White Mold Resistance in Pea and Lentil through Breeding and Biotechnology

Kevin McPhee, USDA-ARS, Pullman, WA; Weidong Chen, USDA-ARS, Pullman, WA; Blaine Schatz, North Dakota State University, Carrington, ND; Bob Henson, North Dakota State University, Carrington, ND and Fred Muehlbauer, USDA-ARS, Pullman, WA

Abstract

Two approaches to develop resistance to *Sclerotinia sclerotiorum* in pea and lentil were undertaken in 2005. The first approach involved screening 37 pea genotypes under field conditions at Carrington, ND and 24 and 12 genotypes of pea and lentil, respectively, under field conditions in a grower's field near Spangle, WA. Research plots at Carrington consisted of seven rows spaced 18cm apart and 7.6 m long and were arranged in a randomized complete block design with 4 replicates. During the flowering period, all plots were inoculated with a solution of ascospores on 6 July (3.32 million ascospores/plot) and again on 11 July (2.40 million ascospores/ plot). Beginning immediately after the first inoculation, a misting system was employed to maintain a humid environment to favor disease development. The misting system was run for 2-4 minutes every half hour, 24 hours/day, for 4 weeks. Disease was scored periodically and growth, development, and grain yield and quality data were recorded. Natural infection from inoculum present in the soil was relied on for infection at the Spangle location. Unfortunately, environmental conditions at the Spangle location were not conducive to disease development in the relatively open canopy of peas while some disease was observed among the lentil genotypes. Statistically significant differences were observed in all parameters measured at Carrington except days to physiological maturity. However, the progression of disease did not allow evaluation of physiological maturity (and powdery mildew) in all plots. Several entries showed relatively high levels of susceptibility on the first evaluation date. The second evaluation may be the most useful for selection, since the disease had progressed sufficiently without dominating all entries and quite large differences were observed among commercial varieties. On the final evaluation date, Arvika (forage pea) and CDC Sonata showed the lowest disease occurrence. A highly significant negative correlation was observed between days to beginning and end bloom and Sclerotinia rating, but no relationship was shown to days to physiological maturity. Yield was highly negatively correlated to disease ratings and lodging. Genotypes with the greatest level of resistance will be used to develop genetic mapping populations for inheritance studies. The second approach involved introducing the oxalate oxidase gene from barley (*Hordeum vulgare* L.) into pea and lentil through *Agrobacterium tumefaciens*-mediated transformation. The oxalate oxidase gene was successfully cloned from barley cDNA and incorporated into the binary vector, pART27A. The resulting plasmid is currently being used in transformtion studies to transfer the gene into pea and lentil germplasm. In addition, efforts are in progress to develop a twin binary plasmid which will allow the selectable marker gene, *nptII*, to be separated from the oxalate oxidase gene through natural Mendelian segregation. This will be beneficial if deregulation of the transformants is pursued.