Codling Moth
(Cydia pomonella)

Codling moth (CM) is a non-native fruit tree pest that was introduced from Eurasia in the early 1700s and is well established across the United States. CM lays its eggs on apple, pear, walnut, crabapple, quince, and hawthorn. Once hatched, the larvae burrow into fruits, making them unsellable. If not controlled, CM can infest 20% to 90% of fruits, making it one of the most important pests of apples globally.

Identification

Fig. 1. Adult codling moth. Photo by Mark Dreiling, Bugwood.org, 5460331

Fig. 2. Adult coding moth in a tree. Photo by Csaba Szaboky, Bugwood.org, 5429089

Fig. 3. Adult grayish-brown codling moth sitting on a leaf. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org, UGA5302063

Adults are about 1/2 inch long, hold their wings tent-like above their bodies, and have long, thread-like antennae. Their wings have distinct gray-brown markings with light and dark striping. On the end of their wings is a shiny, copper-colored band of scales.

Fig. 4. Codling moth larva. Photo by Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org, 5429090

Larvae are 1/2 to 3/4 inch long, white to pink in color, and have a dark head. CM looks like a couple of other larvae we consider worms in the fruit, including the oriental fruit moth, apple maggot, and plum curculio, as shown in Table 2.

Eggs are 1/12 inch and oval-shaped. When first laid, eggs are translucent but develop a red embryonic ring later in development.

Life Cycle

The first yearly generation of CM overwinter as larvae in cocoons and pupate in spring. Cocoons can be found under tree bark, in leaf litter, and near protected areas where infested fruit was present. Adults begin emerging in late April to early May, while apple trees are in bloom. Adults are active around dusk when it is at least 60 to 65 degrees. Females lay up to 100 eggs on leaves, branches, nuts, and fruits. Depending on the temperature, eggs take five to 20 days to hatch. Once hatched, larvae burrow into the fruit via the calyx or side and feed as shown in Figures 5 and 6.

Fig. 5. Frass-filled entrance and exit holes from a codling moth on an apple. Photo by Eugene E. Nelson- Bugwood.org, 5360745

Fig. 6. Codling moth entrance and exit holes on an apple. Photo by Ward Upham, Kansas State University, Bugwood.org

They begin by feeding on the outer flesh and burrow into the core, where they feed on the seeds, as shown in Figures 7 and 8. After three to four weeks, larvae exit the fruit to find a protected place to make a cocoon and pupate in Figure 9. Pupation takes one to three weeks, after which the second generation of CM emerges as adults. In Illinois, CM has two generations per year.

Damage

CM damage can be assessed by looking at the outside of fruits for stings and deep holes, as shown in Figures 5 and 6. Stings occur when a larva takes a few bites of an apple but does not fully burrow into it, leaving the flesh intact and only a small blemish on the surface. When larvae burrow into the fruit, they typically make separate entrance and exit holes.

Fig. 7. Codling moth larva in a halved apple. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org, UGA5303061

Fig. 8. Frass-filled codling moth damage through tunnels in an apple. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org, 5443216

Fig. 9. Codling moth pupa stage. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org UGA1243017

Holes can appear to be plugged with brown excrement from the larvae called frass. Holes can sometimes be difficult to see if the larva entered or exited near the calyx or stem. Inside the fruit, infestation can be determined through the presence of tunneling into the center of the fruit, with those tunnels commonly being filled with frass, as shown in Figures 7 and 8. Burrowing damage causes fruit to drop. Damage is more likely to occur in late-maturing than early-maturing varieties.

Monitoring

Monitoring helps estimate pest pressure, insect development, and insecticide timing. The population of CM can be monitored with delta traps and a pheromone lure hung in orchards, like those shown in Figures 10 and 11. Traps should be deployed at bloom in the top third of the canopy, starting at the orchard edge, and 160 feet apart in the orchard. Traps should be checked often when first deployed and weekly after the first trap catch. The date of the first significant CM flight can be used to help determine when to use controls. This is usually when five male moths have been captured. These dates can be input into either of the following tools: Illinois Climate Network: Daily Pest Degree Day Calculator or NEWA: Network for Environment and Weather Application. Find full links to these tools and more in the resources section of this fact sheet.

To check for fruit damage, growers should inspect fruits for holes and stings. Fruits in the top third of the canopy should be inspected, as those are the most likely to become infested. Per 10 acres, 30 to 40 fruits from 40 trees should be inspected for damage.

Fig. 10. A delta trap for codling moth monitoring. Photo by Eugene E. Nelson, Bugwood.org, 5360743

Fig. 11. Sticky trap and pheromone lure in a delta trap. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org

Management

Non-chemical control

Mating disruption

Pheromone mating disruption is the practice of putting species-specific sex pheromones into the environment to disrupt mating. When the air is filled with sex pheromones, males are unable to find and mate with females, reducing the number of eggs laid. This method is most effective in orchards of at least 5 acres and in those with low pest pressure. Mating disruption is part of the pest control toolbox for CM and can be combined with either conventional or organic insecticide sprays.

Sanitation

A helpful practice to reduce CM pest pressure is to remove fruit that is infested with CM. This prevents larvae from pupating, reducing CM mating potential. Growers should inspect, remove, and destroy infested fruit from trees and dropped fruit on the ground.

Bagging fruit

For small-scale and backyard growers, bagging fruit to prevent CM larvae access is very effective at reducing infestations and crop loss. Standard paper lunch bags should be put on apples when they are 1/2 to 1 inch in diameter. This practice is not effective on varieties with short stems or late-developing varieties, and prevents red apples from reaching full color.

Chemical control

Various insecticides are recommended for CM management, as shown in Table 1. The Midwest Fruit Pest Management Guide provides in-depth recommendations based on crop and phenology for using pesticides to control CM.

Table 1. Insecticides labeled and recommended for CM control. Documented chance of resistance is based on published literature with evidence of resistance in the active ingredient.

Conventional

Trade Name	Active Ingredient	Documented Chance of Resistance in the US	Type of Insecticide
Altacor eVo	chlorantraniliprole		diamide
Asana XL	esfenvalerate		pyrethroid
Assail 30SG	acetamiprid	yes	neonicotinoid
Baythroid XL	beta-cyfluthrin		pyrethroid
Belay (2.13SC)	Clothianidin		neonicotinoid
Danitol 2.4EC	fenpropathrin		pyrethroid
Delegate WG	spinetoram		spinosyn
Exirel (0.83SE)	cyantraniliprole		diamide
Imidan 70W	phosmet	yes	organophosphate
Lannate LV (2.4WSL)	methomyl		carbamate
Mustang Maxx (0.83EC)	zeta-cypermethrin		pyrethroid
Rimon 0.83EC	novaluron		benzoylureas
Sevin XLR Plus	carbaryl		carbamate
Verdepryn 100SL (0.83SL)	cyclaniliprole		diamide
Warrior II (2.08CS)	lambda-cyhalothrin	yes	pyrethroid

Organic

Trade Name	Active Ingredient	Documented Chance of Resistance in the US	Type of Insecticide
Azera 0.21EC	azadirachtin + pyrethrins		pyrethrin
Cyd-X HP	Cydia pomonella granulovirus	yes	unclassified
Dipel	B.t. kurstaki		Bacillus thuringiensis
Entrust SC (2SC)	spinosad		spinosyn
Madex HP	Cydia pomonella granulovirus		unclassified
Neemix 4.5	azadirachtin		unclassified

Note: The inclusion of an insecticide brand name does not imply endorsement; it is for educational reference only. **Always read insecticide labels before use.** All users are required by law to follow the label and use all insecticides with care.

Table 2. Important internal feeders of tree fruits. The damaging life stage (larva) of all four of the main internal fruit feeders looks alike.

Common Name	Codling Moth	Oriental Fruit Moth	Apple Maggot	Plum Curculio
Scientific Name	Cydia pomonella (L.)	Grapholita molesta (Busck)	Rhagoletis pomonella (Walsh)	Conotrachelus nenuphar (Herbst)
What is it?	Moth	Moth	Fly	Beetle/Weevil
Adult	1/2-inch-long mottled gray moth, wings with alternate gray and white bands, and a bronze-colored spot on the tip	Small 1/4-inch-long gray moth, and wings with a mottled appearance	Small 1/4-inch-long fly, clear wings with black bands, and an obvious white spot on the rear end of the thorax	Small 1/4-inch-long snout weevil, humped back, and brownish-black in appearance
Larvae	Pinkish white with a black head and 1/2 to 3/4 inch when fully grown	White with a black head, and 1/2 inch when fully grown	Typical maggot, cream color, legless, and no distinct head, 1/4 to 3/8 inch long	Whitish body, brown heads, no legs, and 3/8 inch when fully grown
Number of Generations	2 to 3	4 to 5	1	1 to 2
Signs of Damage	Stings and deep entries	Wilting and shoot flagging	Sunken and dark spots on the fruit skin	Crescent-shaped scar, small round holes on the fruit skin
Crop Damage	Apples, crabapple pears	Peach and other stone fruit	Apples and crab apple	Plum, peaches, apples, cherries, apricots, and blueberries
Monitoring	Pheromone trap and mating disruption	Pheromone trap and mating disruption	Yellow sticky trap and red sphere mimicking a ripe apple	Fruit volatile and aggregation pheromone

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Illinois Climate Network: Daily Pest Degree Day Calculator: https://warm.isws.illinois.edu/warm/warm_pdd/default.aspx

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