COMPARATIVE STUDIES ON TOMATO ASPERMY AND CUCUMBER MOSAIC VIRUSES

by

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SUMMARY

Some properties of the V strain of tomato aspermy virus (TAV) and the Q strain of cucumber mosaic virus (CMV) have been compared. The size, morphology, sedimentation rate, RNA base ratio, and buoyant density of the two viruses are indistinguishable. The capsid structures of both viruses depend on RNA-protein interactions as both are dissociated in low concentrations of sodium-dodecyl sulphate (SDS) and stabilized with formaldehyde. However, the conditions required for their stability differ considerably. TAV is more resistant than CMV to degradation by pancreatic RNase and to precipitation by NaCl. Whereas TAV is stabilized by Mg^{2+}, CMV precipitates in the presence of the cation. CMV is stabilized but TAV is degraded by EDTA.

The requirement for a successful reconstitution of the viruses *in vitro* varies considerably. Mg^{2+} is required for the reconstitution of TAV and is deleterious for CMV. The reconstitution of CMV is not affected by EDTA, while TAV does not reconstitute in the presence of the chelating agent.

TAV and CMV are serologically distinct. Both viruses are poor immunogens in mice and in toads. The titre of antisera did not differ significantly when various doses of antigens were administered into mice. However, when the viral antigens were fixed with formaldehyde they were significantly more immunogenic.

Protein subunits of TAV were more soluble than CMV protein in low molarity salts. Whereas TAV coat protein was slightly immunogenic in mice, no detectable response was obtained with that of CMV. Analysis of SDS-treated viral proteins by polyacrylamide-gel electrophoresis showed that both viruses have protein subunits of molecular weight 24,500 daltons. The amino acid compositions of proteins from the two viruses, although similar, were distinguishable, and the calculated molecular weight of protein subunits were 26,100 and 26,300 daltons for TAV and CMV, respectively. The isoelectric point of TAV was about 5.7, and that of CMV, 4.7.

Molecular hybridization showed that there was no nucleotide base sequence homology between the RNA of the two viruses. TAV-RNA preparations contained species with molecular weights of T_1, 1.26×10^6, T_2, 1.10×10^6, T_3, 0.90×10^6, and T_4, 0.43×10^6, and CMV-RNA species of C_1, 1.26×10^6, C_2, 1.10×10^6, C_3, 0.77×10^6, and C_4, 0.34×10^6 daltons. These molecular weights of TAV-RNA and CMV-RNA species were estimated by polyacrylamide-gel electrophoresis in aqueous solution, but the results were not significantly different with electrophoresis in formamide. Isolated $T_1 + T_2$ or $C_1 + C_2$ had very low infectivity. However, the infectivity of $T_1 + T_2$ was greatly enhanced by the addition of either T_3 or C_3. The pseudorecombinant virus (PRV) resulting from infection by $T_1 + T_2 + C_3$ was shown to possess antigenic properties of CMV. Its behaviour to EDTA and Mg^{2+} was likewise similar to CMV. It induced host reactions indistinguishable from those of TAV. The

results suggest that C_3 contains a cistron for virus coat protein, and $T_1 + T_2$ are responsible for host reactions. RNA-RNA competition hybridization experiments showed that the PRV-RNA possesses more base sequences in common with TAV-RNA than with CMV-RNA.

Based on the behaviour of TAV and CMV in isopycnic density-gradient tubes, and comparison of RNAs extracted from the light and heavy fractions on polyacrylamide-gel electrophoresis, it was concluded that three types of particles were probably present in preparations of each virus.

The comparative studies carried out suggest that TAV and CMV are sufficiently similar to be included in the same taxonomic group. Nevertheless, the two viruses are distinct and the present nomenclature should be retained.