

CODLING MOTH

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The codling moth larva is one of the very destructive pests introduced from Europe by settlers. Female moths lay the scale-like eggs singly on developing fruit or adjacent leaves or stems just after sundown each night. Upon hatching the larva enters into the calyx end or side of the fruit then tunnel to the center where they feed and develop. Brown frass is often noticed near the calyx end of the developing fruit. The larva is pinkish to white in color with a brown head and can reach 3/4 inch. Larval development is completed in 3 to 5 weeks. Larvae exit the fruit to pupate in a thick silken cocoon on the bark or other protected areas. The fully developed larva is the overwintering stage. Pupation occurs in spring beginning about the same time as bloom with adults first active in late April or early May. In Kentucky, there are three generations each year. The adult is about 3/8 inch, gray, with distinctive bronze areas on the bottom 1/3 of the wing.



Control of codling moth in commercial orchards relies on three tools: regular examination of the trees and fruit (termed scouting), pheromone trapping, and the use of weather monitoring and degree day models. Orchards should be scouted twice a week early in the season and on a weekly basis for insects and mites during mid-season. Closer to harvest every other scouting trip may be omitted such that visits are no more than two weeks apart.

Pheromone Trapping

Pheromone trapping uses chemical lures to attract male moths. These chemical lures are synthetic copies of the chemicals female moths use to attract males for mating. A trap consists of plastic top and bottom held together

by a wire hanger with the lure placed inside. The inner surface of the bottom is coated with a sticky material to hold the insects once they land in the trap. Traps are hung in the southeast quadrant of the tree at eye level, usually one for each ten acres of trees (minimum of two



traps per orchard) in commercial orchards.

Home owners have a few different options for controlling codling moths. Home owners can use pheromone traps to time insecticide sprays, or to "trap out" all the male moths. This involves using enough pheromone traps such that all of the male moths are captured before the female moths mate. Female moths are then able to lay only unfertilized eggs that will not develop. Typically, 2 to 4 traps per tree are required for this to be successful. This is less effective if there are additional sources of mated females, such as other trees in the neighborhood or wild hosts.

Traps should be put out at the pink stage of bud development. Every month, pheromone lures need to be replaced. Codling moths can be distinguished from other insects in the traps by their bronze wing tips. For a list of the sources of various type of pheromone traps, see *ENT- 54, Vendors of Microbial and Botanical Insecticides and Insect Monitoring Devices*.

Degree Day Accumulation

Initial trap catches in the early spring are termed biofixes. This information will be used to predict when egg hatch will occur and synchronize insecticide sprays. In commercial IPM orchards, inclusion of an insecticide

in the cover sprays is recommended as long as pheromone trap catches exceed an average of five moths per trap per week.

The biofix for the codling moth is the starting date of the first sustained flight of male moths captured in pheromone traps. Generally, this is when the fifth moth has been captured in the trap. A few moths often emerge very early in the spring ahead of the rest. Using the fifth moth as the biofix better represents when the majority of the codling moths begin to emerge. This usually occurs just after petal fall. Codling moth traps need to be examined daily in order to know exactly when the biofix occurs. After the biofix has occurred, degree days are calculated on a daily basis and a running total is kept (see "Predicting Insect Development Using Degree Days" in ENTFACT-201). The codling moth has a 50°F threshold temperature. These degree day accumulations are compared with the target values in the following table.

DD	Target Action taken when target reached
250	Egg hatch begins. An insecticide spray is recommended*. If codling moth are abundant (more than 10 per trap per week), a second spray may be necessary 7 to 10 days later.
1000	When 1st generation moth begin to fly. Use their emergence as the next biofix.
1300	About when 2nd generation egg hatch begins. An insecticide spray is recommended. If codling moth are abundant, a second spray may be necessary 7 to 10 days later.

* Some of the newer codling moth insecticides, such as Assail, Esteem, Intrepid, and Confirm, require earlier applications between 100 and 200DD after biofix. Check the label.

Codling moth trap catch records need to be maintained throughout the summer to monitor additional generations. However, after the initial biofix it is only necessary to examine the traps twice a week. A threshold of five moths per trap per week is used to determine if there are sufficient levels of moths to warrant an insecticide application.

Trunk Banding

Another tactic that can be used by home owners is the use of cardboard bands placed around the trunk of the trees to serve as pupation sites for the wandering larvae. A four to six inch band encircling the trunk or scaffold limbs will attract the larvae. Bands should be in place before larvae begin to leave the apples in search of pupation sites and removed and destroyed before moth emergence begins. Bands should be placed on trees in

August to capture overwintering pupae and removed and destroyed in December. Bands can also be used in the summer to capture pupae from the summer generations, but timing is more difficult.

Sanitation

Home owners should also pick up and destroy fallen fruit. Often fruit that drop prematurely are infested with either codling moth or plum curculio larvae. For more information on reduced insecticide apple management, see *ENTFACT-201, Apple Insect Control with Reduced Insecticide Usage*.

Pesticide Resistance

Codling moth resistance to traditional organophosphate insecticides such as Imidan and Guthion is becoming more common on the east and west coasts, as well as in the Midwest. Fortunately, there are new labeled insecticide alternatives for codling moth control on apples with different modes of action.

Mating Disruption

Mating disruption relies on confusion to prevent codling moths from mating. Male codling moths locate female moths at night by following the sex attractant released into the air by the females. Mating disruption uses commercial dispensers of synthetic sex attractant to prevent male moths from locating females. Unfertilized moths are not able to lay viable eggs. Unlike other methods, codling moths are not killed with this technique. This technique is most successful in blocks of at least 5 acres and where initial populations of codling moth are low. Keep in mind that mating disruption for codling moth will not control other insects that are normally controlled with cover sprays (plum curculio for example).

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