Marker-Assisted Backcrossing of Two White Mold Resistant QTL into Susceptible Pinto Bean

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Introduction

Resistance to white mold [*Sclerotinia sclerotiorum* (Lib.) de Bary] in dry bean (*Phaseolus vulgaris* L.) is quantitatively inherited with low to moderate heritability. Evaluation of resistance is further complicated by expression of both avoidance traits and physiological mechanisms.

The identification of quantitative trait loci (QTL) with major-effect on resistance provides an opportunity to use marker-assisted breeding (MAS) to combine resistance sources and expedite development of cultivars with enhanced levels of white mold resistance.

Objectives

- Backcross resistance-linked QTL markers into pinto bean (Fig.1)
- Determine utility of MAS for white mold resistance breeding
- Develop pinto bean lines with improved resistance to white mold

Material and Methods

Backcross B7 resistance QTL from G122 source (Miklas et al., 2001) into Winchester pinto bean (Fig. 2) using MAS

Backcross B8 resistance QTL from NY6020-4 source (Miklas et al., 2003) into Maverick pinto bean (Fig. 3) using MAS

Evaluate effectiveness of MAS in $BC_3F_{4:5}$ generation inbred lines

Results

Marker-assisted backcrossing for the B7 QTL (Fig. 4):

Winchester/4/Winchester/3/CO81-12034//G122/Winchester

Population	Lines	Generation
PS02-011A	50	$BC_3F_{4:6}$ in Puerto Rico
PS02-011D	38	$BC_3F_{4:5}$ in Prosser GH

Population	Phs-SCAR	Ratio	Prob
PS02-011A	ongoing	1:1	
PS02-011D	18+ / 20-	1:1	>0.70

Marker-assisted backcrossing for the B8 QTL:

Population	Lines	Generation
PS02-005C	52	$BC_2F_{4:6}$ in Puerto Rico
Maverick/3/Maverick//Maverick/NY6020-4		
PS02-006D	38	$BC_2F_{4:6}$ in Puerto Rico
Maverick/3/OT9630-17-25//OT9630-17-25/NY6020-4		

Population	SCAR markers	Ratio	Prob
PS02-005C	24+ / 28-	1:1	>0.40
PS02-006D	ongoing	1:1	

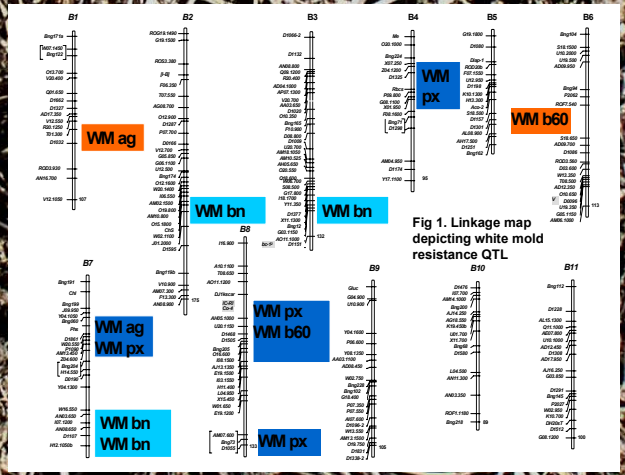

Fig 1. Linkage map depicting white mold resistance QTL

Summary

Phenotypic analysis of F2 populations in the straw test is unreliable

Association of reaction with QTL markers in some tests suggests MAS BC may be useful

Use of the G122 source of resistance in pinto bean may be difficult due to negative linkages associated with the *Phs-T* locus

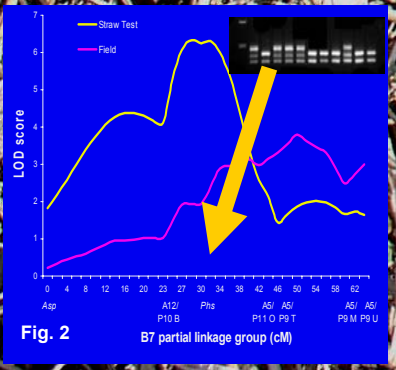

Fig. 2

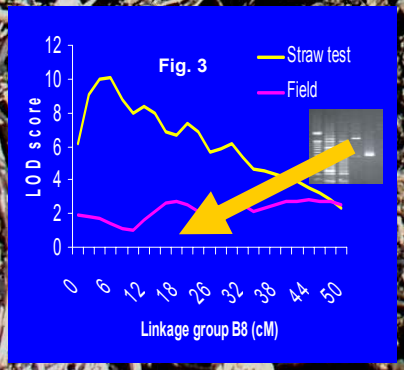

Fig. 3

Fig 4. Marker-assisted backcrossing for B7 white mold resistance QTL

G-122 resistance (*Phs-T**) x pinto cultivar (*Phs-S*) - Winchester

BC1		F1 (*Phs-T*//Phs-S*) X pinto cultivar (*Phs-S*)
BC2	MAS	1/2 BC1F1 (*Phs-T*//Phs-S*) X pinto cultivar (*Phs-S*)
BC3	MAS	1/2 BC2F1 (*Phs-T*//Phs-S*) X pinto cultivar (*Phs-S*)
BC3F1	MAS	1/2 BC2F1 (*Phs-T*//Phs-S*) is selfed
BC3F2		75% R (*Phs-T*// -*) and 25% (*Phs-S//Phs-S*)

Literature Cited

Miklas, P. N., W. C. Johnson, R. Delorme, R. H. Riley, and P. Gepts. 2001. QTL conditioning physiological resistance and avoidance to white mold in dry bean. Crop Sci. 41:309-315.

Miklas, P. N., R. Delorme, and R. Riley. 2003. Identification of QTL conditioning resistance to white mold in a snap bean population. J. Am. Soc. Hort. Sci. 128:564-570.