EVALUATION OF RESISTANCE IN HELICOVERPA ZEA POPULATIONS USING VARIOUS COTTON PLANT TISSUES

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Abstract

Common assay methods for Bt resistance for lepidopteran larvae consist of the overlaying of a purified protein or Bt leaf powder onto a diet and assessing mortality of larvae that are placed on the overlaid diet. These assays are limited by a lack of access to large quantities of purified proteins and convolution of mortality assessments due to the additional influences of leaf tissues on the larvae. Cotton plant tissue could be utilized as an additional source of Bt protein to utilize in assays. This could provide an assessment that is more indicative of how a particular strain of larvae may perform in the field. A known susceptible (Benzon) and Cry1A, Cry1F, and Cry2A resistant strain (G13-Cry2Ab2-RR) of *Helicoverpa zea* (Lepidoptera: Noctuidae) were assayed using both purified proteins and lyophilized cotton plant tissue powder overlays. Results indicated that Bollgard 2 and WideStrike 3 plant tissue overlays could be utilized to detect Bt resistance (Table 1). Results varied based on which type of plant tissue was assayed (Fig. 1). Some plant tissues resulted in more stunting and larvae mortality than others, regardless of whether Bt toxins were present or not. White floral tissue appeared to be the most reliable structure to utilize in tissue assays due a reduced negative influence of this tissue on larval health unless the tissue contained Bt toxins. Further investigation will be necessary to fully implement this concept as an efficient resistance monitoring technique.

Table 1. Probit analyses for *Helicoverpa zea* larvae in assays of a susceptible (Benzon) and Bt-resistant (G13-Cry2Ab2-RR) strain using purified Bt proteins (ug/cm2) or lyophilized leaf tissue from Bollgard 2 and WideStrike 3 cotton (mg/cm^2).

Population	Protein	N	LC50 (Confidence Intervals)	Resistance Ratio
Benzon	Cry1Ac	448	0.105(0.077,0.143)	
G13-Cry2Ab2-RR	Cry1Ac	64	>10	>95.2
Benzon	Cry2Aa	448	0.058(0.047,0.072)	
G13-Cry2Ab2-RR	Cry2Aa	64	>3.16	>54.5
Benzon	Vip3Aa39	448	0.510(0.415,0.627)	
G13-Cry2Ab2-RR	Vip3Aa39	448	0.0316< x <0.1	<1
Benzon	Bollgard 2	448	0.208(0.141,0.313)	
Benzon	WideStrike 3	448	0.955(0.489,2.648)	

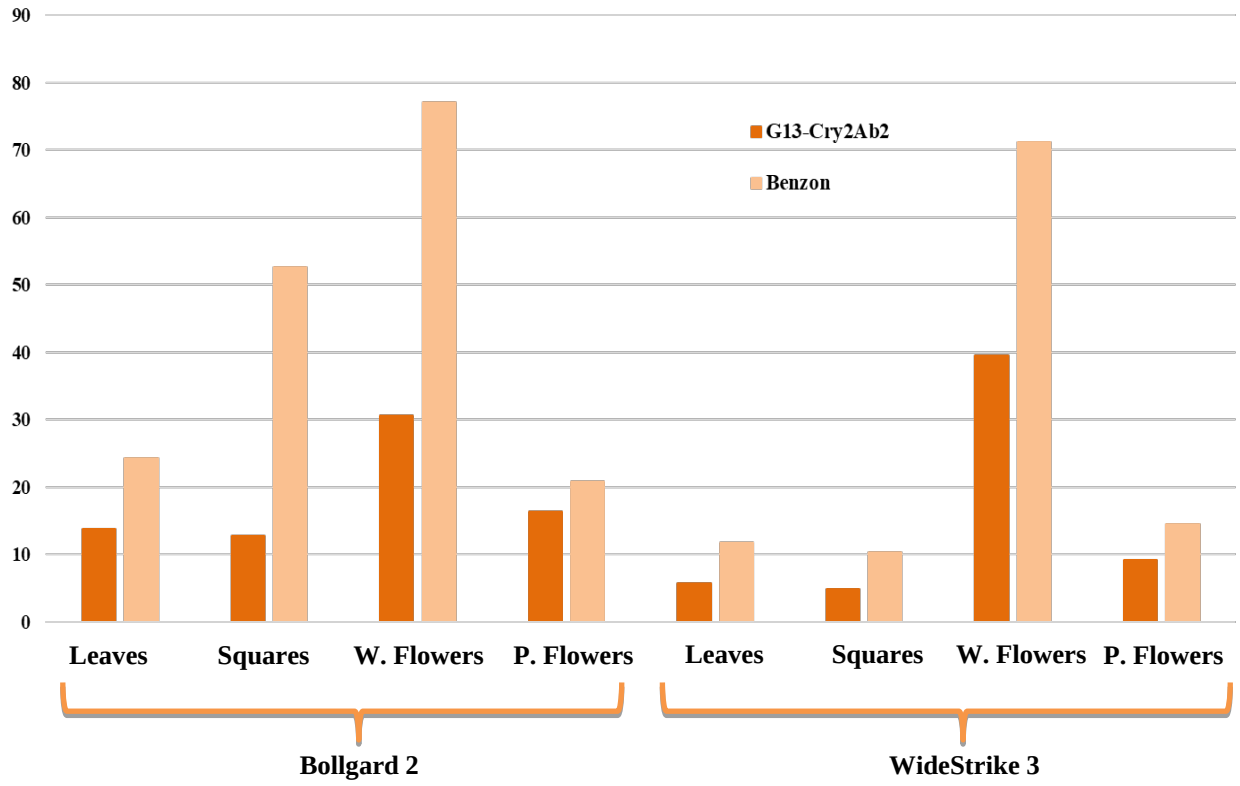

Figure 1. Percent mortality of *Helicoverpa zea* larvae in assays of a susceptible (Benzon) and Bt-resistant (G13-Cry2Ab2-RR) strain on different plant tissues. Data were corrected using Abbott's Formula.