Plant virology

INTRODUCTION

**Plant virology** is a diverse area of plant pathology. Research with plant viruses includes determining the basic molecular structure and mechanisms of viruses, studying the cellular interaction, understanding vector relationships, or working with farmers and producers in the field.

Plant viruses are wide spread and economically important plant pathogens. Virtually all plants that humans grow for food, feed, and fiber are affected by at least one virus. It is the viruses of cultivated crops that have been most studied because of the financial implications of the losses they incur. However, it is also important to recognize that many “wild” plants are also hosts to viruses.

WHAT IS A PLANT VIRUS?

 Plant virus Are highly infectious, submicroscopic and obligate intercellular parasite consisting of one or more molecules of nucleic acid( RNA orDNA) surrounded by a protein coat and capable of replication only within the living cells. The word virus is taken from a Latin word meaning “poison.” They are parasitic on their hosts for energy because they cannot produce or store energy in the form of adenosine triphosphate (ATP).

**WHAT ARE THE IMPORTANT HISTORICAL DEVELOPMENTS IN PLANT VIROLOGY?**

One of the first references to a disease caused by a plant virus occurred during Tulipomania in seventeenth-century Holland (1600–1660;). This is an unusual case of a virus that increased the value of infected plants. It began with the importation of tulips into Holland from Persia.

 People began noticing that some flowers were developing streaks and broken color patterns. These tulips were called “bizarres,” and people quickly learned that they could produce more bizarres by planting a bizarre tulip in a bed or by rubbing the bizarres bulb onto plain tulip plants. They did not realize that they were transmitting a pathogen. Bizarres became so popular that a single bulb was worth large sums of money, thousands of pounds of cheese, or acres of land. One case is recorded where a man offered his daughter in marriage in exchange for a single bizarre tulip bulb.

In 1886, Adolf Mayer scientifically confirmed a primary principle of plant virology when he transmitted TMV to healthy tobacco plants by rubbing them with sap from infected plants. The newly rubbed plants displayed the same symptoms as the original infected plants.

 Mayer’s research established the contagious nature of plant viruses and the first procedure for mechanical transmission of a virus.

A major observation was made in 1892 by **Iwanowski**, who showed that sap from tobacco plants displaying the disease described by Mayer was still infective after it had been passed through a bacteria-proof filter candle. However, based on previous studies, it was thought that this agent was a toxin. Iwanowski’s experiment was repeated in 1898 by **Beijerinck**, who showed that the agent multiplied in infected tissue and called it contagium vivum fluidum (Latin for “contagious living fluid”) to distinguish it from contagious corpuscular agents.

Beijerinck and other scientists used the term virus to describe the causative agents of such transmissible diseases to contrast them with bacteria.

**CHARACTERISTICS OF PLANT VIRUSES**

1. Unable to grow by binary fission but can multiplicate by means of replication using host ribosome and do not produce any kind of specialized reproductive structures such as spores.
2. Viruses cause disease not by consuming cells or killing them with toxins, but by utilizing cellular substances during multiplication, taking up space in cells, and disrupting cellular processes.
3. Plant viruses differ greatly from all other plant, from methods of infection, multiplication, translocation within the host, dissemination, and the symptoms they produce on the host.
4. viruses generally cannot visible under a light microscope but can be viewed by an electron microscope. But Cell inclusions consisting of virus particles, however, in some infected plant are visible by light microscopy.

There are three simplest kinds of parasitic cells have some similar characteristics with virus. The **Mycoplasmas,** the ***Rickettsiae*** and the ***Chlamydiae.***

**Mycoplasmas**

Mycoplasmas and related are not visible by light microscopy.

1. They are 150–300 nm in diameter with a bilayer membrane but no cell wall.
2. They contain RNA along with ribosomes and DNA.
3. -They replicate by binary fission.
4. Some that infect vertebrates can be grown in vitro. Their growth is inhibited by certain antibiotics. Some mycoplasmas are plant pathogenic.

**The Rickettsiae**

for example, the agent of typhus fever,

1-are small, nonmotile bacteria, usually about 300 nm in diameter.

2- They have a cell wall, plasma membrane, and cytoplasm with ribosomes and DNA strands.

3-They are obligate parasites and were once thought to be related to viruses, but they are definitely cells because they multiply by

1- binary fission, and they 2-contain enzymes for ATP production

**The *Chlamydiae****,*

The Chlamydiae, for example, the agent that causes psittacosis,

1-include the simplest known type of cell.

 2-They are obligate parasites that grow by infecting eukaryotic cells and lack an energy-generating system.

3-They are as small as, or smaller than, many viruses.

 4-Chlamydiae have two phases to their life cycle. Inside host cells they take on an intracellular replicative form (termed the reticulate body) and rely on the host cell energy-yielding system; outside the cell they survive by forming infectious elementary bodies about 300 nm in diameter, which is smaller than some pox viruses. Chlamydiae can be grown only where their host cells grow and cannot be propagated in bacterial culture media.

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**There are several criteria that do not distinguish all viruses from all cells:**

1. Some pox viruses are bigger than the elementary bodies of*Chlamydiae.*

2. The presence of DNA and RNA is not a distinguishing feature. Many viruses have double-stranded (ds) DNA like that of cells, and in some the DNA is bigger than in the *Chlamydiae.*

3. A rigid cell envelope is absent in viruses and mycoplasmas.

4. Growth outside a living host cell does not occur with viruses or with many groups of obligate cellular parasites, for example, *Chlamydiae.*

5. An energy-yielding system is absent in viruses and *Chlamydiae.*

6. Complete dependence on the host cell for amino acids, etc., is found with viruses and some bacteria.

**There are four related criteria that do appear to distinguish**

**all viruses from all cells:**

**i**. Lack of a continuous membrane separating viral parasite and host during intracellular replication. Cellular parasites that replicate inside a host cell appear always to be separated from host cell cytoplasm by a continuous bilayer membrane.

ii. Absence of a protein-synthesizing system in viruses.

iii. Genome is either RNA or DNA but not both.

iv. Replication of viruses is by synthesis of a pool of components, followed by assembly of many virus particles from the pool. Even the simplest cells replicate by binary fission.