DOSAGE-MORTALITY RESPONSES OF BEET ARMYWORM POPULATIONS FROM THE YAQUI VALLEY, SONORA, MEXICO TO EMAMECTIN BENZOATE

José L. Martínez-Carrillo
INIFAP-CIRNO-CEVY
Calle Norman Borlaug, Km. 12.5
Cd. Obregón, Sonora, Mexico
Robert Cartwright
Novartis Crop Protection
Stillwater, OK

Abstract

Base-line data were obtained on beet armyworm populations from the Yaqui, valley of Sonora, Mexico in response to emamectin benzoate. This is a new insecticide with a different mode of action, related to the avermectin family. Field collected populations from cotton and chili were compared to a susceptible and a colony reared for one year under laboratory conditions. Bioassays were performed on third instar larvae weighing 20-25 mg, at least 250 larvae from the first to the third generation after field collection were used in each bioassay. Each larvae was treated with one microliter of a solution of technical grade emamectin benzoate dissolved in acetone. Five to seven concentrations were used in each bioassay. Mortality data was obtained 48 hours after topical application of the insecticide, data was corrected for control mortality (never >10%) using Abbot´s formula, then analyzed by the probit model, significant differences 95% were considered only if fiducial limits of the LD_{50} values do not overlap. Results showed a LD_{50} value of 0.68 μg/g and fiducial limits ranging from 0.36 μg/g to 1.41 μg/g, in the susceptible colony, which are similar to those in the LAB-95 and field collected colonies of beet armyworm. The LAB-95 colony can be used as a reference colony to measure any change in response of beet armyworm populations in Mexico. These data indicate susceptibility of the colonies evaluated and represent base lines for emamectin benzoate in beet armyworm populations in Mexico.

Introduction

In resistance management, it is important to have effective pesticides with different modes of action in order to delay the development of resistance through a judicious use of them in rotation or sequences. In recent years various insecticides have come to the market with both effectivity and different mode of action. Emamectin benzoate (MK 0244) is one of the new insecticides, derivative of the natural product abamectin, in the avermectin family. Its mode of action is similar to the members of this family of products. In general the avermectins bind to multiple sites in the insect chloride channels. The result is a loss of function and disruption of nerve impulses, finally producing paralysis. The insect stops feeding shortly after ingestion of the insecticide (White et. al. 1997).

Emamectin benzoate has an excellent efficacy against numerous lepidopterous pests, including the tobacco budworm *Heliothis virescens* (F.), the bollworm *Helicoverpa zea* (Boddie), and the beet armyworm *Spodoptera exigua* (Hubner), (Jansson et. al. 1997).

In Mexico the beet armyworm, has become a serious insect pest of various crops including cotton, tomato, chili pepper and other vegetables. The control of this pest is based mainly in the application of insecticides. Resistance is a major concern when insecticides are overused, which usually occurs in situations of outbreaks of pest such as the beet armyworm. There are already several reports of resistance to different commonly used insecticides in this pest (Brewer and Thrumble, 1989), which makes more important to moderate the use of any new promising insecticide.

Emamectin benzoate, has not been used commercially in Mexico, it represents an option for beet armyworm control and to the establishment of resistance management strategies, thus it is important to develop base line data to this product., which was the objective of this study.

Materials and Methods

Beet armyworm larvae were field collected in the Yaqui, valley of Sonora, Mexico., from commercial cotton (YA-COT), and chili (YA-CHI) fields. This material was reared in artificial diet until bioassayed. One colony collected in 1995 (LAB-95) and reared under laboratory conditions without selection pressure was also bioassayed. In order to obtain resistance ratios, data provided by researchers of INIFAP in Tamaulipas Mexico (Teran, O. P. 1996, Personal communication). were used as a reference, these data were obtained on a susceptible colony known as DOW-ZENECA (DZSUSC). Bioassays were performed on third instar larvae weighing 20-25 mg, at least 250 larvae from the first to the third generation after field collection were used in each bioassay. Each larvae was treated with one microliter of a solution of technical grade emamectin benzoate (supplied by Merck-Sharp and Dohm, Co.) dissolved in acetone. Five to seven concentrations were used in each bioassay. Mortality data was obtained 48 hours after topical application of the insecticide, data was corrected for control mortality (never >10%) using Abbot's formula, then analyzed by the probit model, significant differences 95% were considered only if fiducial limits of the LD_{50} values do not overlap.

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Results and Discussion

Probit analysis data is shown in table 1, the LD_{50} values from the susceptible colony (DZSUSC) were not significant different from those obtained in the laboratory (LAB-95) or the field collected colonies (YA-CHI, and YA-COT) fiducial limits at 95% ranged from 0.36 μg/g to 1.44 μg/g in the susceptible colony overlapping with the values obtained in the other colonies bioassayed, thus indicating not significant differences. The highest slope was observed in the colony collected from chili. These results indicate that all populations evaluated are susceptible to this insecticide. The LAB-95 colony could be used as a reference colony to detect any shift in the response of beet armyworm populations to emamectin benzoate in Mexico. These data will be a base line to follow the response of beet armyworm populations once this product is register to be used commercially in Mexico or to detect any change in response due to cross resistance to abamectin which is already commercially used in vegetables and other crops in Mexico.

Conclusions

The LD50 and LD95 values obtained in these bioassays were similar in the susceptible, LAB-95 and field collected colonies of beet armyworm. The LAB-95 colony can be used as a reference colony to measure any change in response of beet armyworm populations in Mexico. These data represent base lines for emamectin benzoate in beet armyworm populations in Mexico.

References

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Table1. Dosage-Mortality values for emamectin benzoate on Beet armyworm Populations from the Yaqui, Valley of Sonora, Mexico.

Colony	LD_{50} μg/g	Fiducial Limits 95%	LD_{95} μg/g	Slope
DZSUSC	0.68	0.36-1.41	6.86	1.39
LAB-95	0.64	0.49-0.83	7.18	1.57
YA-CHI	0.92	0.74-1.13	5.30	2.17
YA-COT	0.92	0.73-1.19	8.08	1.76