ANALYSIS OF WHITE MOLD RESISTANCE IN DRY BEAN

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White mold is a destructive fungal disease of dry bean (*Phaseolus vulgaris* L.) in temperate regions. White mold is incited by the plant pathogen, *Sclerotinia sclerotiorum* (Lib.) De Bary. Certain cultivars, such as Bunsi (Ex Rico 23), have reported field tolerance (Tu and Beversdorf, 1982), comprised of physiological tolerance and plant avoidance mechanisms (Miklas et al., 1992; Schwartz et al., 1987). The objectives of this study were to evaluate a wide range of adapted dry bean genotypes for field tolerance to white mold.

Materials & Methods: Diverse adapted, dry bean genotypes were evaluated in field trials at the Montcalm Research Farm, in Montcalm County, MI, during the 1996 and 1997 growing seasons. A core group of 27 genotypes were tested in both 1996 and 1997 in a randomized complete block design with three replications. Each 4-row plot consisted of two central rows of the experimental unit (genotype), with a row of the white mold susceptible cultivar (Midland) on each side of the experimental unit. Plots were 6 m long, with 50 cm row spacing. Supplemental overhead irrigation (12 mm) was applied six times in 1996, and three times in 1997, during late July and early August. Fields were naturally infested with white mold sclerotia.

Disease Incidence (**DI**) and Disease Severity (**DS**) were measured at maturity using a 'quarter system' (Hall and Phillips, 1996). Thirty plants per plot were individually rated as 0, 1, 2, 3 or 4, where 0 = 0, 1 = 1 to 25, 2 = 26 to 50, 3 = 51 to 75, and 4 = 76 to 100% of the plant was infested with white mold. DS ratings were accumulated by taking a mean for the plot (based as a percentage). DI ratings were extrapolated from the disease severity ratings, by calculating the percentage of plants with white mold symptoms.

Results & Discussion: The DI and DS ratings in the combined data set of 27 common varieties across two years (Table 1), were correlated ($r = 0.98^{**}$). As suggested by Hall and Phillips (1996), either DI or DS would be an adequate system for measuring disease levels. Disease incidence in 1996 was correlated to DI in 1997 ($r = 0.63^{**}$); DS in 1996 was correlated to DS in 1997 ($r = 0.63^{**}$). Genotypic effects and year effects were found to be highly significantly in DI and DS response to white mold. Yield data in 1996 had a negative correlation to DI ($r = -0.43^{*}$) and DS ($r = -0.51^{**}$); the 1997 yield data had a negative correlation to DI ($r = -0.41^{*}$) and DS ($r = -0.38^{*}$).

Small-seeded genotypes, such as OAC Laser, I92919, ND88-106, N90618, 92BG-7, Mayflower, Crestwood, Huron and Bunsi, were shown to have field tolerance over years. The combination of physiological tolerance and plant avoidance mechanisms has resulted in field tolerance in navy bean genotypes, such as Bunsi and Bunsi-derived lines (Crestwood, I92919 and ND88-106, N90618, Stinger), as well as C-20 - derived lines (Huron, Mayflower, N90618, Vista). The low disease ratings observed in OAC Laser may be due to a favorable compliment of plant avoidance mechanisms that result in field tolerance in the Michigan environment. The field resistance identified in the black bean, 92BG-7, offers a new source of germplasm for white mold resistance in small-seeded beans. In addition, G122 (cranberry) and Isles (dark red kidney) represent a level of field tolerance to white mold for large-seeded beans. Preliminary evidence suggests that G122 may have some level of physiological resistance. Plant avoidance is suspected to be responsible for the low disease ratings observed in Isles. Genotypes that compliment physiological resistance with plant avoidance mechanisms offer potential to plant breeders interested in developing resistance to white mold.

Table 1. Combined white mold ratings of 27 genotypes at Montcalm County, MI, in 1996 and 1997

Disease Incidence (%)		Disease Severity (%)	
Othello	77.7	Othello	65.0
Newport	71.7	Midland	56.7
Midland	71.7	Newport	53.6
N94080	62.8	N94080	46.4
Frontier	61.7	WM3-94-9	44.7
I9365-19	61.1	I9365-19	44.4
I9365-3	59.5	Frontier	40.8
Mackinac	58.3	I9365-3	40.3
WM3-94-9	56.1	Mackinac	38.2
I9365-14	51.7	Raven	34.0
Vista	50.6	Vista	33.8
Raven	45.6	T39	33.3
T39	45.6	I9365-14	31.7
I9365-31	43.9	Crestwood	22.0
I9365-5-pk	35.6	I9365-31	21.5
Stinger	32.2	Stinger	20.6
Bunsi	31.7	Bunsi	19.3
Huron	28.9	I9365-5-pk	18.3
Crestwood	28.9	Isles	17.5
Isles	28.3	G122	15.8
G122	27.2	Mayflower	13.5
Mayflower	21.7	Huron	12.6
92BG-7	21.7	92BG-7	12.4
N90618	18.9	N90618	10.3
ND88-106	13.9	ND88-106	9.0
I92919	9.4	I92919	3.6
OAC Laser	2.8	OAC Laser	1.4
mean (n = 27)	41.4	mean (n = 27)	28.2
lsd $_{(0.05)}$	22.9	lsd $_{(0.05)}$	18.7
CV (%)	48.3	CV (%)	57.9

References:

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