ABSTRACT

The western corn rootworm, Diabrotica virgifera virgifera LeConte, has developed resistance to most control tactics used to manage it. Transgenic corn varieties that express insecticidal proteins from the bacterium Bacillus thuringiensis Berliner (Bt), cause mortality to target pests when ingested. In an attempt to delay resistance formation to these Bt products, the Environmental Protection Agency mandates the development of an insect resistance management program prior to registration for commercial sale. Despite plans to delay resistance being in place, resistance has developed in the field for both Cry3Bb1 and mCry3A-expressing hybrids. Resistance to these products could be due to physiological adaptations or through behavioral avoidance of the toxin in the plant. For the first portion of this work, we investigated a behavioral avoidance hypothesis for resistance. We hypothesized that later hatching western corn rootworm larvae could utilize previous feeding damage on Bt corn roots by early hatching larvae as an entry point into the root cortex containing lower levels of the Bt protein. Field and greenhouse tests involving infestation staggering to facilitate previous feeding damage did not support our hypothesis and did not indicate any effect of previous root feeding on the ability of this pest to establish on Bt plants and cause damage. We also evaluated resistance dynamics in the western corn rootworm in response to the most recent Bt protein commercialized for rootworm management, eCry3.1Ab. For one experiment, an eCry3.1Ab-selected and a paired control western corn rootworm colony were utilized to determine the potential fitness costs associated with eCry3.1Ab resistance. Adult longevity, egg viability, and larval development time results indicated a lack of fitness costs associated with eCry3.1Ab resistance in the western corn rootworm. Reciprocally crossed colonies of the eCry3.1Ab-selected and control colonies were created in order to evaluate whether the resistance trait to eCry3.1Ab was recessive, dominant, or something in between. Each reciprocal cross and their parent colonies were evaluated in diet toxicity and plant assays. Results indicated that the eCry3.1Ab resistance trait we selected for under laboratory conditions is dominantly inherited.