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Root Maggots in Alaska

By

Richard H. Washburn

Department of Entomology



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SUMMARY

The turnip maggot, seed-corn maggot and onion maggot are the root maggots of economic importance in Alaska. They feed on crucifers, crucifers and other crops, and onions, respectively. The damage they cause can be materially lessened by properly timed applications of insecticide and certain cultural practices.

ROOT MAGGOTS IN ALASKA

By

RICHARD H. WASHBURN*

SPECIES OF ROOT MAGGOTS IN ALASKA

Root maggots are the immature stages of a group of small flies of the genus *Hylemya*, family *Anthomyiidae*. The 3 species which are injurious to crops in Alaska at the present time are the turnip maggot *H. floralis* (Fall.), seed-corn maggot *H. cilicrura* (Rond.), and the onion maggot, *H. antiqua* Meigen. The well known cabbage maggot, *H. brassicae* (Bouche), has not been identified from Alaska.

TURNIP MAGGOT

The turnip maggot is the most widely distributed of the 3 species and is found wherever plants of the cabbage family are grown in the Territory. It is probably a native species. Infested crucifers (plants of the mustard family) are often found in the first planting on newly cleared land, possibly because a number of species of wild mustards may serve as wild hosts.

There is usually 1 generation a year. The adult flies emerge from overwintering pupae during the period of mid-May to late June, depending upon weather conditions and other factors. The females commence laying eggs a few days after mating. The small, whitish eggs, about 1/8 by 1/16 inch, are often fastened to the leaf petiole or crown of the plant at, or slightly above, the surface of the ground. If the soil is very loose, the eggs may be placed slightly below the ground surface on the tap root. Each female lays a number of eggs, usually depositing 1 per plant. A partial decomposition of plant tissues appears to make a more attractive egg laying site. For this reason several females may lay eggs on the same plant.

*Entomologist, Alaska Agricultural Experiment Station, Palmer.

Thus larvae of varying sizes often are found in 1 plant. The eggs hatch in 7 to 10 days, and larvae begin to penetrate the stem or root surface of the plant. The larvae feed and molt several times during growth, and usually leave the root to pupate in the surrounding soil when mature. Occasionally pupae are found in cabbage heads.

SEED-CORN MAGGOT

Although this species mainly attacks crucifers in Alaska, it injures many other crops in the States including potato seed pieces, gladioli, nursery stock, germinating beans and corn. The only other injuries besides crucifers observed in Alaska have been in potato seed pieces and leaf mining of chard and spinach. In Alaskan crucifers it appears to attack plants already infested by turnip maggots. As far as is known it is restricted in distribution to the Matanuska Valley area. The life cycle appears to be similar to that of the turnip maggot in Alaska.

ONION MAGGOT

The onion maggot was thought to be of little potential importance until the last 2 years. It is periodically introduced in onion sets grown in infested areas of the States. In 1951 it was found in onions from seed in the Matanuska Valley, and again in 1952, indicating it has become established in this area. The life history of this insect under Alaskan conditions has not been worked out as yet.

MAGGOT INJURY IN CRUCIFERS

Maggot susceptibility or resistance varies considerably among different types of crucifers. Cauliflower, broccoli and cabbage are usually the only types killed by maggot injury. The root types, namely radishes, rutabagas and turnips, are seldom killed but usually rendered inedible. Kale and kohlrabi are seldom attacked. Cauliflower appears to be considerably more susceptible to maggot injury than either broccoli or cabbage. An interplanting of the 3 will often show a complete kill of cauliflower and only an occasionally wilted cabbage or broccoli plant. Maggot burrows are a good invasion route for fungi and bacterial rots.

ROOT MAGGOT CONTROL

Cultural control is the most desirable, but though helpful it cannot be completely relied upon to produce a maggot-free crop.

The elimination of the yellow-blossomed mustards would be desirable, as this group is a wild host plant, and a continuing reservoir of maggots. Three infested species have been collected thus far, and it is possible that any mustard with a tap root of 1/4 inch or larger may be a wild host plant.

Crop rotation, whereby the most susceptible crops are planted as far as possible from the previous year's planting, helps cut down on the degree of infestation. Although this may help the truck gardener, it is of little use to the home gardener.

Experiments in maggot resistance of radishes, turnips and rutabagas show that turnips which are flattened in shape are the only type with any degree of resistance to maggot attack.

Those varieties whose leaves have an upright growth habit are easier to cover with insecticide than the types whose leaves lay on the ground.

The following equipment may be used in the application of materials for the chemical control of root maggots:

For Dusts

Cheesecloth or
sugar sack
Hand duster
Knapsack duster
Power duster

For Sprays

Cup
Sprinkling can
Knapsack sprayer
Low pressure boom type
weed control sprayer.

Dusts

Due to the costs involved, dusts are generally impractical for all but the home gardener where costs are of less importance than ease of application. The material should be applied to the base of the plant at ground level.

Sprays

Most farmers have water available and many have boom-type sprayers for weed control already on hand. By the use of nozzles which may be adjusted to give a fan-type spray at the base of plant or using spray shoes,* effective coverage

*May be seen at Horticulture Department at Matanuska Experiment Station.

may be obtained. Spray shoes are the most desirable, since the guards will raise the foliage so the spray covers the base of the plant and isn't wasted on the upper portion. This is especially important if plants are treated late in the season.

The following are recommended materials for root maggot control:

Mercuric chloride†
Chlordan
Aldrin
Heptachlor

Any of the above materials may have a place in maggot control. The weakest point in the life cycle is the egg or newly hatched maggot. The material used should be applied as soon as eggs are found and application repeated at 10-day intervals as long as egg laying continues. Four applications are usually sufficient. In order to avoid objectionable insecticide residues the last application should be applied at least 20 days prior to harvest.

Corrosive sublimate, which is primarily effective against the eggs, has several disadvantages when compared to other materials. It is very difficult to suspend in water, thus making an even distribution of toxic materials hard to obtain. It attacks metal and badly corrodes any metal equipment.

The other materials may be formulated in any way desired and used as dusts or sprays. Due to high shipping costs it is not economical to use the low concentration dusts. It is very difficult to mix a dust of the newer insecticides on the farm because of the fine particle size and low concentration of insecticide needed for effective control. The emulsions are generally the most satisfactory as they may be mixed easily with water to give the desired concentration. They may be applied with hand sprayer, knapsack sprayer, tractor-mounted equipment or even a sprinkling can.

Due to the fact that materials may be purchased in a range of concentrations, recommendations given are based on the actual amount of active ingredient. For example, dusts may vary from 1 to 50 percent active ingredient. Wettable powders may range from 15 to 75 percent. Emulsion concentrates may range from 15 to 75 percent.

†Another name for corrosive sublimate or bichloride of mercury.

TREATMENT OF RADISHES

1. Furrow treatment with seed:

A convenient method for the home gardener is the application of a 1 percent dust of aldrin, chlordan or heptachlor at the rate of 2 ounces per foot of row with the seed before the seed is covered.

2. Post emergence treatment:

Under certain conditions maggot-free radishes may be raised without chemical treatment. Exclusion of adult flies by screening is effective but may be too expensive to warrant it. If a grower can make daily observations it may be possible to get a crop before egg laying begins. Chemical treatment should begin as soon as eggs are observed.

If the use of insecticides is necessary, any 1 of the following may be used advantageously:

Material	Active ingredient as dust or spray
Aldrin	$\frac{1}{2}$ - 1 pound to the acre
Heptachlor	$\frac{1}{2}$ - 1 pound to the acre
Chlordan	1 pound to the acre
Corrosive sublimate	1 oz. to 10 gal. water to 35 foot of row

Last treatment should be 20 days prior to harvest.

TREATMENT OF TURNIPS — RUTABAGAS

The same materials and rates of application as applied to radishes should be used for turnips and rutabagas. Due to the long season of growth of these crops, chemical treatment is usually required. Two to 4 applications are usually necessary. Coverage is difficult as the plants mature, so weeds should be at a minimum and some device used to raise the foliage where possible during late season application.

TREATMENT OF CABBAGE — CAULIFLOWER BROCCOLI

The control program may vary with the cultural practices of the grower. If plants are set out, the first application may be applied in the transplant water, and following treatments applied at 10-day intervals as long as egg laying persists.

If plants are grown from seed the more desirable practice is to wait for egg laying to begin before treatment.

CONTROL SUMMARY

Crop	Treatment	Number and timing of application
(Use any 1 of the following materials)		
Pre emergence		
Radish	In furrow w/seed 2 oz. 1% dust/5 ft. row	1 treatment
Post emergence		
	$\frac{1}{2}$ -1 lb/acre <i>aldrin</i> , <i>heptachlor</i> 1 lb/acre <i>chlordan</i> 1 oz/10 gal water of <i>corrosive</i> <i>sublimate</i> 35/ft of row	1 treatment usually sufficient*
Post emergence		
Turnip, rutabaga	$\frac{1}{2}$ -1 lb/acre <i>aldrin</i> , <i>heptachlor</i> 1 lb/acre <i>chlordan</i> 1 oz/10 gal water of <i>corrosive</i> <i>sublimate</i> 35/ft of row	2 - 4 at 10-day intervals.*
Post emergence		
Cabbage, cauli- flower, broccoli	$\frac{1}{2}$ -1 lb/acre <i>aldrin</i> , <i>heptachlor</i> 1 lb/acre <i>chlordan</i> 1 lb/50 gal transplant water	2 - 4 at 10-day intervals.*
Green onions	$\frac{1}{2}$ -1 lb/acre <i>aldrin</i> , <i>heptachlor</i> 1 lb/acre <i>chlordan</i>	2 - 4 at 10-day intervals.*
Onion sets	No effective control for infested sets is known. Use only sets from a reputable dealer.	

*First treatment when eggs are observed, followed by 10-day treatments. Last application should be 20 days prior to harvest.

EXAMPLE OF CALCULATION

The recommendation for root maggot control calls for 1 pound of chlordan per acre per application. How many pounds of the 5 percent dust are needed for $\frac{1}{2}$ acre of turnips? For 1 acre it will take 20 pounds of 5 percent dust to give an amount equal to 1 pound per acre. For $\frac{1}{2}$ acre it will take 10 pounds.

For cutworms there is available a 72 percent emulsion concentrate which contains 8 pounds of chlordan per gallon. The recommendation calls for the application of 2 pounds per acre. Since there are 4 quarts in the gallon, 1 quart mixed with 50 to 100 gallons of water and distributed over the acre will give an application rate of 2 pounds per acre.

Dosages for small areas can be calculated in a similar manner.