Comparative toxicities of three insecticides to soybean stem borer, *Dectes texanus texanus* (Coleoptera, Cerambycidae) adults.

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Abstract:

The soybean stem borer (*Dectes texanus texanus*) is a tunneling insect pest taking on more significance across Kansas. Although the adults inflict minimal leaf feeding damage, larvae girdle soybean stems internally, causing plants to lodge as physiological maturity is reached. Chemical control of larvae with non-systemic insecticides appears to be ineffective because they are protected within the petiole, stem and post-harvest stubble of the plant for their entire development. Adult life-history traits compound the problem because emergence and egg laying occur over a period of several weeks. Currently, no insecticides are labeled against this insect and the few studies completed to date have failed to keep adult populations suppressed enough to prevent economic infestations of larvae from developing. As an initial effort to identify more efficacious products to control the adult stage we evaluated toxicities of three insecticides in the laboratory, including two pyrethroids (lambda-cyhalothrin and permethrin) and a carbamate (carbaryl). Generally, all the tested insecticides showed good efficacy against the adult under laboratory conditions. Lambda-cyhalothrin and permethrin were 153- and 26-fold more toxic than carbaryl, respectively.

Materials and Methods:

Insects: Soybean stem borer adults were collected with sweep nets from infested soybean fields in northcentral, KS (Republic County). After the beetles were brought into the lab, they were held individually in small (30ml) plastic cups containing a 1 cm long piece of green bean (*Phaseolus vulgaris* L.) and maintained in a growth chamber at 25^{+}/-1^{o}C until use.

Bioassay: Three technical grade insecticides, lambda-cyhalothrin, permethrin, and carbaryl, were used to determine dose-response relationships based on procedures employed by Zhu et al. (2000) with some modifications. Briefly, a single, unsexed beetle was transferred into an 8-ml glass sample vial coated internally with an appropriate concentration of insecticide diluted in acetone. Beetles were added after the acetone evaporated and the internal surfaces were dry. Forty vials per concentation were used to individually expose beetles during each bioassay. A small piece of green bean was added to each vial and the vials were placed in a growth chamber at 25^{+}/-1^{o}C. Mortality was assessed after 24 hours. Beetles were considered dead if they failed to walk following light tapping on the vial. The insecticide bioassay data were analyzed using probit analysis (PROC PROBIT, SAS Institute, 1996).

Results and Discussion:

Lambda-cyhalothrin was 153- and 5.8-fold more toxic than carbaryl and permethrin, respectively, based on LC_{50} values (Table 1). The Prob>Chi-squared values were all high (greater than 0.05) indicating a good fit of the predicted line to the data (Fig. 1).

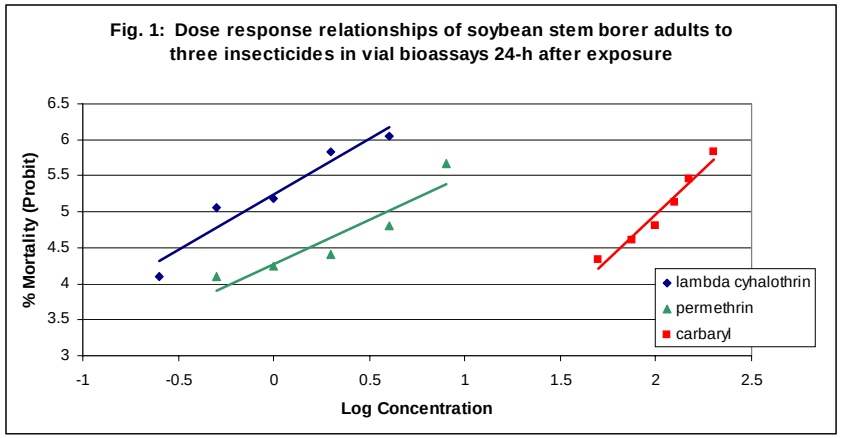
Lambda-cyhalothrin and permethrin showed low but similar slopes in these probit analyses (Fig. 1), indicating that the tested beetle population exhibited similar responses to the two pyrethroids. In contrast, the slope for carbaryl is about two-fold that of the pyrethroids, suggesting that the response of the beetle population is more uniform to carbaryl than to differing amounts of these pyrethroids. The pyrethroids caused high 24-hr mortality with low concentrations of active ingredient. These differences may be caused by different modes of action characteristic of pyrethroid and carbamate insecticides.

Table 1: Comparisons of susceptibility of the soybean stem borer to three insecticides.

Chemical	Number*	LC_{50} (95% Cl) µg/vial	LC_{90} (95% Cl) µg/vial	Slope (SE)	Prob>X^2
Lambda-Cyhalothrin	200	0.68 (0.49-0.90)	4.54 (2.89-9.87)	0.54 (0.094)	0.27
Permethrin	200	3.93 (2.79-6.54)	39.40 (17.57-204.21)	0.45 (0.11)	0.20
Carbaryl	240	103.88 (88.20-121.64)	332.84 (241.28-626.72)	0.94 (0.095)	0.84

* Represents total number of beetles used for this trial.

Fig. 1: Dose response relationships of soybean stem borer adults to three insecticides in vial bioassays 24-h after exposure



Conclusions:

Knowing that these chemicals are effective against the soybean stem borer adult under laboratory conditions and that some appear more effective than others justifies further experiments to determine their long-term residual activity and to establish whether laboratory results are predictive of field performance.

Literature Cited:

Zhu, K.Y., J.-R. Gao, and S.R. Starkey. 2000. Organophosphate resistance mediated by alterations of acetylcholinesterase in a resistant clone of the greenbug, *Schizaphis graminim* (Homoptera: Aphididae). Pesticide Biochemistry and Physiology. Vol. 68, 138-147.

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