IDENTIFICATION OF GERMPLASM WITH RESISTANCE TO THE SOYBEAN APHID TRANSMITTED VIRUS COMPLEX

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Introduction

A virus disease complex causing plant stunting, pod necrosis and malformation as well as yield loss in snap beans (*Phaseolus vulgaris* L.) was observed in the 2000-2002 growing seasons. The disease was widespread, and has been reported in the snap bean production areas of Wisconsin, Illinois, Minnesota, Michigan, Iowa, Kentucky, New York and Ontario, Canada (Larsen, et al., 2002). In snap beans, the disease is thought to be caused by a virus complex consisting predominantly of CMV (Cucumber Mosaic Virus), AMV (Alfalfa Mosaic Virus) and TSV (Tobacco Streak Virus) (Grau, et al., 2002). Viruses CMV and AMV are transmitted in a non-persistent and stylet-borne manner by the soybean aphid (*Aphis glycines*) which was first discovered in the Midwest in 2000 and is thought to have been introduced from Asia. Although not aphid transmissible, TSV has also been implicated in the virus complex.

Cultural practices; e.g. carefully timed foliar applied insecticides (Orthene, Capture and Dimethoate) and nicotinic-based insecticidal seed treatments (Cruiser and Gaucho) may provide some protection from the aphid on snap bean (Wyman, 2002). Virus symptoms were most severe in late season plantings, which may be related to weather conditions and the buildup of the soybean aphid populations. Foliar sprays and seed treatments may offer some protection; nevertheless, a genetic solution allowing the transfer of favorable genes to adapted cultivars is the best long-term solution to the future security of the snap bean industry.

Materials and Methods

A replicated field trial of 240 accessions was planted at Arlington, WI Research Station in mid-July. Two weeks prior to planting the trial, mixed spreader rows consisting of a soybean and virus susceptible snap bean cultivar, Hystyle were planted. Germplasm accessions included 170 accessions from the USDA Regional Plant Introduction Station in Pullman, WA, 10 commercial cultivars and 60 recombinant inbred lines from a cross of Eagle x Puebla 152.

One month after the spreader rows were planted, the snap beans in the spreader rows were inoculated using infected CMV, AMV and TSV tissue (Larsen, et al., 2002). Carborundum was included as an abrasive agent. Soybean aphid (winged adults and nymphs) counts were taken at 4, 5 and 6 weeks after the trial was planted.

At 55 days after planting, a 10 leaf sample from each of the 480 plots were taken for ELISA (Enzyme-Linked Immunosorbent Assay). Agdia (Elkhart, IN) CMV, AMV and TSV antibody specific ELISA kits were used

Results

Initial composite sample results indicated that although the spreader rows were inoculated with TSV, only 12 plots tested positive for the virus. In contrast, approximately 60% of the plots tested positive for AMV and 100% tested positive for CMV.

Visual ratings of virus symptoms were also taken. Thirty-one accessions were phenotypically symptomless. These plots were resampled for AMV and CMV using ELISA. One leaf per plant in each plot was taken for individual plant ELISA. Each leaf was numbered according to it's corresponding position within the plot so if it tested negative for both CMV and

AMV, seed could be harvested from the correct individual. Of the 592 individual plants harvested, 147 plants tested negative for both AMV and CMV (Tables 1 and 2). Mature seed was harvested from approximately 50% of the 147 plants. This seed will be evaluated in the greenhouse in collaboration with Dr. Craig Grau, Univ. of Wisconsin, Dept. of Plant Pathology in the Spring 2003.

These results suggest that genetic variability exists within *Phaseolus vulgaris* and could serve as a source of resistance to this soybean aphid transmitted virus complex.

Table 1. ELISA results for accessions scored as visually symptomless in the field

Accessions	Total No. Evaluated	Visually Symptomless	ELISA (-) AMV and CMV
PIs	170	21	2
Cultivars	10	2	0
E x P RILs	60	8	0

Table 2 ELISA results of individual plant screening for CMV and AMV

Entry	%AMV(-)	%CMV(-)	%AMV& CMV(-)
151	100.0	100.0	100.0
13	100.0	80.0	80.0
21	100.0	0.0	0.0
51	61.3	12.5	6.3
186	88.9	55.0	43.9

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