

Root Maggots in Alaskan Home Gardens

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Root maggots are the most serious annually recurring insect pest problem of vegetable production in Alaska. They attack all varieties of crucifers. Most home gardeners are familiar with the damage caused by these insects. Successful vegetable growers make themselves aware of potential pest problems and plan a pest management strategy before planting their gardens. Integrated Pest Management (IPM) techniques and philosophy should be used in developing a pest management strategy.

When root maggot larvae feed on root crops such as turnip, rutabaga, and radish, they leave surface scars and feeding tunnels (Figure 1).



Figure 1. Damage to turnip caused by root maggot larvae. Note the scars of surface feeding and entrances to feeding tunnels within the root.



Figure 2. Broccoli plant showing symptoms of root maggot damage.

Any feeding scars may render the produce unacceptable for market, but the home gardener can trim off lightly damaged portions if the extent of damage is not too great. However, the root often is severely damaged. Feeding tunnels predispose the plants to infection by soft-rot bacteria and to secondary infestation by springtails and thrips.

Feeding by root maggot larvae on the stem, leaf, and flowering crucifers (cauliflower, broccoli, cabbage, brussels sprouts, and kohlrabi) results in slight to severe decline of the plants. The extent of the decline depends on the species of the host (Figure 2). Young plants may be girdled and die. Root systems on older plants

may be extensively damaged and the tap root may be destroyed. In wet seasons, the damaged plants may be able to survive because of the production of adventitious roots, if there is a constant supply of water at the soil surface and cool air temperature. If plants survive, yield and quality are reduced. On warm days the damaged root system cannot support the plant and the plant wilts. If days are warm and surface moisture is low, damaged plants may die.

To effectively deal with root maggots, it is necessary to have an understanding of their biology and seasonal activity. Root maggots are the immature stage, or larvae of small flies that belong to the Insect Order *Diptera* (Flies) and the family *Anthomyiidae*. Root maggots occur worldwide. They are short-lived insects (living for 2-5 weeks). The most serious root maggot pests in Alaska include: the turnip maggot *Delia* (= *Hylemya*) *floralis*, seed corn maggot *Delia* (= *Hylemya*) *platura*, and the cabbage maggot *Delia* *radicans*. The turnip maggot and cabbage maggot are found throughout Alaska and feed on all varieties of crucifers.

All species have basically the same life cycle. They overwinter as pupae (Figure 3) in the soil at a depth of 1 to 5 inches. As the soil warms, in the spring the root maggots complete pupal development and emerge



Figure 3. Root maggot pupae (about 1/4 inch in length) in soil.



Figure 4. Adult female root maggot fly.

as adults. The date of adult emergence varies from year-to-year and region-to-region, depending on the soil temperature regime but occurs very early in the growing season. Emergence continues four to eight weeks as the soil slowly warms at different depths. Following emergence adults mate and lay eggs (Figure 5) at the bases of host plants at the soil surface, in cracks or under soil clods, or they may adhere to the plant stem. Egg laying begins 2 to 7 days after the flies begin to emerge. Early in the season the flies appear to have a preference for larger plants, usually faster growing varieties. More than 100 eggs can be laid on a single plant over a period of two days. Eggs hatch in 3 to 10 days. The tiny first stage larvae migrate down and tunnel into root tissue as they feed. In middle to late summer, when the larvae are mature (Figure 6) they move out of the root tissue and into the surrounding soil to pupate. Usually only one generation matures each year.

CONTROL

Several techniques should be combined to provide the most complete protection against root maggots. Several cultural considerations should be considered in root maggot control. Root maggots thrive in organic matter, so organic gardening and soils high in organic matter can expect recurrent root maggot problems. The use of diatomaceous earth placed around the base of the seedlings will



Figure 5. Root maggot eggs are laid singly and in clusters at the base of the plant.



Figure 6. Root maggot larvae feeding on the root of a mustard plant.

provide good control with no environmental hazards. Diatomaceous earth (a coarse sand-like particle) should be applied following each rain early in the season.

Crop rotation—Plant this year’s root maggot host plants in ground that did not have host plants in the previous year. The greater the separation between this year’s and last year’s crucifer plantings the greater the effectiveness of this procedure. Crop rotation is often difficult in the home garden but even a modest rotation and separation should be somewhat helpful.

Sanitation—This is a very important procedure that can be done easily by the home gardener. Do not abandon root maggot infested crops. They harbor countless numbers of larvae, which, if allowed to mature, will be the source of next year’s infestation. If you have given up on a crop for any reason (root maggot infestation or weed competition, etc.), remove the crop and destroy it. As you harvest stem crucifers, remove the root system. This is especially important in earlier maturing varieties. Keep the garden and adjacent areas free of weedy mustards or other host plants.

Protective Covering—Floating row covers, such as remay, can prevent or drastically reduce infestation by root maggot populations when placed over transplants or seedlings. Row covers are not effective if the area planted is already infested with root maggot populations. Care must be taken when using polyethylene tunnels to prevent high temperatures or condensation and resultant foliage disease. Flat waterproof discs (4-6 inch diameter) or cotton can be placed closely around the stem of transplants to act as a barrier to egg laying.

Biological Control—Beneficial nematodes (parasitic and entomopathogenic species *Heterorhabditidae* and *Steinernematidae*) have proven to be effective in reducing root maggots when introduced annually. Enhanced natural populations of Rove Beetles (*Aleochara* sp.) also provide biological control of root maggots. Studies remain inconclusive on use of specific fungi, such as *Bacillus thuringiensis* (*Bt*), to control root maggots. Use of biological control organisms requires careful handling and application and avoidance of most pesticides.

Pesticides—Use root maggot biology and seasonal occurrence to guide you as to when pesticides should be applied and where they should be directed. When handling and applying pesticides always read and follow the label directions and wear appropriate personal protective equipment.

Chemical pesticides will also kill beneficial insects that attack root maggots, such as ground and rove beetles. Currently the only general use insecticide (no pesticide applicator certification required) available and labeled for use in Alaska against juvenile root maggot is Lorsban 15G (granular formulation). Lorsban is phytotoxic (kills plants) when applied to foliage. The Lorsban granules should be applied to the soil according to the label, prior to or shortly after transplanting. Dursban and diazinon are no longer labeled for use in vegetable gardens. Although malathion and Bt are labeled for crucifer crops, it is doubtful that control of adult root maggot flies will have any meaningful impact on root maggot damage. When applying pesticides read and follow the label.

To know when to begin and end a chemical control program, you must closely monitor your garden. Look at the base of several

crucifer plants at regular intervals, preferably every day. Be sure to look at some of the larger, more mature plants. Look closely for the creamy, white, oblong eggs. They are about $\frac{1}{16}$ th inch long and are laid singly or in clusters of several at the base of the plant, on the soil, in cracks, and under clods. If you look closely they are quite conspicuous. Begin your program at the first sign of eggs in the garden. Eggs may be laid for a period of 4 to 8 weeks, and the control program should continue throughout this period.

Any insect control strategy, including chemical, nonchemical, and home remedies, should be based on facts about the biology of the pest and the principles of Integrated Pest Management (IPM). Spend time in your garden and know exactly what is happening there. Become familiar with the biology and seasonal cycles of insect pests so that you can understand why some methods of control work and others do not. Use facts and common sense and plan ahead.

Remember—Use pesticides safely. Follow all label directions. All users have a legal responsibility to use pesticides according to label directions.

Note: The inclusion or exclusion of names on this list does not constitute endorsement or lack thereof by the Cooperative Extension Service.

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