	FACTSHEETS OF PESTS OF PHYTOSANITARY SIGNIFICANCE TO KENYA	**10**

Thaumatotibia leucotreta

Identity

Preferred Scientific Name: *Thaumatotibia leucotreta* Meyrick

Preferred Common Name: false codling moth

Other Scientific Names

- *Cryptophlebia leucotreta* Meyrick
- *Cryptophlebia roerigii* Zacher
- *Olethreutes leucotreta* Meyrick
- *Thaumatotibia roerigii* Zacher

Adult false codling moth

Hosts/species affected

It is a polyphagous pest which can feed on more than 70 host plants within 40 plant families. It can attack many cultivated and wild fruit species. Common hosts include: avocado (*Persea americana*), roses (*Rosa spp*), cacao (*Theobroma cacao*), carambola (*Averrhoa carambola*), citrus species, coffee (*Coffea* spp.), guava (*Psidium guajava*), litchi (*Litchi sinensis*), macadamia (*Macadamia ternifolia*), stone fruit *(Prunus* spp., *Prunus armeniaca, Prunus domestica,* and *Prunus persica),* pepper (*Capsicum* spp.), persimmon (*Diospyroskaki*), pomegranate (*Punica granatum*). It is also a pest of field crops such as: beans (*Phaseolus* spp.), cotton (*Gossypium hirsutum*), castor bean (*Ricinus communis*), and maize (*Zea mays*) (CABI, 2016).

Growth stages affected

The pest mainly attacks the fruiting stage (CABI, 2016)

Biology and Ecology

The life cycle has four stages comprising of egg, larva, pupa and adult. Development is completed between 30-174 days depending on climatic conditions. With uninterrupted food supply, FCM occurs throughout the year with upto ten generations per year.

Females lay up to 800 eggs during her life span. Eggs are laid during the night, singly or bunch on bolls or fruits on ridges or near the calyx of fruits or on foliage and debris. The eggs

are small in size (< 1mm), white to creamish in color when freshly laid, flat and oval. Eggs take 2-22 days to hatch depending on temperature.

There are five larval instars varying in size and color. Upon hatching, the neonate larva chews through the skin and feeds within the fruit where larval development takes place. Not more than three larvae are found in a fruit due to cannibalism. The first three instars are white to creamish in color while the fourth and fifth instar is bright red to pink. The head capsule is brownish black for the early instars tending to light maroon in fully grown larva.

Larval size ranges from 1 mm in first instar to 20 mm in 5th larval instar. Mature larvae exit the fruit and

drop on the ground on silken threads for pupation or in dropped fruits, crevices under the back or within galls. Larval period lasts 12- 67 days depending on temperature.

Figure 1: FCM pupae
Photo by J.H. Hofmeyr

Pupae are cream yellow to dark brown in color when mature. Females take shorter period to emerge 11-39 days while males take 13-47 days. The male pupa is small in size than female and has two knobs side by side in the center lacking in females. Both female and male pupae have serrated posterior ending.

Adults are active at night and spend days while resting in shaded portions of the host. They are poor flyers with limited dispersal and moth activity increases with the onset of host flowering thus larval presence is common in the late fruiting season. Males are attracted to females for mating by pheromones release by females after dark. Female moths are larger than males and their longevity is higher (16-70days) than males (14-57 days). Adults are affected by water and temperature (Couilloud, 1988, Williams, 1953 and Komai, 1999).

Figure 2: Adult FCM
Photo by; ARC • LNR

Symptoms

Eggs on fruits: Adult moths lay eggs on the host's fruit mainly near the calyx or in depressions of the fruit singly or in batches.

Entry holes: Shortly after hatching, the first larval instars chew through the skin creating a small entry hole which is difficult to detect, mainly near the calyx. A scar may be left at the point of entry when healing occurs. Feeding is restricted near the skin surface by the young larvae but once they mature, they move deeper into the fruit.
Frass (darkish in color) and damage is found inside the infested fruit.

Figure 3: Exit holes in capsicum

Larvae feed on the fresh and darkish granular excreta can be seen when the fruit is cut open. A mature larva exits the fruit by eating through the skin for pupation leaving an opening for. Secondary infestation by fungus and scavengers may occur further damaging the fruit.

Fruits infested by FCM may be discolored and drop prematurely. Fruit deformation is also likely to occur due to FCM infestation.

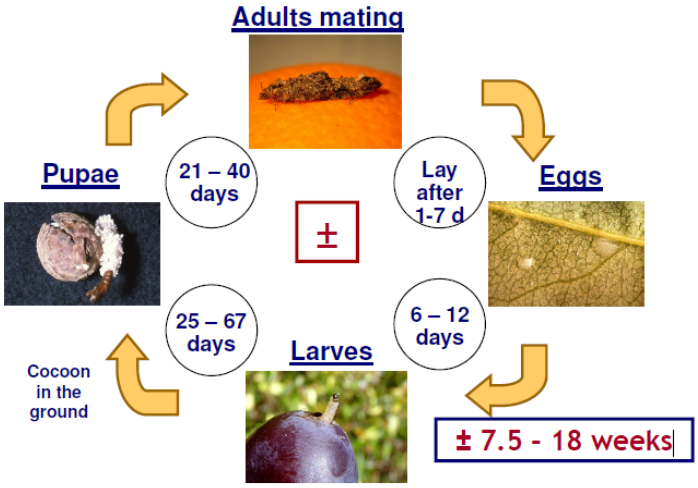

Figure 4: Lifecycle of FCM in citrus. Photo by: Tom Blomefield

Means of movement and dispersal

Detailed information about the potential for natural spread is lacking but adult moths of *T. leucotreta* are not considered to be strong flyers. It has been observed that populations in the field were generally highly localized. Over long distances, *T. leucotreta* is probably spread by trade through agricultural products.

Impact

Larval feeding and development can affect fruit development at any stage, causing premature ripening and fruit drop. Damage is caused by larva feeding on affected parts and upto 90% losses have been reported on some hosts. Feeding damage can also lead to the development of secondary infections by fungi or bacteria. Of the lepidopteran pests that damage avocado fruits, false codling moth is the most important (Erichsen & Schoeman 1992).

This moth is a serious pest of citrus in Southern Africa, of cotton in many parts of Africa and maize in West Africa. At least 10-20% losses in citrus have bene reported in South Africa (Glas, 1991) and 90% in late crops of cotton in Uganda (Reed, 1974).

Movement in trade

Over long distances, *T. leucotreta* is spread through trade of agricultural products.

Detection and inspection

Figure 5: FCM larvae within orange fruit
Photo by Sean Moore

These will vary according to the crop affected. Examine host fruits, nuts, berries, heads of grain, corn ears, and seed from the core and buffer areas. Look for plants showing signs of poor growth or rot; holes in fruit, nuts or bolls; adults hidden in foliage and crawling larvae.

Eggs are laid on the fruit or on foliage close to fruit. Larvae hatch and develop, and can enter through the skin. FCM larvae feed internally, so that on most hosts there are few external symptoms. Lesions develop into a raised crater on the fruit surface, with an inconspicuous hole in the center where the larva has entered. Granular excreta can also be seen. Pupae are found within the first few centimeters below the soil surface. For macadamia, larvae damage the nuts by feeding on the developing kernel after they pierce the husk and shell. On oranges, look for a brown patch on the skin, usually with evidence of a hole bored in the center, sometimes with a dark brown frass exuding from the hole

Figure 6: Damage caused by false codling moth on citrus.
Photo by: J.H. Hofmeyr

Phytosanitary significance

FCM has been regularly intercepted by several EPPO member countries and Europe in export consignments. The EPPO Panel on Phytosanitary Measures decided that this pest should be added to the EPPO Alert List thus categorized as an A2 pest thus qualifying for inclusion as a harmful organism. Of recent, consignments of Capsicums from and Kenya and other African countries are have been intercepted in Europe.

Management

Cultural control – Sanitation aims to destroy the pest to reduce the introduction and build-up of FCM over the season. If the life cycle can be broken by destroying fruits that are infested, particularly rejects or ones that have fallen to the ground, there will be fewer adults laying eggs and fewer larvae affecting the current crop and later crops. Exposing larvae to the air and sunlight will kill most, or allow them to be found and killed by predators. Infested fruits can be destroyed by putting them in plastic bags and exposing bags them to the sun, or by burning or burying them to a depth of 60 – 90 cm. Use of physical barrier e.g. growing crops

under green houses, reduced plant population and pruning to reduce hiding places, filed and exit inspections leading to certifications

Biological control – Although there are other living organisms that kill FCM, (e.g. the egg parasitoid *Trichogrammatoidea cryptophlebiae*) there are currently very limited options for utilizing them to control FCM.

Use of mating disruption by use of pheromone traps which attracts and kills the males as well as sterile insect techniques have been used to manage FCM.

Phytosanitary measures- Several measures such cold treatments (e.g. -0.5°C or below for 22 days) are approved to eliminate the pest from citrus fruits. Eggs have been reported to be killed by temperatures below 1°C, and the exposure to temperatures below 10°C reduces survival or development of several life stages. Restricted movement of capsicums from infested farms to un-infested places is also an effective phytosanitary measure.

Chemical control- Use of registered pest control products in Kenya for FCM management such as Collagen, cypermethrin, and Insect Growth Regulators (IGR), such as lufenuron which are is recommended. However, management using pesticides is usually difficult because of the overlapping generations and the fact those larvae live inside fruits shortly after hatching and the risk of resistance development.

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