RESPONSE OF THE BEET ARMYWORM TO INSECTICIDES IN MEXICO

A.P. Terán-Vargas, J.L. Martínez-Carrillo and J. Vargas-Camplis
INIFAP-CIR Noreste-CESTAM
Tampico, Tam. México

Abstracts

The LD_{50} of different insecticides was determined using strains of Beet Armyworm from Nortwestern Mexico (Valle del Yaqui, Sonora), and from the Northeastern regions (Altamira, Mante and Rio Bravo, Tamaulipas). The strains from Valle del Yaqui and Rio Bravo were the most tolerant to Methyl Parathion, Azinphos-Methyl, Chlorpyrifos and Methomyl, while Mante and Altamira strains were the most susceptible. In relation to Pyrethroids, Altamira's strain was equal or more tolerant as Valle del Yaqui and Rio Bravo strains, while Mante's was the most susceptible.

Introduction

The Beet Armyworm, *Spodoptera exigua* (Hubner) is a polyphagous insect, its diet consists of several wild and cultivated plants (Metcalf and Metcalf 1992). Occasionally, this insect causes damage to cotton. However, recently its has been recognized as an important secondary pest causing severe losses (Headley 1988). In the last decade the Beet Armyworm was a more consistent pest on cotton on Southern United States, particularly on the States east of the Mississippi river (Smith 1994). In Georgia, in 1977, 1980, 1981, 1988 and 1990 heavy infestations ocurred, and they were related to a lower than normal precipitation during the cotton growing period (Duose and McPherson 1991).

In 1995 a heavy infestation was experienced in the United states, 44% of the planted area suffered fron this pest and this in turn caused a loss of 368,141 bales of cotton (Williams 1996).

In Mexico, in the last decade,this insect has been an occasinal problem on crops such as chile peppers and tomatoes on the Mexican Pacific region, particulary on the States of Sonora and Sinaloa, as well as on the gulf part of Mexico, particulary on Southern Tamaulipas. On recent years, severe intestations have been observed causing heavy damage. In southern Tamaulipas in 1994 more than 10,000 cotton hectares were saverely defoliated and this pest also caused heavy damage on chile peppers and onions.Before 1995 this pest occasionally was detrimental to crops; but in the last two years it is considered a problem on chile peppers, tomatoes and cotton.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1227-1229 (1997)
National Cotton Council, Memphis TN

As a characteristic on both region of Mexico has been the difficulty on the
control of this insect with insecticides,due to the lack of effectiveness of the currently registered products, and this can obey to the high level resistance. This was the reason that made us to carry out bioassays to determine the LD_{50} of S. exigua of different regions of Mexico.

Materials and Methods

Larvae of Beet Armyworm (100-150) were collected on cotton at Valle del Yaqui (1987 and 1989), at Altamira and Mante, Tamaulipas (1995) and at Rio Bravo in 1996. Larvae were kept on artificial diet (Southland Products Inc.)until they reached pupal stage.Pupae were transferred to 3 L glass jars and the adults that emerged were fed with a 10% sugar solution.

Groups of five larvae were placed in 1 oz plastic cups with 2 ml artificial diet. Bioassays were performed at Valle del Yaqui using larvae of 35±8 mg and a 25±3 mg larvae were used for the bioassays carried out at the Northeastern. Larvae were treated topicaly with µl of acetone. Insecticides evaluated were Endosulfan, Methyl Parathion, Azinphos-Methyl, Profenofos, Chlorpyrifos, methomyl, Permethrin, Cypermethrin and Deltamethrin. Al last eigth dosis where 0 and 100% mortality ocurred were used for each treatment.Four replications with 10 larvae each were used per treatment.Mortality was assessed 48 h later for the Northwestern colony and 72 h later for the Northeastern colonies .

The LD_{50}, slope,standard error and the confidence limits at 95% were determined using Probit Analysis (Polo-PC,LeOra Software 1987)

Results and Discussion

We found differences among treatments. Endosulfan, which was only evaluated with the Northeastern colonies,demonstrated its lowest effectiveness with the Rio Bravo colony (Table 3). The Mante's colony was the most susceptible(Table 2).

The highest LD_{50} for Methyl Parathion was obtained with the Valle del Yaqui colony (Table 4),followed by the Rio Bravo colony (Table 3) while Altamira and Mante colonies were the most susceptible (Table 1 and 2). The former two colonies were statistically different from the other two, but not different among them.

The colonies from Rio Bravo and Altamira were not significantly different to Azinphos-Methyl(Table 1 and 3) while the Mante's colony demonstrated the highest susceptibility (Table 2). With relation to Profenofos, the colonies from Northeastern Mexico were not significantly different.

Chlorpyrifos showed different susceptibility to the colonies. The Rio Bravo colony was found more tolerant compared with the others (Table 3). The Valle del Yaqui colony obtained an intermediate value and Altamira and Mante's were the most susceptible (Table 1 and 2).

The highest value to Methomyl was observed with the Valle del Yaqui colony with a value of 10.12 µg (Table 3). Statistical differences were found between the Northwestern and Northeastern colonies. No statistical differences were found among the Northeastern colonies,but the highest values were obtained with the Rio Bravo population (Table 1 and 2).

Regarding to the Pyrethroids, the highest values were obtained with Permethrin, except with the Rio Bravo's colony. The highest value, and significantly different was obtained with the Altamira's colony (Table 1). Cypermethrin was the least toxic pyrethroid, its highest value was obtained with the Rio Bravo colony but not significantly different to Altamira and Valle del Yaqui (Table 3). The lowest and significant value was obtained with the Mante's colony. The highest tolerance to Deltamethrin was obtained with Altamira's population but not differences were found among them (Table 1 and 4). The lowest values were obtained with Mante and Rio Bravo colonies.

In general, there is not a clear pattern of susceptibility of one colony to all insecticides; some differences were found and this can be explained as the particular use of an insecticide on a different region, which produced a determined selection pressure. Although some colonies demonstrated susceptibility to certain insecticide, this does not imply that this product is effective in controlling this pest to that given dosis, it is necessary to assess its effectiveness in each region and determine the LD_{50} which is effective to control this insect.

Acknowledgements

Carlos Blanco-Montero PhD. for helping me in this work.

References

Douse, G.K. and R.M. McPherson (Eds.). 1991. Summary of losses from insect damage and costs of control in Georgia, 1989. Ga. Agric. Expt. Stn. Special Pub. 70. 47 pp.

Headley, C. 1988. Beet Armuworm sneak attack. Cotton Grower 24: 13-15.

LeOra Software. 1987. Polo-PC, a user's guide to probit or logit analysis. LeOra Software, Inc. Berkeley. Ca. 15 pp.

Metcalf, R.L. and R.A. Metcalf. 1992. Destructive and useful insects., 5 th ed. McGraw-Hill, New York, 1104 pp.

Smith, R.H. 1994. Beet Armyworm: A costly caterpillar, pp 13-14. *In*: Proceeding Beltwide Cotton Prod. Res. Conf. National Cotton Council, Memphis, TN.

Williams, R.M. 1996. Cotton insect losses. 1995. pp. 670-689. *In:* Proceedings Beltwide Cotton Conferences. National Cotton Council. Nashville, TN.

Table 1. Toxicity of insecticides to beet armyworm from Altamira, Tamaulipas, Mexico in 1995 CESTAM-INIFAP.

Insecticide	Insect test	Slope±SE	LD_{50} * µg/larva	Confidence limits 95%
Endosulfan	260	1.424± .229	7.018	3.646-11.057
Methyl Parathion	320	1.870± .171	0.957	0.651- 1.381
Azinphos-Methyl	240	2.243± .284	4.518	3.583- 5.603
Profenofos	360	2.683± .421	0.924	0.630- 1.184
Chlorpyrifos	240	2.141± .386	0.289	0.196- 0.380
Methomyl	240	1.560± .200	0.589	0.245- 1.216
Permethrin	230	3.158± .524	3.528	2.675- 4.312
Cypermethrin	280	2.022± .238	0.751	0.567- 0.942
Deltamethrin	320	1.974± .290	0.829	0.528- 1.133

* 72 hrs. after aplication.

Table 2. Toxicity of insecticides to beet armyworm from Mante, Tamaulipas, Mexico in 1995 INIFAP-CESTAM.

Insecticide	Insect test	Slope±SE	LD_{50}* µg/larva	Confidence limits 95%
Endosulfan	280	0.768±0.107	1.016	0.274-2.385
Methyl Parathion	320	2.034±0.236	0.922	0.686-1.178
Azinphos-Methyl	360	1.354±0.220	0.954	0.251-1.533
Profenofos	280	2.796±0.394	0.965	0.687-1.159
Chlorpyrifos	280	2.024±0.241	0.315	0.196-0.450
Methomyl	240	2.555±0.303	0.553	0.389-0.739
Permethrin	280	2.783±0.339	1.980	1.376-2.616
Cypermethrin	440	1.633±0.191	0.159	0.116-0.208
Deltamethrin	360	1.474±0.211	0.119	0.074-0.233

* 72 hrs. after aplication.

Table 3. Toxicity of insecticides to beet armyworm from Rio Bravo Tamaulipas, Mexico in 1996 INIFAP-CESTAM.

Insecticide	Insect test	Slope±SE	LD_{50}* µg/larva	Confidence limits 95%
Endosulfan	320	1.238±0.126	17.135	5.153-45.558[1]
Methyl Parathion	400	4.534±1.244	14.867	7.871-18.797[1]
Azinphos-Methyl	280	2.810±0.832	4.391	2.113-6.224[1]
Profenofos	280	2.769±0.350	1.301	0.560- 2.033
Chlorpyrifos	280	5.041±0.893	1.376	1.101- 1.601
Methomyl	280	1.928±0.312	2.094	0.346- 3.929
Permethrin	360	1.601±0.143	0.769	0.473- 1.201
Cypermethrin	280	2.050±0.291	1.776	0.543-3.390[1]
Deltamethrin	400	1.303±0.111	0.157	0.107 - 0.233

[1/] Confidence interval 90%.
* 72 after aplication.

Table 4. Toxicity of insecticides to beet armyworm from Valle del Yaqui, Sonora in Mexico.

Insecticide	Insect test	Slope±SE	LD_{50}* µg/larva	Confidence limits 95%
Methyl Parathion	300	1.95±0.24	26.34[1]	20.90-31.84
Chlorpyrifos	250	1.56±0.23	0.77[2]	0.61- 0.98
Methomyl	250	1.24±0.23	10.12[2]	7.63-13.43
Permethrin	300	1.73±0.24	1.38[1]	1.10- 1.72
Cypermethrin	250	2.17±0.25	0.70[1]	0.57- 0.49
Deltamethrin	250	2.20±0.20	0.41[2]	0.35- 0.89

* 72 after aplication.
[1] Year of collection 1987.
[2] Year of collection 1989.