CHARPTER 6

Conclusions

ZYMV, CMV, SqMV, PRSV-W, WMV-2, and Tospovirus were detected in zucchini, pumpkin, and cucumber samples. ZYMV was the most common detected and dual infections of ZYMV+CMV and ZYMV+PRSV-W were the common combination of viruses found in infected cucurbit samples.

A survey of insect vectors and alternate hosts was conducted in the cucurbits growing areas throughout 2008 and 2009. Number of insect vectors was collected from the third leaf, except the beetles were collected from the whole plant. Number of all insect vectors; aphids, thrips, adult whiteflies, and beetles were found as 2.02, 0.32, 0.14, and 0.6 per leaf, respectively. Aphids population were found distributed in all the growing seasons. Number of aphids was increased in summer and down in rainy season. Numbers of aphids were the most found in zucchini, cucumber, and pumpkin as 3.0, 2.14, and 0.92 per leaf, respectively. Whitefly often not found at seedling stage while beetles did not found at the end of growing stage. The 28 alternate host types were collected from cucurbit growing areas. Negative result was found in *Acmella oleracea, Amaranthus lividus, Bidens pilosa, Emilia sonchifolia, Euphorbia heterophylla,* and *Synedrewla nodiflora*. Geminivirus were detected in *Ageratum conyzoides, Solanum torvum* and *S. melongena.* Cucurbitaceae e.g. *Benincasa hispida, C. moschata, C. pepo, Luffa acutangula, L. cylindrica and Sechium edule* were detected CMV, PRSV-W, WMV-2, ZYMV, CGMMV, potato virus Y (PVY), melon necrotic spot virus (MNSV), watermelon (WSMoV), tomato mosaic virus (TMV), TSWV, Tospovirus, and Potyvirus. Solanaceae e.g. *Capsicum annum, Solanum lycopersicum, Physalis angulate, P. peruviana,*and *S. torvum* were detected CMV, TMV, tomato mosaic virus (ToMV), pepper mild mottle mosaic virus (PMMoV), pepper mottle virus (PeMV), PVY, Tospovirus.

The correlation between the aphid vector and the viral pathogen ZYMV was studied. The aphids carried ZYMV collected from the infected zucchini plants were brought to the laboratory to check the ZYMV. Five aphids were minimum detectable number of these aphids did react with ZYMV antisera used in DAS-ELISA method. After acquisition access period, individuals of both aphids were able to transmit ZYMV to at least five plants. Tested plant which feed by number of aphids increasing was shown virus symptoms i.e. mottle and mild mosaic at 7 days after aphids' inoculation. Single aphid shown virus symptoms at 15 days after aphids' inoculation.

Detection of seed transmission virus in cucurbitaceous crops was used ELISA kit. DAS-ELISA result, CMV, ZYMV, SqMV and CGMMV were not detected in the commercial seeds of zucchini (*C. pepo*) cultivar SENATOR (hybrid squash, lot No.978883); Japanese pumpkin (*C. moschata*) cultivar DELICA (hybrid squash, lot No.08021); and Japanese cucumber (*C. sativas*) cultivar PRETTY SWALLOW 279 (cucumber F1 hybrid, lot No. EA25061). The virus was not found in the ground cucumber seeds, endosperm, seed coated, cotyledons and true leaves (10 dap.) saps.

The relationship between the CGMMV transmitted seed and proper detection stages of the infected cucumber plants was conducted at three different locations in the highland area of Northern Thailand. Two of the locations, Huai Luek (greenhouse production) and Mae Tha Nuea (field production), are in the main cucumber growing areas and the third location, Thung Roeng (field production), had not been previously cropped with cucumber. The research was carried out to investigate seed transmission of CGMMV and detection of the virus at different crop growth stages (seedling, flowering and 1 month after fruit-set). Polyclonal antibodies (ELISA kits, Agdia Inc., Elkhart IN., USA) were used to detect the virus. CGMMV was not detected in whole ground cucumber seeds, endosperm, seed coat, cotyledons or leaves in 1600 seeds from the seed lot tested. The virus was also not detected in any of the growth stages of cucumber at Thung Roeng where the crop had never been grown before. However, CGMMV was detected in each of the three stages at the other two sites at incidences ranging from 7.3 to 30%, except in the seedling stage at Mae Tha Nuea. Total marketable cucumber yield was significantly higher at Thung Roeng (21.25 kg) than at Huai Luek (16.75 kg) and Mae Tha Nuea (15.87 kg). These results suggest that soil

transmission of CGMMV was likely and that the virus played a role in the reduction of cucumber yields.

The correlation between viral combination and symptom on zucchini was studied. Single and mixed infection of virus, e.g. ZYMV, CMV, PRSV-W and CGMMV were evaluated. Inoculation of zucchini with single virus infection was produced systemic mild mottle and mosaic symptoms in plant at 7 dap. ZYMV was produced mild mottling and blistering on leaves. Mild mottling was revealed by CMV and CGMMV. PRSV and WMV-2 were produced systemic mottle and vein clearing on leaves. The reaction on the zucchini at 14 dap. was found severe symptoms on the apical leaves, crinkling and deformed leaves. During the subsequent development of plants, severe stunting and leaf symptoms were predominant, expressed as deformation and yellow mosaic. CGMMV inoculated zucchini was breaking off grown suddenly and deformed leaves. PRSV was produced discontinuing zucchini grown became severely stunted over time with distorted and wrinkled leaves. Infection with ZYMV caused severe mosaic, curling and deformed leaves. CMV was elicited severe mosaic. At 21 and 28 dap., the zucchini was presented stunting and growing retardation in all the virus treatments. Inoculation of zucchini with mixed virus infection was produced systemic mild mottle and mosaic symptoms in plant at 7 dap. The systemic symptoms were produced by viruses similar to single infection. The reaction on the zucchini at 14 dap. was commonly found the synergistic symptoms of severe mosaic, vein clearing, blistering, vein banding and deformation on zucchini leaves. The reaction on the zucchini at 21-28 dap. was appeared severe mosaic, blistering, vein banding, deformation, stunting and dead in zucchini.