

Plum Curculio

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Plum curculio, *Conotrachelus nenuphar* (Herbst) (Coleoptera: Curculionidae), is one of the most common and detrimental pests of apple in Wisconsin and can cause significant damage to tree fruit. Along with apple, it attacks pear, quince, and stone fruits such as plum, cherry, peach, and apricot.

Plum curculio is a native beetle, distributed throughout the eastern and midwestern United States and Canada. In its natural environment, it survives in wild plum, native crabapple, and hawthorn. Many wild crabapples and stone fruits occur in woodlots and fencerows, which, along with neglected or abandoned fruit trees, can host plum curculio populations. All of these plants are potential sources of infestation for cultivated trees. In the winter, the adult beetles seek protection in wooded areas with an abundance of fallen leaves from deciduous trees or shrubs. Most orchards that receive insecticide applications do not have resident plum curculio populations, as the adults tend to overwinter outside the orchards. In this situation, damage to cultivated trees is more common adjacent to the overwintering habitats. In abandoned, low-sprayed, or poorly sprayed sites, plum curculio can overwinter within the orchard.



FIGURE 1. Plum curculio adult.

Identification

Plum curculio is a type of weevil (snout beetle). Adults have a distinctive, long, curved snout, characteristic of weevils (figure 1). Adults are about $\frac{1}{6}$ to $\frac{1}{4}$ of an inch long and are speckled gray, brown, and black. They have four pairs of ridges along the back, although only one pair is readily apparent. Eggs are minute (approximately $\frac{1}{50}$ of an inch long), white, and oval shaped. The full-grown larva is $\frac{1}{4}$ to $\frac{1}{3}$ of an inch long, with a legless, C-shaped, cream-colored body and brown head (figure 2). Plum curculio pupae are about the size of full-grown larvae and are white to tan in color.

Life cycle

Plum curculio overwinters as an adult beetle among fallen leaves in wooded areas or hedges. Overwintering plum curculio adults will migrate into orchards early in the season. When temperatures are below 70°F, they typically walk into the orchard and climb up tree trunks. When temperatures are warmer, they often fly into orchards. Early spring activity of overwintered adult females is somewhat unpredictable and depends on the number and timing of warm days in the spring. Usually females move to fruit trees about the time the trees are blooming, but in some years this may be delayed as long as 2 to 3 weeks after bloom. Factors causing this delay include cold temperatures, high winds, and low humidity, which forces the beetles to remain in the soil searching for moisture.

Female plum curculio beetles lay eggs just below the fruit skin. The female uses her mouthparts to cut an approximately $\frac{3}{16}$ -inch-long, shallow slit in the surface of the fruit and then deposits a single egg in the center of the flap of tissue created by this slit. After pushing the egg under the slit with her snout, she cuts crescent-shaped slits on either side of the egg (figures 3 and 4). Females are capable of



FIGURE 2. Plum curculio larvae inside a peach.

laying 100 to 500 eggs in their lifetime. Egg-laying occurs for 3 to 5 weeks after the end of bloom. Eggs typically hatch in about 1 week.

Larval development varies by fruit type. In apple and pear, after hatching, almost all larvae are soon killed by the firmness of the young fruit tissue as it develops. Often the only injury to the fruit is the crescent-shaped surface scar where the egg was laid. Larvae that are most likely to survive and develop are those in dropped fruit. In stone fruit, when the egg hatches, the larva bores through the fruit and feeds internally until fully grown. Therefore, larvae are able to fully develop within hanging fruit.

In both types of fruit, larvae progress through four larval stages (instars) over the course of about 16 days. When fully mature, they leave the fruit and pupate 1 to 2 inches down in the soil. The new generation of adults will emerge approximately 30 days after pupation (typically early August through mid-September) and feed on the surface of fruit for a short period of time before looking for overwintering sites. Plum curculio adults spend around 300 days of the year in their overwintering sites.

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FIGURE 3. New plum curculio oviposition scar on a tart cherry, early season.



FIGURE 4. Plum curculio oviposition scar on an apple, midseason.



FIGURE 5. Plum curculio egg-laying scars on a mature apple. The scars are a result of early season damage caused by overwintering plum curculio adults.



FIGURE 6. Late season adult plum curculio damage.

Damage

Damage from plum curculio occurs primarily to the developing fruit. The egg-laying scars on the surface of newly developing fruit are often the first visual symptoms of plum curculio damage. As the fruit grows and expands, so does the scar created by the slit, resulting in a large, semicircular lesion on the fruit surface (figure 5). In apple, where the plum curculio egg is often killed, this surface scar may be the only type of injury apparent on the fruit. In stone fruits, such as plum or apricot, the egg-laying scars look identical to those on apple, but a drop of clear to amber-colored sap may weep from the wound. The sap is due to the fruit

rotting internally as the larva develops and feeds within the fruit. While there may be multiple egg-laying scars on a single fruit, typically only one larva develops inside each fruit. In all targeted fruit species, infested or damaged fruit often fall from the tree.

In addition to damage from laying eggs, plum curculio adults may feed on the base of flowers prior to egg-laying. After pollination, fruit develop from this part of the flower, so flowers damaged in this way may result in lumpy and misshapen fruit at harvest.

In late summer, the new generation of adult plum curculio may feed at the surface of fruit to gain sufficient nourishment to

survive the upcoming winter. The beetles chew round holes about $\frac{3}{16}$ -inch in diameter and $\frac{3}{16}$ -inch deep into the fruit (figure 6). Often the feeding damage from the second-generation adult beetles is near the stem end of the fruit. Fruit feeding by the new generation of adults occurs from late summer until temperatures drop in the fall. Insecticide sprays throughout the summer targeting other fruit pests frequently contribute to keeping plum curculio levels low later in the season, preventing widespread damage. Late-season damage can be higher in unsprayed, low-sprayed, or organically managed orchards.

Control

In many regions, including Wisconsin, plum curculio damage can be severe. Before treatment begins, orchards should be scouted to check for the slit-like egg-laying scars on developing fruit, especially along orchard edges near potential overwintering sites. Documented history of the pest within an orchard is also very important to identify areas that tend to have higher populations each year. In areas with large plum curculio populations, tapping tree branches over a white sheet and searching for beetles that fall off can work to determine if adult plum curculio are present. However, this technique can be unreliable, so it should only be used along with searching for damaged fruit. Plum curculio is equally active during the day and night, so damage may be detected in orchards that have been previously scouted, but the beetles themselves were not found.

Pest management strategies will vary for backyard fruit trees versus commercial orchards. In all settings, elimination of wild, abandoned, or neglected fruit trees will reduce breeding grounds for plum curculio. However, they are capable of moving a significant distance (over ¼ mile) in search of hosts. Therefore, if populations are relatively high in the area, host removal may not be practical or sufficiently effective. Dormant pruning of cultivated fruit trees is also important to open up the tree canopy, allowing for more light penetration and reduced moisture. This makes the environment less favorable to plum curculio. Trapping to intercept plum curculio adults and prevent them from laying eggs has not been successful. Despite being a native species, there are very few natural enemies of plum curculio, so natural biological control has not been shown to effectively prevent damage to fruit.

Options for commercial orchards

Due to the size of commercial orchards, the use of insecticides is the most practical and effective control method. Timing of pesticide applications is critical for successful plum curculio management. Scouting should begin towards the end of the bloom period using the methods mentioned above. Typically, the period for control of plum curculio is during the first few days of warm and humid weather after petal fall. Low temperatures will extend the treatment window because the beetles will not develop as quickly. Numerous conventional and organic-approved insecticides are available for commercial orchards and provide good activity against plum curculio:

- Carbamates (e.g., Sevin)
- Diamides (e.g., Exirel)
- Neonicotinoids (e.g., Actara, Assail, Belay)
- Organophosphates (e.g., Imidan)
- Oxadiazines (e.g., Avaunt)
- Pyrethroids (e.g., Asana, Danitol, Mustang Max, Permethrin, Warrior)
- Kaolin clay (Surround) (OMRI)

Caution should be taken when applying pyrethroids and carbamates because they can kill mite predators, leading to secondary outbreaks of mites. Kaolin clay (Surround) is a fine-powdered mineral clay that is mixed with water to form a physical barrier over the fruit. Surround is approved for use in organic production by the Organic Materials Review Institute (OMRI) and can provide sufficient control. One limitation to using kaolin clay is the need for frequent reapplication as the fruit grows and after rain events.

Regardless of the insecticidal product, fruit typically needs to be protected starting immediately after bloom and then approximately every 7 to 10 days for the following few weeks. Do not spray insecticides during bloom in order to protect pollinators. Using the minimum number of sprays required for control can also help reduce the risk of secondary pest outbreaks. When developing a spray

program, keep in mind that sprays for plum curculio may also control or give partial control of other mid-season pests such as leafrollers, codling moth, and plant bugs.

Before using a particular insecticide, it is important to understand the way the product kills insects (also known as the *mode of action*). Rotating chemical modes of action is important to reduce the likelihood of insecticide resistance for both plum curculio and other insect pest species in the orchard. Keep in mind that multiple products may contain the same chemical. When choosing different products, check the active ingredients list on the label to make sure they contain an insecticide with a different mode of action than the one used previously.

Chemical registrations vary by year, state, and crop. For products currently available for plum curculio control, refer to the current year's *Midwest Fruit Pest Management Guide*. The publication can be purchased or downloaded for free at https://ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx. As always, make sure to read the label and follow all label directions before using any pesticide.

Options for backyard and small orchards

Control options in a backyard orchard include both chemical controls as well as cultural controls. If low numbers of plum curculio are present, beating branches to dislodge and remove adults can be an alternative or complement to chemical controls. To perform this technique, a white sheet is placed under the tree and each branch is tapped with a stick. If done around petal fall when the adult beetles are active, this will dislodge them, causing them to fall onto the sheet. Early in the morning is the best time of day to beat branches because temperatures are cooler and the beetles are more likely to fall off rather than fly away. This works best for small trees where it is possible to hit each branch. Beetles that fall off the tree should then be killed. This practice would need to be repeated almost every day for about 4 weeks beginning at bloom to have any level of control.

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Throughout the season, all dropped fruit should be removed and thrown away or buried to kill any developing larvae that may be inside the fruit. Composting the fruit is not sufficient to kill the insects.

Physical barriers to prevent fruit infestation include kaolin clay (Surround) and bagging fruit. As in commercial orchards, kaolin clay will need to be reapplied frequently to fully protect the fruit. To bag fruit, plastic bags (e.g., sandwich baggies), can be tied or stapled at the stem of the fruit, leaving ample room inside the bag for the fruit to grow. Cutting two small holes at the lower corners of the bag allows condensation to drip out. The bag can remain around the fruit until harvest. Fruit properly sealed in bags will typically be protected from insect damage for the remainder of the growing season. However, because plum curculio often attacks fruit before it is large enough

to bag, one or two insecticide sprays may be needed before bagging fruit to fully protect them from damage.

Some chemical control options for home fruit trees include:

- Acetamiprid (e.g., Ortho Flower, Fruit, and Vegetable)
- Carbaryl* (e.g., Sevin)
- Gamma-cyhalothrin (e.g., Spectracide Triazicide)
- Kaolin clay (Surround) (OMRI)
- Permethrin (e.g., Bonide Eight)
- Pyrethrins (e.g., Ferti-lome Triple Action Plus, Pyganic) (OMRI)
- Spinosad (e.g., Bonide Captain Jack's, Ferti-lome Spinosad, Monterey Insect Spray) (OMRI)

Read the entire product label before purchasing and applying any product to ensure that it is the best option for the tree(s) in question. Application rates, personal protective equipment, and preharvest intervals (the amount of time required between the last application and harvest) are all listed on the label and **must** be followed by law for safe use of the pesticide.

Although plum curculio can be detrimental in an orchard, with proper scouting, timing of treatments, and proper methods of control, damage can be minimal.

*Carbaryl is an effective insecticide for controlling plum curculio, but it should not be used within a month of bloom because it can cause healthy, developing fruit to fall off the tree and lead to secondary outbreaks of other pests.

References to pesticide products in this publication are for your convenience and are not an endorsement of one product over other similar products. You are responsible for using pesticides according to the manufacturer's current label directions. Follow directions exactly to protect people, animals, and the environment from pesticide exposure. Failure to do so violates the law.



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