

B.Sc. (Honours) Part -1

Paper-II

Topic- Transmission of plant viruses and control measures

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Type- UG

Course- B.Sc.

Faculty-Science

Subject- Botany

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TRANSMISSION OF PLANT VIRUSES AND CONTROL MEASURES

Plant viruses are type of viruses that specifically invade plants. Viruses are obligate parasites that require a living host for their growth and multiplication. Viruses enter the plant cell through plasmodesmata and to various plant parts by the phloem. Plant Viruses are made up of two components a protein coat and the nucleic acid center. The nucleic acid is the major infectious component of a virus, once the virus enters the plant cell they shed their protein coat and multiplies by itself. Plants and humans do not transmit viruses to each other, but through physical contact human can spread plant virus infection. Viruses may also spread through infected seeds, grafting, wind, splashing, pollination, and dripping sap.

Unlike human beings, plant cell cannot recover viral infection in their lifecycle. Plant viruses cause major damage to the farmer's economy by affecting on crop yield. Viruses cause an estimated of US\$60 billion loss in crop yields worldwide each year. The first virus to be discovered was *Tobacco mosaic virus* (TMV). Plant viruses are grouped into 73 genera and 49 families.

Plant virus transmission and transmission mechanisms

Plant cells are made up of rigid cell wall and viruses cannot penetrate them easily so viruses transmitted through

1. **Insects:** Insects acts as a vector group for the Plant virus transmission.
2. **Aphids,** B. Whiteflies, C. Hoppers, D. Thrips
3. **Nematodes**
4. **Mites**

Plant cells are eukaryotic cells that are similar to animal cells. Plant cells, however, have a cell wall that is nearly impossible for viruses to breach in order to cause infection. As a result, plant viruses are typically spread by two common mechanisms: horizontal transmission and vertical transmission.

- **Horizontal Transmission:** In this type of transmission, the plant virus is transmitted as a result of an external source. In order to "invade" the plant, the virus must penetrate the plant's outer protective layer. Plants that have been damaged by weather, pruning, or plant vectors (bacteria, fungi, nematodes, and insects) are typically more susceptible to a virus. Horizontal transmission also occurs by certain artificial methods of vegetative reproduction typically employed by horticulturists and farmers. Plant cutting and grafting are common modes by which plant viruses may be transmitted.
- **Vertical Transmission:** In vertical transmission, the virus is inherited from a parent. This type of transmission occurs in both asexual and sexual reproduction. In asexual reproductive methods such as vegetative propagation, the offspring develop from and are genetically identical to a single plant. When the new plants develop from the stems, roots, bulbs, etc. of the parent plant, the virus is passed along to the developing plant. In sexual reproduction, viral transmission occurs as a result of seed infection.

In most cases, scientists have been unable to find cures for plant viruses, so they have been focusing on reducing the occurrence and transmission of the viruses. Viruses are not the only

plant pathogens. Infectious particles known as viroids and satellite viruses cause several plant diseases as well.

Types of Viral diseases in plants are

1. Tobacco Mosaic Virus

Host/crop- Tobacco, Pepper, Potato, Tomato, Eggplant, Cucumber and Petunia

Transmitting agent- Insects or other physical damage

Symptoms - Discoloration of leaves.

2. Cauliflower Mosaic Virus

Host/crop - Cucumber, Tomato, Peppers, Melons, Squash, Spinach, Celery, Beet and other plants.

Transmitting agent- Aphids

Symptoms - Twisting in young leaves that stunts growth of the entire plant and causes poor fruit or leaf production.

3. Barley Yellow Dwarf

Host/crop- Grains and staple crops, including wheat

Transmitting agent- Aphids

Symptoms - Discoloration of leaves and the tips of the plants, which reduce photosynthesis, stunts growth and decreases production of seed grains.

4. Bud Blight

Host/crop - Soybeans

Transmitting agent- - Nematode

Symptoms - Stem to bend at the top and the buds to turn brown and drop off the plant.

5. Sugarcane Mosaic Virus

Host/crop - Sugarcane

Transmitting agent- Aphids and infected seeds

Symptoms - Discolors leaves stunts the growth of young plants.

6. Lettuce Mosaic Virus

Host/crop - Lettuce

Transmitting agent- Aphids and infected seeds

Symptoms - Mottles the leaves of lettuce, stunting its growth and eliminating its market appeal.

7. Maize Mosaic Virus

Host/crop - Maize

Transmitting agent- Leafhoppers

Symptoms - Yellow spots and stripes on the leaves of corn, stunting its growth.

8. Peanut Stunt Virus

Host/crop - Peanut

Transmitting agent- Aphids and sap

Symptoms - Discoloration and distortion of the leaves of peanuts and some other rhizomes, stunting their growth.

9. Leaf curl Virus

Host/crop - Cotton, Papaya, Bhendi, Chilly, Capsicum, Tomato, Tobacco

Transmitting agent- white flies

Symptoms - Upward and downward curling of leaf and leaf thickening.



Tobacco mosaic virus



Cauliflower mosaic virus



Barley yellow dwarf



Bud blight



Sugarcane mosaic virus



Lettuce mosaic virus



Maize mosaic virus



Peanut stunt virus



Leaf curl virus

Control of Plant Viral diseases:

1. Avoiding exporting or importing of viral disease plant materials to disease free localities through quarantine law certification and inspection.
2. Selection of viral disease free seeds from the disease free regions.
3. Selection of viral disease free planting materials like Cutting, bull, rhizomes, tubers etc.
4. Cultivation of trap crops will avoid disease causing insect vectors Eg: Marigold in bhendi for white fly control.
5. Application of Soil Fumigation for Nematodes transmitted viruses to control nematodes.
6. Destruction of weeds that serve as host for virus causing viral disease in plants Ex. broad leaf weeds in banana.
7. Cultivation of resistant varieties will avoid viral disease in plants

8. Application of temperature treatment Ex. Sugarcane mosaic can be destroyed or reduce by hot water treatment 52⁰ C for 30 minutes.
9. Application of Insecticides will controls the insect vectors that that serve as host for virus causing viral disease in plants.

Products that control Viruses

1. **Aphids-** UPL PHOSKILL INSECTICIDE, ACTIVE GOLD NEEM OIL, AZAAL NEEM OIL, JASHN INSECTICIDE, KORANDA 505 INSECTICIDE
2. **Nematode -** FMC FURADAN INSECTICIDE
3. **Leafhoppers-** UPL PHOSKILL INSECTICIDE
4. **White flies-** ANANT INSECTICIDE, ACTIVE GOLD NEEM OIL, AZAAL NEEM OIL
5. **Virus-** V-BIND VIRICIDE