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Transmission of Plant Viruses

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Viruses are very small, sub-microscopic, infectious particles composed of nucleic acid and protein coat. They carry genetic information in nucleic acid, which typically encodes for two or more proteins. Translation of genome for producing proteins or replication and transcription for producing nucleic acid takes place in the host cell by using some of the host's biochemical "machinery". Viruses are not functionally active outside their host. They are therefore considered parasites and/or pathogens thus are called inert, crystalline organism.

Most viruses infect bacteria which are known as bacteriophages, whereas others infect fungi which are called mycoviruses, algae, protozoa, vertebrates, invertebrates or vascular plants. Viruses cause many important plant diseases like yellowing, mosaic, curling, vein-banding etc and are responsible for huge economic losses in production and quality all around the world. Infected plants may show a wide range of symptoms depending on infected disease but most coomon ones is leaf yellowing (either in the form of stripes or yellowing of the whole leaf), curling and/or other growth distortions like stunting of the whole plant etc. Viruses can be transmitted by various means such as through wounds, lenticels, vectors etc.

Yellow vein-banding on grapevine caused by *Grapevine fanleaf virus*

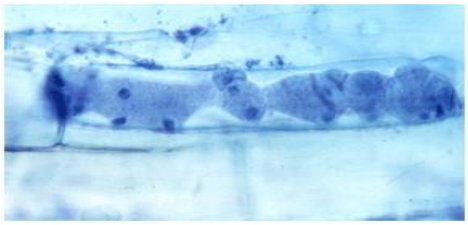
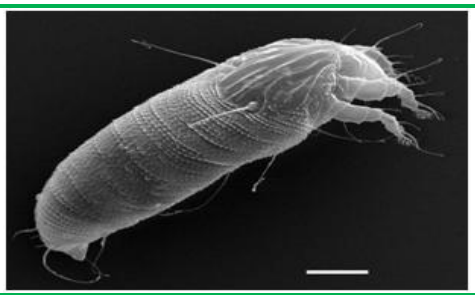
Fruit distortion on eggplant caused by *Tomato bushy stunt virus*

Bark scaling caused by *Citrus psorosis virus*

Transmission of Viruses: Cell of plants have a robust cell wall and viruses are unable to penetrate them unaided. Most plant viruses are therefore transmitted by the help of a vector organism that are introduced through wounds made during cultural operations (e.g. pruning). A small number of viruses can be transmitted to the seed through pollen (e.g. *Barley stripe mosaic virus*). The major vectors of plant viruses are:

- **Insects**. This forms the largest vector group which includes:

- **Aphids**: transmit viruses from many different genera,including *Potyvirus*, *Cucumovirus* and *Lute ovirus*. For example, green peach aphid *Myzus persicae*, which is the vector of many plant viruses like *Potato virus Y*.

○ **Whiteflies**: transmit viruses from several genera but particularly those in the genus *Begomovirus*. For example, *Bemisia tabaci* is a vector of *tomato yellow leaf curl.*	
○ **Hoppers**: transmit viruses from several genera, including those in the families *Rhabdoviridae* and *Reoviridae*. For example, *Micrutalis malleifera* is a treehopper vector of *Tomato pseudo-curly top virus*.	
○ **Thrips**: transmit viruses in the genus *Tospovirus*. For example, *Frankinella occidentalis*, the western flower thrips which is a vector of *Tomato spotted wilt virus*.	
○ **Nematodes**: these are root-feeding parasites, which transmit viruses in the genera *Nepovirus* and *Tobravirus*. For example, an adult female of *Paratrichodorus pachydermus* is the vector of *Tobacco rattle virus*.	
○ **Plasmodiophorids**: these are obligate parasites traditionally regarded as fungi that mainly infected roots of plants. They transmit viruses in thegenera *Bymovirus, Benyvirus, Pecluvirus, Furo virus* and *Pomovirus*. For example, *Polymyxa graminis* is the vector of *Barley yellow mosaic virus*.	
○ **Mites**: these transmit viruses in the genera *Tritimovirus* and *Rymovirus* . For example, *Aceria tosichella* is a vector of *wheat streak mosaic virus*.	

The virus-vector relationships are of several types:

- The association occurs within the feeding apparatus of the insect, where the virus can be rapidly adsorbed and then released into a different plant cell. The feeding insect looses the virus rapidly when feeding on a non-infected plant. Such a relationship is termed "non-persistent". For example, transmission of potyvirusby aphids.
- The virus is also taken up by the vector, circulates within the vector body and is released through the salivary glands. The vector needs to feed on an infected plant for much longer and there is an interval before it can transmit. Once it becomes infective, the vector will remain virulent for many days and such a relationship is termed "persistent" or "circulative". For example, transmission of luteovirus by aphids. In some cases, the virus multiplies within vector and this is termed "propagative".

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