

## **Transmission of Viruses**

- Viruses must be brought in contact with the contents of living host cells. They achieve this quite effectively by transmission from an infected plant to a healthy plant in a number of ways.

### **Through vegetative propagation**

- The viruses are transmitted from the infected plant parts to the healthy ones of the same generation and it results in only primary infection and occurs in monocyclic diseases.
- Examples are mosaics and leaf roll of potato, and sugarcane viruses.

### **Mechanical transmission through sap**

- Some viruses can transmit from diseased to healthy plants through the mechanical transmission of the infected sap by touch.
- Virus infected sap adhering to tools, implements, insect mouth parts, and body, hands, clothes of man etc. can transmit viruses to the wounded plant cells.
- This type of mechanical transmission is wide spread in *Tobacco mosaic virus* (TMV), *Potato virus X*, etc.

**Seed transmission:** Majority of seed transmitted viruses are carried internally.

- Virus may be carried to the seed from the infected ovule or the pollen.
- A small percentage show seed transmission.
- Examples are *muskmelon mosaic virus* in watermelon, *barley stripe mosaic virus*, *tobacco ring spot virus* in soybean, *common bean mosaic virus*.

### **Pollen transmission**

- Pollen transmission of virus occurs in sour cherry infected with *Prunus necrotic ring spot virus*.

### **Insect transmission**

- Aphids, leaf hoppers, white flies, mealy bugs and scale insects constitute the insect vectors. However, aphids and leaf hoppers transmit a larger number of viral diseases and are most important .
- The viruses can be classified as:
  - a) **Stylet borne viruses** (mostly aphid transmitted), which do not go into the system of insects and remain near the tip of the stylet and are lost after one or two visits. They are also called ‘non-persistent viruses, e.g., *Cucumber mosaic virus*, *Papaya ring spot virus*, etc.
  - b) **Circulative viruses**, mostly vectored by leaf hoppers, which take them into their system and after circulation, they are returned to the stylet, mixed with the saliva and are transmitted to healthy plants they visit, e.g., *Maize streak virus*
- Some viruses of circulative nature may multiply inside the insect body and are called as ‘**propagative viruses**’. Leaf hoppers transmitted viruses are mostly circulative and propagative in nature, e.g., *Tomato spotted wilt virus*
- c) **Persistent viruses**, which are acquired by leaf hoppers and are incubated for 1-2 weeks and become viruliferous. Once they start

transmitting viruses, they remain infective for long periods or even for rest of their life, e.g., *Banana bunchy top virus*.

- d) **Transovarial transmission**, in which the viruses once acquired are transferred to their following generations.

**Examples of other Insects transmitting viruses:**

- Green peach aphid transmits *potato virus Y (Potyvirus)* and *potato leaf roll virus (PLRV)*
- Leaf hoppers transmit *rice stunt virus*, *aster yellow virus* etc.
- White flies can transmit *Papaya leaf curl virus*, *Yellow vein mosaic virus*, *Tomato leaf curl virus*
- Mealy bug transmits Swollen shoot of cocoa
- Thrips transmit *Tomato spotted wilt virus*
- Beetles transmit *Squash mosaic virus*, *Cowpea mosaic virus* and *Turnip yellow mosaic virus*
- Grass hopper transmits *Tobacco mosaic virus (TMV)*, *Potato virus X (PVX)* and *Tobacco ring spot virus*.

**Mite transmission**

Mites transmitting viruses have piercing and sucking mouth-parts.

Examples are *Wheat streak mosaic virus*, *Peach mosaic virus* and viruses of sterility disease of pigeon pea. **\*(only on example)**

1.

**Fungus transmission:** Three major classes of fungi can transmit viruses.

**\*(only on example)**

(a) Chytridiomycetes- *Olpidium brassicae* transmits *Lettuce big vein virus*; and *Synchytrium endobioticum* transmits *Potato virus X* and *Potato mop top virus* .

(b) Plasmodiophoromycetes- *Polymyxa graminis* transmits *Wheat soil borne mosaic virus*, *Spongospora subterranea* transmits *Potato mop top virus*.

(c) Oomycetes- *Pythium ultimum* transmits *Pea false leaf roll virus*.

**Nematode transmission:**

2. **NEPO viruses**- *Longidorus* and *Xiphinema* species are shown to transmit several polyhedral viruses, such as *Grapevine fan leaf virus*, *Tobacco ring spot virus*, *Cherry leaf roll virus* and *Tomato black ring virus*.
3. **NETU viruses**- Species of *Trichodorus* and *Paratrichodorus* transmit tubular viruses, like *Pea early browning* and *tobacco rattle virus*.

**Dodder transmission:**

4. Plant viruses are also transmitted from one plant to another through the bridge formed between two plants by twining stems of the parasitic plant dodder (*Cuscuta sp.*)
5. Most commonly involved species are *C. campestris* transmitting *Cucumber mosaic virus*, *Tomato bushy stunt virus* and *Tobacco mosaic*

*virus*; and *C. subinclusa* is known to transmit *Sugar beet curly top virus*.

### **Symptoms of viral diseases**

- Viruses cause a number of symptoms on plants, like mosaic, mottle, vein clearing, vein banding, ring spots, enations, yellow vein mosaic, etc.