

4. Biological Control of Cucumber Mosaic Virus (CMV) Using Attenuated CMV Strains Containing Satellite RNA (satRNA) in Japan

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CMV of tomatoes has become increasingly important in Japan since the mid-1970s, particularly in processing tomatoes. The virus caused serious damage to tomato plants in the main production areas. A large number of farmers have stopped cultivating tomatoes, and in some areas, tomato production has essentially been terminated. NDM has started to work with attenuated CMVs in 1983 through collaboration with J. M. Kaper, U.S. Department of Agriculture and succeeded to develop mild satRNA-containing CMV strains (CMV vaccines). Those vaccines have been put to practical use since 1995 to protect tomato plants from CMV in processing tomato fields where CMV outbreaks occur regularly. We also found that CMV vaccines are suitable for practical use in fresh market tomato, Capsicum (sweet pepper and paprika) and Gentiana (gentian, perennial flower plant) in CMV-infested fields. All the CMV vaccines were isolated from naturally infected tomato plants in Japan and contained non-necrogenic satRNAs with 330 to 391 nucleotides in length. CMV vaccines induced milder symptoms than a Japanese virulent CMV isolate, CMV-853 in many important host plants. No synergistic effect was observed in tomato plants from mixed infections of CMV vaccines with tobacco mosaic virus, potato virus Y, or tomato spotted wilt virus. In CMV infested fields, vaccinated plants produced 19 to 118% more fruits compared to non-vaccinated plants. Ascorbic acid contents (vitamin C) of tomato fruits were increased about 30% in vaccinated plants. We have carried out risk assessment studies by systematically comparing vaccinated and non-vaccinated tomato fields from 1997 to 1999. No clear adverse risk associated with a CMV vaccine, CMV-KO3 was observed during the 3-year period. NDM and M. Chang, Yeungnam University, Korea, are collaborating to investigate possibilities of CMV vaccines applied in Korean hot peppers. The greenhouse experiment showed that CMV vaccines induced only mild chlorotic or mild mosaic symptoms in Korean hot pepper cultivars and that vaccinated hot pepper plants were protected from a Korean virulent CMV isolate, CMV-KP. This paper describes characterization of CMV vaccines, their practical usefulness and risk assessment, and perspective of CMV vaccines in Korean hot peppers.