



Insect-Pests of Tomato and their Management



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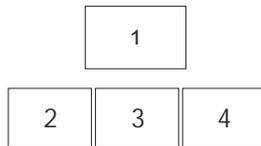
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1. Healthy tomato fruits at IPM adopted Narayana village, Akhnoor, Jammu
2. Pheromone trap catches
3. Bored fruit by *Helicoverpa* larva
4. Pupa of *Campopletes chloridae*

Back cover



1. Farmer Field School at Pahariwala Village, Akhnoor, Jammu

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Pest Complex of Tomato and their Management

Shankar, U., Kumar, D., Singh, S. K. and Gupta, S.

Introduction

Solanaceous vegetables are the important and economically group of vegetables including brinjal (*Solanum melongena*), tomato (*Lycopersicon esculentum*) and chillies (*Capsicum annum*). These crops are extensively cultivated in South East Asia and in Indian sub- continent for their taste and nutritive value. Tomato is a very popular constituent of Indian diet. These popular crops are devastated by an array of insect pests, however the major losses are caused by fruit borers (*Helicoverpa armigera*) and (*Spodoptera litura*), serpentine leaf miner (*Liriomyza trifoli*), tomato fruit fly (*Bactrocera tau*), white flies (*Bemesia tabaci*), tomato thrips (*Frankliniella* spp.), aphids (*Aphis gossypii*), red mites (*Tetranychus* spp.) and tomato mealy bug (*Phenacoccus solenopsis*), the later five being the vector also for transmitting the viral diseases in tomato crop. Due to certain aberration in climatic change, some insect pests which were earlier considered as minor pests have now assumed the status of major pests. These include serpentine leaf miner, fruit fly, mealy bugs, red mites, thrips and white flies. Besides these insects, stink bugs are also recorded causing damage to the tomato fruits.

Insect pests of Tomato

Tomato Fruit borers

1. Tomato fruit borer, *Helicoverpa armigera* Hubner

Helicoverpa is a very serious insect pest of several vegetable crops and has been reported on more than 200 host plants in India. Caterpillars are the immature stage of



Egg



Larva feeding on flower



Defoliating leaves



Fruit damage by larvae



Moth laying eggs on leaf

the insect which causes the considerable damage to the crops in various stages. In the pre-fruiting stage, the caterpillar feeds on the tender foliage including leaves, flowers, buds and even sometimes they make holes in the tender twigs which reflects the perforated look to the crops. After fruiting, the larvae bore large, clear, circular holes into fruits and feed on the pulp. Its name has been changed according to its host. Its larvae are stoutly built and robust. In tomato, it is responsible to destroy many fruits and make them unfit for the human consumption. Its larvae have peculiar feeding habit on host crop. The larvae thrusts its half of the body into the fruits and feeds the inner contents and rendering them unfit for the human consumption. A specific phenomenon cannibalism is found among its larvae. A great colour variation have also been observed among its larvae which scientists opined that it is due to its substrate/host food consumption but the recent studies proved that it is due to their genomic make up. It causes damage up to the tune of 50 to 80 per cent if not intervened at right time.

Management

Combination of various control methods

- Soil solarization in nursery beds as well as in the main field.
- Plant one row of marigold as trap crop for every 16 rows of tomato.
- Monitor and clip top three tender leaves for *Helicoverpa* eggs destruction.

- Seed treatment with *Trichoderma herzianum* @ 4g/ kg of seeds.
- After 25 days of transplanting give 2-3 sprays of NSKE 4% at days interval.
- Erection of bird perches @ 50/ha for the insectivorous birds (Black drongo).
- Installation of pheromone traps @ 5-7 per ha for early detection and 12-15 per ha for trapping and mass destruction for mating disruption.
- Release *Trichogramma pretiosum* @ 50,000 adults /ha per release (6 times) at weekly interval when eggs of *Helicoverpa* are noticed.
- Conservation of *Campoletus chloridae*, a potential parasitoid of *H.armigera*.
- Spraying of EPN *Steinernema carpocapsae* against *Helicoverpa* gave an excellent result in killing the larvae within 24 to 48 hrs.
- Spray *Ha-NPV* 250 to 500 LE/ha (freshly prepared) 2-3 times at 10 days interval at evening hours.
- Spraying of bacterial formulation *Bt* @ 500 g /ha also may proved beneficial in regulating the *Helicoverpa* larvae in the field condition.
- Early maturing varieties should be planted to escape the damage by borers.



Trap catches



Traps and bird perches



Mortality in larvae by EPN

Chemical Control

- Spraying of the following insecticides may proved effective in controlling the attack of *helicoverpa* in tomato.
- Endosulfan @ 3ml/ lit of water or cypermethrin @ 1 ml/lit water followed by
- Dimethoate @ 2ml/lit of water after 12 days of first spray.

2. Tobacco caterpillar, *Spodoptera litura* Fabricius

Spodoptera litura has also wide host range and economic insect pest of tomato but it is usually kept under damaging levels by management practices targeted to *Helicoverpa*

in tomato crop. The young larvae feed gregariously and scrape the leaves and later on it may completely defoliate the leaves. The insect is active during the entire year except severe cold months and females can lay up to 600 eggs each, usually in groups of about 100. Eggs are laid on the underside of lower leaves and are covered with fuzzy, white creamy scales. Under warm conditions, eggs hatch within two to three days. The neonate larvae feed from one to three weeks, in groups at younger stage and scattered on the plants when larger.



Egg mass and larvae



Defoliating larva



Magnified larva



Larvae damaging fruits



Adult moth



Trap catches

Management

- Summer ploughing is beneficial to expose the hibernating pupae to natural enemies and for bird predation.
- Hand picking and mechanical destruction of egg masses, caterpillars and spraying of NSKE 5% during early stage may proved beneficial.
- Installation of pheromone traps @ 25 to 30 /ha may be the useful tool for early detection and also for mass trapping and destruction of tobacco caterpillar.
- Spraying of *Splt* NPV @ 250 LE with gur or jaggary (10 g/lit) and sticker during evening hours may be the promising to control tobacco caterpillar.
- Foliar spray of *Bt* formulations @ 500 g/ ha is the good for controlling the

caterpillars.

- EPN may be quite promising to suppress the *Spodoptera* larval population in the field condition.
- Conserve and encourage the *Telenomus* spp. which were recorded as a predominant egg parasitoids of *Spodoptera litura* egg masses in tomato fields.
- Need based and alternate application of cypermethrin @ 1 ml per lit or endosulfan @ 3 ml per lit of water followed by imidacloprid @ 0.3 ml or dimethoate @ 2 ml per lit of water 12 days after first spray can also be used in case of severe infestation.

3. White-fly, *Bemisia tabaci*

Whiteflies are minute sized whitish yellow adults and nymphs and they suck sap from the leaves of the host plants and reduce the vitality of crops. They often congregate and can be seen on the underside of leaves. They also act like vector for transmitting the virus in tomato and disease is known as tomato leaf curl virus. Severe stunting of plant with downward rolling, crinkling of leaves and severe chlorosis of newly formed leaves takes place. Older leaves become leathery and brittle in severe infestation of white flies.



Whiteflies infested plant

Management

- Rouge out and burning of the infected plants in early stages.
- Use of delta traps or sticky traps for effective catching of whiteflies.
- Cover the nursery bed with Agronet or nylon net (200 gauge) or muslin cloth for 25-30 DAS to prevent entry of adults of whitefly.
- Root dipping of seedling in tetracycline solution 1000 ppm (1gm in 1 lit of water) followed by 3 spray after 10-12 days.
- Use of Carbofuran 3G @ 1.5 kg a.i. per ha as soil treatment in nursery
- Seed treatment with Gaucho @ 3 g/ kg seed provides protection from whiteflies at nursery.
- Spray metasystox @ 1.0 ml or imidacloprid @ 0.3 ml per lit of water.

4. Serpentine leaf miner, *Liriomyza trifoli*

Leaf miners cause heavy leaf mining on upper or lower side of the leaves. Mines starts



Adult miner laying eggs



Mines on leaves with larva



Pupa

From the margins of leaves and progress towards the base/centre of leaf. Mines are initially narrow and gradually enlarge often twisting through leaf which causes stippling of young seedlings. Severe leaf mining slows down the plant growth and accelerates the leaf drop.

Management

- Nuvon / DDVP or dimethoate @ 2 ml per lit of water are found to be effective against leaf miner.
- Hymenoptera (Eulophidae) an endo-larval parasitoid of leafminer, *Hemiptarsenus varicornis* is found to be very effective.
- Neem seed kernel extract (NSKE) @ 5 per cent concentration found promising in controlling leaf miner followed by Karanj, *Pongamia pinnata* oil next in the order of efficacy.

5. Tomato aphids, *Aphis gossypii*

Tomato aphids also feed on cucurbits, potato, okra, brinjal, chilli and peach etc. Both adults and nymphs suck sap from the underside of the young leaves in the early growth stage of tomato leading to curling and yellowing of leaves. They also secrete honeydew on which black sooty mould develops which inhibits the photosynthetic activity of the leaves. Besides this, they also acts as vector and transmit mosaic viruses in tomatoes.



Plant infested with aphids



Magnified aphids

Management

- Yellow sticky traps are quite successful in trapping aphids population.

- Spray 2 ml of Malathion 50 EC per lit of water or imidacloprid @ 0.3 ml /lit of water as and when the pest is noticed. If necessary, repeat the spray after 10-12 days.

6. Tomato fruit fly, *Bactrocera tau* and *Bactrocera cucurbitae*

Fruit flies have been found infesting the tomato fruits, growing shoots of brinjal and curds of cauliflower in and around the fields of Jammu region. The adult female flies have been found puncturing the tomato fruits even in unripe condition. This behaviour was confirmed through rearing in laboratory condition. Females lay eggs by inserting their ovipositor into the fruits. The eggs hatch within 7-10 days. The newly hatched maggots start mining

inside the fruits which become rotten due to secondary infection of bacterial. After attaining maturity, the maggots come out from the rotten



Fruit fly ovipositing eggs



Maggots emerges from rotten fruit

fruit and pupate in soil. The adult emergence takes 7-10 days.

Management

- Deep ploughing of fields during summer months to expose the hibernating pupae in sun or for parasitization by natural enemies.
- Flooding the entire fields.
- Application of carbofuron 3 granules @ 25-30 kg per ha at the time of field preparation.
- Use poison baiting for trapping the fruit fly population.
- Use Methyl Eugenol traps to kill the fruit fly adults population.

7. Tomato Thrips, *Frankliniella* spp.

Several species of thrips also infest tomatoes including western flower thrips, flower thrip and melon thrips. These are tiny, slender insects that may vary in colour from yellow to dark brown or black. Nymphs and adults usually prefer to feed in flowers but also feed in flower, leaf buds and on leaves. Thrips feeding in blossoms may cause

flower abortion and blossom drop, or fruit may not develop properly and become deformed. Feeding on foliage may cause a silvering of foliage.



Plant infested with thrips



Magnified thrips on fruit

Crops are at greatest risk

during flowering and fruit set

stage

of

Eggs inserted in fruit causes dimpling, and the infested area may appear white. Thrips are also vectors of tomato spotted wilt virus (TSWV). Infected plants have dark lesions on the foliage and fruit show characteristic halo markings.

Management

- Pirate bugs, lacewing larvae and ladybirds prey on thrips.
- Application of systemic insecticides like imidacloprid or thimethoxam or dimethoate after 10 days of transplanting may help to suppress the thrip population and delay the tomato spotted wilt virus symptoms in the field.

8. Tomato mite, *Tetranychus* spp.

Nymphs and adults of these mites lacerate the leaves from the lower surface and suck sap resulting in the production of white patches at feeding sites between main veins. In case of severe attack, intense webbing occurs that invites trapping of dust particles giving dusty and purplish appearance of leaves. The infested leaves dry up and fall off prematurely. The growth of the plant is hindered and fruit setting is greatly reduced.



Damaged plants



Eggs and adult red mites

Management

- Mechanical destruction of infested plant / spot application can check further spread of pest in field.
- Spray Metasystox 25 EC / Rogor 30 EC/ propargite 57 EC / dicofol 18.5 EC @ 2 ml per lit of water. If necessary, repeat the spray after 12 days.

9. Tomato mealy bugs, *Phenacoccus solenopsis*

Mealybugs are found infesting on leaves, stems and fruits of tomato, brinjal and okra in Jammu region during experimentation. They are covered with white wax, which makes them difficult to control. Both nymphs and adults suck the sap from leaves causing withering and yellowing of leaves. Fruit may drop prematurely on crop plants. Heavy infestation can cause defoliation and even death of the plants. The excess sap is excreted as honeydew which attracts ants and further development of sooty mould.



Infestation of mealybugs on flowers, leaves and shoots

Management

- The crop residues in earlier infested fields should be removed and burnt.
- Soil raking and field sanitation (free from weeds and debris) should be followed.
- Spray dichlorvos 76 EC 2 ml/l, chlorpyrifos 20 EC 2 ml/l, imidacloprid 200 SL 0.5 ml/l or malathion 2.5ml/l of water at 15 days intervals.

Diseases of Tomato

1. Damping off of Seedlings

Causative Agent: *Pythium* spp., *Phytophthora* spp. and *Rhizoctonia* spp.

Diagnostic Symptoms

Damping off disease attacks in two phases i.e., at pre emergence and post emergence

In pre emergence the seedlings are killed before emergence of soil surface

In post emergence the seedlings topple down from soil surface after emergence from soil



Damping off of seedlings

Management

- Soil amendment with neem cake @ 400 g / m sq area
- Addition of *Trichoderma* spp. @ 10 g / m sq area
- Raised nursery seed bed preparation and follow the soil solarization practices should be followed.
- Green manuring and addition of sand to the soil for making them well pulverized and well drained
- Light frequent irrigation and avoid heavy irrigation
- Seed treatment with Ceresan, Agrosan GN, Captan or Thiram @ 2.5 g / kg seed
- Drenching of copperoxychloride @ 2-3 g/lit of water as preventive use

2. Late Blight

Causative Agent: *Phytophthora infestans*

Diagnostic Symptoms

Disease can affect at any part of the plant and any time of the crop growth.

Lesion develop at any point on leaflet, petiole, stem or leaf.

Lesion advance rapidly to cause a severe blight under warm and humid conditions.

Dark olivaceous greasy appearing spots are formed on the entire plants and fruits.



Late blight in nursery

Management

- Collection and destruction of diseased plant parts
- Periodical spray of Sulfex, Bavistin, Benlet, Kelthane or Calixin or Mancozeb or
- Ridomil MZ @ 2g /lt water at 12 to 15 days interval after appearance of disease
- Avoid late planting
- Grow Resistant Variety

3. Early Blight

Causative Agent: *Alternaria solani*

Diagnostic Symptoms

Disease appear on the leaves as circular to angular ,dark brown to black spots.

Concentric rings often form leathery necrotic tissue.

Infected leaves wither droop and drop off. On the stem dark spots appear at any point and it leads to collar rot In case of pod infection the seeds are smaller in size and aborted



Alternaria leaf spot

Management

- Collection and destruction of diseased plant parts
- Seed treatments with Ceresan or Captan @ 2gm,/kg of seed before sowing.
- Spray of Dithane Z 78, Ziram or Dithane M - 45 @ 2g / lt water at 12 15 days interval in case of heavy infestation of disease

4. Buckeye rot or Fruit rot

Causative Agent: *Phytophthora parasitica*

Diagnostic Symptoms

The disease appear on the lower fruits in the form of spots.

The spots are pale brown with concentric rings.

These spots may be small or they may cover a major portion of fruit surface.

The circular spots at the blossom end, shrink and get mummified.



Fruit rot of tomato

Management

- Staking of plants.
- Collection and destruction of diseased plant parts
- Good soil drainage can prevent disease.
- Seed treatments with Agrosan GN @ 2.5 g/kg of seed before sowing.
- Spray of Dithane Z 78, Ziram, Dithane M - 45 @ 2g / lt water
- Difolatan @ 3 g / lt water at 12 to 15 days interval in case of heavy infestation of disease.



Staking of plants

5. Fungal wilt of tomato

Causative Agent: *Fusarium oxysporum*

Diagnostic Symptoms

Typical symptoms are wilting, stunting and yellowing of the foliage and finally collapse of the entire plant.

The vascular system becomes choked and turns brown.

The lower stems **doesn't exude the ooze** when cross cut and dip into the water (Ooze test).

The symptom mostly appears at the time of flowering and fruiting.



Fusarium wilt

Management

- Use of *Trichoderma* sp. Before transplanting the crop in main field
- Seedling dip in spore suspension of *Trichoderma* sp. @ 1×10^6 spores/ml
- Seedling dip in 0.01 per cent solution of carbendazim for 20 to 30 minutes before transplantation
- Two to 3 sprays or drenching of carbendazim 0.01 per cent at 12- 15 days interval

6. Bacterial wilt of tomato

Causative Agent: *Pseudomonas solanacearum*

Diagnostic Symptoms

Typical symptoms are wilting, stunting and yellowing of the foliage and finally collapse of the entire plant.

The vascular system becomes brown.

The lower stems exude the bacterial ooze when cross cut and dip into the water (Ooze test).



Milky secretion from bacteria infected plant



Ooze test

The most conspicuous symptoms is sudden drooping of leaves without yellowing and rotting of the stems.

The symptom mostly appears at the time of flowering.

Management

- Grow cruciferous plant in the infested field.
- Collection and destruction of diseased plant parts
- Seedling dip in 25 ppm (1 g / 40 lit water) solution of Streptocyclin
- Periodical spray of Streptocyclin @ 100 ppm at 12- 15 days interval before flowering stage (at least 2, one after transplantation and second at the flowering stage)
- Cultivation of resistant variety, if available.

5. Leaf curl of tomato

Causative Agent: Tobacco virus transmitted by insect vector *Bemisia tabaci*

Diagnostic Symptoms

Severe stunting of plant with downward rolling and crinkling of leaves. Severe chlorosis of newly formed leaves

Leathery and brittle older leaves



Leaf curl symptoms

Management

- Rounding and burning of diseased plants
- Spray of Metasystox 25 EC @ 1.25 ml per lit. or Imi dactoprid @ 0.5 g per lit.
- Use of Carbofuran @ 1.5 kg a.i. per ha as soil treatment in nursery
- Use of Carbofuran 3 G @ 20 kg per ha as soil treatment in main field at the time of

transplanting

Potential natural enemies fauna in tomato crops

Coccinellids beetle were recorded to regulate the mealy bugs in field conditions.

Predatory bugs, *Eocanthecona* spp. were found predated on the *Helicoverpa* and *Spodoptera* larvae in the field conditions.

Telenomus spp. of parasitoids were found parasitizing the egg masses of *Spodoptera litura* and their egg masses have also been recovered from tomato fields.

Another abundant larval parasitoids, pupae of *Campoletus chloridae* were collected from tomato fields and brought to the laboratory for emergence of adults to ascertain the *Campoletus* species.

Black drongo or king crow were also observed predated the fruit borers larvae from tomato field. To increase the visit of black drongo, bird perches should be installed in the fields.

Spiders are generalist predators of insects and various type of spider species were noticed in tomato crops to predate upon small larvae.



Lady beetle



Telenomus spp.



Campoletus chloridae



Spider



Black drongo



Parasitized mealy bugs



Insect-Pests of Tomato and their Management



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