

# SOIL INSECT PESTS OF WISCONSIN CRANBERRY PRODUCTION

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**Introductory comments.** With over 1 million different species in the world, insects have successfully colonized a great diversity of habitats. The soil is a particularly ideal niche for insects because the soil provides protection from heat and cold, drying and heavy rains, and natural enemies such as birds. And the roots and underground stems, tubers, corms, bulbs, and rhizomes of various plants provide an abundance of food. When root-feeding insects build up to large numbers, they can cause significant plant damage. Most crops have one or more serious pests that live in the soil. Corn rootworm larvae, an abundant and widespread pest of corn roots, can reasonably be considered the most important agricultural pest in the entire state.

Depending on the crop, soil insects can cause damage directly to the marketable commodity, such as carrots, potatoes, onions, radishes, and ornamental bulbs. Other soil insects do not damage the harvestable crop, but, instead, cause plant stress and correlated loss in yield or quality by feeding on the roots that are necessary for moisture and nutrient uptake; such is the case with the pests living in cranberry soils. In severe situations, prolonged root feeding by large numbers of soil insects can lead to plant death.

Across North America, there are about 10 types of soil insects that are injurious to cranberry. Here in Wisconsin, we are fortunate to have relatively few of these, and the ones we have are often not as severe as in other growing regions. The distribution of the major soil insects can be seen in the following table. Note that the first four insects are all in the white grub family, the next three are in the leaf beetle, flea beetle, and rootworm family, and the next two are weevils; these are all beetles (Coleoptera). The last is a moth (Lepidoptera).

Insect	Wisconsin	East Coast	West Coast
cranberry root grub			
June beetle grubs			
Oriental beetle			
<i>Hoplia</i> grubs			
cranberry rootworm			
striped colaspis			
redheaded (cranberry) flea beetle			
black vine weevil			
strawberry root weevil			
cranberry girdler			

 Not present, or not significantly damaging

 Present at damaging levels

As can be seen in the table, Wisconsin has three soil insects of primary importance: white grubs (June beetle larvae), cranberry flea beetle, and cranberry girdler. Each of these will be discussed individually below.

**General control strategies for managing soil insects.** Each of the following strategies has been used to manage various cranberry soil pests. Specific controls will be discussed below for each of the three pests.

*Soil insecticides.* Currently, there are two insecticides of interest for use against soil pests of cranberry. Diazinon 14% granular insecticide has been available for use for many years. It does not have a national label, but registration has been through the Special Local Needs (SLN) process as reviewed by the Wisconsin Department of Agriculture, Trade, and Consumer Protection. This SLN label was not supported by the registrant in 2004, but will likely be reinstated for the 2005 field season. Diazinon 14G can not be applied by air, and there must be a 10 ft. untreated buffer next to all bed ditches. The target insect is only cranberry girdler. The other product is a new registration, Admire, with the active ingredient of imidacloprid. This insecticide has good activity against certain soil pests on the East Coast, but not for our complex of species. We are not recommending it for use at this time, pending further research trials.

*Foliar insecticides.* Insecticides applied to the above-ground parts of the plant are not generally recommended to control soil insects. The exceptions are with those soil insects that have an accessible above-ground stage. This is the case with cranberry flea beetle, the adult of which is an important foliage feeder and can be controlled with foliar insecticides. Whereas no insecticides are specifically registered for this pest on cranberry, most broad-spectrum materials will work well.

*Biological controls.* Commercially-available insect parasitic nematodes have been tried by many growers for controlling cranberry girdler and other soil insects. Such nematodes vary in their effectiveness depending on species of nematode, pest species, and quality of the product as supplied by the producer. Generally, nematodes are much more expensive to use than insecticides, but in some cases, such as for certified organic production, they may be the only option. Currently, effective nematodes are available for cranberry girdler but not June beetle grubs. I know of no efficacy studies against flea beetle larvae.

*Flooding.* Flooding is a long-established practice for controlling many types of insects in cranberry. It is also a control practice widely used against soil insects in many other crops. The benefits of flooding are restricted to those insects that will be killed in a flood with a short duration, so that plant injury or crop loss does not also occur. Growers are currently using flooding to control cranberry girdler. Flooding does not control June beetle grubs and, as far as I know, there have been no studies conducted on cranberry flea beetle.

*Sanding.* Sanding has long been known to provide benefit for beds infested with cranberry girdler. It does not control white grubs and there are no data for control of flea beetles. The benefits of sanding also include improved root and runner growth.

*Good horticultural practices.* Soil insects that destroy roots or damage the conductive capabilities of stems result in the reduction of moisture and nutrient flow to the above-ground portions of the plant. Proper fertilization and irrigation, especially in

times of drought, will help maintain plant vigor even in the presence of low to moderate populations of soil insects.

**Cranberry girdler.** Cranberry girdler is a member of the sod webworm complex, which has several species that damage turfgrass. Cranberry girdler has a peculiar range of host plants. In addition to cranberry and turf, it is also a pest of certain conifers and can cause damage to young trees in seedling plantations.

*Biology and damage.* Cranberry girdler spends the winter as a fully grown larval caterpillar in the soil, inside of a cocoon composed of silk, soil, and dry plant residues. After the weather warms in the spring the larvae pupate within their cocoons. Adult moth flight usually begins in late May, peaks during the month of June, and tapers off and ends by late July; this is the period when adults mate and females lay eggs. Young larvae are present beginning in late July; in this stage they feed on the fibrous cranberry roots. As they grow they begin to feed on the bark of the horizontal runners, chewing away the woody tissue and leaving a very rough surface to the stems. In some cases the stems may be chewed sufficiently that they are totally severed. Bark removal (girdling) results in restricted nutrient and moisture flow into the uprights. Larvae continue to feed well into September. If population levels are high, plants may appear drought stressed during late summer and fall. Feeding is finished and cocoons are produced by early October. There is only one generation per year. The most noticeable damage occurs in spring after the winter flood has been removed. At this time, the severely injured areas will have dropped their leaves and dead spots will be seen in the field. Inspection of the vines at this time will reveal the feeding injury if girdler is the culprit.

*Monitoring and control.* Pheromone traps are available for monitoring adult flight. Traps should be placed in the field by May 15. Check and record trap results weekly; yearly records should be kept to evaluate seasonal activity in comparison with long term trends. When patches of dead vines are seen, inspect the runners at and below soil surface for chewing.

Diazinon 14G has been the product historically recommended for controlling cranberry girdler. Registration is based on a state Special Local Need (24(c)) label, which was not renewed by the registrant in 2004. As I write this, WDATCP is evaluating a petition for reinstatement of this label for the 2005 field season. A single application is permitted; appropriate timing is 10-14 days after peak flight, after most eggs have hatched but before larvae get too large to be controlled. Diazinon 14G may not be applied by air and untreated buffers must be used adjacent to in-bed ditches. Check the label for full instructions. Diazinon 14G will likely be phased out by EPA within the next few years; we will be working to evaluate other potential soil insecticides. Foliar insecticides are not available for controlling cranberry girdler.

Biological controls, in the form of insect parasitic nematodes, have been used by the industry. Both lab and field studies show that nematodes can be an effective control tactic. However, difficulties with production, handling, and application of these living organisms has sometimes resulted in less than optimum results. Further, they tend to be quite expensive. When used properly, they should be a viable control option, especially for specialized uses, such as in certified organic production. Timing of application is approximately the same as for Diazinon 14G, roughly 10-14 days past peak adult flight.

Flooding is becoming a more widely accepted option for controlling girdler larvae. In Massachusetts, a flood one week in duration in late September is recommended. Floods of shorter duration and a bit earlier seem to be used here. In order to protect the health of the vines, flooding should only occur when cool cloudy weather is forecast for the duration of the flood. No university research has yet been done to evaluate flooding for control of cranberry girdler.

Sanding has proven to be successful in suppressing cranberry girdler by reducing habitat favorability. The sand layer should be as thick as possible, and a minimum layer of 1" is recommended. The benefits of sanding are temporary, allowing populations to ultimately rebound, and sanding every three years is recommended. In addition to reducing the girdler population, sanding also has benefit in rejuvenating injured vines.

**Redheaded flea beetle.** Redheaded flea beetle (often called cranberry flea beetle by the cranberry industry) is a general feeder that attacks a multitude of types of wild, cultivated, and weedy plant species. Crop plants attacked include corn, soybeans, alfalfa, potatoes, grapes, flowers, and many more. Flea beetles get their name because they are good jumpers. Redheaded flea beetle causes plant damage in the larval stage by feeding on cranberry runners, stems, and roots, whereas the adult beetle can cause significant damage as a leaf feeder.

*Biology and damage.* Adult flea beetles are up to ¼" in length, and mostly shiny black in color, but with a dark reddish head. They can be found in cranberry beds from late July through September, during which time they feed on the leaves of cranberry and certain weedy species found in cranberry beds. When feeding on cranberry leaves, the beetles feed primarily on the leaf surface in a skeletonizing fashion. The opposite leaf surface dies and turns brown, somewhat resembling the damage caused by fireworms, except the leaves are not webbed together. There is conflicting information as to the stage of development in which this insect overwinters, however, it is likely the egg stage. Eggs hatch in spring and the small, slender, pale colored larvae feed on roots (and underground stems) of cranberry and other plants during late spring and summer. Eventually they pupate in the soil, and a few weeks later the adult beetles emerge. There is just one generation per year. Larval feeding damage on stems looks similar to that cause by cranberry girdler, but is done earlier in the growing season. Plants often respond by sending up small weak upright stems that arise near the damaged areas. Discolored and thin areas of vines are readily seen in mid to late summer. The problem may be compounded by drought stress.

*Monitoring and control.* Monitoring is best conducted during routine sweepnet sampling. IPM specialists have developed a working threshold of 10-20 beetles per 25 sweeps. In addition, growers and crop consultants should be aware of the insect and its symptoms during routine crop examination. If feeding by the larvae is suspected, check the runners for visual evidence of feeding.

I have seen no information on the possible efficacy of either flooding or sanding to control this insect. Neither have I seen data on insect parasitic nematodes, however, it is known that some nematodes successfully parasitize other members of the flea beetle family. Admire insecticide is registered for use as a soil insecticide against rootworms (the flea beetle family) in cranberry, but I have seen no data on the effectiveness against redheaded flea beetle. The most frequently used approach to controlling flea beetle is to

use foliar insecticide sprays. Although carbaryl (Sevin) is a commonly used product, I expect other materials are similarly effective.

**White grubs.** The term “white grub” is a bit of a generic name that refers to the larvae of many types of beetles in the scarab family. One group of scarabs consists of the common May and June beetles. These are members of the genus *Phyllophaga*, and include nearly 30 Wisconsin species. Only one of these is known to attack cranberry, *Phyllophaga anxia*.

*Biology and damage.* June beetles are quite large, robust insects, often over an inch long in the adult stage and nearly twice that size as the larval grubs. Most species require three years to complete their life cycle. Adult beetles fly in May and June and mate and lay eggs during this period. Eggs hatch within a couple weeks and young larvae begin feeding on plant roots; initially they are well under ¼” in length. They continue to feed through this first year of their life cycle until the soil turns cold in fall or early winter, at which time they burrow down below the frost line. The following spring they move back up to feed on roots, and continue in the larval stage throughout this entire year, once again burrowing downward as the soil cools. In the third year, they come back to the surface, feeding until early summer. They then pupate in the soil, and develop into adults in fall. The adults stay in the soil until the following spring, when they emerge and start a new generation.

Larvae cause damage by pruning roots, thereby inhibiting the plant’s ability to take up moisture and nutrients. Plants are not anchored to the soil and when the stems are tugged on, the sod feels as though it is loose, just sitting on the soil surface. In heavily infested areas, significant plant death can occur. The greatest amount of damage is usually done in the second and third years of the life cycle.

*Monitoring and control.* There are no traps or other specialized monitoring methods. Plant dieback can be caused by many factors. Where dieback is evident, dig up the soil inspecting for grubs and damaged roots. The grubs are easily seen and usually within the top 3-4” of soil; some may even be at the soil surface. In any given area of the state, many of the white grubs may be in the same stage in the same year. In such locations, some years may have more noticeable adult flights. In these cases, damage is more likely to show up in the second and third years after the big flights.

Currently there are no good measures to control white grubs in cranberry. They are not controlled by flooding, sanding, or currently available biological controls. There are no effective soil insecticides registered for use on cranberry. In areas where there are moderate white grub populations, good horticultural practices such as proper irrigation and fertilization will reduce plant stress. Admire insecticide is registered for white grub control in cranberry, but the target species are different white grubs found on the East Coast. Admire is not an economically effective control for *Phyllophaga* grubs.