

agMOOCs

INTEGRATED PEST MANAGEMENT IN TOMATO



Course teacher

Prof. Prabhuraj A.

(University of Agricultural Sciences, Raichur)

TOMATO (*Lycopersicon esculentum* L.; Family Solanaceae)

Area ('000 ha)	Production ('000 mt)	Productivity (t/ha)
846	18305	21.63

- **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



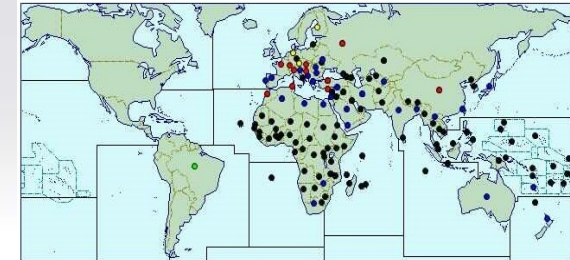
Pests of National significance

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

Pests of Regional significance

Sl. No.	Insect and mite pests		States of occurrence
	Common name	Scientific name	
1.	Leafhopper	<i>Amrasca biguttula biguttula</i> Ishida (Hemiptera: Cicadellidae)	Madhya Pradesh, Rajasthan, Uttar Pradesh, Tamil Nadu
2.	Cut worm	<i>Agrotis ipsilon</i> (Hufnagel) (Hemiptera: Cicadellidae)	Jammu & Kashmir
3.	Aphids (Hemiptera: Aphididae)	<i>Myzus persicae</i> (Sulzar)	Bihar, Rajasthan, Karnataka
		<i>Aphis gossypii</i> (Glover)	West Bengal, Punjab
		<i>Aphis fabae</i> Scopoli	Rajasthan
		<i>Aphis craccivora</i> Koch	Uttar Pradesh
4.	Mealybug	<i>Phenacoccus solenopsis</i> Tinsley (Hemiptera: Pseudococcidae)	Andhra Pradesh, Uttar Pradesh, Punjab

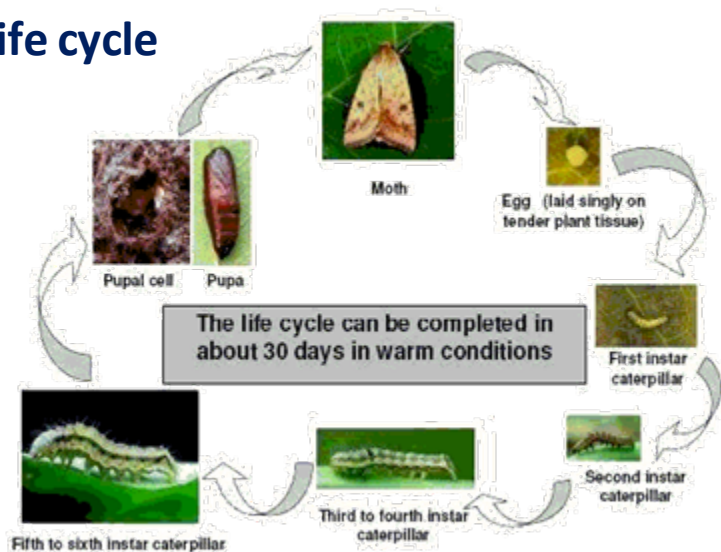
Fruit borer: *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae)



● = Present, no further details ● = Widespread ● = Localised
 ● = Confined and subject to quarantine ● = Occasional or few reports
 ● = Evidence of pathogen ● = Last reported... ● = Presence unconfirmed
 ● = See regional map for distribution within the country

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

Life cycle



Nature of damage

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

Symptoms of damage



1	Bored fruits with round holes
2	Rotting and premature dropping
3	Fed leaves, shoots and buds.

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

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



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

Life cycle



Nature of damage

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

Symptoms of damage

1	Yellowing of leaves
2	Downward curling and drying of leaves
3	Stunted growth
4	Vector of tomato leaf curl disease



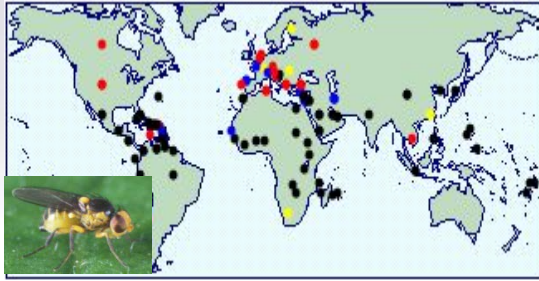
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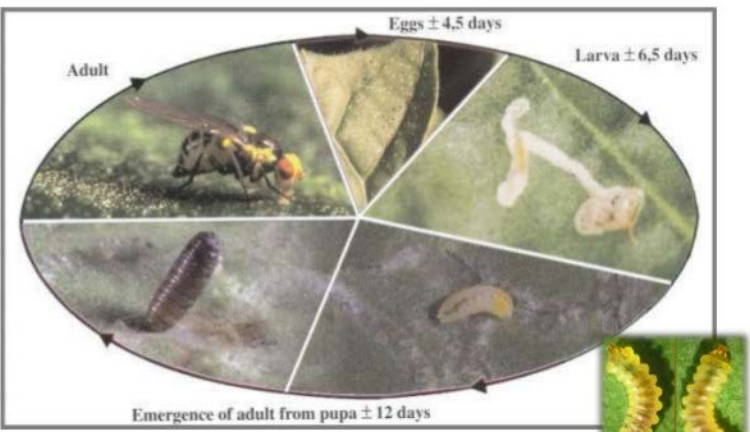
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Favourable conditions: Warm weather condition

Serpentine leaf miner: *Liriomyza trifolii* (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

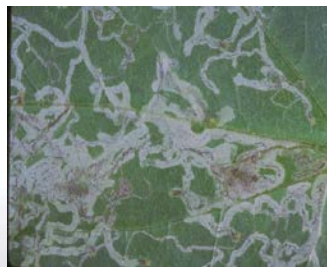


Nature of damage

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

Symptoms of damage

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



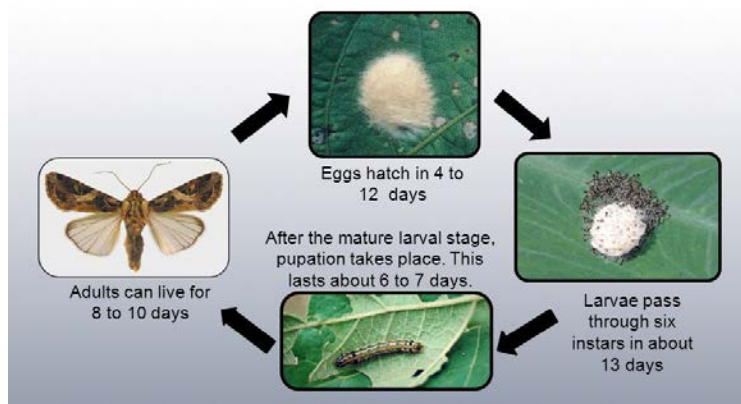
Favourable conditions: Warm weather condition

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

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

Symptoms of damage

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

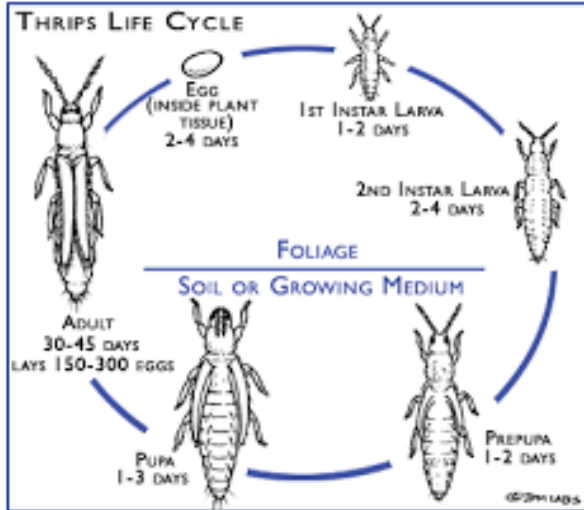


Favourable conditions: Warm weather and rainy conditions

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.



Nature of damage

- | | |
|----|--|
| 1. | Both larvae and adults feed on leaves and fruits |
| 2. | Feeding is by laceration and sucking of oozing plant juice |

Symptoms of damage

- | | |
|----|--|
| 1. | The affected tissue appears as whitish spots or silvery spots or streaks |
| 2. | In advanced injury the tissue develop necrotic patches |
| 3. | Affected fruit develop corky or rough surface |



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

- | | |
|----|---|
| 1. | Both larvae and adults feed on leaves by constructing spider like webbing on leaves |
| 2. | With chelicerate mouth parts, they rupture the cells and feed on oozing sap |

Symptoms of damage

- | | |
|----|--|
| 1. | Initially white speckling found on upper surface of leaves |
| 2. | Later, they turn into bronze colour due to development of necrotic patches |

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 great economic importance in Latin America and the Mediterranean basin. Also known to attack many other solanaceous crops like brinjal, potato etc.

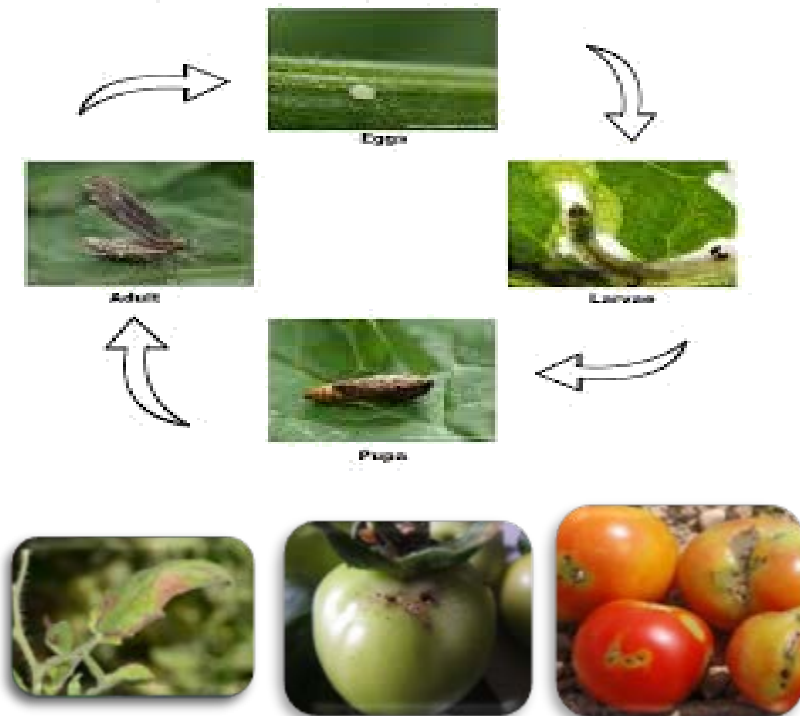
Nature of damage

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

Symptoms of damage

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

The Life Cycle of *Tuta absoluta*



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

I. Resistant or tolerant varieties

Tomato leaf curl virus	Arka Ananya, Kashi Vishesh, Kashi Amrit, COTH 2, TNAU Tomato Hybrid Co3
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II. Pre-sowing operations

Operations	Target insect/s
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

III. 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

IV. Management in the main field

A. 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.

B. Mechanical methods

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

C. 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, Helicoverpa
3	Install pheromone traps @ 4-5/acre for monitoring Helicoverpa and 10-12 traps/acre for mass trapping of pinworm (replace the lures with fresh lures after every 2-3 weeks)	Helicoverpa, Pinworm

D. Biological control

Sl. No.	Operations	Target pest
1	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	Helicoverpa, Spodoptera, pinworm
2	Spray Ha NPV / SINPV (@250 LE/ha) with 1% jaggery as sunscreen at 28, 35 and 42 DAP in the evening	Helicoverpa and Spodoptera
3	Spray NSKE 5% or azadirachtin 5% W/W neem extract concentrate @ 80 g in 160 l of water/acre	Helicoverpa, thrips, mites, hoppers

E. Chemical control

Sl. No.	Chemicals	Target pest
1	Fifteen days after planting spray imidacloprid 200 SL @ 0.4ml/l or thiomethoxam 25 WP @ 0.3g/l of water	Whitefly, thrips, aphids
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	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 chlorantranilioprole 18.5% SC @ 0.3ml/l or lambda-cyhalothrin 4.9% CS @ 0.6 ml/l of water	Helicoverpa, Spodoptera and pin worm

THANK YOU