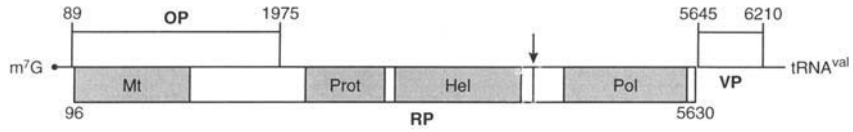

Fig. 1. Map of the 6319-nucleotide long genome of turnip yellow mosaic tymovirus. The first and last nucleotides of the ORFs of the replicase polyprotein (RP), overlapping protein (OP), and virion protein (VP) are numbered, and the portions of the RP that probably function as a methyltransferase (Mt), papain-like protease (Prot), NTPase/helicase (Hel), and RNA-dependent RNA polymerase (Pol) are shaded. The arrow marks the nucleotides encoding the site, between ala^{1259} and thr^{1260}, where the RP is posttranslationally hydrolyzed.

wild cucumber mosaic, and finally erysimum latent, which is the only member of a fourth lineage.

Tymoviruses cause yellow mosaic and vein-clearing symptoms by clumping and disorganizing the chloroplasts of infected cells ***(3)***. The chloroplasts develop characteristic patches of peripheral vesicles, especially where they touch. The vesicles develop as invaginations of the outer chloroplast membranes and remain attached by their necks. The vesicles are the site of viral genomic replication, but the subgenomic virion protein mRNA, at least, is translated by cytoplasmic ribosomes, and the virions assemble on, or near, the cytoplasmic end of the vesicle necks.

The virions of tymoviruses are isometric, about 28 nm in diameter, and have a shell that is a regular T = 3 icosahedron constructed of 180 subunits of a single protein species. Virions sediment at 110–120 S and each contains a single viral genome, which constitutes 35% of their mass. All tymoviruses also produce virion-like particles that sediment at 50–55 S and consist of genome-free protein shells. The virions and/or the empty shells of some tymoviruses also contain small RNA molecules: virion protein (VP) mRNA or host tRNAs.

The genomes of all tymoviruses are single-stranded RNA about 6.3 kb in length, and are infectious when chemically separated from the virions. They have an unusally large cytosine content, up to 42% on average, and even more in the third codon positions of the replicase and virion protein genes. The genomes of all tymoviruses have three open reading frames (ORFs) (**Fig. 1**). There are small untranslated regions at both termini, and also, in some, between the largest and smallest of the ORFs; the 3'-terminus of most can form a tRNA-like structure that can be specifically valylated.

The largest of the ORFs is the most conserved and occupies most of the genome. It encodes the replicase protein (RP) of approx 206 kDa, which has motifs (N- to C-terminal) characteristic of a *N*-methyl transferase ***(4)***, a papain-