INVESTIGATION FOR A RAPID DIAGNOSTIC TEST FOR CATERPILLAR RESISTANCE TO TRANSGENIC COTTON

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Abstract

Proof of concept was demonstrated for a rapid bioassay to monitor resistance in lepidopterans against *Bacillus thuringiensis* (Bt) crops. Many approaches are possible to diagnose resistance including Log-Dose probit modeling on populations established from the field, biochemical assays, molecular methods and long-term feeding assays in some cases with a 7 d incubation period. In this preliminary study, we investigated whether or not a rapid and practical Bt resistance diagnostic assay could be developed. Two approaches to establish a rapid diagnostic bioassay were examined in this study. First, we devised a behavioral bioassay where diagnostics were performed by observing avoidance of larvae to Bt in artificial diet. A simple ON-OFF (on diet) bioassay suggests that it is possible to separate resistant and susceptible strains of the tobacco budworm (TBW) and cotton bollworm (CBW) based on their avoidance of diet with Bt. Our preliminary results showed that TBWs and CBWs have a mechanism to sense and avoid Bt in their diet. In this work, 89% and 79% of Bt susceptible TBWs were found on non-Bt diet and avoided diet with MVP II Bt toxin and WideStrike extract, respectively. In addition, a susceptible strain of the CBW spent about 71.4 % of its time on non-Bt artificial diet as compared to only 31.9 % on diet with MVP II Bt toxin. Our second assay examined the rate of fecal pellet production on artificial diet with a diagnostic dose of toxin. When fed on diet containing Bt (MVP II), the resistant strain (YDH2) began producing fecal pellets as early as 2 h. The TBW susceptible strain (YDK) did not produce fecal pellets even after 18 h. Similarly, the susceptible strain of CBW started producing fecal pellets at 2 h and within 5 h about 90 % of the larvae produced fecal pellets. In 5 h the CBW larvae excreted at least double the amount of fecal pellets as compared to the larvae on Bt diet. These studies show proof of concept for a rapid assay using two different approaches, which could provide operators with a 5 h or less diagnosis for resistance; more work is needed to determine assay details, minimum assay times and field validation. A 24 h assay was demonstrated both in the lab and field which needs wider field testing. These assays likely can be applied to other caterpillars and other species outside of the Lepidoptera.