MIXED VIRAL INFECTIONS IN PLANTS: CO-OPERATION OR TERRITORIAL RIVALRY BETWEEN VIRUSES?

Summary

Mixed infections occur when two or more viruses or strains of the same species invade the host at different times (super-infection) or simultaneously (co-infection). Interactions between plant viruses in mixed infections are generally categorized as synergistic or antagonistic. Synergism refers to a situation in which the presence and activity of one virus stimulates the replication dynamics of the second virus. The phenomenon occurs when the virus present in the host plant suppresses, by a specific viral protein, post-transcriptional gene silencing (PTGS), i. e. a natural plant defense response, and may target another virus entering the plant cells. The increase in virus accumulation is usually associated with an enhanced severity of disease symptoms exhibited by the plant, as compared with those shown by singly infected plants. Severe response to the multiple infection may lead to the premature death of the plant. Unlike synergism, antagonistic interactions rely on the inhibition of life functions of one virus by a second virus. A typical example of antagonistic interaction is cross-protection, the phenomenon used to protect cultivated plants against infection by virulent strains of viruses. According to the currently prevailing hypothesis, behind this phenomenon is the mechanism of viral RNA silencing. In response to infection, a signal is induced in the plant which initiates PTGS to degrade RNA of a homologous virus. Cross-protection can be manifested in the host tissue by the occurrence of spatial separation between the viral subpopulations. In its spectacular form this phenomenon occurs when two or more homologous viruses invade the plant simultaneously. Then their subpopulations separate from each other, thus colonizing different cells in the host tissue. Virologists believe that good knowledge of within-host interactions between viruses will contribute to a better understanding of viral evolution and pathogenesis.