

## Identification of Tomato Insect Pests and Their Integrated Pest Management

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### SUMMARY

Tomato, *Lycopersicum esculentum* L. (Solanaceae), is an important vegetable crop in the Mariana Islands (Guam, Saipan, Rota and Tinian). Because tomato is heavily attacked by both the tomato fruitworm *Helicoverpa armigera* Hübner and the red spider mite *Tetranychus marianae* McGregor, research was begun in 2011 to develop an integrated pest management program to better protect the crop from these pests. Our previous studies have indicated nominal threshold levels for *T. marianae* to be 8-12 mites/leaf in the dry season and 8-14 mites/leaf during the wet season, while for *H. armigera* the threshold was found to be 2 eggs per 10 of the plants, followed by an additional pesticide application only if 2 damaged fruit or *H. armigera* larvae were detected per 50 immature fruits. Other studies have found the IPM package used here of petroleum spray oil (PSO), BotaniGard, neem, and DiPel applied 15, 30, 45 and 60 days after tomato transplant to be a viable approach, significantly reducing the pest complex and giving higher tomato yield compared to both the growers' current practice (carbaryl or malathion, 15 applications per cropping season) and control plots.

### INTRODUCTION

Sucking insects pierce through the epidermis and suck the sap. Many of the sucking insects serve as vectors of plant diseases and also inject their salivary secretions containing toxins that cause severe damage to the crop. Insects affect human beings in a number of ways. Many of them fed on all kinds of plants including crop plants, forest trees, medicinal plants and weeds. They also infest the food and other stored products in godowns, bins, storage structures and packages causing huge amount of loss to the stored food and also deterioration of food quality. Insects that cause less than 5 % damage are not considered as pests. The insects which cause damage between 5 - 10% are called minor pests and those that cause damage above 10% are considered as major pests.

### Tomato (*Lycopersicon esculentum* L.; Family Solanaceae)

**Nutritional value :** Rich source of Vitamins A, C, other minerals and fiber

Major tomato growing states in India are Bihar, Karnataka, Uttar Pradesh, Orissa, Andhra Pradesh, Maharashtra, Madhya Pradesh and West Bengal

**Varieties:** Pusa rubi, Megha (L-15), NTDR-1 (VASB), Roma, Arka Sourabha, Arka Vikas, Arka Ahuti, Arka Aashish, Arka Alok, Arka Mehali.

### Pests of National significance

#### Insect and mite pests

Sl. No.	Common name	Scientific name	Order	Family
1.	Fruit borer	<i>Helicoverpa armigera</i> (Hübner)	Lepidoptera	Noctuidae
2.	Whitefly	<i>Bemisia tabaci</i> (Gennadlus)	Hemiptera	Aleyrodidae
3.	Serpentine leaf miner	<i>Spodoptera litura</i> Fabricius	Lepidoptera	Noctuidae
4.	Thrips	<i>Thrips tabaci</i> Lindeman; <i>Frankliniella schultzei</i> Trybom	Thysanoptera	Thripidae
5.	Red spider mite	<i>Tetranychus</i> spp.	Acarina	<i>Tetranychidae</i>
6.	Pinworm	<i>Tuta absoluta</i> (Meyrick)	Lepidoptera	Gelechiidae

**Pests of Regional significance**

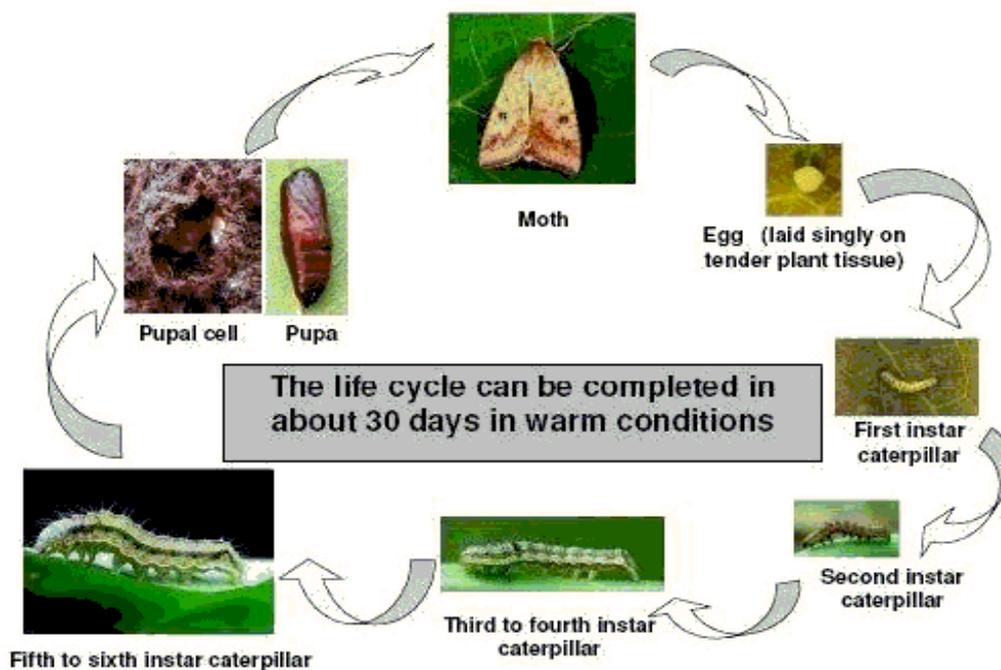
**Insect and mite pests**

Sl. No.	Common name	Scientific name	Order	Family	States of occurrence
1.	Leafhopper	<i>Amrasca biguttula biguttula</i> <i>Ishida</i>	Hemiptera	Cicadellidae	MP, RJ, UP, TN
2.	Cut worm	<i>Agrotis ipsilon</i> (Hufnagel)	Hemiptera	Cicadellidae	J&K
3.	Aphids	<i>Myzus persicae</i> (Sulzar)	Hemiptera	Aphididae	Bihar, RJ, KT
		<i>Aphis gossypii</i> (Glover)	Hemiptera	Aphididae	WB, PB
		<i>Aphis fabae</i> Scopoli	Hemiptera	Aphididae	RJ
		<i>Aphis craccivora</i> Koch	Hemiptera	Aphididae	UP
4.	Mealybug	<i>Phenacoccus solenopsis</i> Tinsley	Hemiptera	Pseudococcidae	AP, UP, PB

**Fruit Borer: *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae)**

- Serious and regular pest.
- Polyphagous pest, infesting gram, lablab, safflower, chillies, groundnut, tobacco, cotton etc.

**Life cycle**



**Nature of damage**

- Young larva feeds on the leaves for some time and then attacks fruits.
- Internal tissues are eaten severely and completely hollowed out.
- While feeding the caterpillar thrusts its head inside leaving the rest of the body outside.

**Symptoms of damage**

- Bored fruits with round holes.
- Rotting and premature dropping.
- Fed leaves, shoots and buds.



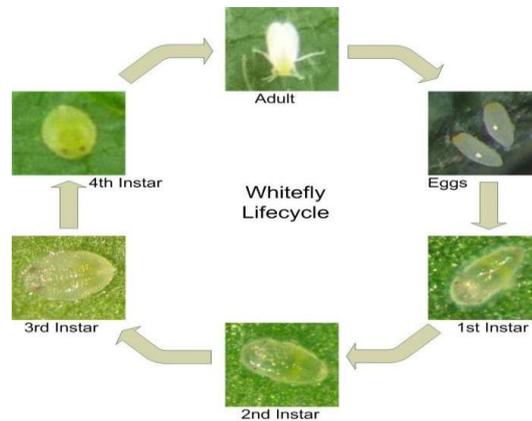
**Damaged fruits**

**Favourable conditions:** Warm weather followed by light rains and dry spells.

**Whitefly: *Bemisia tabaci* (Gennadlus) (Hemiptera: Aleyrodidae)**

- A cosmopolitan and polyphagous pest attacks wide variety of fruits and vegetables.

**Life cycle**



**Nature of damage**

- Both adults and nymphs suck plant sap.
- Nymphs are sedentary and remain under surface of leaves.
- Adults tiny, white, moth like, active and vector of viral diseases.

**Symptoms of damage**

- Yellowing of leaves.
- Downward curling and drying of leaves.
- Stunted growth.
- Vector of tomato **leaf curl** disease.



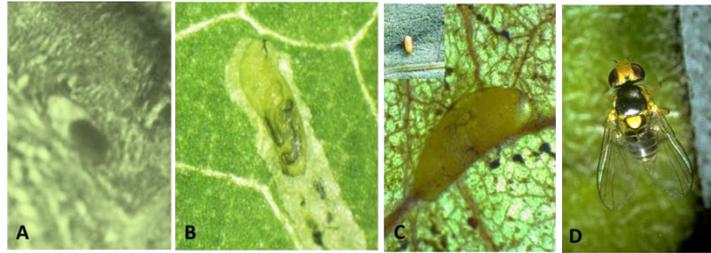
**Damage symptoms on leaves**

**Favourable conditions:** Warm weather condition.

**Serpentine leaf miner: *Liriomyza trofolii* (Burgess) (Diptera: Agromyzidae)**

- Accidentally introduced into the Indian sub-continent during 1990-91 from USA through imported chrysanthemum cuttings.
- Polyphagous and has been recorded attacking ornamental and vegetable crops of 25 families.

**Life cycle**

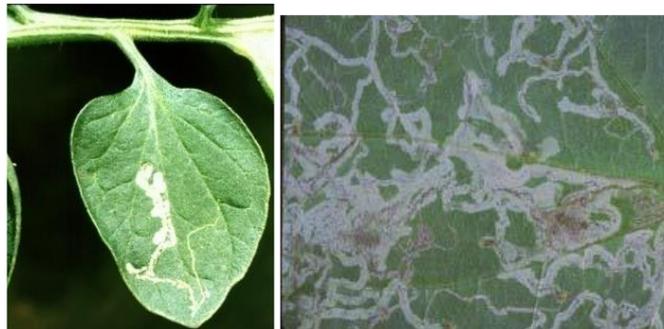


**Nature of damage**

- Maggots are damaging stage.
- Maggot mine between epidermal layer of leaves and feed on internal tissues.
- Adults make ovipositional punctures on leaves.

**Symptoms of damage**

- Leaves with serpentine mines.
- Drying and dropping of leaves in severe cases.



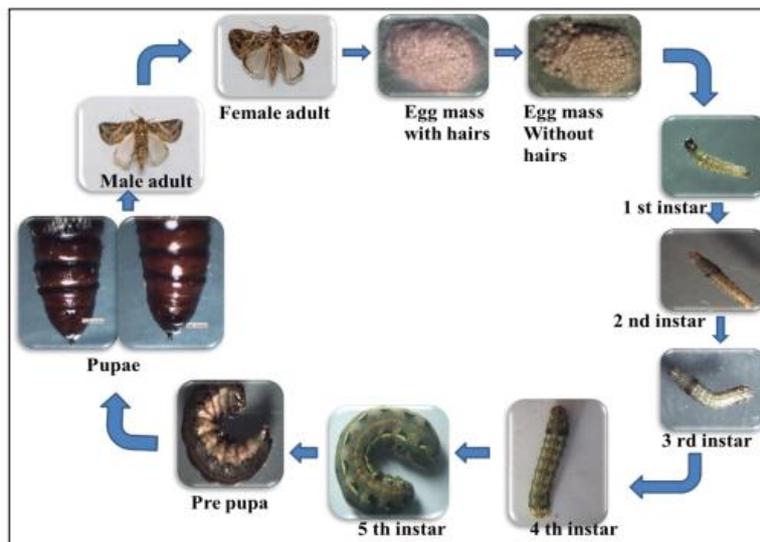
**Damaged symptoms on leaves**

**Favourable conditions:** Warm weather condition.

**Tobacco caterpillar : *Spodoptera litura* Fabricius (Lepidoptera: Noctuidae)**

- Found throughout the tropical and subtropical parts of the world, wide spread in India.
- Besides tomato, feeds on cotton, castor, groundnut, tobacco, cabbage and other cruciferous crops.

**Life cycle:**



**Nature of damage**

- In early stages, the caterpillars are gregarious and scrape the chlorophyll content of leaf lamina.
- Later they become voracious feeders making irregular holes on the leaves.

**Symptoms of damage**

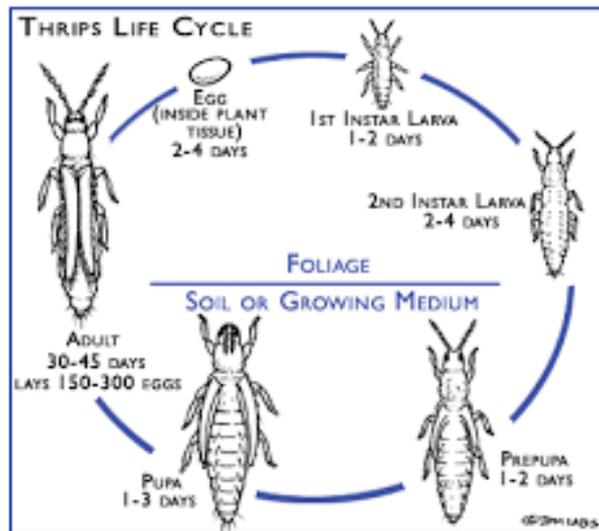
- Papery white appearance of leaves due to scraping by young leaves.
- Irregular holes on leaves initially and later skeletonization leaving only veins and petioles.
- Bored fruits with irregular holes.

**Favourable conditions:** Warm weather and rainy conditions.

**Thrips:** *Thrips tabaci* Linderman; *Frankliniella schultzei* Trybom (Thysanoptera: Thripidae)

- Cosmopolitan.
- Polyphagous in nature and feeds on many cultivated crops like beans, cucumber, garlic, melon, papaya, peas etc.

**Life cycle:**

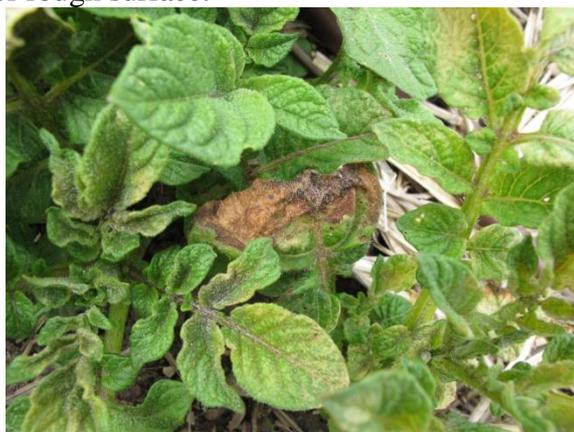


**Nature of damage**

- Both larvae and adults feed on leaves and fruits.
- Feeding is by laceration and sucking of oozing plant juice.

**Symptoms of damage**

- The affected tissue appears as whitish spots or silvery spots or streaks.
- In advanced injury the tissue develop necrotic patches.
- Affected fruit develop corky or rough surface.



**Damaged leaves**

**Favourable conditions:** Warm weather with intermittent wet and dry condition.

**Red spider mite, *Tetranychus* spp. (Acarina: Tetranychidae)**

- Cosmopolitan in distribution, wide spread in India.

- Polyphagous in nature and feeds on many cultivated crops like beans, cucumber, garlic, melon, papaya, peas etc.

#### Nature of damage

- Both larvae and adults feed on leaves by constructing spider like webbing on leaves.
- With chelicerate mouth parts, they rupture the cells and feed on oozing sap.

#### Symptoms of damage

- Initially white speckling found on upper surface of leaves.
- Later, they turn into bronze colour due to development of necrotic patches.



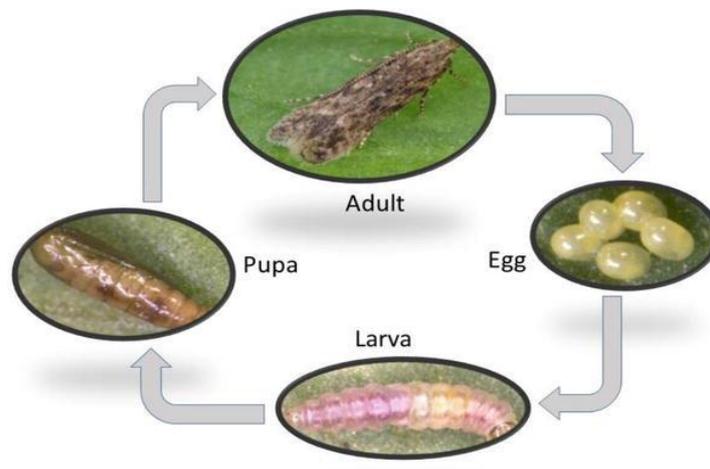
Damage symptoms by mite

**Favorable conditions** Warm weather with prolonged dry condition.

#### Pinworm : *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae)

- It is a new invasive pest in India, first observed in Maharashtra during 2014.
- Now spread to Karnataka also.
- Globally it is a pest of is a pest of great economic importance in Latin America and the Mediterranean basin.
- Also known to attack many other solanaceous crops like brinjal, potato etc.

#### Life cycle:



#### Nature of damage

- Larva feeds on leaves, stems, buds, calyces, young fruit or ripe fruit.
- On leaves, acts as miner and on stem and fruit acts as borer.

#### Symptoms of damage

- Affected leaves exhibit white patches which later dries up leading to burnt appearance.
- Affected fruits shows fine pin holes on the site of entrance and exit which lead to secondary infection and rotting.
- Affected stem dries up and droops down.

**Favourable conditions:** Warm weather with intermittent wet and dry condition.

**Economic Threshold Levels (ETLs) of pests of tomato**

Sl. No.	Name of the pest	ETL
1	Fruit borer	1 larva/m row length or 2% fruits damaged
2	Leaf miner	2-5 miners per plant

**Integrated Pest Management****Resistant or tolerant varieties**

**Tomato leaf curl virus:** Arka Ananya, Kashi Vishesh, Kashi Amrit, COTH 2, TNAU Tomato Hybrid Co3

**Pre-sowing operations**

Operations	Target insect/pests
Deep summer ploughing	Helicoverpa, Spodoptera, Thrips, serpentine leaf miner and pinworm
Soil solarization (with polythene sheet of 45 gauge (0.45 mm) thickness for three weeks before sowing)	Helicoverpa, Spodoptera, Thrips, serpentine leaf miner and pinworm
Apply Neem cake 250 kg/ha at the time of land preparation	Thrips and nematodes

**During nursery development**

- Raise Marigold (Tall African variety golden age bearing yellow and orange flowers) nursery 15-20 days before tomato nursery (as trap crop for *Helicoverpa*).
- Use nylon net of 40 gauge mesh to protect seedlings against whitefly infestation for leaf curl management.

**Management in the main field****Cultural methods**

- Transplant 20-25 day old tomato and 45-50 day old marigold simultaneously in the ratio of 16:1. Simultaneous flowering of both the crops ensures attraction of fruit borers to marigold flowers.

**Mechanical methods**

- Collection and destruction of eggs and early stages of larvae (*Spodoptera*).
- Handpick the older larvae during early stages of plant (*Helicoverpa*).

**Physical methods**

Sl. No.	Operations	Target pest
1.	Use yellow/blue pan water / sticky traps @ 4-5 trap/acre	Leaf miner, Thrips, Aphids
2.	Use light trap @ 1/acre and operate between 6 pm and 10 pm	Pinworm, <i>Helicoverpa</i>
3.	Install pheromone traps @ 4-5/acre for monitoring <i>Helicoverpa</i> and 10-12 traps/acre for mass trapping of pinworm (replace the lures with fresh lures)	<i>Helicoverpa</i> , Pinworm

**Biological control**

Sl. No.	Operations	Target pest
1.	Spray Ha NPV / SINPV (@250 LE/ha) with 1% jaggery as sunscreen at 28, 35 and 42 DAP in the evening	<i>Helicoverpa</i> and <i>Spodoptera</i>
2.	Egg parasitoids, <i>Trichogramma chilonis</i> , <i>T. braziliensis</i> or <i>T. pretiosum</i> @ 2.5 lakhs/ha (five releases @ 50,000/ha/release) starting from flower initiation	<i>Helicoverpa</i> , <i>Spodoptera</i> , pinworm

3.	Spray NSKE 5% or azadirachtin 5% W/W neem extract concentrate @ 80 g in 160 l of water/acre	<i>Helicoverpa</i> , thrips, mites, hoppers
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### Chemical control

Sl. No.	Chemicals	Target pest
1.	Spray indoxacarb 14.5% SC @ 0.8 ml/l or flubendiamide 20% WG @ 0.2 g/l or novaluron 10 % EC @ 0.75 ml/l or carbaryl 50% WP @ 2g/l or chlorantraniliprole 18.5% SC @ 0.3ml/l or lambda-cyhalothrin 4.9% CS@ 0.6 ml/l of water	<i>Helicoverpa</i> , <i>Spodoptera</i> and pin- worm
2.	Spray fenazaquin 10% EC @ 0.4 ml/l or spiromesifen 22.9% SC @ 0.8 ml/l or dicofol 18.5 EC (1.5 ml/l)	Red spider mite
3.	Cyantraniliprole 10.26% OD @ 360 ml in 200 litre water/acre	Thrips
4	Fifteen days after planting spray imidacloprid 200 SL @ 0.4ml/l or thiomethoxam 25 WP @ 0.3g/l of water	Whitefly, thrips, aphids

### CONCLUSION

The IPM strategy with African marigold as a trap crop and sprays of Ha NPV, neem soap, pongamia soap and NSP and soil application of neem cake for the management of the major insect pests, fruit borer and leaf miner, in tomato and root dipping of tomato seedlings in Imidacloprid, wider spacing and physical removal of TLCV-affected plants has been found effective. Since management of fruit borer has been possible with Ha NPV sprays, trap crop may be an option for the farmers.

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