

phytoplasma strains such as group 16SrI (Aster yellows) and group 16SrXII (Stolbur group) phytoplasmas in which mulberry dwarf phytoplasma and chrysanthemum witches broom phytoplasma are belonged to, respectively. The same results were obtained from both Korean- and Chinese-isolates of JWB. Nested-PCR using phytoplasma universal primer pair P1/P7 and 16S rRNA group V specific primer pair 16S(V) F/R could detect group V phytoplasma rapidly and easily, in particular JWB phytoplasma.

4-27. Replicase and movement protein of *Cucumber mosaic virus* are symptom determinants in zucchini squash

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A pepper strain of *Cucumber mosaic virus* (Pf-CMV) induces a mild chlorotic spot symptom in zucchini squash at 9 days post-inoculation (dpi), while Fny strain of CMV causes severe mosaic and stunting symptom at 4 dpi in this host. Pseudorecombinants were constructed between the two strains, and assessments of symptom severity were indicated that both RNA2 and RNA3 were responsible for both mildness and the slow appearance of symptom elicited by Pf-CMV in zucchini squash. With various RNA2 and RNA3 chimeras between two strains of CMV, the genetic symptom determinants of phenotype of Pf-CMV were mapped to Tyr residue at positions amino acid 267 in 2a protein and at positions amino acid 168 in 3a movement protein (MP). Chimeras changed the sequences (both changed Tyr to Ile) in the codons of both amino acid 168 of 3a MP and amino acid 267 of 2a protein were resulted in the high RNA accumulation, severity of symptom, and the rapid systemic spread, suggesting that 2a replicase as well as MP is involved in virus movement. The RNA accumulation pattern of all pseudorecombinants and chimeras are identical in protoplast of zucchini squash, indicating the virus movement is responsible for the phenotypes of two CMV strains rather than virus replication.

4-28. Ultrastructural Characteristics of Necrosis and Stunt Disease in Red Pepper by the Mixed Infections of *Tobacco mosaic virus* or *Pepper mild mottle virus* and *Pepper mottle virus*.

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The commercial cultivars of red pepper were screened against *Tobacco mosaic virus* (TMV), *Pepper mild mottle virus* (PMMoV) and *Pepper mottle virus* (PepMoV) by seedling test. In single infection of TMV or PMMoV, mosaic symptom was produced on the cultivars of

'Cheongyang' and 'Wangshilgun'. However, in cultivars of 'Manitta' and 'Bugang', symptoms were not occurred. In single infection of PepMoV, symptoms of mottle and malformation were produced on the tested cultivars of 'Manitta', 'Bugang', 'Cheongyang' and 'Wangshilgun'. In the cultivars of 'Cheongyang' and 'Wangshilgun', synergistic symptoms of stunt and lethal death were induced by mixed infections in the two combinations of TMV+PepMoV and PMMoV+PepMoV. However, in cultivars of 'Manitta' and 'Bugang', synergistic symptom was not occurred as mottle which was milder than that of single infection. Cells were single infected with TMV and PMMoV the cultivars of 'Cheongyang' and 'Wangshilgun', respectively, had typical ultrastructures of tobamovirus as the stacked-band structure and multiple spiral aggregate (SA). Ultrastructures of cell and tissues infected with PepMoV on the cultivars of 'Cheongyang', 'Wangshilgun', 'Manitta' and 'Bugang', the potyvirus inclusions of pinwhills, scrolls, lamminated aggregates and amorphous inclusion were observed. Infected cells with a combination of TMV+PepMoV and PMMoV+PepMoV, the virus particles and inclusions of the two different viruses were found only mixed infection in the same cytoplasm and the amounts of viruses in mixed infections were abundant than in single infection. The angled-layer aggregates (ALA) was observed in the cells infected mixedly with TMV and PepMoV.

4-29. Identification of *Potato mop-top virus* from *Solanum tuberosum* cv. Gawon in Korea.

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Potato mop-top virus(PMTV) was identified from *Solanum tuberosum* cv. Gawon showing bright chlorotic mottle symptom in Namwon, Korea. Samples were collected green-house in February, 2003. Electron microscopic examination of negatively stained preparation revealed that PMTV were rigid-rod shaped particles about 100-150, 250-300 nm × 18-20 nm in length. In ultrathin sections of leaf tissue from diseased potato plants, cluster of viruses particles were observed in the cytoplasm. TAS-ELISA determined that the virus was serologically related to PMTV. PMTV produced double ring necrotic local lesion in inoculated leaf of *Chenopodium amaranticolor* in incubated at 15°C. The PMTV could be detected with RT-PCR using PMTV detectable primer set designed to amplify about 540 bp of the partial CP gene of PMTV.

4-30. Characterization of *Grapevine leafroll-associated virus 1* and *Grapevine leafroll-associated virus 3* isolated from *Vitaceae* in Korea.

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Grapevine leafroll-associated 1 virus (GLRaV-1) and *Grapevine leafroll-associated 3 virus* (GLRaV-3), member of the genus *Ampelovirus*, are important viral disease of grapevine in the world. these viruses transmitted only dicotyledonous host by vectors such as mealybugs and there