TMV ORFs and Their Products

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The Tobacco mosaic Tobamovirus is an elongated rigid rod, the particle of which is modeled after the helical symmetry. An ssRNA that is plus sense, forms a spiral at the centre of the rod, and the protein subunits are attached around it. The ssRNA genome is (+) sense, that is to say, that it is analogous to an mRNA, and can hence directly attach to ribosomes for translation in the host cell. It is made up of 6400 nucleotides.

The TMV genome consists of five ORFs, along with untranslated regions at either end, designated as 5'-UTR and 3'-UTR. The coding regions lie in between the two UTRs, and range as follows:

ORF 1: nt 69 to 3417
ORF 2: nt 69 to 4917
ORF 3: nt 3495 to 4917
ORF 4: nt 4903 to 5709
ORF 5: nt 5712 to 6191

Please note that ORF 1 and ORF 2 share the start position, whereas ORF 2 and ORF 3 share the stop. Also note that if ORFs 1 and 2 have the same start, how can ORF 2 have a stop that falls after the ORF 1 stop, considering that both are translated in the same reading frame. This is because the ORF 1 stop codon is a 'leaky' stop codon and is suppressed at the time of translation of ORF 2, that carries on to its own stop codon. The protein thus formed is a 'readthrough protein'.

The products of the five ORFs are as follows:

ORF 1: 126 kDa replicase
ORF 2: 183 kDa replicase
ORF 3: 54 kDa protein possibly linked to breakdown of host defences
ORF 4: 30 kDa movement protein
ORF 5: 17.5 kDa coat protein

References:

1. Wilson, CR, 2017, Applied Plant Virology, CABI, 177 pp.
2. Hull, R, 2014, Plant Virology, 5th Ed., Academic Press, 1118 pp.
3. Verma, HN, 2003, Basics of Plant Virology, Oxford and IBH, 228 pp.