Inheritance of Resistance to Zucchini Yellow Mosaic Virus in the Interspecific Cross Cucurbita maxima x C. ecuadorensis

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Cucurbita ecuadorensis has been reported to be resistant or tolerant to the major cucurbit viruses, namely zucchini yellow mosaic (ZYMV), cucumber mosaic, papaya ringspot, W-strain (= watermelon mosaic 1), squash mosaic, and watermelon mosaic 2 (1, 2, 3). The purpose of this study was to determine the inheritance of resistance to ZYMV in populations derived from the interspecific cross C. maxima cv. Buttercup x C. ecuadorensis.

Plants of both parents, F_1, F_2, and of the backcross to Buttercup were mechanically inoculated with the Connecticut strain of ZYMV (2) when the cotyledons were fully expanded. A week later, all plants were reinoculated on the first leaf. This dual inoculation minimized the number of plants escaping infection and increased the reliability of the data. Test plants were held in a greenhouse at 25 C (day) and 20 C (night), with a photoperiod of 14 hours. Specimens of every plant were analyzed for isozymes, using the electrophoretic procedures previously described (5).

Plants of C. ecuadorensis reacted to ZYMV with a few scattered chlorotic spots on the inoculated leaves, but the virus failed to move systemically. Conversely, 'Buttercup' was severely stunted and exhibited prominent foliar yellow mosaic, accompanied by lamina malformation and reduction. F_1 plants also reacted with a persistent mosaic, but symptoms were generally less severe than those of the susceptible parent. In an F_2 population, three classes were discernible: 16 plants were systemically resistant, 19 were severely infected, and 44 showed symptoms of intermediate intensity (for 1:2:1, P = .54). Plants of the backcross to the susceptible parent segregated in the ratio of 25 severely infected to 23 moderately infected (for 1:1, P = .78). Thus, it appears that resistance to ZYMV in C. ecuadorensis is conferred by a single major gene, to which the symbol zym is assigned.

The varying degrees of symptom expression in heterozygous plants suggested the presence of modifying genes influencing zym. It has been possible through selection and selfing to develop breeding lines from the backcross to C. maxima that have good fertility and a high degree of resistance to ZYMV.

Leaves of C. ecuadorensis are marbled with a white mottle, whereas those of 'Buttercup' are uniform green. Plants of the F_1 and the backcross to C. maxima had leaves similar to those of 'Buttercup'. In an F_2 population, segregation was 14 mottled to 125 uniform green. Inheritance of the mottled pattern differed from the single monogenic dominant (M) segregation previously reported for Cucurbita (4). The intensity of

mottling on different F_2 plants varied considerably and ranged from prominent to barely perceptible, hence, penetrance may have been incomplete. Of 80 F_2 plants inoculated with ZYMV, 2 were mottled and ZYMV-resistant, 5 mottled and intermediate susceptible, and none were mottled and very susceptible. Thus, there was no indication of zym being closely linked to the foliar mottle.

Twenty isozyme loci have been identified as distinguishing C. ecuadorensis from C. maxima (5). During this study, no linkage was detected between zym and Aat-mb, Ast-m2, Aat-p2, Acp-1, Acp-2, Est-1, Gal-1, Gal-2, Gpi-c2, Lap-1, Mdh-c2, Mdh-m2, Pgm-p, Pgm-c2, Per-1, Per-3, Sod-1, Tpi-c2, or Tpi-p2. Relatively few plants were scored for the SKDH phenotype, but it was clear that Skdh-1 was not tightly linked to zym.

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