BREEDING VALUE OF HOST PLANT THRIPS RESISTANCE FOR NEW CULTIVAR DEVELOPMENT

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Abstract

Thrips (Thysanoptera: Thripidae) management is an important component of cotton production on the Texas High Plains. With the loss of systemic aldicarb insecticides, host plant resistance can be a valuable tool for mitigating thrips injury to cotton seedlings. Understanding the nature and breeding value of such resistance is key for its utilization in cultivar development. Field and greenhouse trials were conducted in 2011-2014 to evaluate genetic segregation and estimate broad sense heritability (H^2) and actual gain from selection (G_s). In 2011, an interspecific F_2 population was grown in a greenhouse trial to evaluate genetic segregation of the trait. Individual plants were evaluated for thrips feeding injury at 4-5 true leaves, utilizing a visual damage rating scale. Phenotypic data were continuously distributed, and subsequent chi-square analyses confirmed that the data did not fit known single- or two-gene segregation ratios ($P < 0.05$). A similar trial was repeated at the field level in 2012, utilizing a different interspecific F_2 population. Chi-square analyses again suggested quantitative inheritance of thrips resistance ($P < 0.05$). Therefore, in 2013-2014, five families, derived from interspecific crosses, were evaluated in greenhouse trials to estimate the H^2 of thrips resistance. Individual parent and F_2 plants were planted and visually assessed for thrips damage. H^2 values ranged 40-70%, depending on the family. F_2 and F_3 populations, resulting from an interspecific cross, were evaluated at the field level in 2012 and 2013, respectively, to estimate actual gain per cycle of selection. A 10% selection intensity (SI) resulted in an approximate 9% gain per cycle of selection; 5% SI resulted in a 22% gain and 1% SI resulted in only a 3% gain. Given the potential sensitivity of this trait to environmental conditions, a 5% SI appeared to optimize actual genetic gain, whereas 1% SI was likely too intense. Selection intensity should therefore be adjusted according to ambient thrips populations in a given location, to ensure greater capture of genetic effects through selection. These results suggest that host plant thrips resistance in cotton is quantitatively-inherited, with moderately high heritability. Significant genetic improvement can be thereby achieved through visual selection, depending on selection intensity in a given cycle.