

Fall armyworm

An identification guide in relation to other common caterpillars,
a South African perspective

Updated 25 June 2017
v. 1.3



Aim of presentation

Incorrect identification of the fall armyworm (*Spodoptera frugiperda*), as well as incorrect reporting of feeding on uncommon hosts, are usually due to the lack of good visual reference material. This presentation aims to address this shortcoming, and it is hoped that the information and visuals contained herein will assist workers in the field to improve their ability to do preliminary identifications, not only of the fall armyworm, but also identifications of other common caterpillars on crops in South Africa. However, final and conclusive identifications should always be performed by the experts.

Common caterpillars on crops in South Africa

The following caterpillars may be found in most parts of South Africa, and should therefore be considered when scouting various crops for the fall armyworm. See relevant slides for descriptions of stages and feeding locations.

Caterpillar pest

Crops attacked or affected

- | | |
|------------------------------|-----------------------------------|
| 1. Fall armyworm | Mostly maize and sorghum |
| 2. African bollworm | Most crops |
| 3. Tomato moth caterpillar | Many crops, especially vegetables |
| 4. Lesser armyworm | Mostly vegetables |
| 5. African armyworm | Mostly grasses and maize |
| 6. Semi-loopers | Many crops, especially vegetables |
| 7. Cutworms | Many crops, mainly a soil pest |
| 8. False armyworm | Mostly maize and barley |
| 9. <i>Chilo</i> borer | Mostly maize |
| 10. African maize stem borer | Mostly maize |

Additional caterpillars can be found on various crops, some specific to certain crops. The caterpillars listed above are all approximately the same size. Some of these species may be found on the same crops and on the same plants.

Stages of the fall armyworm that will be illustrated

Moths

Signs of infestation (egg masses)

Signs of infestation (1st instars)

Signs of infestation (larger caterpillars and moths)

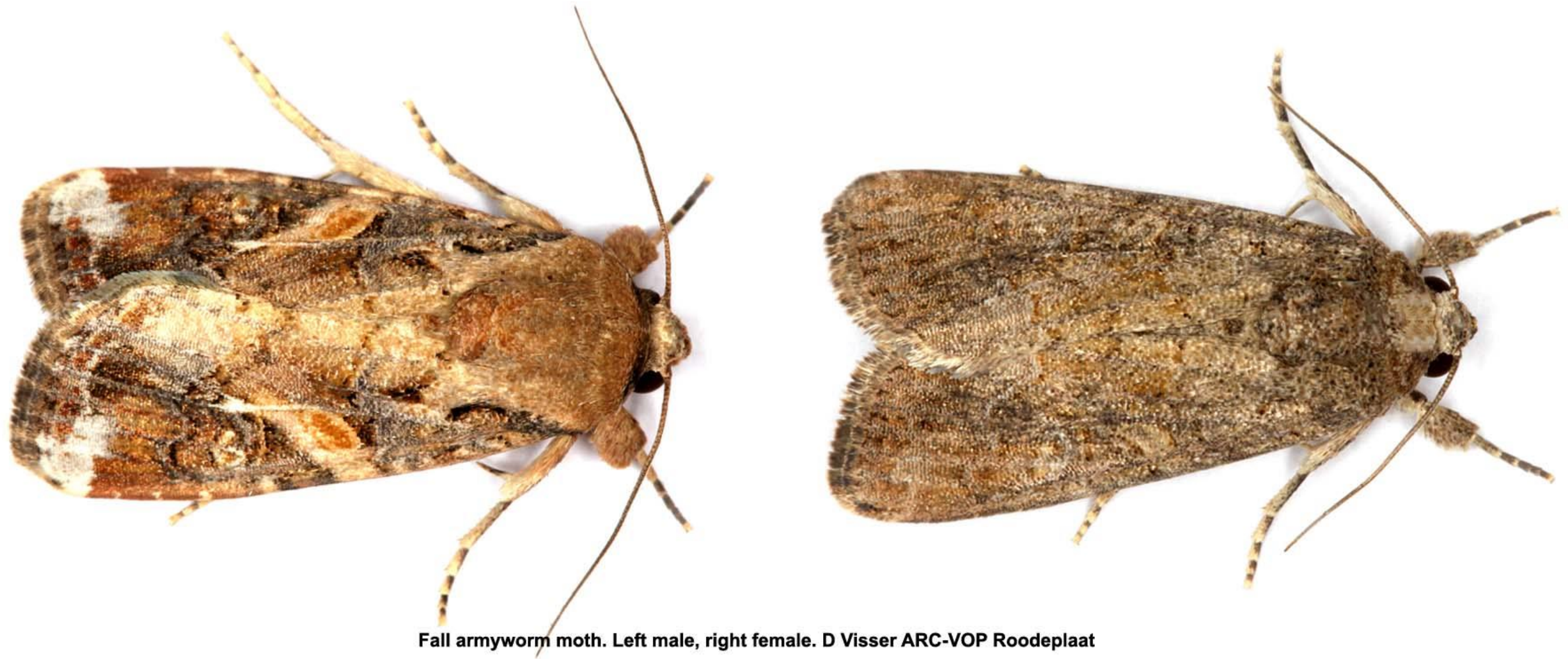
Characteristic marks on caterpillars

Small caterpillars

Large caterpillars

Pupae

FAW: adults



Fall armyworm moth. Left male, right female. D Visser ARC-VOP Roodeplaat

Fall armyworm moths are active during the evening and hide during the day. They are sometimes found hiding between maize leaves or in whorls. Male moths find females by following pheromones released by the females. Mating takes place and eggs are laid in masses, two or three days later.

FAW: variation in patterns on wings



Male



Male



Female



Female

Fall armyworm adults. Mounted by V Uys, ARC-PPR; Photos by D Visser, ARC-VOP

FAW: first signs of infestation (a) egg masses



Fall armyworm egg masses. D Visser ARC-VOP Roodeplaat

Eggs are laid in masses on leaves, mostly on the underside, but also on the upper side and on stems. Females can deposit eggs in more than one layer before they are covered by anal hairs of the moth. Egg masses without hair covers may also be encountered. Eggs may be cream-coloured, green or brown, but the whitish colour of the hair covers is easily observed on the green leaves. The presence of egg masses plays an important role in the scouting process.

FAW: first signs of infestation (b) first instars



Fall armyworm first instars. D Visser ARC-VOP Roodeplaat

The first signs of infestation is most often feeding marks by first instars. They only feed superficially on one side of the leaf. Young fall armyworm caterpillars use ballooning (spreading by wind on a thread of silk) to spread to new host plants. One fall armyworm egg batch contains too many eggs for one plant, and ballooning nearly always occurs soon after hatching. Ballooning is one of the reasons why infestation levels of a field can reach 100%, and also why unrelated crops nearby can seemingly be attacked – the small airborne caterpillars have no control on what plants or crops they land on.

FAW: signs of infestation at a later stage



Fall armyworm damage to young maize plants. D Visser ARC-VOP Roodeplaat

Fall armyworm infestations often are only noted at a later stage, when large holes, accompanied by larval droppings (excrement), are noticed in the whorls and on surrounding leaves. When dry, the excrement takes on a very characteristic appearance, that of sawdust. The caterpillars usually hide deep in the whorl while the excrement they produce serves as a protective barrier which also helps to camouflage them from predators from above.

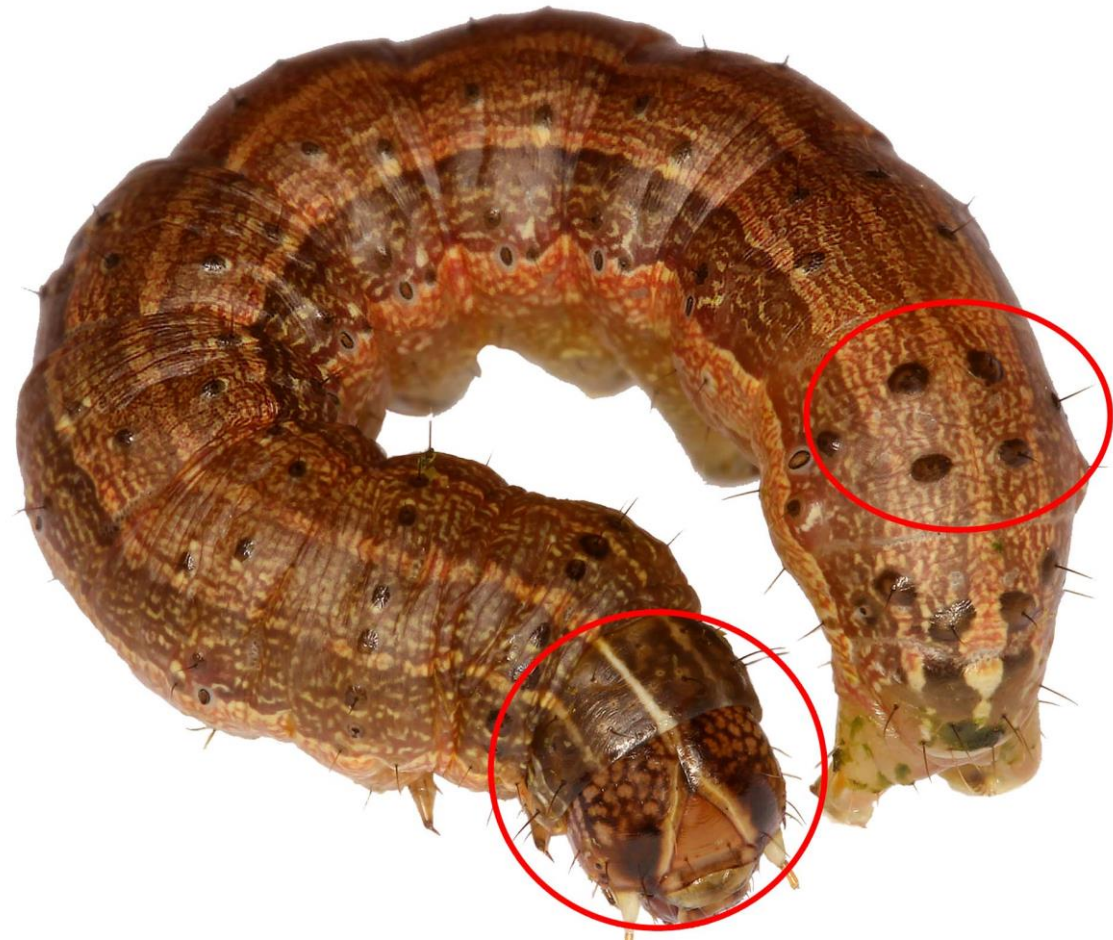
Detection of FAW caterpillars and moths



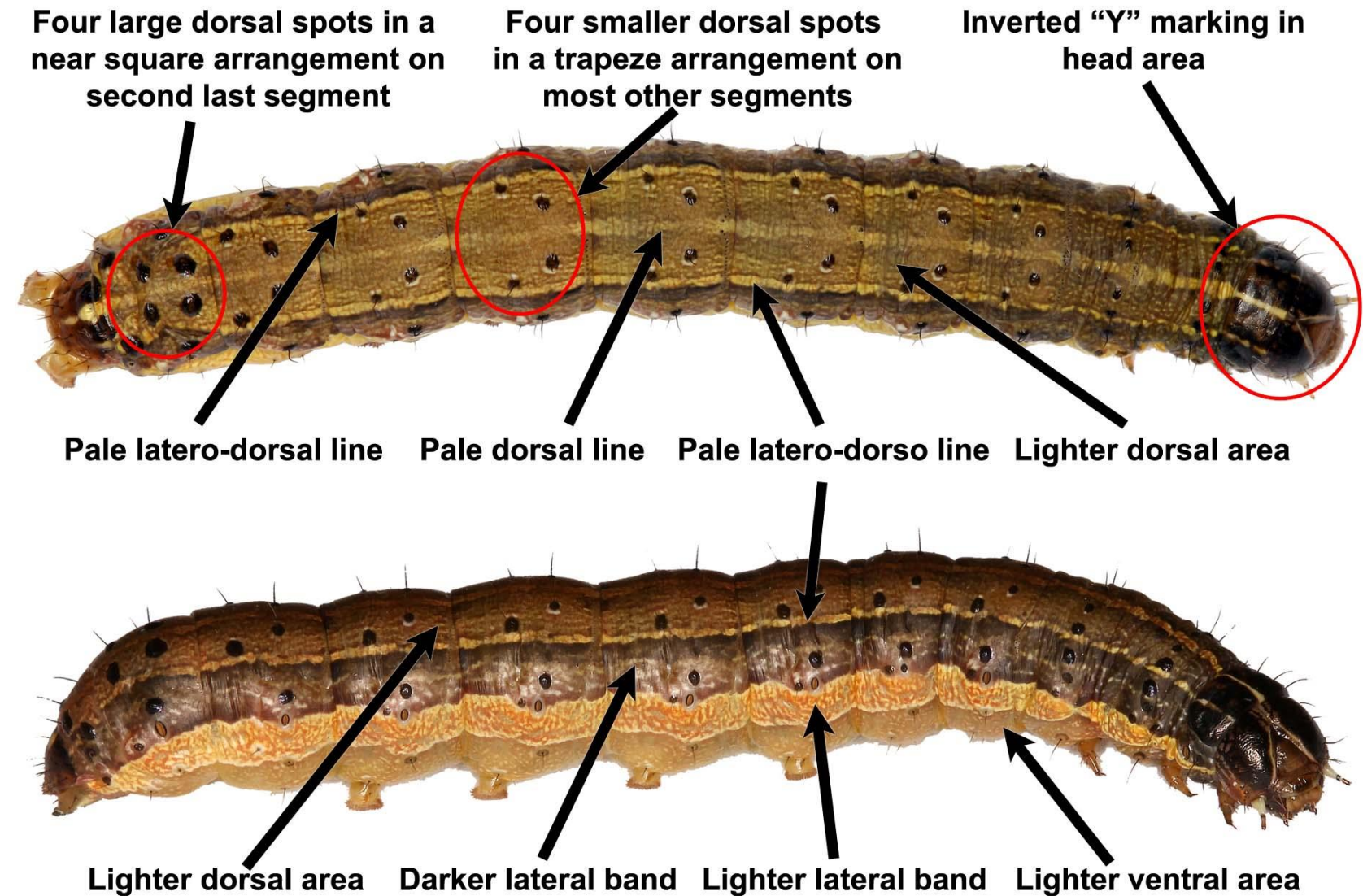
Fall armyworm caterpillars and moths on maize plants. D Visser ARC-VOP Roodeplaat

Caterpillars are usually found in whorls of young maize plants. On mature plants they may infest ears, where they feed on soft tissue like kernels, soft inner leaves, and silk hairs. They rarely feed on older mature leaves. Moths hide in debris or in other secluded places on the ground, as well as in whorls.

FAW: characteristic marks on caterpillars



Fall armyworm characteristic marks. D Visser ARC-VOP Roodeplaat



Fall armyworm characteristic spots, bands and lines. D Visser ARC-VOP Roodeplaat

Larger caterpillars may contain characteristic marks and spots. Marks that are often used for identification include the upside Y mark on the head region and the four larger spots on the second last segment. The most common lines and spots are indicated above. Note: variations from the illustrations above may be encountered, and other non-related caterpillars may show similar marks and spots, although usually not as vividly as in the fall armyworm.

FAW: young larvae – length 6-9 mm

Top view



Young fall armyworm larvae (6-9 mm). D Visser ARC-VOP Roodeplaat

Small fall armyworm caterpillars are mostly lighter in colour compared to the older or larger individuals. Green and/or yellow colours are common. These lighter colours not only camouflage the larvae on the green leaves, but also may lead to confusion with other pests. The heads may be black or orange, and the spots on the body may not always be equally clear or apparent. Marks on the head may not be easy to observe on small caterpillars.

FAW: young larvae – length 6-9 mm

Side view



Young fall armyworm larvae (6-9 mm). D Visser ARC-VOP Roodeplaat

The lateral bands are not yet clear on small caterpillars, compared to larger individuals. The colour of small individuals may include green, yellow, brown and black, but mostly greenish/yellowish. A pinkish tint is common on the sides of young individuals. The hairs and bumps are more pronounced on small individuals, similar to all stages of the bollworm. Some may walk with an action similar to the semi-loopers (but not as pronounced).

FAW: mature larvae – length 30-36 mm

Top view



Mature fall armyworms (30-36 mm). D Visser ARC-VOP Roodeplaat

The colour of fall armyworms in the late stages is mostly brownish, but may include variations of light to dark brown as well as greenish to blackish. Darker individuals appear when overcrowding occurs. The spots on the body are not always equally clear or apparent.

FAW: mature larvae – length 30-36 mm

Side view



Mature fall armyworms (30-36 mm). D Visser ARC-VOP Roodeplaat

The lower lateral sides of the fall armyworm are usually lighter in colour, with a brown or black band just above the light band. The general appearance is brown, although blackish or greenish individuals may be encountered. The head may be black, brown or orange. Larger caterpillars never walk with a looping action.

FAW: pupae, soil cells and cocoons



Fall armyworm pupae, soil cell, and cocoon. D Visser ARC-VOP Roodeplaat

Pupae of the fall armyworm are usually found in the soil and are therefore not frequently encountered. They do, however, sometimes pupate on the plant, e.g. when feeding in the ears. The mature caterpillar drops to the ground, burrows shallowly into the soil and makes an earthen cell by constructing a flimsy cocoon into which sand particles are incorporated. Pupae are approximately 15 mm in length and the earthen cells 20 to 25 mm.

The following caterpillars will be illustrated

African bollworm

Tomato moth caterpillar

Lesser armyworm

African armyworm

Semi-loopers

Cutworms

False armyworm

Chilo borer

Maize stem borer

African bollworm



African bollworm. D Visser ARC-VOP Roodeplaat

The colour of the African bollworm (*Helicoverpa armigera*) varies considerably. The spots on young individuals are usually more prominent (middle column). Some individuals may have lighter bands on the sides, similar to the fall armyworm. Of all the caterpillars, it is only the bollworm that displays the characteristic “sphinx stance” when disturbed (top right). Moths are pale brown and do not lay eggs in masses. Pupae are formed in earthen cells.

Tomato moth caterpillar



Tomato moth. D Visser ARC-VOP Roodeplaat

Caterpillars of the tomato moth (*Spodoptera littoralis*) are usually brownish with distinctive black spots (the black spots are sometimes absent). Some may be yellowish, blackish, or may contain yellow lines or spots on a brown body. Moths are brownish with characteristic “scratch-like” patterns on the forewings. Eggs are also covered with anal hairs and pupae are also found in earthen cells.

Lesser armyworm



Lesser armyworm. D Visser ARC-VOP Roodeplaat

The lesser armyworm (*Spodoptera exigua*) is usually olive-green in colour, but yellow or darker individuals may be encountered (darker forms appear during overcrowding). A characteristic pink line or spots are found on the sides of some individuals. The moths have characteristic orange spots on the forewings, while eggs are also covered by anal hairs. Pupae are also found in earthen cells (not illustrated).

African armyworm



African armyworm. D Visser ARC-VOP Roodeplaat

In the swarming phase, African armyworms (*Spodoptera exempta*) are usually blackish in colour, but brown to green otherwise. Similar to fall armyworm, they also have an inverted Y marking in the head region, as well as similar lateral stripes and bands. They lack the clear spots, however, and only enter the damaging swarming phase once every five to ten years. They are usually found in masses on grasses and do not hide in crops during the daytime like the fall armyworm. Pupae are also found in the soil. The moths look similar to that of the fall armyworm, and also lay eggs in hair-covered masses.

Semi-loopers



Semi-loopers. D Visser ARC-VOP Roodeplaat

Semi-loopers are so-called because they typically bend their bodies in a semi-loop while walking. The larvae are usually greenish in colour, but yellowish individuals may also be found. The body typically tapers (becomes narrower) to the front. The moth of the plusia semi-looper (*Trichoplusia orichalcea*) has a characteristic yellow area on each forewing, while the tomato semi-looper (*Chrysodeixis acuta*) has silvery spots on the wings. Eggs are not laid in masses and the pupae are formed in silken cocoons on plants.

Common cutworm



False armyworm



Common cutworm and False armyworm. D Visser ARC-VOP Roodeplaat

Various cutworm species may be found damaging crops, usually in the soil. The common cutworm, *Agrotis segetum*, is greyish in colour, while the moths are brown with characteristic spots on the wings. They lay eggs singly on plants and the pupae are formed in earthen cells.

False armyworm (*Leucania loreyi*), varies in colour. It is usually pale pinkish with longitudinal stripes and bands, similar to the fall armyworm. They also produce excrement in whorls. Moths are brownish in colour and lay eggs in masses on plants (not covered). Pupae are found in the soil or on plants.

Stem borers

Chilo borer



Chilo partellus. D Visser ARC-VOP Roodeplaat



Chilo partellus. A Erasmus ARC-GCI



Chilo partellus. D Visser ARC-VOP Roodeplaat



Chilo partellus eggs. A Erasmus ARC-GCI

Maize stem borer



Busseola fusca. D Visser ARC-VOP Roodeplaat



Busseola fusca. D Visser ARC-VOP Roodeplaat



Busseola fusca. D Visser ARC-VOP Roodeplaat



Busseola fusca eggs. A Erasmus ARC-GCI

At least three stem borers are known to damage maize, of which the *Chilo* borer (*Chilo partellus*) and the maize stem borer (*Busseola fusca*) are the most common. Young caterpillars feed in whorls but older caterpillars bore into stems and ears. The *Chilo* borer moth is elongated, light brown in colour, while the maize stem borer is a stout brownish moth. Eggs of the maize stem borer are laid in egg batches (not covered) behind the leaf sheath (between leaf and stem), and the *Chilo* borer lays egg batches on both the upper and lower surface of leaves. The pupae are formed inside the tunnels, within ears or stems.

Conclusion

The fall armyworm has been reported in most provinces of South Africa, mostly damaging young maize plants. Identification of the caterpillars are sometimes problematic due to the lack of visual reference material and the usual mistaken identity and confusion with other caterpillars that are encountered on crops.

The information and illustrations in this presentation should assist workers in the field to differentiate between the fall armyworm and other common caterpillars. Workers can also use the illustrations to help farmers with preliminary identification of caterpillar pests on other crops, or work through a process of elimination to establish the most probable identity of a collected caterpillar.

For final and conclusive identifications, adult moths should always be submitted to an expert taxonomist who usually compares the microscopic genitalia of male moths with reference material from a collection.

This presentation is an output of the Fall Armyworm Steering Committee of the South African Department of Agriculture, Forestry and Fisheries

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Version of this presentation: v1.3

Date of this presentation: 25 June 2017

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