

CODLING MOTH

Ric Bessin, Extension Entomologist

The codling moth larva is one of the very destructive pests introduced from Europe by settlers. This is the 'worm in the apple.' While it can attack various fruits, it primarily damages apples. This is a key pest of apples that requires management in every orchard in Kentucky.

Identification and Biology

Female moths lay individual scale-like eggs on developing fruit or adjacent leaves or stems at 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 emerging 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.



Figure 1. Adult codling moth showing coloration at tip of wings

Control of codling moth in commercial orchards relies on three tools: regular scouting of the trees and fruit, 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 scouting visits may be stretched to 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.



Figure 2. Codling moth larva feeding in the apple core

Homeowners can use pheromone traps to time insecticide sprays by identifying when peak flight periods are occurring. See the section on degree days to time applications following peak flights.

Some homeowners have attempted 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.

Pheromone 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. Pheromone trap suppliers can be found by searching the internet.

Degree Day Accumulation

Initial trap catches for adult moth in the early spring are termed biofixes. This information will be used to predict when egg hatch will occur and synchronize insecticide sprays. 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.

Throughout the growing season in commercial IPM orchards, pheromone trap catches that exceed an average of five moths per trap per week can trigger an insecticide application. Growers need to estimate the residual activity of previous insecticide sprays (generally 10 to 14 days of activity after each application) relative to the anticipated egg hatch predicted by the degree day accumulation to determine the need for additional sprays.

DD Target Action taken when target reached	
50 to 150	Appropriate time to apply <i>Rimon</i> TM (an insect growth regulator) against codling moth.
100 to 200	Appropriate time to apply <i>Assail</i> TM , <i>Esteem</i> TM , <i>Calypto</i> TM , <i>Intrepid</i> TM , or <i>Clutch</i> TM against codling moth.
250	Egg hatch begins. Appropriate time to apply <i>Imidan</i> TM , <i>Altacor</i> TM , <i>Belt</i> TM , <i>Danitol</i> TM , <i>Delegate</i> TM , or a pyrethroid against codling moth. If codling moth are abundant (more than 10 per trap per week), a second spray may be necessary.
1000	When 1st generation moth begin to fly. Use their emergence as the next biofix.
1300	Approximately when the next generation egg hatch begins.

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 is becoming more common on the east and west coasts, as well as in parts of Kentucky. Fortunately, there are new labeled insecticide alternatives for codling moth control on apples with different modes of action. Growers should not rely on a single insecticide mode of action throughout the year to control codling moth.

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 or Oriental fruit moth for example).

Revised: 2/10