

Plant viruses – the not so threatening kind

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Due to the coronavirus (COVID-19), the knowledge about virus infections has increased dramatically for most people, as it has caused havoc to people's health, travel plans and the economy. Plant viruses on the other hand, are not as threatening, but have in the past also caused major problems to people in a number of different ways.

The tulip breaking virus is most famous for its dramatic effects on the colour of tulip petals. This highly sought-after effect led to the tulip-mania in the Netherlands in the 17th century. Prices for one such bulb could be as much as the price of a stately home on the canals in Amsterdam.

As money was so easily made, more and more people joined the trade of virus-infected bulbs, which reached extraordinarily high levels and then dramatically collapsed in February 1637. Dutch commerce suffered a severe shock, but eventually recovered.

At the time of the mania, it was not known what was causing the tulip petals to 'break', as viruses were only identified early in the 20th century. In 1939, there were 129 plant viruses named. Now, we have about 1,000 officially recognised plant virus species. These figures relate only to cultivated plants, which represent a tiny fraction of the total number of plant species. Viruses in wild plants have received relatively little study.

Plant viruses are similar to human and animal-transmitted viruses, in that they are biological agents that reproduce inside the cells of living hosts. When infected by a virus, a host cell is used to produce thousands of identical copies of the original virus. While animals have an immune system that produces antibodies, which may ultimately eliminate the virus and confer lifetime immunity to the host, plants do not. Plants either have to live with it, or succumb.

The first plant virus discovered was the iconic tobacco mosaic virus. The discovery is accredited to A. Mayer (1886) working in the Netherlands, who demonstrated that the sap obtained from infected tobacco leaves



Tulipa 'Orange emperor' with virus infection.

developed mosaic symptom when injected in healthy plants. However, the infection of the sap was destroyed when it was boiled. Viruses cause an estimated \$60bn loss in crop yields worldwide each year.

As plants do not sneeze, travel, congregate and mingle in large groups, how do viruses spread from plant to plant? Just as many viruses are very specific as to which host plant they attack, each virus relies on a particular method for spreading and for that they use vectors.

Vectors are mostly sap-sucking insects (such as leaf hoppers or green flies), but can be other organisms too, such as soil-borne nematodes or gardeners taking cuttings and passing on sap from one plant to the next with their secateurs.

If a sap-sucking insect such as an aphid moves from one infected plant to a healthy plant, and injects its stylet into it, that can transfer the virus. Within the plant, viruses can spread through plasmodesmata (little openings between cells).

Plant virus transmission from generation to generation can also occur through seed (20% of plant viruses), but seed is usually a safe way to start clean again. If cuttings are taken from an infected plant, the virus is automatically taken with it.

Some plant viruses are attractive, such as the Abutilon mosaic virus.



The mosaic symptom is considered more interesting than the healthy plant, and it is often marketed as a form of variegation.

If you have plants infected with an unwanted virus infection, as plants cannot get rid of a virus, the best thing to do is place it on the compost heap and wash your hands.