TRANSFERRING WHITE MOLD RESISTANCE FROM THE SECONDARY GENE POOL OF COMMON BEAN

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ABSTRACT

White mold [caused by *Sclerotinia sclerotiorum* (Lib.) de Bary] is a severe and widespread disease of dry and green common bean (*Phaseolus vulgaris* L.). Low levels of white mold resistance occur in the common bean. But, higher levels of resistance occur in the secondary gene pool (SGP) species such as *P. coccineus* and *P. costaricensis*. The objectives in 2009-2010 were to (1) complete the evaluation and selection of interspecific breeding lines (IBL) derived from crosses of common bean with the *Phaseolus* species of the SGP, and (2) compare the white mold reaction of the resistant IBL with known sources of white mold resistance. These objectives support the Sclerotinia Initiative area of Crop Germplasm Resources and Genetics. Twenty of 915 IBL derived from three different accessions of *P. coccineus* that survived sequential screenings until May 2009 along with the three previously developed IBL (VCW 54, VCW 55, VRW 32) and eight partially resistant and susceptible checks were compared in the greenhouse in Colorado and Idaho in 2009-2010. A randomized complete block design with three replicates (approximately 6 plants per replicate) was used. Each plant was inoculated two times and white mold disease severity was scored on a 1 to 9 scale (where 1 = healthy with no disease symptoms and 9 = severely diseased or dead plants) at 14 and 28 days post the first inoculation using a modified cut-stem method. The mean white mold score of all genotypes was lower at 14 d compared to 28 d evaluation in both greenhouses. Also, white mold scores were lower at both 14 and 28 d evaluations post the first inoculation in Colorado than in Idaho. The IBL derived from *P. coccineus* and *P. costaricensis*, in general, had lower white mold scores than other resistant checks. Furthermore, six of 20 IBL had lower white mold scores than previously developed IBL. But, all new IBL were still variable for their white mold reaction, and will require additional screenings in the greenhouse. Seed of white mold resistant IBL VRW 32 derived from recurrent backcrossing of ICA Pijao with *P. costaricensis* accession S 33720 was produced in the greenhouse. The first field increase was made at Kimberly, Idaho in May-September planting in 2010. Harvested seed has been sent to Puerto Rico for additional seed increases during the off-season to obtain sufficient quantity of seed for its public release and registration in the near future.

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GOAL - to improve common bean resistance to white mold caused by *Sclerotinia sclerotiorum*.

OBJECTIVES - to transfer WM resistance from the secondary gene pool of common bean:

- Using congruity-backcross and recurrent-backcross breeding methods,
- Resistance from G 35172 & PI 433246 (*P. coccineus*) and S 33720 (*P. costaricensis*)
- Were transferred into ICA Pijao black bean and UI 320 pinto bean (*P. vulgaris*) backgrounds.

MATERIALS AND METHODS:

- Small black bean ICA Pijao and *Phaseolus coccineus* G 35172 were used in the congruity-backcrossing to develop two IBL (Singh et al., 2009).
- *Phaseolus coccineus* PI 433246 was used in the recurrent-backcross with pinto UI 320 to develop four IBL and *P. costaricensis* S 33720 was used in the recurrent-backcross with ICA Pijao to develop one IBL.
- These IBL and resistant and susceptible checks were compared in a randomized complete block design with three replicates in the greenhouse in Colorado and Idaho in 2010. Each plot in the greenhouse consisted of 6 plants.
- Plants in the greenhouse were inoculated two times using the cut-stem method and two mycelial plugs each time. White mold reaction was recorded on a single-plant basis at 14 and 28 days after the first inoculation. A 1 to 9 rating scale, where 1= no disease symptoms and 9= severely diseased or dead plants (Terán et al., 2006) was used.

TABLE 1: Mean White Mold Scores for Interspecific Breeding Lines Evaluated in the Greenhouse in Colorado and Idaho in 2010

	Mean White Mold Score (1 to 9)			
Identification	Colorado – 14 days	Colorado – 28 days	Idaho – 14 days	Idaho – 28 days
New Interspecific Breeding Lines				
VCW 54	3.4	4.7	5.0	6.5
VCW 55	4.3	6.3	7.7	8.2
VRW 32-1	2.9	4.6	6.4	6.9
F609W436-4	2.0	2.0	5.0	6.2
F609W439-7	2.5	3.3	5.6	6.0
F809W449-8	2.3	3.2	5.3	6.2
F809W451-3	2.0	3.4	4.8	5.2
Parents and Controls (resistant and susceptible)				
ICA Pijao (parent)	8.1	8.6	8.3	9.0
UI 320 (parent)	6.9	7.5	8.3	8.8
92BG-7 (resistant)	5.2	6.1	8.3	8.7
ICA Bunsi (resistant)	6.3	6.7	8.7	8.8
A 195 (resistant)	3.2	3.5	6.8	7.2
G 122 (resistant)	3.5	4.6	6.7	7.8
Othello (susceptible)	7.1	7.9	8.9	8.9
LSD (P = 0.05)	1.2	1.6	1.2	1.2

White Mold Reaction Based on a 1 to 9 Score: 1 = no visible disease symptoms to 9 = severely diseased or dead plants

RESULTS AND DISCUSSION:

- The effect of greenhouse environments was significant ($P < 0.05$). On average, disease scores were lower in Colorado than in Idaho, apparently due to differences in the greenhouse conditions and/or aggressiveness between pathogen isolates.
- Mean white mold scores increased from the 14 day to the 28 day evaluation in CO and ID (Table 1).
- Mean white mold scores of the seven IBL were significantly ($P < 0.05$) lower than the common bean parents used in the recurrent and congruity backcrosses, suggesting that resistance genes and/or QTL (quantitative trait loci) were transferred from the SGP (Table 1).
- The new IBL also had significantly lower disease scores than other known sources of resistance to white mold.

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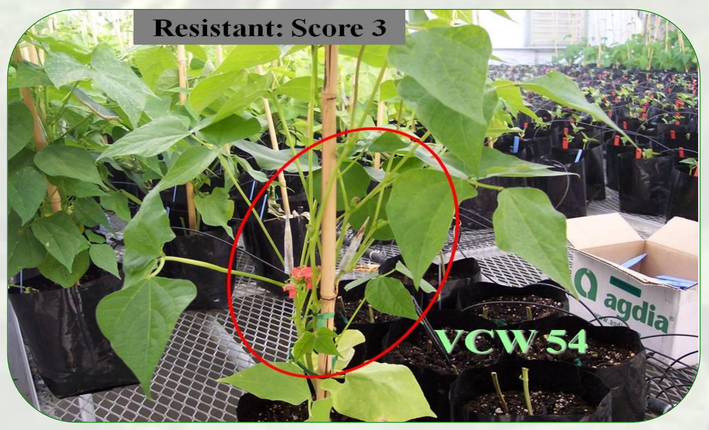

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