

Reduced rate of virus accumulation in inoculated leaves and slower systemic spread are frequently observed in transgenic CP-accumulating plants. This could be a result of slower replication rates or interference with local and systemic virus transport. In many reports of CPMR, the presented data is not sufficient to clearly indicate which step in virus infection is inhibited. In cases in which CPMR can be overcome by inoculation with viral RNA, it is likely that protection is mainly because of inhibition of virion disassembly. However, additional steps can be affected. Replication rates of TMV in protoplasts are reduced after electroporation with up to 40 µg/mL TMV RNA. Transgenic plants accumulating the CMV CP can sometimes accumulate CMV in inoculated leaves, but no systemic spread occurs. In this case, there seems to be interference with either entry of the phloem or vascular long-distance transport.

8. Summary

Expression of viral CP genes in transgenic plants can lead to virus resistance by interference of either the transcript or the protein with virus infection. Dependence of resistance on CP accumulation can be most convincingly shown by comparison of plants that accumulate CP with plants that accumulate a nontranslatable CP transcript. Even in cases in which CP accumulation is required, the degree of resistance does not always correlate with CP levels in transgenic plants.

In cases in which CPMR can be overcome by inoculation with viral RNA instead of virions, interference with virion disassembly is the likely cause of resistance. Classical crossprotection can also sometimes be overcome by RNA inoculation, and, in this case, appears to work by a similar mechanism. There is no evidence yet that CPMR is caused by a nonspecific plant defense response that might be triggered by the accumulating CP.

Measurement of virus accumulation in protoplasts prepared from transgenic plants was used to show interference with early events of virus infection. There is no clear evidence yet for inhibition of local virus spread in transgenic plants. A reduced rate of virus accumulation in inoculated leaves can usually also be explained with reduced rate of replication. However, in the case of CPMR to CMV, it appears that early events, as well as systemic spread, are affected. Reduced vector transmission of virus infection from inoculated transgenic plants to nontransgenic plants has been observed. It is not known whether this is just a consequence of lower virus levels in the transgenic plants or whether direct interference with acquisition and transmission by the vector is also involved.

In addition to virion formation, CP can function in different ways in plant virus infections. Replication, long-distance spread, and vector transmission can also depend on the presence of CP. Expression of genes encoding nonfunctional CPs in transgenic plants can be tried in order to interfere with normal CP