

# False Codling Moth

## What growers need to know about control

By Anna Mouton

False codling moth is — you guessed it — a moth and it belongs to the family Tortricidae. Its relatives include other important agricultural pests such as codling moth, Oriental fruit moth, and pear leafroller. False codling moth is indigenous to South Africa and is considered a phytosanitary pest by most of our major overseas markets.

**T**he phytosanitary status of false codling moth ups the ante for control. Detection of false codling moth damage in fruit destined for export will result in rejection of the entire consignment. Too many interceptions and the importing country may refuse South African fruit altogether — with serious cost implications for our industry.

False codling moth also leads to direct economic losses due to damage. Its larvae feed on a wide variety of crops, including some stone fruit, citrus, pomegranates, cotton, macadamia and pecan nuts, peppers, olives and maize. They have a wide host range and are found on wild hosts such as wild figs, wild olives, yellowwood, kei apple and red milkwood. False codling moth larvae do not attack apples.

Their indiscriminate feeding habits and year-round activity make false codling moths formidable adversaries. But happily for growers, they can be controlled — read on to learn how.

### MONITORING

“If you don’t monitor your moth populations, you’re not going to make an impression,” says Matthew Addison, programme manager for crop protection at

Hortgro Science. “You’ve got to monitor to apply the correct management.” Monitoring is also compulsory for growers wishing to export to specific markets.

Pheromone traps and damage assessments are the two methods for monitoring and growers should use both. “Pheromone-baited traps are fantastic,” affirms Addison, “but they’re indirect. Fruit damage assessments work a dream. It’s accurate and you cover a whole lot of other insects as well — and diseases for that matter.”

The key to successful monitoring is to start when the trees are in blossom and to continue after harvest. Traps should be checked weekly and scouting for damage done every two weeks. A preharvest damage assessment should be performed within ten days prior to harvest.

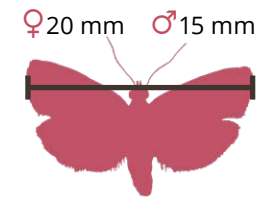
Larvae of false codling moth may be confused with those of other pests. Growers can make use of the insect identification service offered by Stellenbosch University to obtain an accurate diagnosis. [Click here](#) for more about this service.

### PESTICIDES

Monitoring will tell you how serious your problem is. What then? Pesticides might seem the obvious

All false codling moths have characteristic **black marks** — shaped almost like a question mark — on the outer edge of the top wing.

Males have a **scent organ** on the bottom wing for detecting pheromones. They can pick up the trail of a female when she is more than a kilometre away.



Female moths lay small groups of **eggs** on the surface of fruit. A female can produce more than 400 eggs during the warmer months.

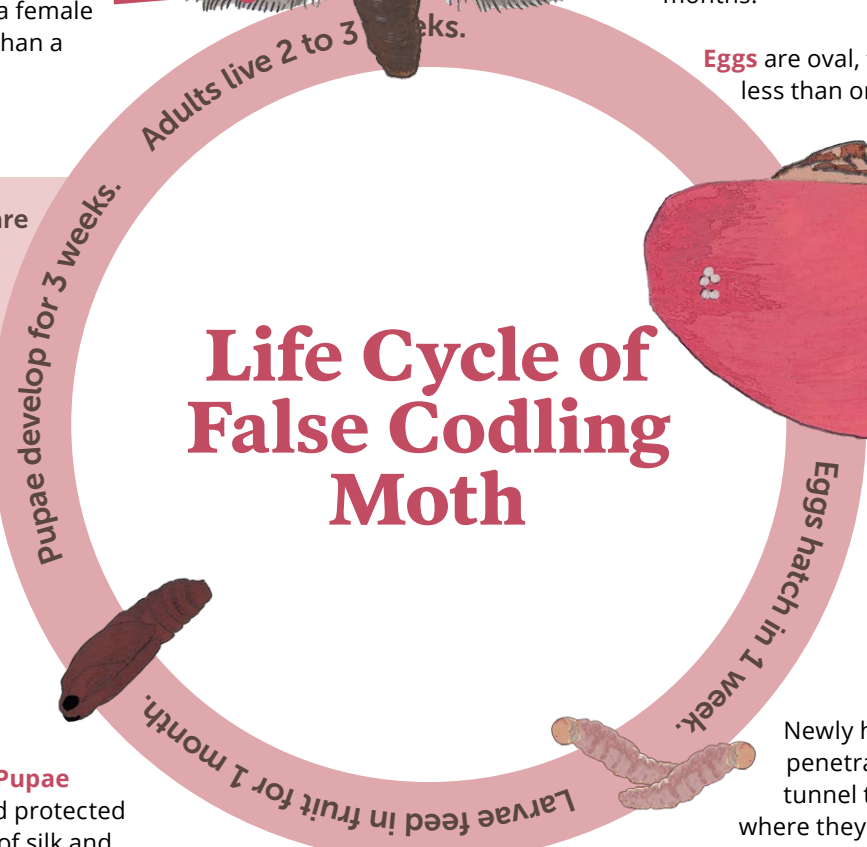
**Eggs** are oval, flattened, and less than one millimetre in diameter.

Durations given are for development at 25°C and are longer at lower temperatures.

Adult **moths** emerge from the pupae with the sole purpose of reproducing.

Fully grown larvae leave the fruit to pupate in the soil. **Pupae** are dark brown and protected by a cocoon made of silk and soil particles. They are about a centimetre long.

## Life Cycle of False Codling Moth



The **larvae** moult four times before reaching their final length of around fifteen millimetres. At this stage they are pink with a brown head.

Newly hatched **larvae** penetrate the fruit and tunnel to the centre where they feed around the stone. Their droppings are sometimes visible at the entrance to their tunnels.

False codling moths are **not dormant** in winter. They continue to reproduce throughout the year, but their life cycle takes longer to complete at lower temperatures.

Produces **6** generations per year.

Adult numbers peak **November** and again **January or February**.



**“DO YOUR MATING DISRUPTION PROPERLY AND THE PROBLEM GOES AWAY”**

solution and there are dozens of products registered for use against false codling moth in stone fruit in South Africa. These represent more than ten active ingredients and several different chemical groups. Most are inexpensive and should decimate false codling moth larvae. Sound too good to be true? It is.

Most chemical pesticides are only effective against the newly hatched larvae. False codling moth females lay their eggs on the surface of fruit and the larvae penetrate the fruit soon after hatching. Once inside they are protected from pesticides. The application window is therefore only a small part of the entire life cycle. There are no chemical pesticides registered for use against eggs or adult moths.

On top of this, there is the ever-present danger of resistance. “We need to promote non-chemical control, because a thing that’s polyphagous, like false codling moth, is many times more likely to develop insecticide resistance than something that only eats one fruit,” Addison says. Polyphagous creatures feed on a range of host plants — Addison calls false codling moth the ultimate polyphage.

Resistance reduces the number of chemical options available to growers. So do increasing demands for residue-free products. Addison explains that markets are changing and requirements are set to become more stringent.

A further problem with pesticide use is that it affects beneficial insects such as pollinators and

predators. Growers that make the transition from heavy spraying to a more integrated pest management system find that they have fewer secondary pests. “There are lots of track records that illustrate this,” Addison says. “A whole load of secondary pests like mealy bug and mites go away. Suddenly your fruit quality improves.”

Addison acknowledges that chemical pesticides will continue to be part of programmes for false codling moth control. “It’s getting that first generation. So spray — even if it’s four sprays — early.” He thinks that by implementing more holistic pest control, that could drop to two applications in the second year.

### **MATING DISRUPTION**

False codling moth females release substances known as pheromones to attract males. Male moths spend much of their short lives searching for and following pheromone trails. Mating disruption works by dispensing artificial pheromones in the orchard, confusing the males and preventing them from finding females.

Dr Vernon Steyn, researcher with pest management company Insect Science, examined the response of false codling moth to mating disruption as part of his doctoral research. He found that dispensers that release relatively low quantities of pheromones compete with females for the attention of males — so-called competitive mating disruption.

“The male will find a trail and follow it to the dispenser. He’ll see that it’s not a female and fly away again to look for another trail,” Steyn says. This means that you need a large number of dispensers to ensure that you lead males astray. “The dispenser is stronger than a female, so it needn’t be one to one, but you’ll want around one dispenser to five to ten females.”

Dispensers which release high concentrations of pheromones work a little differently. “The males follow the trail but the pheromone concentration is too strong for them. They become disorientated and stop searching. So you can use fewer dispensers,” Steyn explains. This is known as non-competitive mating disruption and is more effective for controlling large populations of moths.

Mating disruption is most successful when dispensers are hung out early in the season. There are several registered products and these have different lifespans — it may be necessary to repeat the application or supplement with spraying. Speak to your consultant and use trap catches to warn when mating disruption is wearing off.

Steyn determined that mating disruption can reduce the ability of false codling moths to find mates by 86% – 94%. “It seems expensive but it keeps the population small so that your other control measures just help to eliminate those last few moths.”

“I’m a believer,” Addison concurs. “Do your mating disruption properly and cover the whole farm — not

just this orchard and that orchard. The problem goes away. Not completely — you still have to manage it. But eventually you get to the point where you’ll be applying very few sprays and you will not have detectable damage.”

### **STERILE INSECT TECHNIQUE**

Sterile insect technique involves the release of — you probably guessed this one too — sterile insects. The sterile insects compete with fertile insects for mates. This reduces the overall number of successful matings and therefore the overall number of viable eggs laid by females. Sterile insect technique for false codling moth is available in South Africa through XSIT, an initiative of the citrus industry. [Click here](#) to visit the XSIT website.

Both male and female moths are released under sterile insect technique for false codling moth. The adult moths don’t cause any direct damage to the fruit and it’s therefore not necessary to exclude females. Releases must be done over large areas — all growers in a region have to buy in for the method to be effective.

Steyn believes that sterile insect technique should combine well with mating disruption. “Each one of those sterile females is her own pheromone dispenser. So it’s extra pheromone you’re adding to the system.”

Research has shown that sterile insect technique

## Get an augmentorium!

Orchard sanitation is key to controlling pests like false codling moths and fruit flies. But destroying damaged fruit can mean simultaneously destroying beneficial predators such as parasitic wasps. What to do? One solution that saves the good guys is to use an augmentorium.

An augmentorium is a tent-like structure for covering decaying fruit. The idea is to place damaged and fallen fruit under a mesh that prevents the escape of pests that may have developed in the fruit. At the same time, the mesh allows beneficial predators such as parasitic wasps free access.

It has been found to be very effective for fruit flies. Prof. Pia Addison of the Department of Conservation Ecology and Entomology at Stellenbosch University believes it should work equally well for false codling moth.

"The one we have is a tent," she explains, "but any structure or container covered in a mesh that retains the adult fruit flies and releases the parasitic wasps will work. An added benefit could be the production of compost from the rotting fruit."

A mesh size of 1.96 mm<sup>2</sup> will contain adult fruit flies and should work equally well for false codling moth.



LEFT Place discarded fruit in an augmentorium to outwit false codling moth and other pests.

PIA ADDISON | STELLENBOSCH UNIVERSITY

“YOUR BEST BET IS AN INTEGRATED PEST MANAGEMENT SYSTEM THAT INCLUDES MATING DISRUPTION”

in commercial citrus orchards reduced fruit infestation by 96% and export rejections by 89%. “Citrus sterile insect technique works,” Addison affirms. “They’ve gone from very high populations to very low populations.” He is confident that areas with concentrated stone fruit production could be reaping similar rewards.

### BIOLOGICAL CONTROL

Biological control relies on diseases and predators to exterminate pests. Growers can give nature a leg up by boosting populations of pathogens — organisms that cause disease — and predators through applying a range of commercially available products. These do not harm beneficial insects and have a zero-day withholding period.

Egg parasitoids are wasps that parasitise the eggs of other insects. *Trichogrammatoidea cryptophlebiae* is one such a wasp and can destroy the majority of false codling moth eggs by late summer. *Trichogrammatoidea* is sensitive to pesticides and tends to disappear when orchards are oversprayed. They can be purchased as pupae in sheets of parasitised eggs to be distributed as soon as false codling moths are detected.

*Cryptophlebia leucotreta* granulovirus kills the larvae of false codling moth and can be as effective as pesticides in reducing infestation. Growers can spray it in the same way as they would chemicals. Weekly applications are recommended. The formulation is sensitive to ultraviolet radiation and not suitable for certain areas during peak summer months.

*Beauveria bassiana* is a fungus that attacks not only false codling moth larvae but also other pests such as red spider mite. It too is available as a spray with similar characteristics to granulovirus sprays.

Steyn’s research uncovered other organisms that hold promise in the fight against false codling moth. He tested pathogenic nematodes against the soil stages and found that some nematodes kill 100% of false codling moth larvae within 48 hours. The nematodes penetrate the larvae and release bacteria that

liquify its organs. After consuming the resulting larval smoothie, the initial one or two nematodes will have multiplied to as many as 15 000, which re-enter the soil, ready to find their next victim.

“I found in field trials that the nematodes persist for as long as four weeks after application,” recalls Steyn. Work continues on finding ways to grow the millions of nematodes that would be required for widespread use — growers can expect to see new products in the near future.

### SANITATION

“Sanitation makes up a large part of false codling moth control,” says Steyn. “You remove everything that gets out of the fruit into the soil.” Results from citrus have shown that it’s possible to remove as many as three-quarters of the false codling moth larvae from an orchard by practicing good sanitation.

Addison stresses that false codling moth larvae will continue to develop in fallen fruit. “The fruit falls off and gets full of fungi and yeasts which convert it into to a really good food supply.” The same is true for fruit flies — the larvae readily mature in decayed fruit and then pupate in the soil.

Orchard sanitation consists of weekly removal of injured and fallen fruit during the season as well as removal of all fruit remaining after harvest. Fruit can be buried 30 centimetres below the surface or deeper, or alternatively it can be finely pulped. Augmentoria are another option for destroying larvae while simultaneously amplifying populations of parasitoids.

“The best strategy is to target every life stage so that you remove some individuals at every step. You want a small population — if you have a huge population, you can throw everything at it, but it’ll be hard to have an impact,” advises Steyn. “But if you went in with sanitation, mating disruption, implemented all of those things systematically, you won’t end up with that big population.”

Addison agrees. “Your best bet is an integrated pest management system that includes mating disruption. There are no silver bullets.” **FQ**