Grain Yield and Charcoal Rot Resistance Stability in Common Beans under Terminal Drought Conditions

Jesus G. García-Olivares1,2, Ernesto López-Salinas3, Javier Cumpia´n-Gutiérrez3, Miguel A. Cantú-Almaguer3, Francisco Zavala-García1 and Netzahualcoyotl Mayek-Pérez2

Authors_ addresses: 1Facultad de Agronomía, Universidad Autónoma de Nuevo León. General Escobedo, Nuevo León, México; 2Centro de Biotecnología Genómica, Instituto Politécnico Nacional. Blvd. Del Maestro s ⁄ n esq. Elı´as Pin˜ a, Col. Narciso Mendoza, 88710, Reynosa, Tamaulipas, México; 3Programa de Frijol. Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, Campos Experimentales Cotaxtla, Papaloapan y Río Bravo, México.
(correspondence to N. Mayek-Pérez. E-mail: nmayek@ipn.mx)

Abstract

Charcoal rot (*Macrophomina phaseolina*) is a major disease of beans (*Phaseolus vulgaris* L.) in Mexico. The use of germplasm combining high-yield stability with resistance to drought and charcoal rot could reduce damage from this disease. In this study, we compared the Eberhart and Russell method and the Additive Main Effect and Multiplicative Interaction (AMMI) model plus biplot analysis for measuring grain yield (GY) and charcoal rot resistance (CHRR) stabilities in 98 F8 : 10 recombinant inbred lines (RILs) derived from a cross between bean adapted to the tropics (BAT) 477 (resistant) x Pinto UI-114 (susceptible). Experiments were conducted from 2007 to 2009 in Isla, Cotaxtla, Río Bravo and Díaz Ordaz, México, under irrigated or terminal drought conditions. anova detected significant differences ($P \leq 0.05$) in GY and CHRR among environments, genotypes and genotype x environment interactions (GEI). Most RILs showed good responses to unfavourable environments based on GY (48) and CHRR (40). AMMI anova s for both traits showed that all sources of variation in the model accounted for approximately 49% of the total squared sum. For the first principal component (PC1), we found 13 RILs that were stable for GY, and for the second (PC2), we found 9 that were stable for GI. For CHRR, we detected 14 stable RILs (PC1) and eight (PC2). Biplot analysis showed the largest vectors for Díaz Ordaz (irrigated and drought, 2008), where the highest and most variable GYs were detected. The shortest vectors were found in Isla (drought, 2007) and Río Bravo (irrigated and drought, 2008), where the lowest and least variable GY were found. We found differential responses of RILs to locations, years and soil humidity conditions as well as significant GEI based on GY and CHRR. The two methods were complementary, and both gave us information to select stable, high-yield germplasm associated with resistance to charcoal rot disease.