

Q4. Describe the Structure and Replication of TMV.

Ans →

TMV is a best known plant virus which affects tobacco plant. It was first isolated by W.M. Stanley (1935) and its nucleoprotein nature was demonstrated by Bowen and Pirie (1937).

* Structure :- TMV is a simple rod shaped (Cigarette like) helical virus measuring about 3000 \AA in length and about 180 \AA in diameter. TMV consists —

- a central core of ssRNA, and
- a proteinaceous sheath called — Capsid.

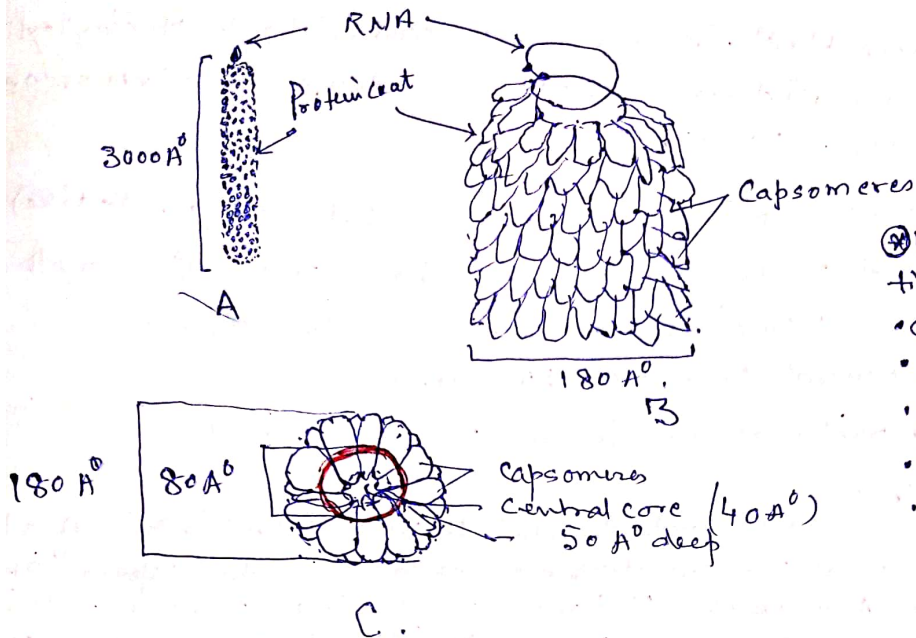
* RNA :- The single stranded RNA is found in form of a long helix. It remains deeply embedded in the capsid. The ssRNA is about 11 times longer than virion. It is little more in length ($3,300 \text{ \AA}$) slightly protruding from the rod. Its molecular weight is nearly 25,000 daltons. The diameter of RNA helix is about 80 \AA and it lies about 50 \AA inward from the outermost surface of the rod. The ssRNA has nearly 7,300 nucleotides. It provides a code which directs the synthesis of specific viral proteins.

* Capsid :-

Capsid is made up of smaller sub-units called 'Capsomeres'. These are grape like elongated structure which remain closely arranged in a helical manner around the RNA helix forming a hollow cylinder. About $16\frac{1}{3}$ capsomeres form one turn of the helix. In this way 49 capsomeres are found in three turns of the helix. Nearly 2,130 capsomeres take part in capsid formation, hence there would be about 130 turns per rod with a pitch of 23 \AA .

Each capsomere is composed of 16 different kinds of 158 amino acids and has mol. wt. of 17,000 daltons.

(ii)
 In TMV, protein amounts about 94.4% of the total substances of the rod and the remaining 5.6% is RNA. The protein are of high mol. weight about 40 million.



- ⊗ Elementary Composition of the RNA is -
- Carbon - 50%
 - Nitrogen - 16.7%
 - Hydrogen - 7%
 - Phosphorus - 0.54%
 - Sulphur - 0.2%

Fig - A, B & C - Structure of TMV

★ Life cycle / Replication of TMV :-

TMV infects tobacco leaves. It is transmitted and introduced in the host cells either by vectors such as myzus pseudosolani, M. Circumflexus and grasshoppers or by mechanically through rubbing, transplanting and handling.

It is assumed that entire body of TMV enters the host cell and cause infection. Now it becomes undetectable and is known as Eclipse phase. Inside the host cell the protein coat dissociates and viral RNA becomes free in the cell cytoplasm. Although, the actual process is not clearly understood, yet the study suggest the movement of viral RNA into nucleus from the cytoplasm.



Replication of RNA viruses takes place by two different ways —

a) RNA (single or double stranded) may direct the synthesis of DNA which synthesises a large no. of viral RNA molecules. Eg. Rous sarcomavirus (RSV), a RNA virus which replicate through a DNA intermediate. The ssRNA viruses use a DNA intermediate to replicate, whereas those containing DNA genomes use an RNA intermediate during genome replication. In both cases the enzyme "reverse transcriptase" is essential.

(b) A/c to ^{the} second view, the RNA first synthesises a new enzyme "RNA synthetase" on the host ribosome. This enzyme then helps in the synthesis of a complementary strand of RNA (-RNA) so that single stranded RNA becomes double stranded. This newly formed RNA serves as a template for the synthesis of new viral RNA molecules. However, viral RNA itself behave like m RNA and by utilising the host system synthesises new protein molecules for new virus particles.

Economic Importance of RNA Viruses.

1. RNA viruses are basically plant viruses which causes PTO, several plant diseases such as disease on rice, cauliflower, tobacco mosaic etc.
 2. Influenza viruses cause influenza.
 3. AIDS viruses cause the dreadful disease — AIDS.
 4. Newly discovered "Corona viruses" cause Coronadisease.
- Thus we see that they cause great loss to human plant leaves.