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APPLE MAGGOT
CONTROL IN BACKYARD SITUATIONS

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THE APPLE MAGGOT is the most serious insect pest of home grown apples, having the potential to damage nearly 100 percent of the fruit. Greatest damage usually occurs to backyard trees located near abandoned apple orchards or in neighborhoods where apple trees are neglected or poorly sprayed. It is a native North American insect, common to the northeastern United States and eastern Canada. Its original host plants are assumed to be crab apple, hawthorne and juneberries. The apple maggot secondarily adapted to commercial apples when they were introduced into America 350 years ago. By 1867, apples throughout the New England area were under attack by the maggot. The apple maggot prefers early maturing sweet apple varieties but no variety is immune from attack. Therefore, it is essential to protect all varieties, using a combination of pest control tactics which include insecticide sprays and good orchard sanitation.

Life History

The life history of the apple maggot is diagrammed in Fig. 1. The apple maggot passes through one complete generation a year. The winter is spent as a pupa (Fig. 2) in the soil. Flies (Fig. 3) emerge from the soil beginning in late June or early July and continue to emerge until September. When the fly emerges from the soil it requires a period of time to mature sexually and mate. During this 8- to 10-day period, referred to as the preoviposition period, flies wander about the foliage of the apple tree and adjacent trees and shrubs in search of food. They consume food particles found on the foliage surface in a manner much the same as an ordinary house fly feeds.

Following the preoviposition period, egg laying begins. The flies seek out fruit and deposit an egg beneath the skin with the aid of a sharp

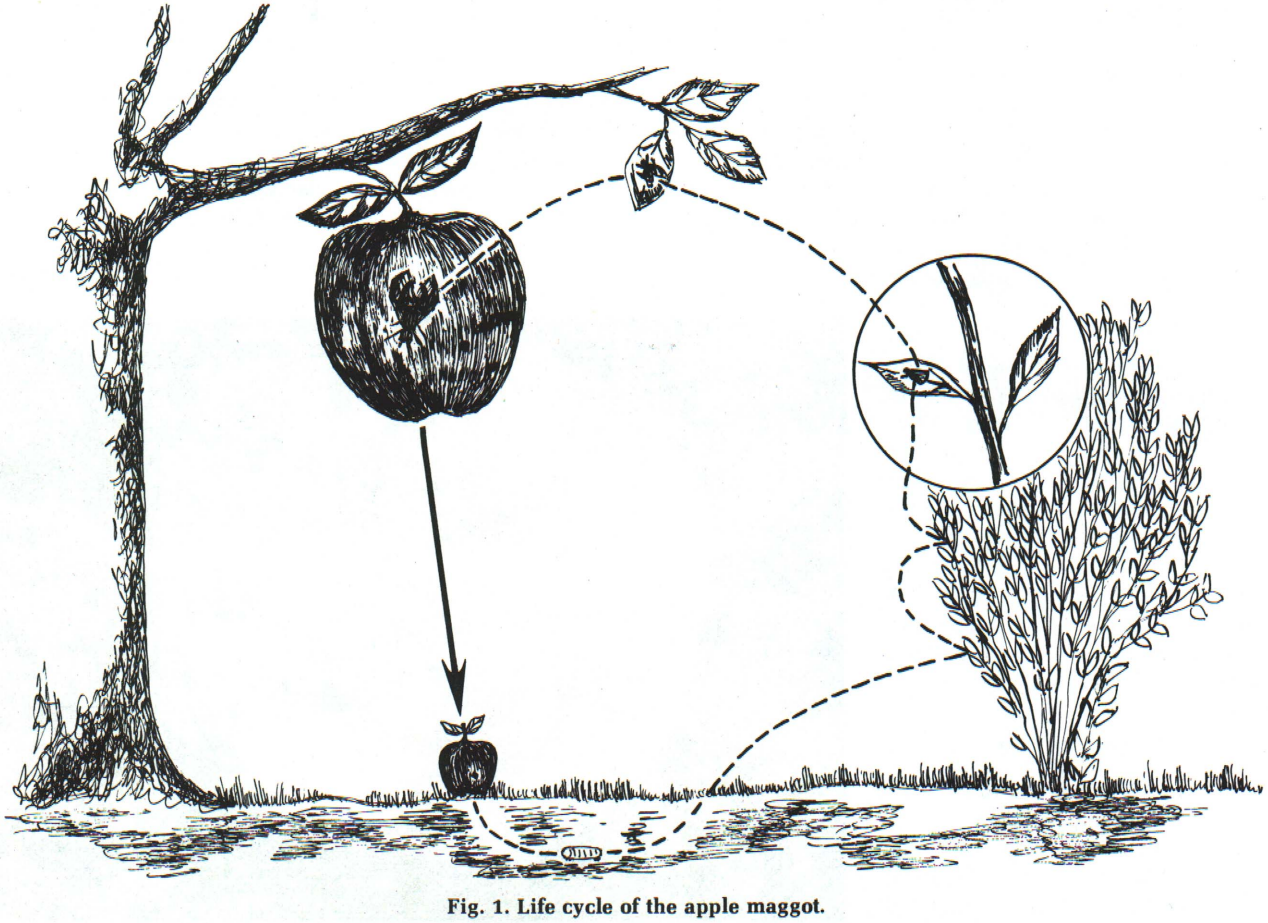

Fig. 1. Life cycle of the apple maggot.

pointed ovipositor. Many eggs may be laid in a single apple. The initial damage noticed by home fruit growers is a result of the egg-laying activities of the fly. When the egg is inserted into the apple, a few plant cells adjacent to the puncture are killed. As the cells around the egg puncture continue to grow, there results a definite depression in the apple. A typical example of an apple in which many apple maggot eggs have been laid is shown in Fig. 4. Apples attacked late in the growing season will not be as deformed as this but egg-laying punctures are still evidenced by a slight depression around the egg puncture and often a blackening of the tissue in the immediate region of the puncture.

Approximately 7 days following the deposition of the egg it hatches. The larva, or maggot, (Fig. 5) burrows into the flesh of the apple, consuming portions of it in the process. The burrowing of the larva is readily recognized when apples are cut open. The brown streaks or spots usually observed (Fig. 6) result from a breakdown of the apple tissue caused by the excrement of the maggot and a bacterium always associated with it. In certain sweet, early-maturing apple varieties infested with a number of maggots, the tissue breakdown may be quite severe (Fig. 5).

Larval development is completed in 3 to 4 weeks at which time the infested apple usually drops prematurely from the tree. The fully grown larva then leaves the apple and burrows into the soil ½ to 1 inch deep. Once in the soil, the outer skin of the larva hardens to form a puparium. The change to the pupal stage then occurs inside the puparium. The pupal stage is resistant to harsh environmental conditions, and it is only in this stage that the apple maggot survives the winter. Most of the pupa will transform to the adult fly the following spring and emerge, but a small percentage remain as a pupa for 2 winters before emerging.

Control Tactics

Potentially, there are three tactics which could be employed to control or regulate apple maggot populations at desired levels. They are natural control, sanitation, and chemical control.

Fig. 2. Apple maggot pupal stage.

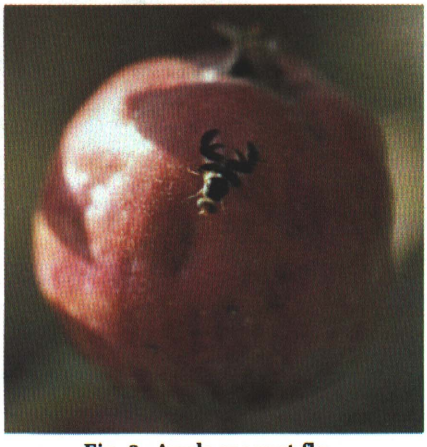

Fig. 3. Apple maggot fly.

Natural Control—Damage inflicted on some agricultural commodities by insect pests has, in a few cases, been essentially eliminated through the effects of natural enemies in reducing the pest species involved to very low levels. In other cases, natural enemies in conjunction with insecticides have been used in integrated control programs to reduce damage. It is known that all life stages of the apple maggot are subject to attack from one natural enemy (predator, parasite, or pathogen) or another. However, none of these are capable of reducing apple maggot populations to levels low enough to preclude the use of other control measures. Even in abandoned orchards where natural enemies are most prevalent, the apple maggot damages a high percentage of the fruit. For this reason, natural enemies are not considered an important tactic for controlling the apple maggot.

Sanitation—In almost all cases, mature maggot larvae leave the apple to burrow into the soil only after the apple has dropped to the ground. For this reason, it is important to pick up and destroy all apples which fall from the tree during the year. If this is done on a regular basis, the maggot larvae are prevented from entering the soil and thus from contributing to your problems next season. If you have any soft, early-maturing apple varieties,

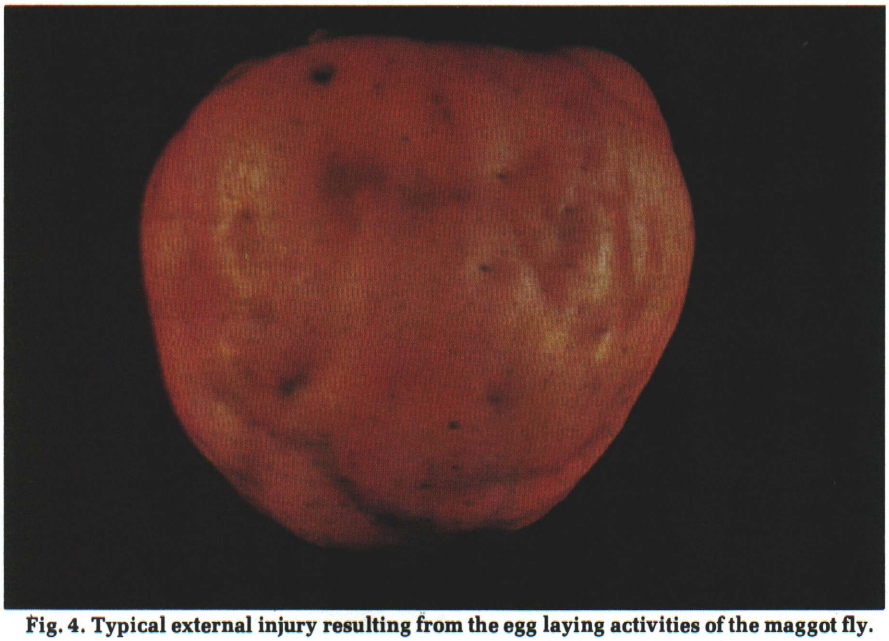

Fig. 4. Typical external injury resulting from the egg laying activities of the maggot fly.

Fig. 5. Apple maggot larva and an example of severe internal breakdown of an apple.

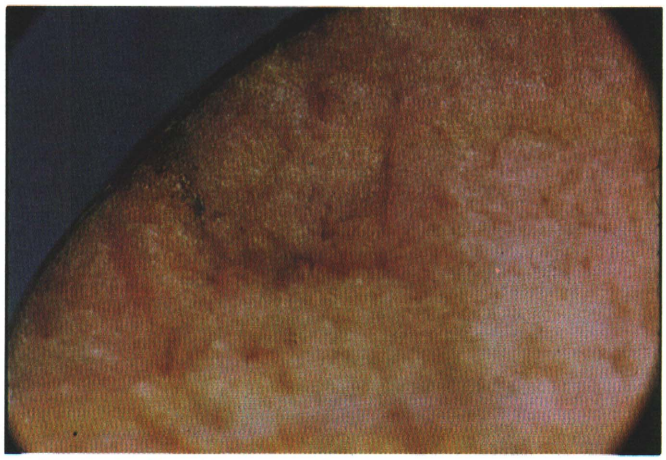

Fig. 6. Apple cross-section showing an egg puncture and brown trails from larval tunneling.

pick up the fruit twice a week. Fruit from harder, later-maturing varieties can be picked up once a week.

Benefits derived from sanitation practices may not be immediately evident. The small percentage of pupae which pass through two winters before emerging leave a residual population that will affect fruit the following season. The effort expended in good sanitation procedures can also be frustrating if sources of infestation, abandoned apple orchards or backyard trees, close to your trees go untreated. The apple maggot fly has the ability to cover a radius of one-quarter mile in search of food. If you reside where there are numerous backyard apple trees, a cooperative neighborhood control program of sanitation and chemical control would be a practical method of efficiently reducing apple maggot problems. Despite residual maggot populations or neighboring sources of infestation, the rewards derived from simple sanitation efforts will over time reduce the apple maggot pressure on your fruit.

Chemical Control—The attractiveness of chemical control lies in its ease and in immediate results. It is important to remember, however, that chemicals (insecticides) are effective only if properly timed to coincide with the presence of the pest and properly applied to the tree. The apple maggot fly begins emerging in early summer. The date of first fly emergence varies between geographical location as shown by the map in Fig. 7. This map was developed from historical data on earliest fly emergences observed in the fruit growing areas of the western part of the state. These dates can be used as estimates of first fly emergence in other areas of the state.

Another source of the first fly emergence date, providing you reside in the fruit-growing areas of the state, would be your county extension service office.

Probably the best way to detect the emergence of the first fly would be to develop your own biological

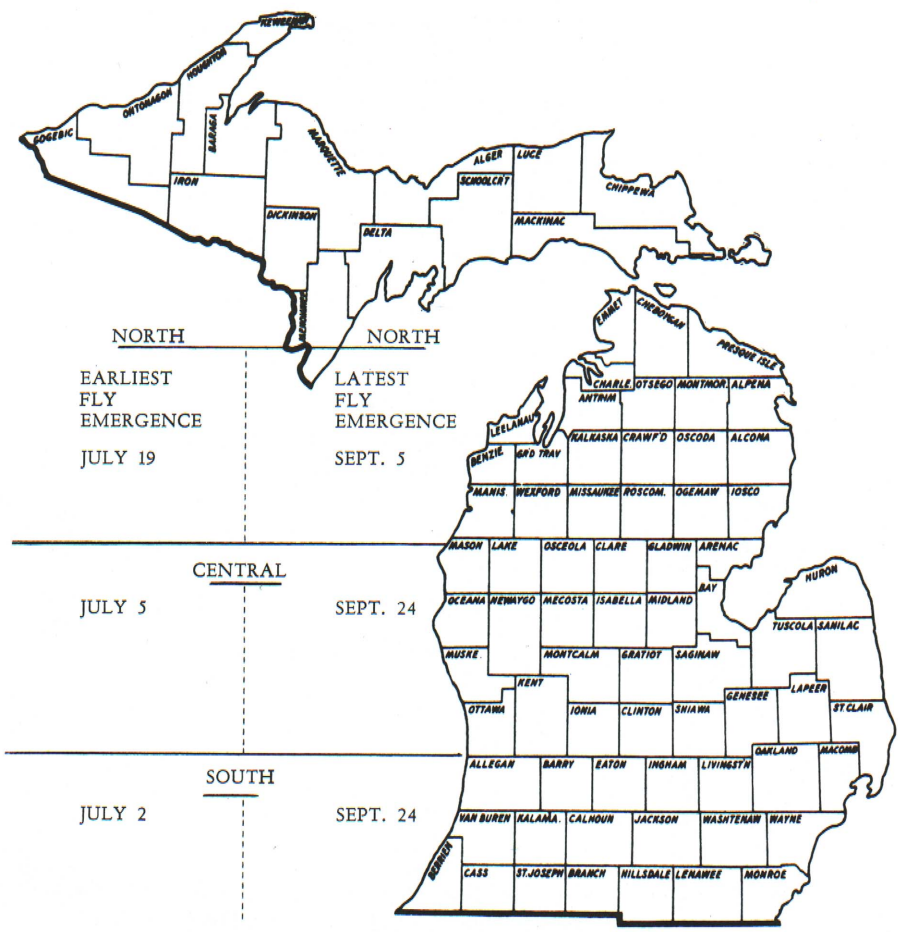

Fig. 7. Earliest and latest appearance of apple maggot flies in different geographical locations in Michigan.

monitoring system. The basis of a monitoring system lies in a trap designed to attract and catch apple maggot flies after they emerge from the soil. Two trap designs will be described here. The first is constructed of a red wooden ball about 3 inches in diameter, hung from a branch of the apple tree and coated with a sticky material, *Bird Tanglefood*. The attractiveness of this trap to the apple maggot fly is based on its color and shape. The other trap is constructed of a flat board (1'x1') painted canary yellow and covered with *Bird Tanglefoot*. In addition, a small vial filled with ammonium hydroxide (household cleaning ammonia) and equipped with a wick is hung at the bottom of the trap (see Fig. 8). The attractiveness of this trap is based on its color and the odor of the evaporating ammonia.

Both traps should be hung from an interior limb of the apple tree. Regardless of which trap you choose in your monitoring program, hang it by late June and check it daily for the presence of apple maggot flies. The flies can be readily recognized by the distinct banding pattern of the wings (Fig. 1). By using one of these monitoring traps you should be able to catch some of the first apple maggot flies which emerge.

Knowledge of first fly emergence is the key to initiating an effective chemical control program. Make the first insecticide application 7 days after the first fly is caught in one of the monitoring traps, or 7 days following emergence dates given by the map in Fig. 7. Following the first emergence of the apple maggot, flies continue to emerge throughout the growing season. Fruit must be protected throughout this period, resulting in the need for additional sprays every 10-14 days following the first application. The last spray application is dependent on how close to harvest a spray can legally be applied (see spray schedule chart).

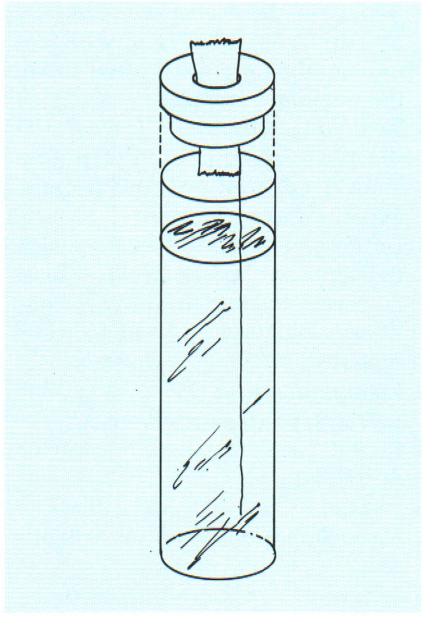

Fig. 8. Example of an ammonium hydroxide dispenser used in apple maggot monitoring traps.

Suggested Chemicals

Diazinon—This organophosphate insecticide is effective in controlling the apple maggot, codling moth, aphids, scale and the red-banded leafroller. It is moderately toxic to humans. It has an effective residual activity for 11-14 days against susceptible insect pests and is available at most garden centers. Diazinon is formulated as 50% wettable powder for use on apples.

Carbaryl (Sevin)—This carbamate insecticide is effective in controlling apple maggot, codling moth, and the red-banded leafroller. It is of low relative toxicity to humans. It has an effective residual activity of 10-14 days against susceptible pests and is easily obtained from most garden centers. Sevin is quite toxic to certain predator mite species and may lead to a problem with phytophagus mites. It is also hazardous to bees, so avoid spraying around flowering shrubs or other plants bees frequently visit. **CAUTION:** Sevin is recognized as a fruit-thinning agent, and use should be avoided until at least 30 days after full bloom. Sevin is formulated as a 50% wettable powder for use on apples.

What is a wettable powder? It is a dry powder which contains a mixture of the insecticide, a wetting agent and an inert compound called a carrier. Wettable powder formulations may contain from 15 to 80 percent of active ingredients, meaning the actual insecticides. These powders are formulated to enable a mixing of the active ingredients with water to form suspensions.

Apple Maggot Spray Schedule

Insecticide	*Formulation*	*Rate/gal.*	*Interval between last application and harvest*
Diazinon**	50% W.P.*	1 tablespoon	14 days
Carbaryl (Sevin)	50% W.P.*	2 tablespoons	1 day

**W.P.–wettable powder.*

***Also available in a liquid formulation–if used read and follow label instructions precisely.*

NOTE: Initiate spraying 7 days following the detection of first fly emergence and apply subsequent sprays at 10-14 day intervals until fly activity ceases in mid-September.

Spray Equipment

The thorough coverage of the apple tree is as essential as correct chemicals and proper timing of spray applications. Therefore, it is important to use a sprayer that is powerful enough to reach all parts of the tree. A set of measuring spoons is an important accessory tool to insure the preparation of accurate spray mixtures. For mature standard trees, a trombone or slide sprayer or a wheelbarrow sprayer will do an adequate job. If you have a number of trees (10 or more) a small power sprayer may prove to be a worthwhile investment. For young trees or trees on dwarfing rootstocks, compressed air or knapsack sprayers are suggested. Garden hose sprayers are not suggested for fruit-tree spraying of wettable powder insecticides because the nozzles plug and pesticides don't mix thoroughly with water due to insufficient pressure.

Mature standard trees should receive 5-7 gallons of spray each, young

or dwarf trees 3-5 gallons each. Apply sprays so that *all* of the foliage and fruit is well wetted but avoid excess spraying to the point which much of the spray material runs off onto the ground. If the maggot is a severe problem, spray the foliage of bushes or shrubs in close proximity of the apple trees.

Pesticide Safety

The insecticides suggested for use against the apple maggot were chosen because of their efficacy in controlling this pest and for their relative safety for use around the home. Remember that while these insecticides are safe relative to many other insecticides, they are still toxic nerve poisons and should be treated with respect and caution. The following are some pesticide safety reminders which you should be aware of before starting to use any pesticide.

- Always read the label before buying or using pesticides. Use pesticides only for the purpose(s) listed and in the manner directed.
- Pesticides that require special protective clothing or equipment should be used only by trained, experienced applicators.
- Do not apply more than the specified amount of pesticide. Overdoses can harm you and the environment.
- Keep pesticides away from food and dishes.
- Keep children and pets away from pesticides and sprayed areas.
- Do not smoke or eat while applying pesticides.
- Avoid inhalation of pesticides.
- Never spray outdoors on a windy day.
- When you mix pesticides, do it carefully to avoid splashing.
- Avoid breaks or spills of pesticide containers.
- If you spill a pesticide on your skin or on your clothing, wash with soap and water and change your clothing immediately.
- Store pesticides under lock in the original containers with proper labels. Never transfer a pesticide to a container that would attract children, such as a soft drink bottle.
- Dispose of empty containers safely. Wrap single containers of home use products in several layers of newspaper, tie securely and place in a covered trash can. Never burn boxes or sacks. In the case of farm or ranch use, single containers may be buried where water supplies will not be contaminated. Dispose of large quantities in special incinerators or special landfills.
- Wash with soap and water after using pesticides, and launder clothes before wearing again.
- If someone swallows a pesticide, check the label for first-aid treatment. Call or go to the doctor or the hospital immediately and keep the pesticide label with you.