Using Degree-Day Models and Camera Traps to Manage Codling Moth in 2025

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The codling moth (*Cydia pomonella*) is a major pest affecting apples, pears, and other pome fruits. Native to Europe, it has become a global concern for fruit growers. The insect undergoes a complete life cycle (egg, larva, pupa, and adult) (Fig. 1) and can produce up to three generations per year, depending on climate. Damage is caused by larvae that tunnel into the fruit and feed on the seeds, often causing the fruit to drop prematurely.

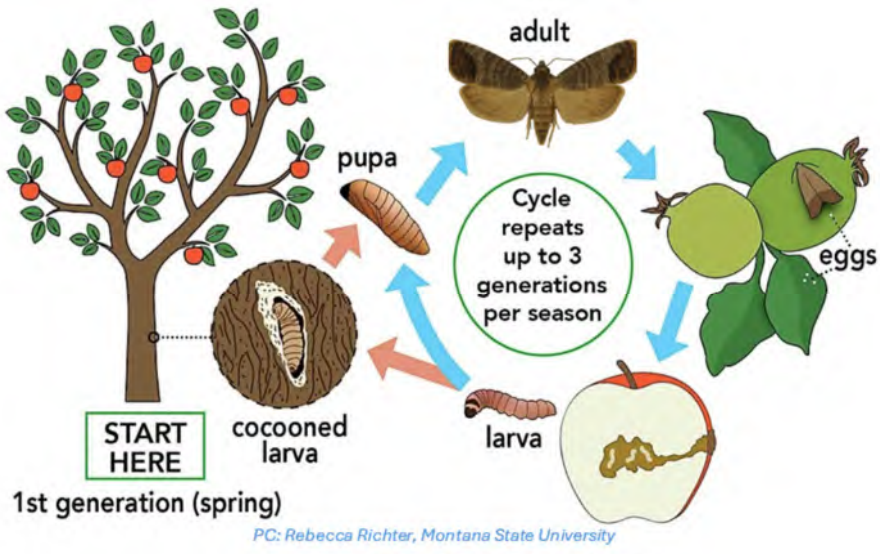

Figure 1. Codling moth life cycle. Eggs hatch into larvae that tunnel into fruit, then pupate under bark or debris before emerging as adults. Two to three generations occur each year.

Camera Trap Technology.

To improve monitoring, a specialized camera trap was developed by Barn Owl Technologies. This trap features a trapezoid-shaped design with a top-mounted camera, and a sticky liner and CM sex pheromone to attract and capture moths (Fig. 2A). It is powered by a rechargeable battery that lasts up to 12 weeks. The camera system uploads three high-definition images daily through an iOS mobile app called *FarmBugReport* (Fig. 2B). While identification of captured moths is currently done manually (Fig. 2C), automated identification using custom-designed image analysis tools is under development.

Advantages of Camera Trap Monitoring.

Using camera traps offers several practical benefits. It enables remote monitoring, reducing the need for frequent field visits. The system provides accurate, daily records of moth captures, giving insights into their temporal activity. This helps growers determine biofix (the date of the first consistent moth capture) which is crucial for synchronizing pest management activities with the biological development of the CM. Currently, camera traps are deployed at 15 locations across three New England states (Fig. 2D).

Biofix and Degree Days (DD).

Establishing a biofix helps predict critical stages in the CM's development, such as egg-laying and larval emergence. This can be further refined by tracking degree day (DD) accumulation, a measure of heat units above a base temperature (50°F base for CM) required for insect development. DD can be calcu-

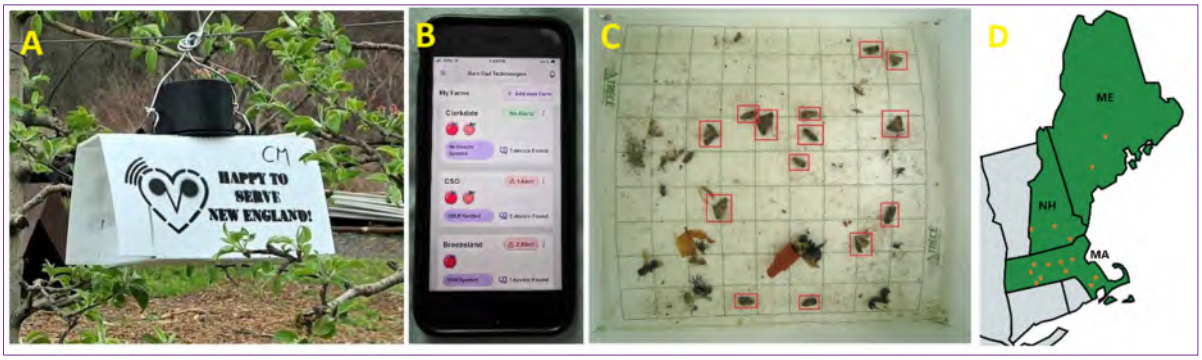

Figure 2. Camera trap (A), mobile app interface (B), and an uploaded image from the camera trap (C). In 2025, camera traps were deployed across three New England states (D).

lated using the formula: *(MaxTemp+MinTemp)/2 – 50°F*, or by using online tools such as the Network for Environment and Weather Applications (NEWA) website, which offers location-specific pest models.

Application in CM Management.

Tracking biofix and DD enables growers to forecast the optimal timing for pest monitoring and intervention. For instance, CM egg hatch typically begins around 100 DD after biofix. Larval activity peaks in between 220 to 250 DD. This window is often recommended for the first insecticide spray (Table 1), especially after petal fall. A second spray may be needed at 500 to 600 DD, if the CM pressure is high around the peak of the first generation's egg hatch. Later in the season, a third spray may be required when the second generation begins egg hatch at 1000 to 1260 DD, with a possible fourth spray during the 1320 to 1720 DD range if pest pressure remains high.

Case study: CM monitoring and management decisions - 2025 season.

During the 2025 season, CM activity was tracked in orchards across Massachusetts (Easthampton, Warren, Phillipston, Leominster, and Stow) and New Hampshire (Hollis). The first sustained moth captures, or biofix, occurred between May 13 and May 16. Shortly afterward, a cold spell from May 18 to May 25 brought temperatures below the developmental threshold of 50°F, temporarily slowing moth development (Fig. 3). Once conditions warmed, trap counts rose sharply, signaling a second wave of adult activity. By early June, degree-day accumulation reached the critical 220–250 DD window (June 6–8), when the first insecticide spray was recommended to target newly hatching larvae. A follow-up spray was advised at 500–600 DD to protect against larvae from the later wave of moths. While the first generation typically ends around 700–800 DD, consistent trap captures throughout June indicated a prolonged flight this year due to the cold spell and naturally staggered emergence.

The second-generation flight began in mid-July, though timing varied by location. For example, cooler conditions in Phillipston delayed development by

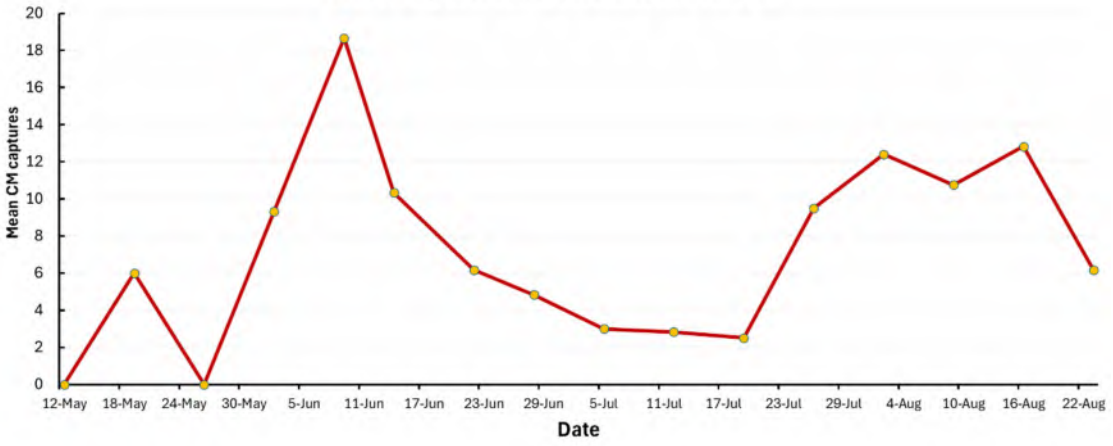

Figure 3. Mean codling moth (CM) captures across six orchards in Massachusetts and New Hampshire in 2025.

roughly 150 DD compared to other orchards. To manage this generation, sprays were recommended between 1000 and 1260 DD, with an additional application in the 1320–1720 DD window if trap captures and fruit pressure remained high.

Looking ahead, although New England usually experiences two complete generations of codling moth, the warmer late summer in 2025 increases the likelihood of a partial third generation. Controlling these later larvae is especially important, since they are more likely to damage fruit close to harvest.

Acknowledgements

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