



# Cotton bollworm

*Helicoverpa armigera*



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Adult moth of cotton bollworm.



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Cotton bollworm caterpillars in two different colours.

**SUMMARY:** The cotton bollworm is a major pest of many important food, oil and cash crops worldwide, including cereals, legumes, fruits and vegetables. A severe infestation of caterpillars of this moth can cause a complete loss in yield. Chemical control needs to be carefully timed as the caterpillars bore into the grains or fruit of the plant and are then protected. Resistance to pesticides, such as pyrethroids, has been reported in many countries. *Bacillus thuringiensis* (Bt) and neem extracts provide effective control against the caterpillars while minimising damage to natural enemies. Important cultural controls include removal and destruction of post-harvest crop residues, ploughing the soil to expose the pupae and uniform planting times.

## KEY SIGNS

The cotton bollworm is considered to be one of the most important pests worldwide, attacking over 200 species of plants. The caterpillars feed on leaves and developing grain heads, and bore into the fruiting parts of plants.

The eggs are 0.4-0.6 mm across, round and yellowish-white, but change to a dark-brown colour before hatching. The eggs are typically laid singly on plants that are flowering or about to flower. The young caterpillars are yellowish-white to reddish-brown, with a dark brown to black head and black bumpy rows of short hairs running lengthwise on their backs. The fully grown caterpillars are 35-40 mm long and vary in colour from dark brown, yellowish-green, to reddish-brown, with greyish-black stripes along the side of the body and a thin light stripe. The pupae are 14-16 mm long, brown, and smooth on the surface. The adults also vary in colour, but typically the forewings are yellowish-brown with black kidney shaped markings in the middle of the wings and 7-8 small spots in a line along the border of the wing. The hindwings are white with a darker coloured band along the edge. The wingspan is about 35-40 mm at its widest point, and the body is 14-18 mm long. The adult moths are active at night and are good at flying, so they can easily move from plant to plant and field to field.

The caterpillars typically feed on the buds, flowers, grains, fruits and pods, but will also feed on the leaves and stems. In sorghum and millet, they feed on the developing grains during the milky stage and hide in the head during the day. In beans and tomato, they bore into the fruit. In maize, they feed on the developing seeds and bore into the cobs. The bore holes left by the caterpillars provide an entry point for bacterial diseases.

Monitoring is extremely important to prevent a severe outbreak. Monitoring should be done one or two days per week once the sorghum flowers bloom. Caterpillars can be seen on the plants, or shake the panicle heads over a bucket or sweep net. Bore holes and caterpillar dropping (frass) can often be seen on the plant. Pheromone traps and light traps can also be used to monitor the adult moths and provide some control.

## MANAGEMENT

**Prevention** – what to do before signs are seen

*Cultural approaches:* Sorghum varieties with tight compacted heads are more likely to be attacked; plant varieties with loose open heads to reduce infestations and damage.

Resistant varieties of cotton, pigeonpea and chickpea have been released. Talk to local agro-input suppliers to see which varieties are available.

Planting a whole field at the same time (uniform planting) prevents movement of the moths from the older plants to the younger plants and reduces the damage.

Two post-harvest practices are important for preventing the population of bollworms from building up and becoming a severe problem the following season. First, it is important to remove and destroy crop residues immediately after harvest. Second, plough the soil to expose the pupae to direct sunlight and natural enemies.

Rotating with non-host crops can also prevent the population from building up, but because the bollworm can attack and harbour on many species of plants, rotation must be used together with other prevention and control practices.

**Control** – what to do after signs are seen

*Cultural approaches:* For small plots, it is possible to hand pick and destroy the eggs and young caterpillars.

There are many natural enemies of the bollworm, including *Trichogramma* spp. (egg parasitoids), several species of wasps and flies (caterpillar parasitoids), as well as many predators such as ants, lacewings, ladybugs, assassin bugs, minute pirate bugs and birds. Providing habitat to attract and preserve these natural enemies is an important strategy for controlling the bollworm.

*Chemical approaches:* The older caterpillars feed inside the fruiting part of the plant, protecting them from pesticide sprays. Therefore, if pesticides are used, they should be applied before the caterpillars bore into the pods or fruit of the plant. It is important to monitor the field regularly to look for eggs and young caterpillars before they bore into the plant. The decision to use a pesticide needs to be based on the severity of the problem, the presence of natural enemies and the economic value of the crop.

The cotton bollworm has developed resistance to several pesticides, notably synthetic pyrethroids.

Two microbial pesticides, *Bacillus thuringiensis* subspecies *kurstaki* and *Bt aizawai*, and *Helicoverpa armigera* nuclear polyhedrosis virus (HaNPV) can be used to control the young caterpillars with minimal harm to natural enemies. There are commercial products of these microbial pesticides available in many countries. Neem extracts, made from the neem seeds and leaves, and neem oil are also reported to be effective against the larvae and eggs.

## CAUSE

*Helicoverpa armigera* has also been classified as *Heliothis armigera*. It is commonly known as the cotton bollworm, but is also called the African bollworm, tomato fruitworm, corn earworm, gram pod borer, old world bollworm and tobacco budworm. In French it is called chenille des épis du maïs, noctuelle des tomates, or ver de la capsule.

Adult females can lay hundreds of eggs in a lifetime. They lay eggs singly on the tender parts of plants including the leaves, flowers, or fruit, and the eggs hatch in 3 to 5 days. The caterpillar period lasts 17 to 35 days, and the pupa period 17 to 20 days. The caterpillars drop from the plant to pupate inside a silk cocoon, 3-15 cm deep in the soil. The adult moths live between 1 and 25 days. The total life cycle can last up to 60 days; if conditions are favourable, then the total life cycle can be completed in 30 days. The length of time for development is mostly dependent on availability of food and the temperature: development time is shorter at higher temperatures. In warmer areas there can be numerous cycles per season.

## IMPACT

The cotton bollworm is a major pest of many crops, including sorghum, soy, cotton, maize, common beans, chickpeas, groundnut, sunflower, potatoes, winter grains, citrus, wheat, barley, oats and a wide range of vegetable crops, including okra. The larvae can develop on many wild plant species, including *Amaranthus*, *Cleome* and *Acalypha*. The bollworm has a preference for feeding on the flowering and fruiting parts of plants, which causes high economic losses. If the infestation is severe, then it can result in a complete crop loss.

## DISTRIBUTION

Native to Africa, the cotton bollworm has spread to Asia, Europe, Australia and the Pacific Islands. There have also been recent reports of infestations in South America. The pest can be spread through infested plant propagation materials. The adults are strong flyers and can move easily from field to field in areas where host plants are available; they can also be spread by strong winds.

## FURTHER READING

Plantwise Knowledge Bank [www.plantwise.org/knowledgebank](http://www.plantwise.org/knowledgebank)