Department for Environment Food & Rural Affairs

Plant Pest Factsheet

False Codling Moth

Thaumatotibia leucotreta

Figure 1. Adult False codling moths are sexually dimorphic with the female (left) being larger than male (right). The male has a distinctive structure on the hind wing (see insert). Image © Todd Gilligan, CSU, Bugwood.org

Background

Thaumatotibia leucotreta (Meyrick), better known as the False Codling Moth (FCM), is a highly polyphagous and economically damaging tortricid pest of plants across its natural range in sub-Saharan Africa. It is not currently present in the UK or the rest of Europe, but it has been introduced to Israel. Live FCM caterpillars have been found within citrus fruit (mainly oranges) imported from South Africa for many years in the UK, as well as occasional findings on other hosts. From 2011, FCM caterpillars started to be detected in fresh chillies (*Capsicum frutescens*), a commodity that arrives in the UK in large quantities

each week from Africa. This, together with recent changes to the inspection regime targeting commodities such as chillies arriving as air-freight, has resulted in a dramatic increase in the number of interceptions of this pest, peaking in 2015 at 217. From 2007 to June 2017 almost all findings (some 93%) were associated with fresh African chillies.

There is, therefore, concern that this pest may be introduced and have an economic impact in the UK. It is thought that in northern Europe it is most likely to become a problem should it establish under protected cultivation, for example in *Capsicum* crops, whilst in southern Europe *Citrus* crops would be most at risk. Following Pest Risk Analyses in the UK and Europe, FCM is considered to pose a risk to parts of Europe, and, as a result, is expected to be listed in the EU Plant Health legislation in the Autumn of 2017.

Geographical Distribution

The natural geographical range of the FCM is Afro-tropical, and it is known to be present throughout sub-Saharan Africa, including some of the offshore islands.

Since 1984, FCM has been detected in Israel in association with commercial crops of macadamia nut (*Macadamia integrifolia*), castor bean (*Ricinus communis*) and cotton (*Gossypium* spp.). An incursion was also reported in the Netherlands in 2009 in a glasshouse growing *Capsicum chinense* (chillies) and *Rosa*, and again in 2013 in a glasshouse growing *C. annum* (pepper). The Netherlands declared the pest to be eradicated following surveys in 2014. While it is frequently intercepted in produce entering the UK and Europe, no breeding populations are currently known to be present in any part of the EU.

Host Plants

At the present time, FCM is the most frequently intercepted pest on fresh chilli peppers (*Capsicum frutescens*) arriving in the UK from Africa. However, the caterpillars of this species are very polyphagous and are known to feed on and damage more than 70 plant species, including crops of major economic importance such as aubergine (*Solanum melongena*), avocado (*Persea americana*), *Citrus* spp., cotton (*Gossypium* spp.), cacao (*Theobroma cacao*), coffee (*Coffea* spp.), guava (*Psidium guajava*), maize (*Zea mays*), mango (*Mangifera indica*) and peach (*Prunus persica*).

Biology

The lifecycle proceeds from egg, through 5 larval instars to the pupa and then adult without any diapause. This takes between 30 to 174 days to complete depending on temperature with 25°C being optimum. FCM has 2-5 generations annually in natural conditions and up to 10 generations in culture. The speed with which the lifecycle is completed and the number of generations produced is dependent upon environmental

factors such as temperature, humidity, food availability and quality and photoperiod. Under suitable conditions, the FCM is able to breed year round and can remain active all year.

Male FCM are attracted to the female via the pheromones she emits. Once mated, the female lays her eggs at irregular intervals throughout her life span (16-70 days). The eggs are laid singly on foliage or on developing fruits, with each female capable of producing up to 800. On hatching, the larvae burrow through the skin of the fruit and start to feed and develop on the flesh (and the seeds in the case of *Capsicum* spp.). The larva continues to feed and moult within the fruit before reaching maturity. The mature larva exits the fruit and descends to the ground on a silken thread to pupate in the soil, in crevices or within fruit debris. It then remains inactive for between 2-27 days in a pre-pupal state, before the pre-pupa moults into a pupa, forming a new cocoon. Adult moths emerge after 11-47 days, with males taking longer to emerge. Adults are nocturnal and spend the day hidden on shaded portions of the host. They are poor flyers and dispersal is usually limited to a maximum of several hundred meters from the original host plant.

Description

Eggs: Small, less than 1 mm in length and width, oval and flattened with an uneven surface. Pale yellow when first laid and become translucent prior to hatching.

Larva (caterpillar): 12-20 mm in length when fully mature. Head brown to black, but the body colour is variable with the early larval stages usually pale or translucent. As they grow larger they can remain pale, be suffused with pinkish tinges or occur in a range of shades from pink through to orange-red (Figure 2).

Adults: Small, 7-8 mm in body length with a 15-20 mm wingspan. These inconspicuous brown/black moths have some subtle wing patterning in the form of a complex of dark crescent marks in the apical region of the forewing, and each forewing also has a single spot of white scales. The hindwing is paler, and in the male is slightly reduced in size with a distinctive pale ‘key-hole’-shaped pocket on the hind margin (Figure 1).

Figure 2. False codling moth caterpillars showing variation in colour © Fera Science Ltd

Figure 3. FCM larval entrance hole in a *Citrus* fruit skin, which has caused a sunken brown spot © Fera Science Ltd

Figure 4. FCM larva hollowing out a *Citrus* fruit. (© Fera Science Ltd

Figure 5. Fungal infiltration following FCM damage on *Citrus* ©Fera Science Ltd

Figure 6. Internal feeding by FCM caterpillars in grape, with dead caterpillars and fungal infiltration (© Fera Science Ltd)

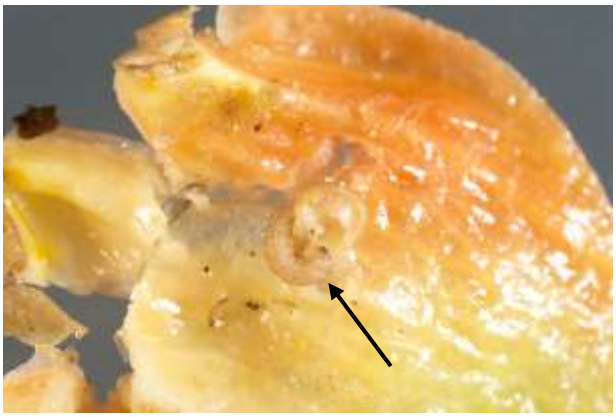

Figure 7. FCM caterpillar (arrowed) feeding on chilli seeds © Fera Science Ltd

Figure 8. FCM internal feeding damage in chilli fruit © Fera Science Ltd

Detection and damage

It is unlikely that the very small and inconspicuous eggs, the rather non-descript and equally inconspicuous adults, or the pupae of the FCM will be detected or recognised in the field. The caterpillar is the most frequently encountered life stage. Due to its habit of feeding internally on fruits FCM larvae are able to develop in hard green fruit before control measures can be started and as a result are frequently moved inside traded commodities and are regularly intercepted. Even so, the positive identification of FCM caterpillars in the field is not a practical proposition, as the biological structures that need to be examined to positively identify the FCM are microscopic and require access to suitable equipment and some technical knowledge. In addition, other moth species, including *Thaumatotibia haematoma* and *Etiella zincknella*, which are not considered threats to the UK have also been intercepted in the same commodities and these species are not easily differentiated from the FCM.

Although FCM caterpillars can cause significant internal damage to fruits, there is usually little or no evidence of infestation that can be seen from the outside. The only external evidence may be a small oxidised mark on the skin of the fruit where the first instar caterpillars originally penetrate, but this can be very difficult to detect. With time this can become a distinctive, but not always obvious, sunken brown spot on the skin (Figure 3).

In the UK, damage is most often observed to the internal structure of imported fruits. In citrus, the feeding activities of FCM caterpillars create cavities and produce copious quantities of fluffy-looking frass (Figure 4). Caterpillar damaged fruit often becomes colonised by moulds and bacteria that then further accelerate deterioration (Figures 5 & 6). In chillies, FCM caterpillars have been observed feeding preferentially on the seeds (Figure 7), presumably because the seeds are more nutritious, before moving into the flesh (Figure 8), but again copious quantities of frass are produced. Chillies damaged by the FCM often seem to be more readily colonised by bacteria that rapidly reduce the damaged fruit to a pungent slimy mess.

While many of the recorded impacts are on crops not commonly grown in the UK, up to 70% infestation has been reported in untreated plants in Senegal. IPM is widely implemented by UK growers and consequently chemical products are avoided unless compatible with biological control agents. There is a very low tolerance for cosmetic damage to *Capsicum*, and economic losses could be significant.

Control

When FCM is detected on *Capsicum* in the UK, statutory action is taken in order to reduce the risk to pepper production. Proposals are currently being developed in the EU to include this pest on the list of quarantine organisms. The list may introduce a requirement for EU member states to take action against the pest when found in consignments of *Citrus.*

Commercially available pheromone traps can be used to detect FCM and it would be advisable to use them on any sites packing potentially infested produce or plants originating in Africa or Israel, especially those sites which also grow host crops. The most important hosts to monitor at packing sites would be *Capsicum* sp. and *Citrus* sp., but there have also been finds on *Prunus* sp. fruit in the UK and *Rosa sp.* in the Netherlands. Pheromone traps would also be recommended for monitoring crops in the event of an outbreak.

FCM can be difficult to manage or eradicate with insecticides because the larvae spend most of their lives within the host which provides protection against non-systemic pesticides and also because they have been reported as developing resistance to a number of insecticides. Most published research on the control of FCM is for *Citrus* crops. However, the insecticides that have been used against *Tuta absoluta* in UK tomato crops could also be effective against FCM on peppers, these include indoxacarb (e.g. Steward) and spinosad (e.g. Conserve). Some biopesticides that could be used are *Beauveria bassiana* (e.g. Botanigard) and *Bacillus thuringiensis* (e.g. Dipel DF). Pesticide approvals are regularly changed and the current status should be checked before they are used. The conditions on pesticide product labels and EAMUs must be read and followed and their impact on any biological control agents should be considered. When an insecticide is used on a crop for the first time it is advisable to treat a limited number of plants initially to test for any phytotoxic effects. Some cultural control can also be achieved by the removal and destruction of any host material. Although insecticides and cultural methods would be expected to provide some control, they are unlikely to be able to eradicate an established outbreak in a glasshouse. Eradication campaigns in glasshouse situations are likely to involve the disinfection of the glasshouse and a crop break.

Advisory Information

Suspected outbreaks of *Thaumatotibia leucotreta* or any other non-native plant pest should be reported to the relevant local authority:

For **England and Wales**, contact your local **APHA Plant Health and Seeds Inspector** or the **PHSI Headquarters**, Sand Hutton, York. Tel: 01904 405138
Email: planthealth.info@apha.gsi.gov.uk

For **Scotland**, contact the **Scottish Government's Horticulture and Marketing Unit:**
Email: hort.marketing@gov.scot

For **Northern Ireland**, contact the **DAERA Plant Health Inspection Branch:**
Tel: 0300 200 7847 Email: planthealth@daera-ni.gov.uk

For additional information on UK Plant Health please see:
https://secure.fera.defra.gov.uk/phiw/riskRegister/
https://planthealthportal.defra.gov.uk/
https://www.gov.uk/plant-health-controls
http://www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases
https://www.daera-ni.gov.uk

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