FIELD EVALUATION OF FIVE SYNTHETIC PYRETHROIDS AGAINST THE SPINY BOLLWORM, *EARIAS INSULANA* (BOISD.), FOCUSING ON THEIR NEGATIVE IMPACTS ON BENEFICIAL ARTHROPODS (MINIA- EGYPT)

By

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Abstract

Five synthetic pyrethroids were evaluated during 2012 cotton growing season against the spiny bollworm *Earias insulana* (Boisd.). The recommended rates of tested pesticides as suggested by the Egyptian Ministry of Agriculture were used to conduct this study. Comparisons were based on three successive sprays of 15 days interval. Monitoring spiny bollworm infestation and population density was conducted just before the 1st spray and at weekly interval up to six weeks. Data revealed that two formulations of lambdcyhalothrin were the most effective treatments resulting in >90% reduction in insect infestation and larval population density. Cypermethrin, alpha-cypermethrin and zeta-cypermethrin came in the second order with an average of 83-85% reduction in infestation and 85-92% reduction in larval density. The carbamate insecticide, methomyl was the least effective treatment resulting in 61.0 and 64.7% reduction in spiny bollworm infestation and larval content, respectively. Regarding the negative impacts on beneficial arthropods, Kaput (lambdcyhalothrin) and Methocam (methomyl) were the least harmful treatments.

Introduction

In Egypt, spiny and pink bollworms are the key pests of cotton (Amin & Gergis, 2006). Alternative host plants play an important role in the carryover of *Earias* spp. to cotton (Saini & Singh, 2002 and Bhatti *et al.,* 2007). In Egypt, cotton cultivated area decreases annually; in the last five years, farmers do not prefer to cultivate cotton because of the high cost of pests control and cotton hand picking accompanied with the low price of cotton yield that does not cover the costs of cotton production (Aziz, 2011).

Egypt spends about 15-20 million dollars to combat cotton bollworms (CBW) on an area of about 800 000 acres every year. (Temerak, 2003). Without chemical control, damage to cotton crop by bollworms results in a significant yield loss (Al-Ameer *et al,* 2010).

In Minia Governorate, the authors focused on the chemical control of spiny bollworm, however pink bollworm was not included in this study. Pink bollworm start to disappear from Minia region, few numbers of this species were recorded late in the season during September and October, possibly because cotton cultivated area was reduced. In addition, burn the collected plants after harvest prevents the next year infestation. Moreover, their other host plants are very limited.

Synthetic pyrethroids are the most suitable pesticides to control the two insect species; because of the lipophilicity of this chemical group, it is more effective against adult and egg stages. The objective of this study is to evaluate the efficiency of five synthetic pyrethroids against spiny bollworm in comparison with a carbamate insecticide, methomyl. The negative impact of tested chemicals on predators was also considered.

Materials and Methods

Cotton (*Gossypium barbadens*, variety Giza 90) was cultivated in Minia University farm, (Minia Governorate, Egypt) on April, 12. Starting from the first of July, bollworm infestation and larval content were weekly monitored. When infestation reached 3-5%, spraying program was started after dividing the cultivated area to 24 plots of 175m^2 each; in addition to a large separated plot was used as a control treatment to prevent the overlapping of pesticides to this untreated area. Before the first spray, samples of 100 green bolls were collected randomly from each plot, then inspected and dissected to record %infestation and %larval content. The first spray was on July 19 and repeated twice at 15 days interval. Green boll samples were collected weekly during the period from July, 19 to August, 30, then inspected and dissected as previously described. At the same intervals of collecting boll samples, predators were counted on 25 plants chosen randomly from each replicate. Percentages of reduction in infestation, larval content and predators were calculated using Telton and Henderson, 1955.

Results

Based the comparisons on percentages of reduction in spiny bollworm infestation after the first spray (Table 2 and Figure 1), the two formulations of lambdcyhalothrin (Kaput and Mampada) exhibited the greatest efficiency in reducing insect infestation (84.1 and 87.7%, respectively). Other tested pyrethroids [Alpha-power (alpha-cypermethrin), Nasrthrin (cypermethrin) and Fury (zeta-cypermethrin)] are statistically less effective than the two formulations of lambdcyhalothrin with percentages of reduction in infestation ranged from 69.3% to 76.5%. The carbamate insecticide, Methocam (methomyl) considered the least effective treatment (55.2%). After the second spray, tested pyrethroids are statistically similar in reducing the spiny bollworm infestation (86% to 97%). However, Methocam was significantly less effective. Data of the third spray confirmed the insignificant differences between tested pyrethroids with ≥ 90% efficiency in reducing spiny bollworm infestation and confirming the unsatisfactory results of Methocam (63.7%).

General averages of the three successive sprays keep the first order for Kaput and Mampada, however pushed the other three pyrethroids to the second order and still Methocam inferior with the least efficiency in controlling this insect species (Table 2 and Fig.1). When the comparison was based on the general average of %reduction in larval content (Fig. 2 and Table 2), Kaput, Mampada and Fury offered the highest efficiency (> 90%) followed by the other two pyrethroids (85-87% reduction). Methocam offered unsatisfactory results (64.7%reduction).

Population of predators was reduced in insecticide treatments by 20-29% (Table 2). The greatest harmful treatments are Alpha-power, Nasrthrin, Fury and Mampada. The least harmful treatment was Methocam (19.89%) and Kaput (23.96%).

Discussion

- In general synthetic pyrethroids are more efficient than the carbamate insecticide evaluated in this study, probably because of the long residual activity of pyrethroids and the greatest lipophilicity. However, when the comparisons were among tested pyrethroids, the two formulations of lambdcyhalothion were superior followed by zetacypermethrin.
- In previous study, alpha-cypermethrin was less effective against the spiny bollworm, *Earias insulana*, than deltamethrin (Scott-Dupree *et al,* 2008). Also, more recent study conducted by Zidan *et al* (2012), revealed that tested pyrethroids (cypermethrin and lambdcyhalothrin) were more effective in controlling the field populations of the spiny bollworm than methomyl.
- In the current study, we focused on the negative impacts on predator populations. The least harmful treatment was Methocam (19.89%) and Kaput (23.96%). Zidan *et al* (2012) found that cypermethrin, and lambdcyhalothrin were more toxic to predators than methomyl which induced a moderate effect. However, in our study, the treatment of Kaput (lambdcyhalothrin) is recommended to use against spiny bollworm because of its effective against this insect species and also the least negative impact on beneficial arthropods.
- In our study, this is the first time to cultivate Giza 90 variety in the University farm at Minia Governorate. Cotton variety Giza 80 was always cultivated in previous seasons. Cotton yield with Giza 90 was significantly less than that from Giza 80 in previous year (data not shown). It is hard to know if the reason related to the unexpected high temperature that was dominant on July and August of 2012 cotton growing season or related to the variety unsuitability to the weather in our region (Minia). However, Aziz (2011) reported that Giza 90 variety is cultivated in Upper Egypt because of its tolerance to temperature stress, short duration, high productivity and ginning outturn.

Table (1): Insecticides used

Trade name	Common name	Formulation & %AI	Rate /feddan (0.42 hectare)
Alfa-power	Alpha-cypermethrin	EC-10%	250ml
Nasrthrin	Cypermethrin	EC-25%	250ml
Fury	Zeta-cypermethrin	EW-10%	200ml
Kaput	Lambdcyhalothrin	EC-5%	375ml
Mampada	Lambdcyhalothrin	EC-5%	375ml
Methocam	Methomyl	SP-90%	300gm

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Experimental design: completely randomized blocks design (six insecticide treatments and four replication, in addition to separate area, served as control treatment. Plot area 175cm^2.

IRRIGATION SOURCE (SOUTH)	KAPUT	MAMPADA	METHOCAM	ALPHA-POWER	Control	NORTH
	FURY	METHOCAM	NASRTHRIN	KAPUT		
	METHOCAM	NASRTHRIN	FURY	MAMPADA		
	MAMPADA	ALPHA-POWER	KAPUT	NASRTHRIN		
	NASRTHRIN	FURY	MAMPADA	METHOCAM		
	ALPHA-POWER	KAPUT	ALPHA-POWER	FURY		
	OTHER EXPERIMENT					
	ROAD (EAST)					

Table (2): Mean percentages of reduction in spiny bollworm infestation, larval content and number of predators (Mean ± SD).

Trade names	%Reduction in infestation	%Reduction in larval population	%Reduction in predator population
Alfa-power	83.1 ± 2.22b	87.8 ± 4.93b	28.65 ± 4.26a
Nasrthrin	83.9 ± 3.24b	85.1 ± 6.52b	26.78 ± .32ab
Fury	85.1 ± 5.56b	92.3 ± 3.76b	28.03 ± 6.11a
Kaput	92.8 ± 2.51a	97.9 ± 1.79a	23.96 ± .79bc
Mampada	92.4 ± 4.52a	98.3 ± 3.47a	29.07 ± 7.79a
Methocam	61.0 ± 6.37	64.7 ± 7.37c	19.89 ± 2.03c

For each column, different letters mean significant difference.

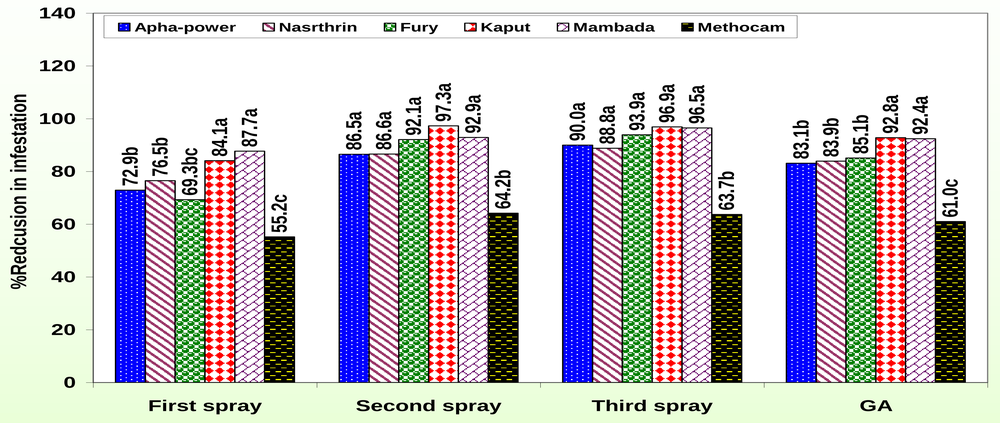

Fig (1): Mean percentages of reduction in spiny bollworm infestation. For each group, means followed by the same letters are not significantly different (LSR$_{0.05}$).

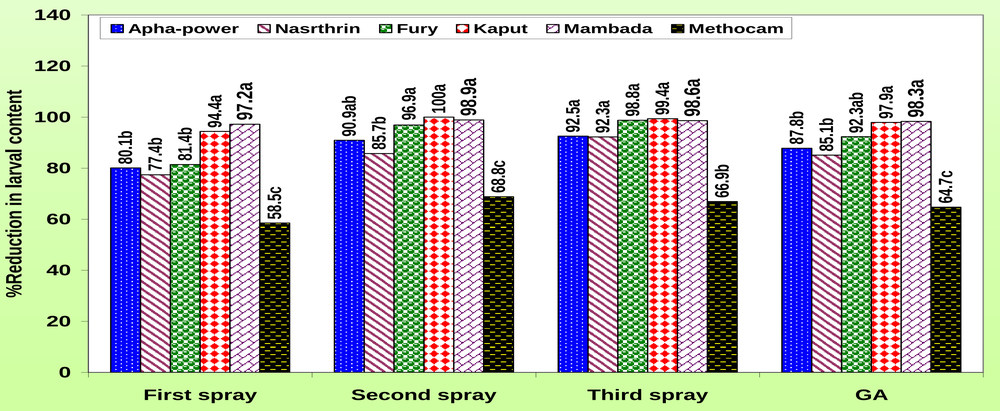

Fig (2): Mean percentages of reduction in the population density of spiny bollworm larvae counted in 100 green bolls/replicate. For each group, means followed by the same letters are not significantly different (LSR$_{0.05}$).