International Journal of Zoology Studies
www.zoologyjournals.com
ISSN: 2455-7269
Received: 10-04-2024, Accepted: 03-05-2024, Published: 27-05-2024
Volume 9, Issue 2, 2024, Page No. 20-23

Disease and pest associated with tomato cultivation and their integrated management in the locality of Rewa (M.P.)

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Abstract
Tomato is one of the most important vegetable crops of India. They are also a very popular garden plant among home owners. Tomato production whether for commercial or personal use is not always an easy task. The pest and diseases are biotic constraints of tomato production. The plant can be damaged at all stages of growth, leading to reduced or poor quality yields. However the major losses are caused by fruit borer (*Helicoverpa armigera*) and tobacco caterpillar (*Spodoptera letura*), Serpentine leaf miner (*Liriomyza tri follii*), White fly (*Bemesia tabaci*) and Aphids insect pest as the also act as vector for transmitting viral disease. Besides these various diseases caused by bacteria, fungi and viruses illustrated in this study were the major causative agents of the less yield of tomato and failure of the crops. During the fruiting stage tomato plants enter the crucial period of growth and development and are susceptible to various diseases and pest attacks that can hinder the health and productivity of tomato crops. This paper describes some of the important insect pests and diseases of tomato and their control in the locality of Rewa (M.P.)

Keywords: *Solenum lycopersicum*, Integrated, plant sap, lessions, anthracnose

Introduction
The tomato is the edible berry of the plant *Solanum lycopersicum* commonly known as the tomato plant. Its domestication and use as a cultivated food. Tomato significant source of Umami favour. They are consumed in diverse ways; raw or cooked and many dishes, sauces, salads and drinks.

While tomatoes are fruit Botanical classified as berries, they are commonly used culinarily as a vegetable ingredient or side dish. Tomato plants are vines that have a weak stem that sprawls and typically need support. In determinant tomato plants are parennials in their native habitat but are cultivated as annuals. This is a good source of vitamins as well as cash crop.

Tomatoes wherever grown as fast for many kinds of insects. All parts of the plant offer food, shelter and reproduction sites for insects. Insects can cause un-thrifty growth or death of the tomato plant and damage to fruits in the form of scarring, tissue destruction and aberration in shape or colour. Insects attack the tomato in a number of ways. They may eat the foliage and fruit, destroy the roots, suck sap from the plants, or transmit harmful diseases to organisms and cause severe yield losses and even sometimes complete crop failure.

This study explores the common pests and diseases that affect tomatoes, their symptoms and effective treatment options and the use of beneficial insects to prevent and manage tomato pests and diseases.

Material and methods
To study the common insect pests and diseases in tomatoes, the investigation was undertaken from agriculture farms, Garden and vegetable markets and other nearest localities of Rewa city and villages closer to the city Insects were collected from the sampling site by hand picking, shaking, or beating etc and equipment used for collection are Hair brush, Forcep, stick, Hand net, killing bottle. The killed insects are kept in bottles for temporary storage with naphthalene balls to prevent fungus attack.

The diseased were identified and analyze by collecting samples of the various parts of plant parts and tomatoes to the laboratory and with the use of various slides and microscope the disease causing agent were identified and described.

Result and discussion
Weekly observation and investigation during the life of tomato plants the result obtained and shows the following

Tomato diseases and their management
The goal of plant disease management is to reduce the economic and aesthetic damage caused by plant disease.

a. Septoria Leaf Spot *(Septoria lycopersica)*
The plant may attack at any stage of growth of the tomato plant. The disease is characterised by numerous, small, grey, circular leaf spots having dark borders.

Control: Removal and destruction of the affected plant parts. Seed treatment with Dithane M-45 (2g/kg seeds) is useful in checking seed borne infection. In the field spray with Dithane Z-78 (0.2%) effectively controls the disease.

b. Damping off *(Pythium aphanidermatum)*
Damping off tomatoes is one of the worst tomato diseases of tomatoes occurring in nurseries. This disease occurs in two stages: pre- emergence and post- emergence phase.

Pre-emergence phase: The seedlings are killed just before they reach the Soil surface.

Post emergence phase: The infection of the young Juvenile tissue of the collar at the ground level. The infected tissue becomes soft and water soaked. The seedling Topple over and collapse.

Control
Seed treatment with fungal culture *Trichoderma viride* (4g/kg seeds) are the only preventive measure for the pre-emergence damping off. Soil draching of the affected seedling with Dithane M 45(3g/liter of water) helps to reduce disease incidence.

c. Early Blight *(Alternaria solani)*
his is the common disease of the tomato occurring in any stage of the growth. The fungus attacks the foliage causing characteristic leaf spots and blights. Early blight is first observed on the plant as a small black lesion mostly on the older foliage. Spots enlarge concentric rings in a bull's eye pattern can be seen in the centre of the diseased area. Tissue surrounding the sport may turn yellow. The fungus also infected the fruit generally through the calyx or stem attachment.

Control
Removal and destruction of the affected plant parts. Practicing crop rotation helps to minimize the disease incidence. Spraying the crop with Difolatan (0.2%), Dithane M-45 (0.2%) or Bavistin (0.1%) is recommended for effective disease control.

d. Fusarium Wilt *(Fusarium Oxysporum f. Sp. lycopersici)*
It is also the worst tomato disease of tomatoes occurring mostly in the nurseries. The symptoms include the clearing of the vein let and chlorosis leave. The younger leaves may die in succession and the entire may wilt and in a course of a few days soon the petiole and leaves droop and wilt. In field yellowing of the lower leaves first and affect leaflet wilt and die. At later stage browning of the vascular system occurs plants become stunted and die.

Control
The nursery should be regularly inspected for wilt infected plants. The affected should be removed and destroyed. Before planting the bed should be drenched with Carbendeazim (0.1%) and the seeds should be treated with the Thiaram (2.5 kg/hect.) crop rotation without cereals to help reduce the disease inoculum.

e. Bacterial Wilt *(Pseudomonas Solanacearum)*
This is one of the most serious diseases of tomato crops. The initial symptom is the wilting of a few of the youngest leaves. The disease progresses rapidly in hot weather and the entire plant wilts suddenly and dies. In cooler conditions wilting is less rapid. Lower leaves may drop before wilting is mostly confined to the vascular region; in advantage cases, it may invade the cortex and pith and cause yellow - brown discolouration of tissue.

Control
Seedling treatment with streptocycline (1g/40 litre) of water for 30 minutes. Protects the seedling in the initial stage of growth.

f. Tomato mosaic virus (TMV)
The disease is characterized by light and day green mottling on the leaves often accompanied by wilting of young leaves on sunny days when plants first become infected. The leaflets of the affected leaves are usually desorted, puckered and smaller than normal size. Sometimes the leaflets become indented resulting in 'fem leaf' symptoms. The affected plant appeared stunted, pale green and spindly, dark necrotic streaks may appear on stems, petioles, leaves and fruit. It may spread through contact with clothes, hands of working labour, touching of infected plants with healthy ones, plant debris and implements.

Control
Seeds from disease free healthy plants should be selected for sowing shoaking of the seeds in a solution of Trisodium phosphate (90 g/litre of water) a day before showing helps to reduce the disease incidence. Seedlings infected with the viral disease should not be used for transplanting.

g. Fruitrots, Anthracnose (*Colletotrichum phomoides*)
Firstly, the infected fruit shows small, slightly sunken, water soaked spots. These spots enlarge, become darker in colours, depressed and concentric rings. Masses of the pink fruiting fungus can be seen on the surface of lesions in moist weather, under warm and humid conditions the fungus penetrates the fruit completely destroying it. The fungus persisting on infected plants refuse in soil.

Control
Control of this disease involves the use of well drained soil, crop rotation and a preventative fungicide program is recommended.

h. Late Blight (*Phytophthora infestans*)
Late blight occurs when humid conditions and mild temperature for prolonged periods. If conditions are ideal for disease development rapid causing severe economic losses. Irregular large greenish - black lesions produced on leaves first. These areas enlarge rapidly, becoming brown and develop a white moldy growth near margins of the disease area on the lower surface of the leaf or on the stem. The disease spread rapidly under humid conditions destroying quickly large areas of tissue. The disease attacks the fruits as well as the leaves of the plant.

Control
Control practice includes using disease free seeds and transplants, rotating fields. Adopting certain prophylactic measures can also control disease. Before planting seeds would be treated with Thiaram (2-3g/kg of seeds). The plants should be sprayed with Captafol (2g/litre of water) or Dithane M45 (2g/kg of seed) at 15 days interval, starting from 30 days after transplanting.

Insect pest of tomato and their management

In the recent past with changes in the cropping pattern, ecosystem and habitat, climate and wider use of hybrid varieties, there has been a Paradigm shift infestation of pests in time and space. These pests cause huge losses depending upon infestation severity some of them are-

a. Tomao Fruit Borer (*Helicoverpa armigera*) (Lepidoptera: Noctuidae)

Young Lava scrap and feed on tender leaves for sometime and then attack fruits and eat the internal content of the fruit bored with round holes. Warm weather conditions with light rains and dry spells are favourable for multiplication.

Control

Soil solarisation in the nursery bed as well in the main field. Seed treatment through Tricoderma herzianum (4g/kg seed). After 25 days of transplanting give 2-3 sprays of NSKE 4% at the day's interval. Conservations of *Cumpoletus chloride*, a potential parasitoid of *H. armigera.*

b. Serpentine Leaf Minor (*Liriomyza trifollii*) (Diptera: Agromyzidae)

Eggs are a minute Orange in colour. Minute Orange yellowish apodous maggots mines into leaves, eats chlorophyll and causes serpentine mines leading to drying and drooping of leaves. Yellowish pupas are noticed within the leaf mines. Warm weather conditions are favourable for multiplication.

Control

Nuvon/DDVP or Dimethoate (2ml/litre of water) are found to be effective against leaf miner, Hymenoptera (Euloiphidae) an endo-larval parasitoids of leaf miner *Hemiptaresenus vericornis* is found to be very effective. Neem Seed Kernel extract (NKSE) 5% concentration found promising in controlling leaf miner.

c. White Fly (*Bemisia tabaci*) (Hemiptera: Aleyrodidae)

Eggs are pear shaped light yellowish stacked both nymph and adults suck the plant sap from the ventral surface of leaves due to which chlorotic spots yellowing wrinkling and curling of leaves is commonly notice. White flies also act as vector of tomato leaf curl disease.

Control

Use of delta trap or sticky trap for effective catching of white flies. Root dipping of Seedling in Tetracycline solution 1000 ppm (1g/litre of water) followed by 3 sprays after 10-12 days use of carbofuran 3G (1.5kg/hect.) as soil treatment in nursery.

d. Tomato Aphids (*Aphis gossypii*)

Both nymphs and adults suck sap from the underside of young leaves in the early growth stage of tomato leading to curling and yellowing of leaves. They also secrete honey dews on which black sooty mould develops which inhibits the photosynthetic activity of leaves. They also act as vector and transmit mosaic virus in Tomato (TMV)

Control

Yellow sticky Traps for trapping effects are quite successful. Spray 2 ml of malathion (50EC/litre of water) or Imiclacloprid (0-3ml/litre of water) as and when the pest is noticed. If necessary repeat spray after 10-12 days.

e. SPIDER MITES (*Tetranychus urticae*)

Nymph and adults lacerate the leaves from the lower surface and suck sap resulting in white patches in between the main vein. Severe infestation silken and webbing on the leaves occur and leaves dry and wither. The growth of plants hindered flowers and fruit formation.

Control

Spray Metasystox 25EC/Rogger 30EC/propargite 57EC/Dicifol 18.5EC; 2ml/litre of water. If necessary repeat the spray after 12 days.

f. Tobaco Caterpillar (*Spodoptera Litura Fabricus*)

The young larva feed gregarious and scrap the leaves and later on it may completely defoliate the leaves. The insect is active the entire year except severe cold months. It feeds chlorophyll content and gives the leaf a papery white appearance. Irregular holes on leaves initially and later skeltonized leaving only veins and petioles. Bored fruits with irregular holes.

Control

Summer ploughing is beneficial to expose the hibernating Pupae to natural enemies and for birds predation. Hand picking and mechanical destruction of egg masses, caterpillars and spraying of NSKE 5% during early stage may proved beneficial spraying of *Splt* NPV 250 LE with gur or jaggery (10gm/litre) and sticker during evening hours may be the promising to control tobacco caterpillar. Conserve and encourage the Telenomus spp. which were recorded as a predominant egg parasitoids of *Spodoptera litura* egg masses in tomato fields.

Potential natural enemies in tomato crop field Natural management

1. Coccinellids beetles were recorded to regulate Aphid population in field condition.
2. Predatory bugs, *ecanthcona* spp. They were found predating *Helicoverpa* and *Spodoptera* larva in the fields.
3. *Telenomus* spp. of parasitoids were found parasitizing the egg masses of tobacco caterpillars.
4. Another abundant larval parasitoids, pupae of *Compoletus* chloride, were found in the tomato field.
5. Black drango or king crow were also observed predating the fruit borer larva from the tomato field.
6. Spiders are generalist predators of insects and various types of spider species were noticed in tomato fields to prey upon small larva.

Conclusion

Tomatoes are affected by several of the insect pests and diseases that wreak havoc on their productivity. Tomato diseases are caused by fungi, bacteria, virus, nematodes or

unfavourable environmental conditions. The various diseases observed and identified were described in this paper

All the tomato insects are more or less general feeders. Preventing the tomato plant becoming heavily infested with insects is often a great help in reducing injury to tomatoes. Insects attack the tomatoes in a number of ways. They may eat foliage and fruit, destroy the route, suck sap from the plant or transmit harmful disease organisms. The type of infestation and injury depend largely upon the feeding habit of the insect.

The main objective of this study is to identify and observe the various disease and insect pests of tomato crops which the farmers face and the various control measures taken by them to overcome these biotic constraints, and we can stop this in their tracks before they inflict too much.

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