

Cornell 501: A White Mold Resistant Snap Bean Breeding Line

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White mold, caused by *Sclerotinia sclerotiorum* (Lib.) de Bary, is an important disease of snap beans and dry beans (*Phaseolus vulgaris* L.) reducing both yield and quality (Kerr et al., 1978). Host plant resistance can be attributed to physiological and architectural components that are controlled by multiple genes (Kolkman and Kelley, 2003). The incorporation of these genes to new market classes can be achieved through recurrent selection that systematically increases the frequency of desirable genes and gene combinations (Lyons et al., 1987). A greenhouse test for white mold resistance known as the straw test shows a very high correlation with field resistance (Petzoldt and Dickson, 1996). This test was used to develop breeding line Cornell 501, a determinate, sieve 4 snap bean with resistance to white mold. No acceptable commercial snap bean cultivar with white mold resistance is available. This breeding line should be useful as a parent in developing white mold resistant cultivars.

Origin

Cornell 501 was an F₈ selection from the cross between two Cornell breeding lines 5223 x 5813, the progeny of which had been evaluated for white mold resistance using the straw test procedure (Petzoldt and Dickson, 1996) at the F₅-F₇ generations. The pedigree of Cornell 501 is complex and involves multiple generations of selection for white mold resistance (Fig. 1). Parent 5223 (Dickson and Hunter, 1989) was developed from a determinate F₉ with white mold resistance tracing back to the accessions PI 204717 and PI 169787 (Dickson and Hunter, 1982). Parent 5223 was developed from breeding lines selected for root rot tolerance and brown spot resistance (WRR 83 and Pryke 102), and from commercial cultivars Flo (Semini Vegetable Seeds, Woodland, Calif.), Early Wax (Syngenta vegetable Seeds, Golden

Valley, Minn.) and OSU 1604 (Oregon State Univ., Corvallis). Parent 5813 was developed from breeding lines 9020, 218 HT (heat tolerant), 1051-RR (root rot tolerant) from Cornell University (Geneva, N.Y.), and the cultivar Podsquad (Semini Vegetable Seeds). The white mold resistance was inherited from PI 204717 and PI 169787.

Description

Cornell 501 has a determinate Type I growth habit with adequate leaf cover. The mature pods are sieve-size 4, straight and uniform with a maturity of about 65 d. The seeds are of reasonable quality with a mean weight of 0.23 g. In a 2003 production trial in Geneva, N.Y., the line yielded an estimated 4 tons/acre similar to the New York State average for sieve 4 cultivars (S.

Reiners and J. Ballerstein, NYSAES, Cornell Univ., personal communication); however, improvements in pod quality and yield are necessary for commercial production, including the need for reduced fiber and increased fleshiness within the pods.

Cornell 501 was evaluated for white mold resistance with 10 commercial snap bean cultivars in greenhouse trials. Each entry was replicated four times with five plants per replication. Inoculations were performed with mycelia of white mold isolate #48 collected from a snap bean field in Murray, Orleans County, N.Y. (Helene Dillard, NYSAES, Cornell Univ.) grown on 2% potato dextrose agar (Difco, Sparks, Md.) using the straw test (Petzoldt and Dickson, 1996). Plants were grown in 15 cm diameter square pots in Cornell mix (Boodley and Sheldrake, 1982) in a greenhouse at 25/22 °C day/night with a 14-h photoperiod under 1000 W metal halide lamps (300 μmol·m⁻²·s⁻¹) in preparation for the inoculation. Plants were inoculated using a modified technique that involved double inoculation of each plant with two 3-cm straws placed on petioles cut 5 cm from the nodes 24 d after planting. Plants were evaluated for disease severity 7 and 14 d after inoculation using a scale of 1 through 5, where 1 = no mycelial growth into the first node (highly resistant), 2 = infection of first node, 3 = growth past first node, 4 = growth through to second node, 5 = growth through

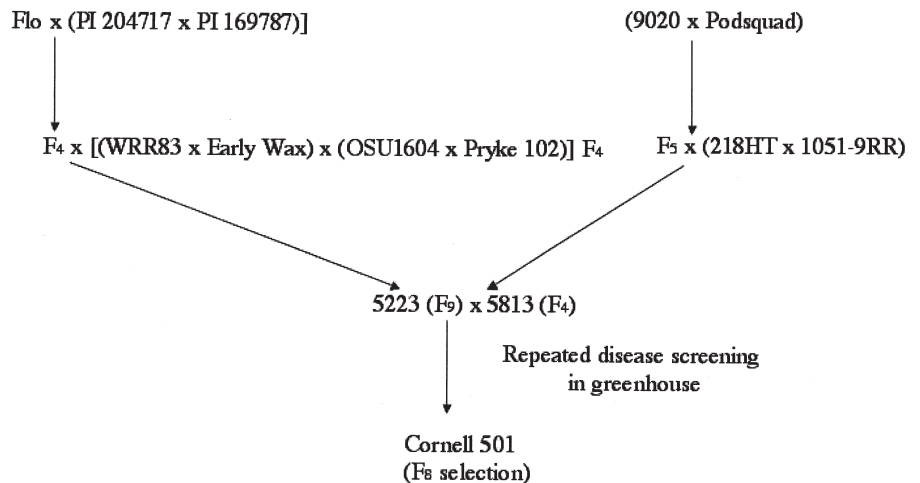


Fig. 1. Pedigree of ‘Cornell 501, a snap bean breeding line with resistance to white mold.

Table 1. Mean disease severity ratings of Cornell 501 and commercial snap bean cultivars evaluated 7 and 14 d after inoculation with white mold isolate #48 at the New York State Agricultural Experiment Station, Cornell University.

Genotype	Source	Evaluation after	
		7 d	14 d
Cornell 501	Cornell breeding line	1.35 e ^z	2.60 d
Opus	Semini	3.32 d	3.75 c
Zeus	Semini	2.94 de	4.00 bc
Hystyle	Harris Moran	4.26 ab	4.16 a-c
Bronco	Semini	4.39 ab	4.40 a-c
Nicelo	Semini	4.15 ab	4.60 ab
Labrador	Semini	4.65 a	4.78 ab
Tapia	Semini	3.68 bc	4.79 ab
Summit	Syngenta	4.40 ab	4.80 ab
Igloo	Pure Line	4.71 a	5.00 a
Brio	Semini	4.20 ab	5.00 a

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^zSeparation of means according to Duncan’s multiple range test ($p \leq 0.05$). Plants were rated on a 1 to 5 scale where 1 = highly resistant, and 5 = highly susceptible.

main stem and plant death (highly susceptible). The modified rating scale was used to represent the five responses of plants with the modified inoculation procedure, a procedure that induces a more severe response than the single inoculation typically used. Disease severity ratings were analyzed for separation of means using Duncan's multiple range test (SAS, 1997).

Cornell 501 had a mean disease severity rating of 1.35 after 7 d and 2.6 after 14 d. Cornell 501 exhibited more resistance to the mycelial growth of white mold than all 10 cultivars evaluated in this test indicating that it is more resistant to white mold than common commercial snap bean cultivars (Table 1). Opus and Zeus had the highest mean ratings of the 10 cultivars tested, and may be candidates for crosses with Cornell 501 to generate white mold resistant lines. Cornell 501 was also field-tested in seven states and greenhouse-tested in five states as part of the White Mold Regional Nurseries in 2002. It was the highest-ranking

bean line based on a mean ranking of the 12 tests (Steadman et al., 2003). Cornell 501 will provide breeders with a white mold resistant source to develop commercial cultivars of common bean.

Availability

Small amounts of seed are available from P.D. Griffiths, New York State Agricultural Experiment Station, Cornell University, Department of Horticultural Sciences, 302 Hedrick Hall, Geneva NY 14456.

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