A3678

Colorado potato beetle

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The Colorado potato beetle *(Leptinotarsa decemlineata)* is a common and destructive pest of potatoes and eggplant in home gardens and fresh-market gardens. If left unchecked, Colorado potato beetle larvae and adults can completely defoliate plants, causing serious yield losses or plant death. Once a garden has been infested, potatoes and eggplants will suffer progressively worse damage in subsequent years. The beetles prefer to feed on potato, but they will also feed on eggplant and weeds such as nightshade, groundcherry, jimsonweed, horsenettle, and mullen. Weeds provide a widespread source of food, allowing beetles to colonize new areas.

Symptoms and effects

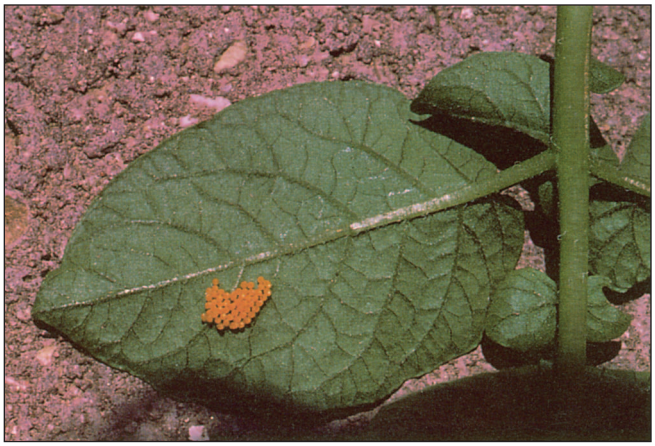
Both adults and large larvae are voracious leaf feeders. They can chew holes larger than ⅛ inch across into the leaves of susceptible plants. They often consume entire leaves beginning with young, succulent leaves. Larvae typically feed in groups and may completely defoliate plants. The larger larvae (later stages) do the most feeding damage. Heavy defoliation will severely reduce plant yields, particularly if it occurs when potatoes are flowering.

Life cycle

Colorado potato beetles overwinter as adults in Wisconsin. In the fall they burrow 2–8 inches deep in the soil, choosing protected areas near trees or in grassy edges surrounding gardens. Adults emerge in the spring, at about the time the first shoots of early season potatoes or volunteer plants appear.

Adult Colorado potato beetles are easy to spot. They have bright yellow bodies with black stripes running the length of their backs and black spots behind their heads. The beetles are about ⅜-inch long with hard, rounded shells.

Larvae and adult Colorado potato beetles devouring leaves from a potato plant.



Look for clusters of bright yellow-orange eggs on the undersides of leaves beginning in early May.

Females lay up to 500 bright yellow-orange eggs in clusters of 15–25 on the lower leaf surfaces before dying. Larvae hatch from the eggs 4–9 days later and begin feeding immediately. The larvae will molt four times before pupating. Each stage between molts is called an instar. First instar larvae are blackish-brown and tiny, about the size of a comma. They congregate on expanding foliage on the ends of stems. Because of their small size, feeding damage is inconsequential. Second instar larvae begin to assume the more typical brown-red larval coloring, and although feeding damage is more evident, damage from second instars will not be severe enough to require treatment. Third and fourth instar larvae are reddish-brown with black heads and legs and black spots along the sides of their bodies. Fourth instar larvae are about the size of a pea (⅜ inch). The last two instars consume increasingly more foliage and will cause serious crop damage. After passing through four instars over 2–3 weeks, larvae return to the soil to pupate. Within 10–14 days, the second generation of adult beetles emerges.

Second generation adults normally appear in mid-July and may cause severe defoliation. When temperatures are above normal in June and July, second generation adults may produce a second generation of larvae. Under normal conditions, these adults produce only a partial second generation and then seek overwintering sites. There are usually 1–2 generations per year in most of Wisconsin.

Control

Begin checking for Colorado potato beetles in early May after potato plants have emerged. Continue checking both potatoes and eggplants through the end of July. Examine the lower leaf surfaces for clusters of bright yellow-orange eggs. In areas that were infested the previous year, look for adult beetles on plants near field edges in early May. Because of the cool weather at this time of year, feeding by adults is minimal.

Potato plants can tolerate varying levels of defoliation before they will suffer yield loss. The level of tolerance depends on the plant's growth stage. Flowering plants can tolerate only 5–10% defoliation; after flowering, plants can tolerate up to 30% defoliation before yields are affected. Control measures for potato are not necessary while defoliation remains below these levels. Eggplants, however, can be defoliated at any stage of development, totally eliminating any yield.

Most chemical pest management practices are timed to calendar dates. But insect development is directly related to temperature: cool weather slows growth, warm weather accelerates it. So unless the weather of a given year is that of the "normal" year, recommended treatment dates may not coincide with the most vulnerable life stage of an insect pest. Using a system based on the daily high and low temperatures instead of calendar dates will help you better anticipate pest outbreaks. This system converts daily average temperatures into degree days. A degree day is a unit of measure for each degree above a base temperature (52°F). To use this approach, begin keeping track of the temperature when you find the first egg mass. Then add the daily high and low temperatures, and divide by 2 to calculate the average temperature. Subtract 52°F from the average to get the number of degree days. Keep a running total of the number of degree days to chart insect development. Table 1 identifies the number of degree days needed for each stage of Colorado potato beetle development.

Table 1. Rate of beetle development using degree days

Life stage	Degree days	Accumulated degree days	Treatment
Egg	120	120	Not susceptible—do not treat
First instar	65	185	Most effective time to apply Btt
Second instar	55	240	Most effective time to apply conventional pesticides
Third instar	60	300	
Fourth instar	100	400	
Pupae	275	675	Not susceptible—do not treat

Natural control

A number of predaceous bugs, two species of parasitic tachinid flies, and some birds may reduce populations of Colorado potato beetle. However, none of these natural controls are particularly effective.

Cultural and mechanical control

A variety of cultural methods are available to reduce the number of Colorado potato beetles. In home gardens, the large larvae and adults can be hand picked or removed with a net. Be sure to wash your hands before touching your eyes or mouth after hand picking Colorado potato beetles because the insects contain a chemical which can burn and blister sensitive skin. Also, planting crops other than potato and eggplant for a year will reduce the population.

Hand picking is not feasible in many fresh-market gardens, so other strategies are needed. Crop rotations that avoid solanaceous plants such as eggplant and potatoes will substantially reduce the beetle population. This practice must be combined with the removal of alternate host weeds to be effective. An alternative approach is to plant strips of potatoes on field edges next to overwintering sites. The beetles are attracted to these "trap" crops, where they can be removed using propane flamers, vacuum suction, or other physical controls.

Physical barriers, such as row covers and plastic-lined trenches, can be used to prevent adult beetles from finding plants and laying eggs. Row covers should be in place before plants emerge and left there until mid-June. Plastic-lined trenches should be situated between fields and overwintering sites before plants emerge. Dig trenches 18 inches deep and 18 inches wide, line them with plastic, and cover the plastic with a thin coating of dust.

Chemical control

Pesticide resistance is a very serious threat to continued effective control of Colorado potato beetles. Wisconsin beetle populations are still susceptible to a wide range of insecticides, but repeated use of any one material can rapidly lead to loss of effectiveness. In fact, races of the beetle exist that are resistant to every class of insecticide currently registered for control. In Wisconsin, many Colorado potato beetles are resistant to the insecticide carbaryl (Sevin), rendering it essentially useless in the home garden.

The best time to control Colorado potato beetles using carbaryl (Sevin) or pyrethroid insecticides is when larvae are at the second and third instar stages. Treatments at the fourth instar stage will be made too late to prevent yield loss. Eggs and pupae are not susceptible to chemical control.

Another product available for control of the young larvae is the biological insecticide *Bacillus thuringiensis* var. *tenebreonis* (Btt). This product is a bacterium that is harmless to people, animals, and plants, but causes a lethal disease in Colorado potato beetle larvae. It is only effective against first and second instar larvae and must be applied as an early spray against small larvae. Bacterial insecticides only persist 1–2 days and should be applied weekly for 2–3 applications if used alone. As with other insecticides, there is a danger that overuse of this product will lead to the development of resistant beetles. *Bacillus thuringiensis* is available in several formulations. However, only *Bt* var. *tenebreonis* is effective against Colorado potato beetles. The more commonly available *Bt* var. *kurstaki* (Btk), which is effective against caterpillars, will have no effect on beetle larvae.

Scientists have genetically engineered potatoes that have Btt present in the plant. Since the bacteria is always present, no sprays are needed. Currently, only the Russet Burbank variety Newleaf® is available as a transformed resistant plant. Other varieties are expected to be released soon. It is important to understand that using resistant plants exclusively is not the answer to controlling this pest. If large amounts of resistant plants are planted in the same location year after year, Colorado potato beetles will become resistant to Btt.

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