

Final Project Report to the NYS IPM Program, Agricultural IPM 2002 – 2003

Title: Breeding and Evaluation of Squash and Pumpkin with Multiple Disease and Insect Resistance

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Project locations: Nationally

Abstract: Over 10,000 plants of 643 breeding lines of squash and pumpkin were tested for resistance to four different viruses in the greenhouse. The breeding lines were classified as homozygous for resistance, segregating for resistance, or susceptible. On the basis of these tests, the best resistant lines were selected for planting in the field. They were evaluated there for resistance to viruses, powdery mildew, and cucumber beetles and for horticultural type.

Resistant plants were pollinated, giving priority to those combining resistance to the greatest number of diseases and insects. Self pollinated seed was provided to seed companies for elite resistant germplasm, including 10 pumpkin, 8 winter squash, and 12 summer squash breeding lines. This germplasm should make possible the introduction of multiple disease and insect resistant varieties of pumpkin and squash.

Background and justification: There has not yet been a pumpkin variety available to New York growers that is resistant to any of the several viral diseases that cause them serious and uncontrollable losses each year, but this is now possible with the pumpkin germplasm developed in this project. There are squash varieties with resistance to some but not to all of these viruses; they have been of considerable value but varieties with combined resistance to each of the major viruses occurring in New York and to powdery mildew and cucumber beetles would be of even greater benefit.

Objectives: The primary purpose of the research proposed for this grant is to breed pumpkins, summer squash, and winter squash for disease and insect resistance. Squash and pumpkin breeding lines that are uniform for multiple disease resistance and other useful characteristics will be evaluated for potential release as varieties or germplasm. Priority will be given to combining the multiple disease resistance of the 'Whitaker' squash variety with resistance to watermelon mosaic virus, and to determine if any of our pumpkin breeding lines resistant to viruses and powdery mildew should be released as a new variety. Squash and pumpkin will also be bred for resistance to gummy stem blight (black rot), *Phytophthora* fruit rot, and cucumber beetles.

Procedures: Seedlings of summer squash, winter squash, and pumpkin breeding lines were tested for disease resistance in the winter/spring greenhouse. Over 10,000 plants of 643 breeding lines were inoculated in the first true leaf stage separately with cucumber mosaic virus, zucchini yellow mosaic virus, watermelon mosaic virus, and papaya ringspot virus by using a leaf blower to forcibly apply inoculum with carborundum abrasive. After a suitable period to allow symptoms to develop, each plant was classified as resistant or susceptible to the inoculated disease. Plants of the best multiple resistant lines were self pollinated in the greenhouse.

On the basis of these greenhouse tests, the best resistant breeding lines were selected for planting in the field. Two replications of 10 plants for each breeding line were direct seeded. Insecticide was not applied to these plots in order to permit selection for cucumber beetle resistance. Breeding lines determined in the greenhouse test to be segregating for resistance to one or more viruses were transplanted to the field after inoculating them with those viruses and discarding susceptible plants. The direct seeded plants and the transplants inoculated with cucumber mosaic virus, watermelon mosaic virus, and papaya ringspot virus were planted at the Research North Farm. Those inoculated with zucchini yellow mosaic virus were transplanted to an isolated field at the Darrow Farm in order to reduce the possibility of spread of the devastating zucchini yellow mosaic virus disease to other cucurbits.

Selection was made for virus resistant plants with little or no damage from naturally occurring cucumber beetles or powdery mildew. Evaluations were also made for fruit yield, size, shape, uniformity, color, and for earliness, yield, and other horticultural characteristics.

Results and discussion: Breeding lines of both pumpkin and squash with combined resistance to four important viruses and powdery mildew, including some lines with good fruit and vine type, were bred for the first time ever. Some breeding lines were identified as having little or no significant damage from the large naturally occurring populations of cucumber beetles. There was not a sufficient amount of gummy stem blight or *Phytophthora* fruit rot occurring in the field or after storage to select for resistance to those diseases.

Some of the resistant lines were homozygous for resistance to a particular disease or insect but others segregated for resistance and will need to be bred for an additional generation or more before becoming uniform for resistance. Resistant plants were pollinated, giving priority to those combining resistance to the greatest number of diseases and insects. Self pollinated seed was provided to seed companies for elite resistant germplasm developed in this project, including 10 pumpkin, 8 winter squash, and 12 summer squash breeding lines. This germplasm should make possible the introduction of multiple disease and insect resistant varieties of pumpkin and squash to benefit growers in New York and elsewhere by reducing losses and pesticide use.

Reference: R. W. Robinson and J. W. Shail. 2002. Pyramiding genes for disease resistance in *Cucurbita*. Abs. XXVI Int. Hort. Congr. p 437.