

The Apple Maggot in Oregon

The apple maggot (AM), *Rhagoletis pomonella*, is a potential threat to the Northwest apple and pear industry. The maggots develop in apples and quince and the fruits of native and domesticated hawthorn. It may also incidentally occur in pear, plum, and sour cherry. Fortunately, the apple maggot population for Oregon seems to attack only apple and hawthorn and to reject pear as a host.

The AM is a major pest of apples in the northeast United States and requires a rigorous insecticide management program to produce fruit free from maggot injury and contamination.

The first apple maggot infestation in Oregon was identified from apples submitted to the Oregon State University Extension Service by a Portland homeowner in the late summer of 1979. Adults emerging from that site made possible the confirmation of the presence of this pest in the state.

From 1980 through 1983, the Oregon Department of Agriculture has trapped AM adults throughout the state west of the Cascades. Relatively large and increasing trap catches have been made in the northern Willamette Valley, indicating establishment of apple maggots in this part of the state.

The diversity of habitat infested and the increasing pest density suggest that the apple maggot has adapted to our climatic conditions and is capable of producing viable populations each year.

Isolated infestations have been found as far east as Cascade Locks and south to Jackson County. Homegrown fruit from various western Oregon locales, infested with the apple maggot, has been seized at the California border.

The discovery of the apple maggot in the Northwest has created problems with interstate movement of fruit. Northwest growers are now subjected to new quarantine regulations imposed by states importing apples from this region.

Adults

The adults belong to the genus *Rhagoletis* (family Tephritidae) and are closely related to the walnut husk fly and cherry fruit fly. They are also related to such notorious



An apple maggot and the damage it does to an apple

pests as the Mediterranean fruit fly, Oriental fruit fly, and Mexican fruit fly—all important pests of fruits and vegetables.

The flies are small, about 5 millimeters long, and have black abdomens. Females have four white crossbands on the abdomen. Male flies are smaller and have only three white crossbands.

Flies are not reproductively mature until from 7 to 10 days after emergence from the ground. Mating occurs in the host-tree canopy, usually on the fruits. Shortly thereafter, the females insert eggs beneath the skin of the apples. One female may deposit up to 300 eggs during her month-long life.

The eggs hatch to larvae, which feed inside the fruit. They eventually fall to the ground, burrow into the soil, and pupate. Adult flies emerge from pupae in the soil. They have been caught in sticky traps from late June through October in western Oregon.

Peak emergence patterns depend on soil temperatures and vary from location to location, occurring later in cooler areas and higher elevations. A small second generation of flies may appear in the fall.

Eggs, larvae, and pupae

Eggs are deposited singly, just under the skin of the apple. They are slender, curved, smooth, white, and tiny (.7 millimeter), not usually visible without magnification. They hatch in from 2 to 10 days, depending on temperature.

The maggot is legless, cream-colored, and about 7 millimeters long at maturity. A maggot is cylindrical in form, with a blunt posterior tapering to a rounded mouth with two black mouth hooks.

The larvae develop within the fruit in from 20 to 30 days and pass through three developmental stages. In Oregon, most AM larvae were found in the earlier maturing soft cultivars such as Yellow Transparent, Lodi, and Gravenstein, and in Pippin types. The later-maturing varieties, such as Yellow and Red Delicious, had fewer larvae.

Mature maggots drop to the ground and burrow into the soil to pupate. The brown-to-yellow puparium, the overwintering stage, is about 4 millimeters long. Puparia can be found beneath the soil surface to a depth of about 5 centimeters.



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Injury

Injury to fruit varies from one variety to another. In soft-fleshed varieties, the egg-laying process (oviposition) often produces a small, dark spot on the surface of the fruit caused by discoloration around the injury. Considerable dimpling or deformation may occur in heavily attacked, hard-fleshed varieties.

The maggots burrow throughout the apple flesh, leaving random gray or brown trails. These feeding tunnels become larger and more evident as the maggot grows. Decay organisms enter the fruit, causing internal rotting that is particularly evident in the softer, early-maturing varieties.

In contrast, larvae of the codling moth tend to leave one track that is lined with frass and webbing. This tunnel gradually increases in size from the point of entry and usually ends up in the core.

Codling moth larvae can be distinguished from the AM by their well-developed brown head capsule, three pair of mid-body legs, and five pair of fleshy "false" abdominal legs.

Detection and control

Sticky traps, such as those produced by Zöecon or Biolure, have been used to monitor AM emergence and activity. You can detect first emergence by hanging traps according to manufacturers' directions in abandoned orchards or in unsprayed apple trees in areas previously infested.

These traps have been used in commercial orchards by placing them in border trees around the orchard to detect immigrating adults. Place traps about 2 meters (5 to 6 feet) high in trees so they are surrounded by foliage and fruit but not obscured from view.

Keep a 12-inch area around the trap clear of foliage and fruit. Hang traps vertically and keep them well-fastened, to avoid movement by wind. Check traps every third day.

Because other species of "fruit flies" resembling the adult apple maggot are caught also, training and careful observation are necessary to interpret the trap catches accurately.

If it becomes necessary to treat commercial orchards, apply the first maggot spray within 7 to 10 days after the first fly has emerged. Later sprays follow at from 10- to 14-day intervals, while adults are active and still can be caught in traps.

If the AM is caught in sticky traps immediately after a codling moth cover spray has been applied, you don't need to apply an AM spray until the previous residue has lost effectiveness (from 10 days to 2½ weeks, depending on the insecticide you use).

Two or three insecticide sprays in addition to those applied for codling moth control may be necessary to control the apple maggot. On the other hand, the current codling moth spray schedules may



Apple maggot or blueberry maggot fly



Cherry fruit fly



Walnut husk fly (Western)

Distinctive wing markings of fruit flies commonly attracted to insect traps (reproduced by permission of Trece, Inc., Palo Alto, Cal.)

control the AM adequately. Unfortunately, additional sprays may upset integrated control of mites in orchards using a reduced insecticide program.

Insecticides

For orchards. Table 1 lists insecticides that are registered for control of the AM and that have been used in northeast control programs. It has not been determined at this time which insecticides or method of application are most effective in Oregon. Complete coverage, though, is essential.

For noncommercial fruit trees. The insecticides in table 1 are either not available in small package sizes suitable for noncommercial orchard use or are considered too toxic for the untrained applicator. Also, the apple maggot, because of its recent discovery in Oregon, is not likely to be listed on insecticide labels.

The insecticides and formulations in table 2 are believed effective against the apple maggot and are available in small packages.

There may be other products equally effective and not mentioned. Consult your county Extension agent if you need more information.

Table 1.—*Insecticides registered for control of the apple maggot*

Material ¹	Amount of formulation product/acre	Minimum days from application to harvest
Guthion (azinphos-methyl)		
50 W	2 to 3 lb	7 to 15
Imidan 50W	4 to 6 lb	7
Diazinon 50W	4 to 6 lb	14
Zolone 3EC ²	5½ to 7 pt	14

¹Select a material compatible with your regular insect management program for codling moth and aphid control.

²May Russet, Golden Delicious, and other yellow varieties of apples.

Table 2.—*Insecticides effective against the apple maggot—and available in small packages for noncommercial use*

Insecticides	Hosts	Amount/gal. of water
Diazinon 25% EC	Apple, plum, cherry	2 teaspoons
Diazinon 16.75 EC	Apple, plum, cherry	1 tablespoon
Malathion 57% EC	Apple, pear	2 teaspoons
Fruit & Berry Insect Spray (contains methoxychlor, malathion, and Kelthane)*	Apple, plum, cherry, pear	2 tablespoons

*This product has a special local needs (24c) label for apple maggot.

Use pesticides safely!

- **Wear** protective clothing and safety devices as recommended on the label. **Bathe or shower** after each use.
- **Read** the pesticide label—even if you've used the pesticide before. **Follow closely** the instructions on the label (and any other directions you have).
- **Be cautious** when you apply pesticides. **Know** your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

This publication was prepared by Glenn Fisher, Extension entomologist, and M. T. AliNiazee, associate professor of entomology, Oregon State University. Mention of trade names or commercial products does not imply endorsement, and the fact that a trade name or product is not mentioned does not imply a criticism of such a trade name or product.