USE OF INBRED BACKCROSS METHOD TO INTRODUCE RESISTANCE TO WHITE MOLD FROM EXOTIC GERMPLASM INTO COMMON BEAN

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Introduction

White mold, caused by *Sclerotinia sclerotiorum*, is a serious disease of common bean (*Phaseolus vulgaris*) that results in substantial yield loss and reduced seed quality. Sources of physiological resistance to white mold in cultivated dry bean are relatively rare. A strategy to increase the genetic variability for resistance in cultivated bean varieties is to introgress genes from primitive landrace varieties and related wild relatives of bean. The genetic basis of bean cultivars is extremely narrow and only a small portion (<5%) of the available genetic diversity in bean has been used, despite nearly a century of organized common bean improvement (Singh, 1999). Since only a small number of genes with large phenotypic effects control the inheritance of traits involved in domestication of *P. vulgaris* (Koinange et al., 1996) the recovery of the cultivated phenotype from wild and cultivated crosses should not be difficult. The inbred backcross method has recently received attention as an effective method to transfer more complex quantitative traits from unadapted or diverse germplasm into otherwise adapted, productive cultivars (Bliss, 1993; Tanskley and McCouch, 1997; Hartman and St. Clair, 1998). A similar strategy is being applied to improve the levels of resistance to white mold in cultivated dry bean through the introgression of germplasm from novel exotic and wild genetic sources.

Material and Methods

Seven populations were developed through inbred backcross method by crossing four plant introduction (PI) accessions, including wild genotypes and landraces, with three adapted dry bean cultivars (Table 1). The plant introductions PI 318695, PI 313850, PI 325685, and PI 313609 were originally selected as potential sources for white mold resistance based on positive greenhouse tests conducted at MSU, NDSU and UNL (Kolkman, 2000). The greenhouse tests included the straw test (Petzoldt and Dickson, 1996), the leaf-agar plug assay (Steadman et al., 1997) and the oxalic acid assay (Kolkman and Kelly, 2000). The accessions PI 325685, and PI 318695 are wild type accessions and could provide new genetic diversity for resistance to white mold and other important traits in cultivated beans. Accession PI 313850 was also identified by Miklas et al. (1999) as having putative physiological resistance to white mold. Due to photoperiodism problems, the crosses between the accessions and adapted navy (Bunsi and Huron) and black (Tacana) bean cultivars were made under short days in a growth chamber during the summer of 2000. Field screening for white mold resistance of unadapted germplasm is not practical, since morphological and phenological traits, such as photoperiod sensitivity and climbing growth habit confound evaluation for physiological resistance. To overcome the problem of lack of adaptation two backcrosses were made to introgress traits from the wild genotypes into the adapted cultivated background and one backcross was made to introgress traits from cultivated landraces. The resulting lines were advanced to BC_2F_3 or BC_1F_4 generation in the greenhouse.

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Results and Discussion

The inbred backcross progenies ($BC_2F_{3:4}$ and $BC_1F_{4:5}$) from the seven populations were grown in a preliminary field test in Saginaw, MI, in 2002. The populations and the number of lines evaluated in the field in Saginaw, in 2002 are shown in Table 1. The lines were visually rated for agronomic traits and both populations with Tacana were selected along with the cross of PI 318695 and Huron for further studies because they were agronomically adapted. Only a few of the best lines in the other populations were selected due to an overall lack of desirable agronomic traits particularly in the crosses with Bunsi. The populations produced using the inbred backcross approach should provide a unique opportunity for the evaluation of new novel sources of resistance to white mold in an adapted cultivated genetic background. Field evaluation was not previously possible due to problems of adaptation of wild bean germplasm lacking the domestication syndrome traits (Koinange et al., 1996). The next step in this study is to evaluate the inbred lines through greenhouse tests and field screening to determine if they carry unique traits for physiological resistance to white mold. A genetic analysis to detect the genomic regions that contribute to white mold resistance is proposed depending on the results of the greenhouse and field screenings.

Table 1. Number of inbred backcross lines developed in crosses between unadapted PI accessions with putative physiological resistance to white mold and three commercial dry bean cultivars.

Accession PI	Improvement status	Origin	100 seed weight(g)	Generation	Tacana crosses	Bunsi crosses	Huron crosses
318695	Wild	Mexico	3.5	$BC_2F_{3:4}$	116	93	37
313850	Cultivated	Peru	57.2	$BC_1F_{4:5}$	97	115	-
325685	Wild	Mexico	3.6	$BC_2F_{3:4}$	-	100	-
313609	Cultivated	Colombia	60.6	$BC_1F_{4:5}$	-	-	80

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