Final Project Report to the NYS IPM Program, Agricultural IPM 2000 – 2001

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

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Abstract: Resistance to five important diseases was combined in summer squash. Some of these breeding lines segregated for resistance to one or more of the five diseases and were therefore self pollinated in order to develop summer squash uniform for multiple disease resistance and other traits. Winter squash and pumpkin were bred for resistance to the same diseases. Seed was produced for virus resistant pumpkin breeding lines that performed well in a variety trial, and that seed is available for trials in the coming season.

Background and justification: Virus and mildew resistant varieties of squash and pumpkin are needed to reduce pesticide use and to improve disease control. Viruses reduce yield of squash and pumpkins and decrease marketablity by distorting fruit shape and color. Powdery mildew reduces yield and quality and can cause the peduncles ("handles") of pumpkins to detach easily, reducing their value.

Powdery mildew resistant pumpkin varieties were recently bred by seed companies from resistant germplasm developed at Cornell University by Drs. M. K. Jahn and H. M. Munger, but a virus resistant pumpkin variety has never been introduced. Virus resistant pumpkin varieties are possible now, however, for some of our pumpkin breeding lines resistant to cucumber mosaic virus (CMV) compared favorably with the best commercial varieties in a trial at Geneva, NY. They were used as parents to breed pumpkins resistant to additional viruses as well as CMV.

It may not help a grower much to have a variety resistant to one disease if he loses his crop to another disease. We are therefore breeding squash and pumpkins to have combined resistance to as many different diseases as possible. We previously bred the summer squash variety 'Whitaker' to be resistant to four important diseases--zucchini yellow mosaic virus, papaya ringspot virus, cucumber mosaic virus, and powdery mildew. Research was done this past season to to combine resistance to these four diseases with watermelon mosaic virus resistance in summer squash, winter squash, and pumpkin.

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: A direct-seeded planting was made of commercial pumpkin varieties and our disease resistant pumpkin breeding lines that had the best fruit and vine type in the previous season. No insecticide was applied, to permit evaluation for cucumber beetle resistance. Evaluations were also made for naturally occurring diseases and for fruit yield, size, shape, uniformity, ribbing, color, and for peduncle length and stability.

Seedlings of summer squash, winter squash, and pumpkin breeding lines were tested for disease resistance in the winter/spring greenhouse. Plants in the first true leaf stage were inoculated separately with cucumber mosaic virus, zucchini yellow mosaic virus, watermelon mosaic virus, and papaya ringspot virus. Each virus test was also inoculated with powdery mildew. Breeding lines identified in greenhouse tests as being homozygous or segregating for resistance were selected for planting in the field. Selection was made for plants that remained free of virus symptoms in the field and had little powdery mildew or other naturally occurring diseases and insects. Resistant plants with good horticultural characteristics, including

earliness, desirable fruit and vine type, good fruit set, uniformity, and high yield, were. elf pollinated and crossed with other desirable plants.

Results and discussion: Progress was made on achieving one of our objectives, that of pyramiding resistance to five important diseases for squash and pumpkin. We previously bred the summer squash variety 'Whitaker' to be resistant to four important diseases--zucchini yellow mosaic virus, papaya ringspot virus, cucumber mosaic virus, and powdery mildew—but it is susceptible to watermelon mosaic virus (WMV). *Cucurbita ecuadorensis*, the wild species used as a source of multiple virus resistance for 'Whitaker', is also resistant to watermelon mosaic virus but previous attempts to transfer WMV resistance along with resistance to the other viruses from this species to squash were unsuccessful. We have finally achieved that goal, but the multiple resistant lines were segregating for WMV resistance. They were therefore self pollinated in order to develop homozygous resistant summer squash germplasm. They were also crossed with pumpkin breeding lines to develop multiple resistant pumpkin germpasm. Winter squash, both 'Butternut'-type (*Cucurbita moschata*) and 'Hubbard'-type (*C. maxima*) was also bred for multiple virus resistance.

The multiple virus resistance of 'Whitaker' and many of our breeding lines is derived from a different source of resistance than that for any other resistant variety of squash or pumpkin. This could be significant if a new pathotype should occur for zucchini yellow mosaic (ZYMV) or another virus that 'Whitaker' is resistant to, since it could reduce vulnerability to the new pathotype. We have found that 'Whitaker' has a much higher level of resistance to the Connecticut strain of ZYMV than squash varieties with resistance to that virus that is derived from another conventional source of resistance.

There is no virus resistant variety of pumpkin available to growers yet, although viruses cause significant losses and they cannot be adequately controlled by pesticides. Pumpkin breeding lines bred for resistance to cucumber mosaic virus performed well in a variety trial and are being further evaluated for possible variety introduction. This germplasm was provided to seed company breeders and will be available for trials next season by interested growers, researchers, extension agents, and IPM personnel.

There were insufficient numbers of cucumber beetles in the field this past season to evaluate breeding material for beetle resistance. Breeding squash and pumpkin for cucumber beetle resistance and also for resistance to gummy stem blight and Phytophthora fruit rot resistance are ongoing goals for this breeding program but little progress was made this year, except for making crosses with resistant parents.

References: (if applicable)