

The Apple Maggot in Oregon

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The apple maggot (AM), *Rhagoletis pomonella*, is a threat to the Northwest apple and pear industry. The maggot has been reported on apples, crabapples, quince, pears, cherries, plums, apricots, the fruits of native and domesticated hawthorn, *Pyracantha* berries, and wild rose hips. To date, apple maggot populations in Oregon seem to infest only apple and hawthorn. The AM is a major pest of apples in the northeast United States, where it 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. By 2000, it had been reported in most western Oregon counties. The apple maggot has adapted to Oregon's climatic conditions and is capable of producing viable populations on feral and unsprayed apples and certain hawthorns each year.

The establishment of the apple maggot in the Northwest has created problems with interstate movement of fruit. Northwest growers must observe established and newly developed

quarantine regulations imposed by some states importing apples from this region. Check with the Oregon Department of Agriculture (ODA) Commodity Inspection Division for the appropriate measures where apple maggot may influence the export of fruit.

Life cycle

The first flies usually are seen in late June. They may be caught in sticky traps through October in western Oregon. Emergence of flies depends on soil temperature, moisture, and ground cover. Patterns of emergence vary from location to location, occurring later in cooler areas and higher elevations.

Mating occurs in the host-tree canopy, usually on the fruit. The females begin laying eggs 7 to 10 days after emergence. They insert eggs under the skin of the apples. One female may deposit as many as 300 eggs during her month-long life.

The eggs hatch in a few to 10 days, depending on temperature. Larvae feed inside the fruit for 20 to 30 days and pass through three larval stages. They eventually fall to the ground, burrow into the soil, and pupate. A small second generation of flies may appear in the fall, but most pupae overwinter.

Identification

Adults: The apple maggot is in the genus *Rhagoletis* (family Tephritidae) and is closely related to the walnut husk fly and cherry fruit fly. The flies are small, about 5 millimeters long, and have black abdomens. Females have four white crossbands on the abdomen (Figure 1). Male flies are smaller and have only three white crossbands.

Eggs: Eggs are deposited singly, just under the skin of the apple. They are slender, curved, smooth, white, and tiny (0.7 millimeter), not usually visible without magnification.

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

Pupae: 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. Some puparia remain in the soil for 2 years before emerging in the second summer.

Fruit 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. Considerable dimpling or deformation may occur in heavily attacked, hard-fleshed varieties (Figure 2).

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 soft, early-maturing varieties (Figure 3).

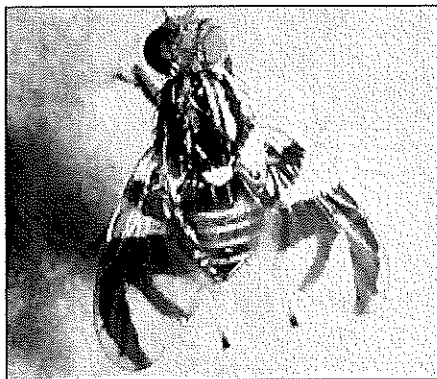


Figure 1.—Adult apple maggot showing characteristic abdomen and wing markings.

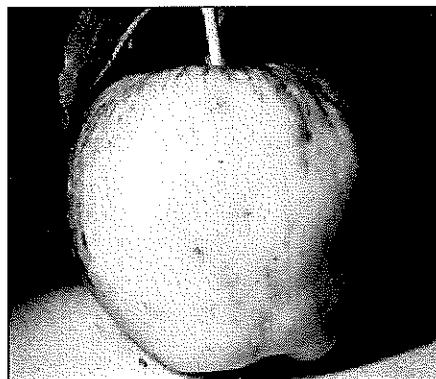


Figure 2.—Dimpling of apple heavily infested with apple maggots.



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In contrast, codling moth larvae 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.

Detection and control

Both yellow rectangle traps and red spheres, covered with Tanglefoot, are used to detect the first emerging flies in the summer as well as to monitor the presence and activity of flies throughout the season. The use of ammonium carbonate "superchargers" will enhance the attractiveness of either trap to the

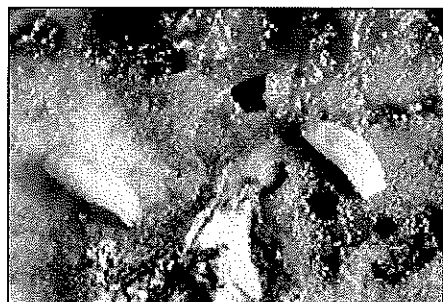


Figure 3.—Apple maggots feed through the fleshy part of the fruit, causing bruising and discoloration.

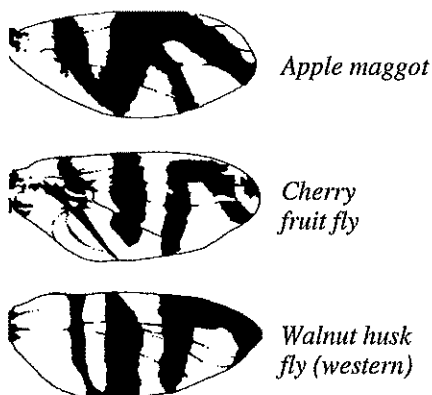


Figure 4.—Wing marking characteristics used to distinguish apple maggot, cherry fruit fly, and the western strain of the walnut husk fly.

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 product before. **Follow** the label instructions **closely** (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.

AM. You can detect first emergence by hanging traps in abandoned orchards or in unsprayed apple trees in areas previously infested.

These traps have been used in commercial orchards to determine whether AM is nearby and is immigrating to an orchard. Traps are placed in border trees around the orchard to detect incoming adults. Place traps about 5 to 6 feet (2 meters) high in trees so they are somewhat "framed" by foliage and fruit but not obscured from view. Keep a 12-inch area around the trap clear of foliage and fruit. Fasten traps to the tree securely to avoid movement by wind. Check traps every third day.

Because other species of "fruit flies" resembling the adult apple maggot also may be caught, careful inspection is necessary to accurately identify the AM trap catches (Figure 4).

If AM is caught in an orchard trap, apply the first maggot spray within 7 to 10 days after the first fly is caught. Later sprays follow at 10- to 14-day intervals while adults are active through the season—usually through October. Commercial orchards exporting fruit outside the state should follow an insecticide spray schedule to ensure maggot-free fruit.

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 to 21 days, depending on the insecticide you use). It may be necessary to apply two or three insecticide sprays after the last codling moth spray to maintain maggot-free fruit.

Insecticides

For commercial orchards: Table 1 lists insecticides that are registered for control of the AM and have been used in Northeast control programs. There is no one best insecticide or method of application. Use registered insecticides at proper rates with complete coverage. Select a material that is compatible with your regular insect management program for codling moth and aphid control.

For noncommercial fruit trees: The insecticides in Table 1 either are not available in small package sizes suitable for noncommercial orchard use or must be applied by licensed, certified applicators. The insecticides and formulations in Table 2 have been effective for apple maggot control and are available in small packages.

Table 1.—Insecticides for control of the apple maggot in commercial orchards.*

Material	Amount of product/acre	Minimum days from application to harvest
azinphos-methyl 50W	2 to 3 lb	14 to 21
Imidan 50W	3 to 5 lb	7

*May be applied only by certified applicators.

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

Insecticide	Hosts	Minimum days from application to harvest
Diazinon EC**	Apple, plum, cherry	14
Malathion EC	Apple, pear	7
Fruit & Berry Insect Spray	Apple, plum, cherry, pear	7
Surround At Home***	Apple, plum, cherry, pear	0

*Consult label for application rates.

**All diazinon products will be removed from retail markets by the end of 2004.

***A clay product, not an insecticide. It is thought to repel flies or interfere with feeding and egg laying. Use at first emergence and every 7 to 10 days thereafter.

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