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Root Maggots

4/16/2012 from C. Welty

Root maggots are the immature stages (larvae) of several different species of flies. The maggots inhabit the soil and consume roots and underground plant parts. The adults live above ground and do not damage plants. Species that are important pests of vegetables are seedcorn maggot (*Delia platura*), bean seed maggot (*Delia florilega*), onion maggot (*Delia antiqua*), cabbage maggot (*Delia radicum*). The carrot rust fly (*Psila rosae*) causes similar problems.

Root maggots kill or weaken plants or make them more susceptible to injury by diseases. A grower might first suspect a maggot problem when plant emergence is poor, or when leaves become discolored and wilted as the result of root pruning and girdling by maggots. Cold, wet weather can seriously aggravate problems associated with root maggots, particularly when plants are small, or have poorly developed root systems. The insects are active and develop at temperatures as low as 40F, while most plants grow very slowly at such low temperatures and cannot recover from maggot injury. With the onset of warmer, drier conditions following cool, wet weather, plants with maggot-damaged root systems often collapse.

The seedcorn maggot and bean seed maggot attack germinating seeds and seedlings of a wide range of plants, including lima, snap, and dry beans, peas, soybeans, corn, wheat, cucumbers, melons, squash, seed potatoes, lettuce, spinach, cole crops, and onions, and can develop on plant debris and weed seeds in the soil. Typical plant injury by the seed maggots is feeding on the cotyledons and developing shoot before the seedling emerges through the soil surface. Plant food reserves are reduced, and the growing point may be removed. Signs of maggot attack are delayed or decreased seedling emergence, tissue damage and sometimes infection of cotyledons, and formation of "snakeheads" or "y-plants" when the growing point is destroyed. Plants differ in their susceptibility to damage by the seedcorn maggot. Cucumber, winter squash, snap and lima beans have shown significant stand reductions when only a few maggots per seed are present, whereas peas and soybean usually require many more maggots per seed to show significant reductions.

The onion maggot infests onions, leeks, shallots, garlic, and chives. Maggots bore into underground stems and consume the interior of bulbs, reducing stands and decreasing the uniformity of remaining plants. A single maggot can destroy up to 20 small seedlings. Injury to older plants may result in wilting, stunting, internal damage and contamination, external scarring and discoloration of the product, and bulb deformation.

The cabbage maggot is a specialist on cabbage, kale, radish, and turnip and all related crops. It also develops on some weeds and other wild plants in the mustard family. It sometimes attack beets and celery. Maggots feed upon roots and tunnel into underground stems, causing stunting, discolored leaves, wilting, and aggravating root rot. Weakened cabbage, cauliflower, and broccoli plants fail to form heads. On root crops, discolored, debris-filled tunnels result in an unmarketable product.

Appearance: Root maggots are creamy yellow to white, 1/3 inch (8.5 mm) long when fully grown. The body tapers toward the head end, but lacks a distinct head and legs. The adults are slender, gray-bodied flies, about 1/4 inch (6.4 mm) in length, with black legs and clear wings; eyes are large and reddish purple. Pupae are enclosed within the hardened, darkened larval skins, called puparia that are oval, red-brown, 5/16 inch (7.9 mm) long.

Life history: Root maggots overwinter as pupae in host plant debris or in the top 5 inches of soil near where the larvae developed. Certain wild crucifers, such as yellow rocket, are important resources for cabbage maggot population increase and are especially important for overwintering; when abundant these wild plants may contribute substantially to infestations of spring crops. In the case of the onion maggot, wild plants do not support substantial pest populations. The timing and size of root maggot populations are highly variable and dependent upon weather conditions. Moderately moist (but not extremely wet) and cool conditions favor large pest populations and severe crop damage, particularly if serious root damage is followed by a prolonged period of hot, dry weather. Root maggots typically have three generations per year, with adults emerging during late April through May, late June through early July, and late August through late September. Eggs are deposited by female flies at the base of host plants or on the soil. Onion maggot flies preferentially lay eggs on damaged plants. Seed maggot flies are attracted to recently plowed soil and are stimulated to lay eggs by the presence of partially decayed organic matter in or on the soil and by germinating seeds; other species lay eggs on or near above-ground parts of their host plants. Seedcorn maggot eggs hatch in 1–11 days; most cabbage maggot eggs hatch in 3–5 days at 66–79F. Young maggot larvae seek underground seeds, roots, and stems or decaying organic matter on which to feed. Complete larval development requires 2–4 weeks. Maggots then enter a pupal stage that lasts 2–4 weeks.

Natural Enemies: Known predators of root maggots are ants, ground beetles, and rove beetles, which consume fly eggs, larvae, and/or pupae. Predaceous mites also eat fly eggs. Adult flies are subject to attack by spiders, male dung flies, yellowjackets, some digger wasps, insect-eating birds, parasitic nematodes, and parasitic fungi. The beneficial fungus *Entomophthora muscae* is particularly important in killing flies during wet weather late in the growing season. Several species of parasitic wasp attack the larval and pupal stages of root maggots. Reduced tillage systems generally have higher levels of predator activity than conventionally tilled fields.

Management: Seed maggots can produce large numbers of larvae in soil prior to planting, thus growers need to be concerned about the impact of tillage practices and organic matter management on pest populations. Cabbage and onion maggots are unlikely to be present in the soil before planting; infestations start by adult flies laying eggs at the base of young seedlings. The key to managing damage by these root maggots is to limit the number of adult flies that can gain access to the crop.

Tillage for weed management and cover crop management can critically affect seed maggots. Seed maggot adults are attracted to recently disturbed soil and stimulated to lay eggs in soil with decaying organic matter, even prior to planting. Spring disking or, plowing and disking winter cover crops, can contribute to substantial increases in seed maggot damage to susceptible spring-planted crops. Plant material should be incorporated into the soil on a schedule that will reduce its availability to ovipositing adult flies. A general rule of thumb is to wait 3 weeks after incorporating plant matter into the soil before seeding or transplanting a crop. Crop residues can be incorporated into soil during hot or dry weather, or otherwise far enough ahead of planting to allow for the breakdown of the green material in the soil. Killing the cover crop with a herbicide prior to soil incorporation is less likely to favor buildup of seed maggot populations. No-till planting into cover crops has not been shown to increase the seedcorn maggot population or crop damage.

Other cultural tactics that are helpful in maggot management but not discussed here are field sanitation, crop rotation, and timing of planting. A mechanical tactic is physical barriers such as row covers

Chemical Control: Damage to seeds and seedlings can be reduced by application of an insecticide at or before planting time or by seed treatment. By now (April), most growers have ordered their seed. Onion seed ordered with a commercial seed treatment of **Trigard-OMC** or **FarMore FI-500** will not need any additional maggot control. The only insecticide for use pre-plant for maggot control is **diazinon**, which can be used on onion, cabbage, and sweet corn. Insecticides for use in soil at-planting are Lorsban, Brigade 10 WSB, and Capture LFR. **Brigade 10 WSB** contains bifenthrin and can be applied to soil in-furrow with seed or transplants for control of maggots as well as wireworms and grubs on succulent peas and beans, cabbage and other Brassica crops, cucumbers and other cucurbit crops, and tomatoes. **Capture LFR** also contains bifenthrin and can be applied to soil at-planting for control of seedcorn maggot, cabbage maggot, wireworms and grubs on Brassicas, sweet corn, cucurbits, beans and peas (succulent and dry), potato, spinach, tomato, peppers, eggplant, and head lettuce. **Lorsban** can be used for a single application either pre-plant, at-plant, or post-plant as a soil treatment to Brassicas, sweet corn, legumes, and dry bulb onions. Many cucurbit growers use **Admire** at planting for cucumber beetle control; although the Admire label does not list seedcorn maggot as a target pest, we have observed good control of seedcorn maggot in plots that were treated with Admire, adjacent to plots that were not treated with Admire that had heavy damage by seedcorn maggot. Radishes, turnips, and onions, which are susceptible to serious damage after the root system is well developed, can be protected by a high volume directed spray to kill newly emerged maggots after egg hatch. Be certain to read pesticide labels to ensure that legal applications are made.

Beware that repeated application of the same insecticide over a period of several years has led to the development of insecticide resistance in some populations of cabbage and onion maggots for organochlorine, carbamate, and organophosphate groups of insecticides. Continuous use of certain insecticides on the same land has also resulted in rapid microbial degradation of these pesticides in soil, rendering them ineffective against these and other pests. Therefore, growers should avoid unnecessary or excessive insecticide treatments, and attempt to alternate among several materials, if available.

Crop Report

Here is a vegetable report for our southern Ohio area (4/13/12) by Brad Bergefurd

Very windy, freezing, frosty and dry conditions has made it rough on vegetable and fruit growers this week. Cole crops that were planted 3 weeks ago cabbage, broccoli are looking rough after 10 days of frost and freezing weather, with growers reporting lows of 28 degrees Saturday morning, 27 degrees Wednesday morning and 25 degrees Thursday morning. These freeze and frost events and low soil temperatures 45 degrees at Piqueton, was 58 degrees the end of March, has resulted in plants not looking very good. Sweet corn that was emerged under plastic and was touching plastic was froze. Potatoes that had emerged planted on black plastic have been frosted and froze off a couple of times. Growers are reporting major damage and severe crop losses from the freeze events on asparagus, strawberry, peaches, apple, cherry, blueberry, blackberry, grapes and cole crops. Damage percentages are being collected from farms but most all southern Ohio peaches that were at shuck split stage were froze with many growers reporting total losses.

On a better note growers began harvesting the first high tunnel tomatoes last weekend, the earliest anyone can remember. Alternaria leaf blight symptoms are showing up on high tunnel cucumbers that are setting fruit. Field plantings continue on schedule due to continued dry field conditions but these dry conditions have also resulted in irrigation being applied to strawberries, onions, garlic, radishes, beets and peas as well as newly planted cole crops in the field. Seed corn maggot is damaging recently set onion plants with one grower reporting 95% loss on a 4000 plant planting and another grower reporting losing 10,000 of a 30,000 plant planting. Seed corn maggot is damaging sweet corn seeds that did not have insecticide applied at planting. Lots of plastic has been laid this week for tomato, pepper and melon plantings while the field conditions have been dry. Some newly laid plastic that has not had rain on it to seal the soil on the tucks was damaged and blown up last weekend and earlier this week when wind gusts were approaching and sometime exceeding 20 mph, this has resulted in a lot of reapplying by hand acres of blown up plastic mulch.



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