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Genetic characterisation of angular leaf spot (ALS) resistance in selected common bean (*Phaseolus vulgaris* l.) cultivars in Ethiopia

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Abstract

The common bean (Phaseolus vulgaris L.) is one of the significant grains used in the human diet, accounting for half of all grain legumes consumed globally. The presence of disease-causing pathogens is one of the primary reasons for decreases in agricultural productivity, particularly in bean production. Angular Leaf Spot (ALS) is among the major diseases of common bean. Selection and identification of resistant genotypes as well as the study of the mechanism of resistance in resistant genotypes are vital to deal with such a disease. Therefore, this study was conducted to characterize Mesoamerican genotype SPS50HB for ALS disease resistance using F2 segregating population derived from crossing between susceptible parent Red Wolaita and SPS50HB and to identify linked molecular markers with the resistance gene. The ALS disease reaction chi-square test shows that ALS disease resistance in SPS50HB is inherited as two independent dominant genes (15:1) (X^2 = 0.047; P = 0.83) from the total plants evaluated, 192 plants were resistant to ALS and 12 plants were susceptible. The expected segregation ratio under this two-gene model is 3 R: 1 S in the SBC (F1 cross with the susceptible parent) progeny, which is strongly supported by the observed segregation (X^2=0.218; P=0.317). The study of the allelic relationship between SPS50HB(R) and Mexico 54(R) was conducted using the F2 population derived from crossing SPS50HB with Mexico 54. Evaluation of F2 populations showed no segregation for the disease resistance, which indicated that the resistance gene in the two genotypes co-segregate and are either in the same locus or are closely linked genes. Heritability for resistance is estimated to be 53% in F2 populations. The markers linked to this trait were identified using previously reported RAPD, SCAR, and SSR primers. Two SCAR ($OPAO4_{709}$, $PF13_{310}$), one STS (g796), and one SSR (BM165) markers showed polymorphism between the susceptible and resistant parents. Among the polymorphic markers, $OPAO4_{709}$ and

PF13$_{310}$ were further tested using the Bulk Sergeant Analysis (BSA) method for polymorphism among resistant and susceptible bulks of F2 individuals. Co-segregation analysis of the polymorphic marker and disease reaction in the F2 population confirmed that these two markers are associated with resistance to ALS in SPS50HB. Therefore, this study identified SPS50HB as a potential source of resistance to the important ALS disease. The information generated from this study will aid common bean breeding programs targeting improving resistance to ALS using SPS50HB as the resistant parent.

Publication

Firew, T. 2022 Genetic characterisation of angular leaf spot (ALS) resistance in selected common bean (*Phaseolus vulgaris* l.) cultivars in Ethiopia

Bean varieties for the mapping population growing the the greenhouse (Red woylata (RW), Mex 54 and SPS-50 HB; i); Ms Firew and Ms Tadesse making crosses in the greenhouse (ii); Ms Firew working in the lab (iii); SPS-50 HB populations grown in field conditions for evaluation to disease resistance (iv).