**Plant Virus Replication**

One of the major features of viruses is their ability to replicate their genomic nucleic acid, often to high levels, in cells in which there are normally strict limits on the production of new nucleic acid molecules.

Some viruses do this by adapting the existing cellular machinery and others replicate their nucleic acid by mechanisms not widely used in host cells.

**Components for virus synthesis**

Viruses use amino acids and nucleotides synthesized by host-cell metabolism to build viral proteins and nucleic acids.

**a. Energy**

The energy required for the polymerization involved in viral protein and RNA synthesis is provided by the host cell, mainly in the form of nucleoside triphosphates.

**b. Protein synthesis**

Viruses use the ribosomes, tRNAs and associated enzymes and factors of the host cell's protein-synthesizing system for the synthesis of viral proteins using viral mRNAs. All plant viruses appear to use the 80S cytoplasmic ribosome system. There is no authenticated example of the chloroplast or mitochondrial ribosomes being used. Most viruses also depend on host enzymes for any post translational modification of their proteins, such as glycosylation.

**c. Nucleic acid synthesis**

Almost all viruses code for an enzyme or enzymes involved in the synthesis of their nucleic acids, but they may not contribute all the polypeptides involved. For example, in the first phase of the replication of caulimoviruses, the viral DNA enters the host-cell nucleus and is transcribed into RNA form by the host's DNA-dependent RNA polymerase II. In most, if not all, RNA viruses, the replication complex comprises the viral RNA-dependent RNA polymerase (RdRp), several other virus-coded activities and various host factors.

**d- Structural components of the cell**

Structural components of the cell, particularly membranes, are involved in virus replication. For example, viral nucleic acid synthesis usually involves a membrane-bound complex.

**VIRUS INFECTION AND VIRUS SYNTHESIS**

Plant viruses enter cells only through wounds made mechanically or by vectors or by deposition into an ovule by an infected pollen grain.

In a simplified replication of an RNA virus, the nucleic acid (RNA) of the virus is first freed from the protein coat. It then induces the cell to form the viral RNA polymerase. This enzyme utilizes the viral RNA as a template and forms complementary RNA. The first new RNA produced is not the viral RNA but a mirror image (complimentary copy) of that RNA. As the complementary RNA is formed, it is temporarily connected to the viral strand, Thus, the two form a double-stranded RNA that soon separates to produce the original virus RNA and the mirror image (-) strand, with the latter then serving as a template for more virus (+strand) RNA synthesis.

The replication of some viruses differs considerably from the aforementioned scheme. In viruses in which different RNA segments are present within two or more virus particles, all the particles must be present in the same cell for the virus to replicate and for infection to develop. In single-stranded RNA rhabdoviruses the RNA is not infectious because it is the (-) strand. This RNA must be transcribed by a virus-carried enzyme called transcriptase into a (+) strand RNA in the host, and the latter RNA then replicates as described earlier.

As soon as new viral nucleic acid is produced, some of it is translated; it induces the host cell to produce the protein molecules coded by its nucleic acid.

**VIRAL GENOME EXPRESSION**

I: is transcription of dsDNA usually by host-DdRP

II: is transcription of ssDNA to give ds template for I (Gemini viruses)

III: is transcription of dsRNA usually by virus coded RdRp (Reoviruses)

IV: is replication of +ve stand RNA via -ve stand template by virus coded RdRp; the viral (+) strand is often the template for the early translation (=ve sense RNA viruses)

V: is the transcription o -ve sense virus genome by virus coded RdRp ( Tospoviruses)

VI: is the reverse transcription of RNA stage of retro and para-retroviruses leading to dsDNA template for mRNA transcription.

