

## Identification and Management of Bollworms and Other Lepidopteron Pests of cotton

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### Introduction:

Cotton, *Gossypium hirsutum* L., an important industrial crop of the world. India ranks first in acreage of cotton crop. India is the second largest producer of cotton in the world after China. Among the major constraints in cotton cultivation, pest damage is the most important one. Cotton crop is infested by several pests right from germination to harvest and the pest spectrum of cotton is quite complex. These insect pests have the potential to cause catastrophic impacts on the crop, resulting in major output losses and financial distress for farmers. Sustainable production depends on identifying the major insect pests that impacts on cotton crop and comprehending their nature of damage and treatment options. Through this article, we seek to give an overview of the major insect pests of cotton and insights into practical insect pest management strategies. Cotton is the most important commercial crop in our country. However, these insect Pest reduce the yield of the cotton, making it difficult to grow. That's why there's a shift towards sustainable cotton production which depends majorly on identifying the main insect pests and comprehending their nature of damage and treatment options so as to know a technique to treat them. However, the crop might become affected and the insect pests caused not only lowers the yield but also has a grave impact on the fibre quality and seed quality. For maintaining the high-quality production of cotton fibre and seeds, it is essential to further comprehend the major insect pests and its management.

### 1. Bollworm complex of cotton:

#### i. Spotted bollworm: *Earias insulana*, *E. vitella* Noctuidae : Lepidoptera

##### Economic Importance:

- This is a cosmopolitan pest, having been reported from all the cotton growing areas of the state.

##### Marks of Identification:

- There are two species of spotted bollworm.
- The adult of one species have pale white upper wings with a broad greenish band in the middle (*E. Vitella*) the adult of another species have completely green upper wings (*E. insulana*).
- The caterpillars of both the species are brownish white and have a dark head and a prothoracic shield.
- Their main characteristic is that their body surface is irregularly covered with black spots (*E. Vitella*) and spins (*E. insulana*).
- A full-grown area measures 19 mm in length.

#### Nature Damage:

- In the beginning of the cotton season, the caterpillars bore into the growing stage of the young plants (generally 6-week-old) and cause curling of the attacked shoot.
- When flower buds appear the larvae are found boring into them which results in the show holes plugged with excreta.
- The infested bolls are mostly shed. But if they remain on the plant, they open prematurely, consequently lint from such bolls fetches a low price in the market.

#### Life History:

- The female lay eggs, singly on tender shoots, flower buds, bracts, bolls etc. The IP is 2 to 10 days. The larval period varies from 9 to 25 days depending on the climate.
- The full fed larvae pupate in a silken cocoon in the soil, in this stage it remains for 6 to 25 days.
- The total period of life cycle is about 7 to 8 generations in a year.
- Summer bhendi is an important source of “carry over” of the pest from one season to another.

#### Host Plants:

- Besides cotton, the pest infests bhendi, ambadi, hollyhock etc.



Spotted or spiny bollworms – (*Earias vitella* Fab.)



### Spotted or spiny bollworms (*Earias insulana* B.)

#### ii. American cotton bollworm: *Helicoverpa armigera* Noctuidae : Lepidoptera

##### Economic Importance:

- It is also popularly known as “gram-pod borer” it is a cosmopolitan and polyphagous pest attacking wide range of crops.

##### Marks of Identification:

- The adult is stout, light yellowish brown, forewings are pale brown with some black dots and the hind wings are lighter in colour with smoky dark margins.
- The caterpillars are greenish with dark grey lines, along the sides of body. They are 30 to 35 mm in length, when full grown.

##### Nature Damage:

- This pest causes substantial damage to cotton crop.
- The newly hatched larvae usually feed on tender leaves and squares of the plant.
- The larvae make holes in bolls and consume the entire contents inside the bolls.
- A single larvae can destroy 9 to 15 squares and bolls. The excreta of the larvae is noticed on the bracts.

##### Life History:

- The eggs are laid singly on the tender parts of the plants and they hatch in about 3 to 7 days.
- The caterpillars become full in 14 to 15 days and descend to the ground.
- Pupate in earthen cocoons in the soil.
- The pupal period lasts for one week to a month.
- There may be as many as 8 generations in a year on different crops.

##### Host Plants:

- Besides cotton, it feed on gram, tomato, peas, tur, tobacco, jowar, maize etc.



**American bollworms (*Helicoverpa armigera* H.)**

**iii. Pink bollworm: *Pectinophora gossypiella* Gelechiidae : Lepidoptera**

**Economic Importance:**

- It is the most destructive pest of cotton, having reported from almost all the countries in the world.
- In Maharashtra also it is noticed in all the areas wherever, the cotton crop is grown.
- The larvae are pinkish in colour and hence the name.

**Marks of Identification:**

- The moth is small sized, Body is dark brown in colour with numerous small spots on the wings.
- The caterpillar is pinkish in colour when full grown and it measures about 18 to 19 mm in length.
- The pupa is brownish and measures about 7 mm in length.

**Nature Damage:**

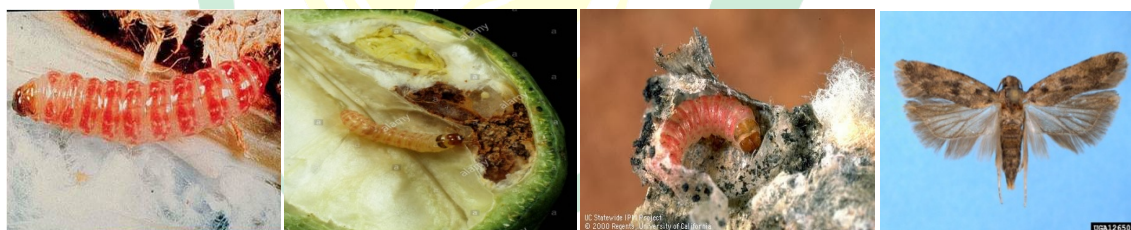
- Unlike the spotted bollworms, the pink bollworm never attacks.
- The shoots but infect buds, flowers and bolls only.
- In the beginning of the season, the caterpillar feed on floral buds, flowers and cause their shedding.
- Later on, they enter the developing boll through the tip portion and entrance hole gets closed up as the boll matures and it becomes extremely difficult to locate the infested bolls unless they drop down to the ground.
- The larva feeds on the Inner Contents (particularly seeds) and moves to adjacent locule by making a hole through the septum.
- As a result of infestation of this pest ginning percentage, oil and spinning quantities are adversely affected.

**Life History:**

- Female lay eggs on the under surface of leaves floral bracts and bolls. They hatch within 3 to 25 days.
- On entering the bolls, the entry hole gets sealed and caterpillar leads a concealed life. It becomes full grown in 8 to 21 days.
- It attains characteristic pink colour in the third instar. They moult thrice.
- The larva then pupates by spinning a cocoon on bracts or in fallen leaves, flowers lint under clods or in soil. The pupal stage lasts for 6 to 20 days.
- This is termed as short cycle generation.
- While in case of long cycle generation the full-grown larvae without undergoing pupation remain the hibernating stage even up to two days years.
- Carry-over through seed in the form of hibernating larvae is quite negligible in our state, while majority of them hibernate in cocoons amongst the shed bolls, plant debris or in cracks in the soil.
- As many as 9 generations are completed in a year.

**Host Plants:**

- Besides cotton, this pest also feeds on bhendi, ambadi and hollyhock.



**Pink bollworms (*Pectinophora gossypiella* S.)**

**Management practices for bollworms of cotton:**

- Bollworms being internal feeders, they are extremely difficult to control.
- **Preventive measures:**
  1. Avoid monocropping.
  2. Synchronized sowing of cotton preferably with short duration varieties in each cotton ecosystem
  3. Removal and destruction of cotton stalks, shed bolls and other plant debris after the last picking.

4. Grow *Bt* cotton viz., Bollgard I containing *Cry 1 Ac* protein that offers protection against American bollworm and Bollgard II containing *Cry 2 Ab* in addition to *Cry 1 Ac* which offers season long protection against *Spodoptera* and *Helicoverpa*.
5. Avoiding growing of bhendi and other malvaceous crops during off seasons.
6. Fumigation of seed to kill the hibernating larvae of pink bollworms with aluminium phosphide @ 600/100 cu. Meter of space before storage of seed.
7. Crushing the larva within attacked drooping shoots due to the spotted bollworm before flowering, arrests multiplication of the pest initially.
8. Collection and destruction of buds, squares, flowers and bolls in the early season helps in keeping the pest under check.
9. Use of light traps and pheromone traps.
10. Use of resistant or tolerant varieties.
11. Inundative release of egg parasite, *Trichogramma spp* at 15 days interval 3 times from 45 DAS, egg-larval parasitoid, *Chelonus blackburnii* and the predator *Chrysoperla* 1,00,000/ha at 6th, 13th and 14th week after sowing.

• **Chemical Control:** -

1. First spraying should be undertaken at square formation subsequent spraying at 15 days interval.
2. For spraying use any one insecticide from group I and alternate it with insecticide from group II.

**Group I:** - carbaryl 0.2%, phosalone 0.05% quinalphos 0.05%

**Group II:** - Cypermethrin 0.0075%, decamethrin 0.0025%, fenvalerate 0.0125%.

**2. Tobacco Leaf eating caterpillar: *Spodoptera litura* Noctuidae : Lepidoptera**

**Mark of Identification:**

- Adult moth is stout with wavy white markings on the brown forewings and white hind wings with a brown patch along its margin.
- Larva is stout, cylindrical, pale brownish with dark markings.
- The body may have row of dark spots or transverse and longitudinal grey and yellow bands.

**Life History:**

- Eggs are laid in groups and covered with hairs on the leaves.

- The egg period is 4-5 days. The larval period is 14-21 days.
- It pupates in earthen cells in soil for 15 days. Life cycle is completed 30-40 days.

#### Nature of damage:

- Neonate, green caterpillars feed on the leaves voraciously and present an appearance to the field as if grazed by cattle.
- Since this pest is nocturnal in habit larvae hide under the plants, cracks and crevices of soil and debris during the daytime.
- Faecal pellets are seen on the leaves and on the ground which is the indicator of the pest incidence.

#### Management Practices:

1. Grow castor as a border (or) intercrop in groundnut fields to serve as indicator (or) trap crop.
2. Set up pheromone trap to monitor, attract and kill the male moths @ 12 nos./ha and change the septa once in 3 weeks.
3. Collect egg masses and destroy.
4. Collect the gregarious larvae and destroy them as soon as the early symptoms of lace-like leaves appear on castor, cowpea and groundnut.
5. Apply NPV @ 250 LE/ha with crude sugar 2.5 kg/ha which is as effective as that of chlorpyrifos at 200 g a.i./ha at 7 days interval.
6. Apply any one of the following insecticides per ha to control early instar larvae (1<sup>st</sup> to 3<sup>rd</sup> instar).
7. Carbaryl 10 D @ 25 kg, carbaryl 50 WP @ 2 kg, quinolphos 25 EC @ 750 ml, phenthoate 50 EC @1250 ml and dichlorvos 76 SC @ 750 ml.

#### Host Plants:

- Groundnut, citrus, soybean, cotton, tobacco, castor, pulses, millets, safflower, banana, cabbage, tomato, sweet potato.





**Tobacco Leaf eating caterpillar (*Spodoptera litura*)**

### 3. Cotton leaf roller: *Sylepta derogata* Pyralidae : Lepidoptera

#### **Economic Importance:**

- This pest is also found in all the cotton growing area of the state, but occasionally assumes a serious form.

#### **Marks of Identification:**

- The moth is medium sized (12.5 mm long) with yellowish wings and having brown wavy marking.
- The caterpillars are glistening green in colour with a dark head. When full grown it measure about 25 to 30 mm in length.

#### **Nature Damage:**

- This young caterpillar feed on the underside of the leaves and later they roll up the cotton leave together into trumpet shape structure and feed on them from the margins by remaining inside the rolls.
- In severe cases of attack all the leaves may be completely eaten up and may fail.

#### **Host Plants:**

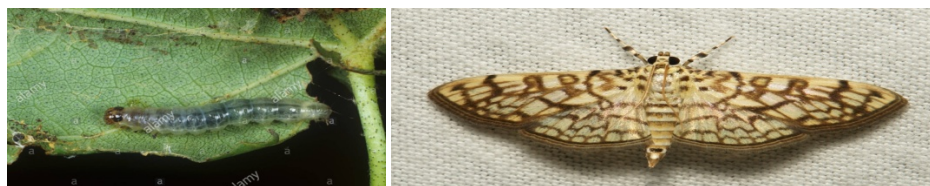
- Cotton, bhendi and other malvaceous plants etc.

#### **Management Practices:**

1. Removal and destruction of the rolled leaves along with the caterpillars.
2. Chemical control Spray carbaryl 50 WP @ 2 Kg or phasolone 2.5 L in 1000 L of water/ha







**Cotton Leaf Roller(*Sylepta derogata*)**

**4. Cotton green semi looper: *Anomis flava* Noctuidae : Lepidoptera**

**Economic Importance:**

- It is a sporadic pest and sometimes causes serious damage to the crop.

**Mark of Identification:**

- The adult is reddish brown with forewings traversed by two dark zig zag bands, while the hind wings are pale brown.
- The larva is semi-looper, 25-30 mm long, pale yellowish green with five white lines longitudinally on the dorsal surface and six pairs of black and yellow spots on the back.

**Life cycle:**

- Eggs are laid singly on the upper surface of the leaf.
- Egg period is 3-4 days; larval duration is 15-20 days and pupal period 8 -10 days.
- Pupation takes place in plant debris or in the soil.
- The life cycle is completed within 28-42 days.

**Nature of damage:**

- The young larvae congregate in groups and move actively, feed on the leaf lamina making small punctures.
- The grown-up larvae feed voraciously leaving only the midrib and veins.
- The caterpillars also feed on tender shoots, buds and bolls.

**Host Plant:**

- Cotton, tomato, bhendi and other malvaceous plants.



**Cotton semi looper (*Anomis flava*)**

**Conclusion :**

Cotton is one of the important fibre crops in Maharashtra and even in India. The cotton plays a vital role in the Indian economy, sustains the Indian cotton textile industry, provides employment to millions of people and contributes substantially to the country's foreign trade. But its productivity is reduced due to pest problem which causes severe damage to cotton resulting in yield losses. The cotton bollworm complex is most devastating, which causes significant reduction in cotton yield to the extent of 60-80 per cent. Among the bollworms, American bollworm *Helicoverpa armigera* (Hubner), spotted bollworm *Earias vittella* (Fabricius), spiny bollworm *Earias insulana* (Boisdual) and pink bollworm *Pectinophora gossypiella* (Saunders) pose greater threat to cotton production in India.

Integrated Pest Management (IPM) in cotton is now at the crossroads with the rapid shifts in the composition of the cultivars mediated through the transgenic *Bt* cotton technology. Caution needs to be observed in the proper utilization of the *Bt* cotton for the sustainable pest management. The IPM module and approaches available for conventional cotton may not fit as such and devising suitable module would be important. Therefore, development of an area specific IPM module based on *Bt* cotton would be useful for making *Bt* cotton cultivation more profitable to farmers and forestalling development of resistance in the bollworms to *Bt* toxins.

The information generated in present study would be helpful in developing efficient pest management strategies against insect pest of cotton crop for increased production efficiency, profit, besides safety to the environment.