parts of a plant. Development from egg to adult takes about 45 days with larvae developing in 5-10 days after eggs are laid.

- **eggs** are ribbed, white and globular and are deposited near food sources.
- **larvae** range from brown to greasy black and are 1-1/2 – 2 inches long when mature. Young instar may feed during the day but later stages feed after dark and move under the soil by day. Depending on temperature, the larvae take 28-35 days to move through 6 instars to become pupa.
- **pupae** develop into adults in about 12-15 days.
- **adults** mate and lay eggs singularly or in groups of 10-30, on leaves or stems close to the ground, producing 3-4 generations in one year. At first frost, adults fly south for better conditions. The adult black and gray moths are usually active at night.

larva



pupa



adult



insectimages.org

Monitor

- Use yellow sticky traps to monitor the number of adults present from March through May.
- Watch for wilted, missing or toppled plants that indicate feeding by older larvae.

Control

- Use floating row covers to prevent egg laying and to exclude larvae.
- Sprinkle rough substances, such as diatomaceous earth, sand or ground shells, over the planted area to discourage crawling larvae.
- For a small infestation, hand pick caterpillars and drop them into soapy water.
- Use aluminum or plastic collars pushed 3-4 inches into the ground around developing plant stems. Remove weeds that surround where brassica are planted.

- Till the soil in fall to disrupt overwintering pupae and in the spring to expose pupae to predatory insects and freezing temperatures.

Cabbage whitefly (*Aleyrodes proletella*)

A pest of brassicas, especially kale and Brussel's sprouts, it has been an emerging problem in northeast gardens since they were first recognized in 1993. They feed by piercing the leaf then sucking out the cell contents. This causes stippling of leaves, yellowing, drying and distortion. Heavy feeding causes premature leaf drop. Heavy feeding may wilt and stunt plants. Leaf drop can result if large groups become established on a plant. Similar to greenhouse and sweet potato whiteflies, this cabbage variety can be identified by two gray blotches on each white forewing. They are not known to be a vector of plant disease but their waxy deposits and sooty mold from honeydew production reduce plant vigor and give them an unpalatable appearance.



Cabbage whitefly infestation on kale

- eggs are laid in groups of about 15 in a semi-circular pattern on a waxy film on the underside of leaves, suspended by a short stalk. They hatch in 10-12 days.
- **nymphs** are pale green to nearly transparent. They can have a waxy white coating and appear flat and scale-like. They have 3 instar stages.
- **pupal** stage is the 4th instar and takes about 10 days. This stage is immobile and has red eyes, is thicker and shows long waxy filaments around the body edge.
- **adults** are very small (1/8 to 1/10 inch long) with white wings and a triangular shape. Adults and nymphs both feed on plant sap. Female adults can produce up to 400 eggs. Depending on climate there can be from 3 -6 generations per year.
- [Grab your reader's attention with a great quote from the document or use this space to emphasize a key point. To place this text box anywhere on the page, just drag it.]



insectimage.org

Monitor

- check all plants for infestation before purchase.
- stunted growth, yellowing or wilted leaves result from the piercing, sucking white fly feeding. The leaf surface may feel sticky. This may be the build-up of honeydew on leaves that can cause a black coating of black/sooty moldy fungus to form.
- check the underside of leaves around the veins for the white insects. When disturbed, they will fly off in a swarm.

Control

- upon discovery, spray the plant leaves with water. This will scatter the feeding flies. Apply neem oil or insecticidal soap on the underside of leaves. Apply during cool parts of the day to avoid harming the leaves.
- hang yellow sticky cards to attract the flying adults.
- encourage natural predators such as lady beetles, spiders and lacewing larvae.
- continuous planting of favored crops to extend the harvest may encourage movement of flies from older to younger crops.

Common Diseases



Alternaria brassiciola insectimages.org

Alternaria leaf spot Alternaria leaf spot is a fungal disease caused by at least three different species of *Alternaria*. Dark brown to black leaf spots appear on plants of any age and can range from a pinpoint to 2 inches in diameter. The lesions often have a concentric circle or bull's eye appearance. Spores of the fungus form within the leaf spots and can, if disturbed, be spread by wind, hands, insects, animals and tools. Dispersal of spores typically occurs during warm dry conditions, and infection occurs when leaf surfaces remain wet for 9+ hours. Spore spread of up to a mile via wind have been reported. On seeds, spores may adhere on seed surfaces and stay viable for up to 3 years, or for up to 12 years if the seed is internally contaminated.

Prevention

- Use disease-free seed, and/or [hot water seed treatment](http://plant.lab.uconn.edu/hwst) for seeds that are known to have originated from diseased plants. (See: <http://plant.lab.uconn.edu/hwst>)
- When selecting seeds to plant, choose resistant varieties.
- Rotate out of brassicas in the same location at least every 2-4 years.
- Avoid excessive irrigation and maintain weed control.
- If leaf spot symptoms emerge, remove infected material and consider a fungicide treatment to help prevent the spread of further infection.
- Remove crop residue immediately after harvest, as spores can accumulate in the soil from infected plant material.
- A straw mulch application has been shown to be effective against further disease spread from soil.



ipmimages.org

Black rot – Black rot is a bacterial disease caused by *Xanthomonas campestris* pv. *campestris*. The pathogen is spread by water, and enters the plant through naturally occurring pores on the leaf surface. Insects, equipment, mechanical injuries or workers are also efficient modes of transmission. Symptoms first appear as v-shaped yellowing lesions along leaf edges, which progress toward the plant's center. Veins of the leaves become blackened. Cauliflower and cabbage are particularly vulnerable as heads can be affected by soft rot. Humid and rainy weather with warm temperatures (~70° F) promote disease spread.

Prevention

- Rotate out of planting brassica crops in an infected area over a 2-4 year period.
- Use seed that is certified as disease free, and/or consider hot water seed treatment for seeds that are known to have originated from diseased plants.
(<http://plant.lab.uconn.edu/hwst>)
- Do not work in beds when plants are wet.
- Use drip irrigation to avoid excess water on leaf surfaces.
- Adequately space plants to promote good air circulation and to encourage drying.
- Control weeds in the planted area as they may serve as alternative hosts of the pathogen and promote bacterial spread.
- Remove and destroy or bury any infected crops after harvest.

Black leg (*Phoma linga*)

Black leg is a fungal disease that causes ashy-to-black circular spots containing tiny black fruiting bodies on leaves or stems of brassica plants. Lesions appear along the stem, lengthen and turn brown with a purplish border. They eventually girdle and blacken the stem, and extend into the soil and into the plant's roots. These effects cause stunting, wilting, and eventual plant death. Blackleg is often introduced from infected seeds, but can also be introduced by transplants and field conditions. Wet, humid conditions and mild temperatures promote spread of the disease. Fall and spring-grown plants are more susceptible to black leg due to favorable weather conditions. Spores can be wind-carried over long distances, and survive for long periods on soil, plant debris, and seed.



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Prevention

- Rotate out of planting brassicas in the same space for 2-4 years.
- Use certified disease-free seed or transplants. Consider hot water seed treatment for seeds that are known to have originated from diseased plants.
(<http://plant.lab.uconn.edu/hwst>)
- Avoid working with wet plants.
- Adequately space plants for good air circulation and to encourage drying.
- Control weeds that may promote spread of fungal spores in the planted area.
- Remove and destroy or bury any infected crops after harvest. Spores of *P. linga* do not survive on buried plant residue, only on those that remain on the surface.

Downy mildew (*Hyaloperonospora parasitica*)



Downy mildew on brassica, Bugwood.org

Downy mildew is a disease caused by a fungal-like organism. Small, angular lesions develop on leaves and flowers. As lesions enlarge, they turn yellow-orange in patches on the upper leaf surface with a greyish powder on the undersides. Heavily infected areas turn gray-purple, and take on a fuzzy, downy appearance. The leaf may look papery as well. The pathogen is spread by wind and water. Infection occurs in wet, cool weather. Downy mildew is most important on brassica seedlings but can occur on older plants as well. The disease stresses plants and may make them susceptible to other diseases. Continuous days of cool day and night temperatures provide conditions for disease development.

Prevention

- Select downy mildew-resistant varieties of seed or transplants.
- Provide space for good air circulation and avoid planting in wet or poorly drained areas.
- Use drip irrigation rather than overhead watering, and water early in the day instead of evening so plants have time to dry out.
- Rotate out of brassicas for at least 4 years.
- Remove infected leaves or whole plants to discourage disease spread.
- Remove remaining plant material after harvest by disposing of it in the trash.

Turnip mosaic virus (TuMV)



ipmimages.org

TuMV is the most important and widespread virus affecting brassica plants. The virus is transmitted by several species of aphids, which acquire the virus by inserting their needle-like stylet mouth part into the leaf as they feed. Aphids can become infective and transmit the virus to healthy plants in a matter of seconds. Infected plants exhibit classic mosaic symptoms, which include light and dark green patches on either side of major veins, rugosity (rough leaf texture), chlorotic patches, and puckering. Plants may look stunted, chlorotic, or necrotic as infection progresses.

Prevention

- Choose varieties known to be resistant to TuMV.
- Once planted, check transplants frequently for evidence or initial symptoms of mosaic.
- Avoid transplants that show signs of the virus.
- Control of TuMV is difficult. Once infected, plants cannot be cured. Remove and dispose of all infested plant material. Affected plants are not marketable. The plant, its leaves and any debris should be burned.
- Spraying plants with mineral oil may deter aphid feeding, which can in turn help limit the spread of the virus. However, most insecticides are of little or no value because aphids can spread the virus so quickly.

For pesticide information or other questions please call toll free: 877-486-6271.

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