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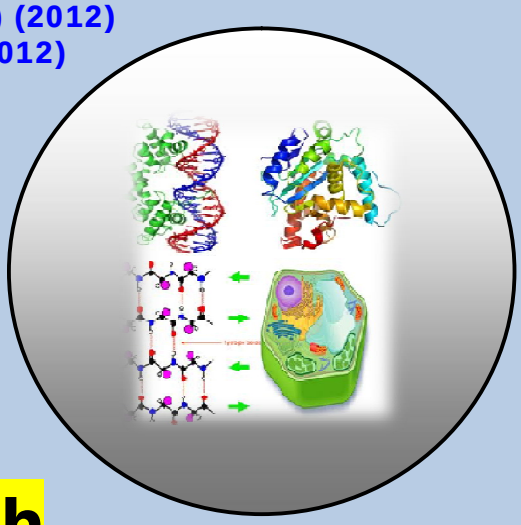

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RESEARCH PAPER

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Monitoring of Resistance to Organophosphorus and Pyrethroides Insecticides against Pink Bollworm *Pectinophora gossypiell* (Saund.) During 2012 and 2013 Seasons

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ABSTRACT

Three field strains of the pink bollworm pectinophoragossypiella(Saund.) were collected from three different Governorates of Egypt during 2012 and 2013 seasons for monitoring of its resistance to six different organophosphorus insecticides and nine pyrthroid insecticides. Results showed high to moderate rseistance in all insecticides during two seasons exceptdursban showed moderate levels of resistance in 2012 cotton season. The resistance ratios were 6.85, 8.70 and5.76 fold in menufia, sharkia and dakahlia, respectively.On the other hand Dorsal no resistance was detected in sharkia governorate, resistance ratio was 0.31 fold in 2012 season but in 2013 season resistance ratio increase to 18.20 fold. While in dakahlia governorate resistance ratio were 5.76 fold and 16.69 fold in 2012 and 2013 cotton season respectively, in sharkia governorate during 2012 season observed that, chlorizan have low level of resistance (4.8 fold)while pesteban was 3.2 fold. Other insecticides on other Governorates indicate high level of resistance.The pyrethroid insecticides showed high resistance all governorates in both seasons exceptedcyper in 2012 season indicated moderat resistance, the resistance ratios were (7.5, 9.74 and 5.3) fold respectively in menofia, sharkia and dakahlia. Also sumi – alpha in 2013 season resistance ratios were (5.76, 8.09 and 6.37) fold respectively atz all governorates. On the other hand in fenethrin in sharkia governorate showed moderate resistance, resistance ratio was 5.46 fold. Finally demethren also showed moderate resistance.

Key words: Pectinophoragossypiella (saund.) organophosphorus Insecticides and Pyrethroide insecticides resistance.

INTRODUCTION

In Egypt, cotton is one of the most important cash crops and represents more than half the income of twomillion small-scale farmers. But cotton is attacked bymany insect species. Cotton bollworms are the mostdestructive pests infesting cotton plants. Pink bollworm (PBW), *pectinophoragossypiella* (saund.) and spinybollworm (SPW), *Eariasinsulana* (Boisd) infest manycotton producing areas of the world and cause a severereduction in cotton yield and quality (Lohag andNahyoon, 1995). Chemical control is still adopted asone of the major techniques for combating theseserious pests.The effectiveness of different pesticides againstbollworms was studied by several authors (Khan *et al.*2007; Balakrishman*et al*. 2009 and Magdy*et al*.2009). Besides, the two pests. Resistance to pyrethroides has already been observed in pink bollworm (Ayad*et.al*., 1989, 1993, 1994 a and b; Al- Beltagy*et. al*. 2001 a and b; matar 2002; Abd El- Haleem, 2007 and Hassan, 2007).

The present work aimed to monitoring the resistance of several organophosphorus and pyrthroid insecticides against Pink bollworm (PBW), *pectinophoragossypiella* (saund.) collected from three governorates during 2012 and 2013 seasons

MATERIAL AND METHODS

Tested Insect

Three field colonies of the pink bollworm *Pectinophoragossypiell*a (Saund) were collected from the cotton fields in several locations (Dkahlia, Sharkia,and Menofia) during 2012-2013 cotton season. The infested green bolls were collected in the end of cotton growth season the disposed larvae were released from the double infested seeds and reared under constant temperature 27 ± 2 ◦C 70 –75 % relative humidity. Five concentrations were used for each insecticide and three reolicates of ten adults each were used for each concentration. Glass chiney cages (6 x 9 cm) were dipped in each concentrations of insecticide for 20 seconds and left to dry at room temperature. The newly moth (zero- day-old)were exposed to residual insecticides in glass chiney cages and covered with muslin cloth to allow air circulation. After twenty-four hours of exposure the mortality percentage were inspected. Abbott's formula (Abbott, 1925) was adapted to correcte the mortality data for natural mortalities in the control and concentration- mortality relationship was determined using the computer program LDP line, based on probit analysis (Busvine 1957). The rates of resistance were expressed as susceptible strain which has bean reared in laboratory condition for more than 15 generations without exposed any insecticides.

Resistance ratio = $\frac{LC_{50} \text{ of the field strain}}{LC_{50} \text{ of the susceptible strain}}$

Insecticides used

Organophosphorus insecticides

Profenofos (Telethon EC72%), Chloroprifos (Dursban, Dorsel, Chlorozan, Helban, Pestban) EC48%.

Pyrethroide insecticides

Cypermethrin (cyper 10 % EC), Alpha cypermethrin (Alpha – cyper 10% EC), Esfenvalerate (Fentrate – S 5% EC, Sumi – Alpha 5% EC), Gama cyhalotherin (Ventix 6% EC), lambadycylatherin (Agrestar 2.5 % EC, Lambda-z), Fenpropathrin (Fenethrin 30% EC) and Deltamethrin (Demethrin 2.5 % EC).

RESULTS AND DISCUSSION

Resistance ratios of organophosphorus insecticides against three strain of *pectinophoragossypiella*during 2012 and 2013 seasons

Resistance ratios of organophosphorus insecticides tested against three field strains of *p.gossypiella*collected from three Governorates,menufia, sharkia and dakahlia during 2012 and 2013 cotton seasons are shown in table (1). The results indicate that, resistance ratios fluctuated from one year to other and from one Governorate to others.During two cotton seasons (2012 and 2013), teleton indicated high critical level of resistance in two years 2012-2013, in all governorates but in 2013 season the resistance level was increase than in 2012 season.

The resistance ratio of teleton fluctuated between (17.29 -35.80- fold) in all governorates during 2012 cotton season on the other hand in 2013 cotton season this compound observed critical level of resistance it was 113.2 fold in sharkia governorate but in menufia and dakahlia the resistance ratio were (42.3 and 56.52 –fold), respectively on tow governorates.Dursban showed tolerance levels of resistance in 2012 cotton season. The resistance ratios were 6.85, 8.7 and5.76 fold in menufia, sharkia and dakahlia, respectively. But in 2013 season resistance ratio exceeded the critical level in menufia and sharkia governorates the resistance ratios were (11.1 and 18.1 – fold), respectively, indakahlia governorate resistance ratio was 8.6 fold. Dorsal no resistance was detectedin sharkia governorate, resistance ratio was 0.31 fold in 2012 season but in 2013 season resistance ratio was 18.2 fold. In menufia governorate resistance ratio was high level in 2012season but in 2013 season resistance level decreased. While in dakahlia governorate resistance ratio were 5.8 fold and 16.7fold in 2012 and 2013 cotton season respectively, on the other hand chlorizan showed high levels of resistance in tow seasons in menufia and dakahlia governorates but in sharkia governorate in 2012 season observed low of resistance level the resistance ratio was 4.8 fold but in 2013 resistance ratio increase to 21.2 fold. In menufia governorate resistance ratio were 13.0 fold and 34.7 for 2012 and 2013 cotton season respectively, while dakahlia governorate showed moderate resistance level resistance ratio were 10.96 fold and 11.7 respectively in 2012 and 2013 cotton seasons.

Helban recorded high levels of resistance in all governorates during 2012 season and 2013 season which it was rangedbetween 13.3 fold and 21.04 fold in 2012 season in Sharkia Governorate in 2013 season resistance level increased they ranged between 25.7- 61.1 folds.in Sharkia and Menofia Governorates.

Finally in pestban insecticide showed low resistance level insharkia governorate resistance ratio was 3.2 fold in 2012 season but in 2013 season resistance ratio increased to 13.8 fold while in all governorates observed high levels of resistance in 2012 season .Resistance ratio in menufia and dakahlia were 13.3 fold and 20.34 fold respectively during 2012 season, on the other hand in 2013 season resistance ratioin Menufia and dakahli were 21.2 fold and 28.5 fold respectively,.

WunanChe*et. al*. (2013). Beet armyworm, *Spodopteraexigua* (Hübner), is a serious pest of vegetables in China, and its control is heavily dependent on chemical insecticides. The current resistance status of nine insecticides was investigated in 16 field populations collected from seven provinces of China during 2009–2012.

Table 1. Monitoring of resistance to some organophosphorus insecticides in pink bollworm *Pectinophoragossypiella* (Saund.) collected from three Governorates during 2012 and 2013 cotton seasons.

Insecticides	Season	Menufia			Sharkia			Dakahlia		
		Slope	LC_{50} (ppm)	RR	Slope	LC_{50} (ppm)	RR	Slope	LC_{50} (ppm)	RR
Teleton Profenefos 72 % EC	Lab strain	1.96	12.72	----	1.96	12.72	----	1.96	12.72	----
	2012 strain	0.87	455.5	35.8	1.12	220	17.29	0.91	366.02	28
	2013 strain	1.33	538.5	42.3	1.39	1439.9	113.2	1.39	719	56.52
Dursban Chloropyriphos 48 % EC	Lab strain	2.356	29.42	----	2.36	29.42	----	2.356	29.42	----
	2012 strain	1.23	201.8	6.85	1.22	258.29	8.7	1.06	169.55	5.76
	2013 strain	0.94	325.2	11.1	1.19	231.4	18.1	0.77	253.8	8.6
Dorsal Chloropyriphos 48% EC	Lab strain	2.522	34.40	----	2.52	34.40	----	2.522	34.40	----
	2012 strain	1.28	374.6	10.89	0.80	10.69	0.31	1.47	199.52	5.8
	2013 strain	0.71	216.9	6.3	0.84	626.4	18.2	1.11	574.2	16.69
Chlorizan Chloropyriphos 48% EC	Lab strain	1.626	18.13	----	1.626	18.3	----	0.626	18.13	----
	2012 strain	1.04	235.77	13.00	0.64	87.43	4.8	0.86	198.75	10.96
	2013 strain	0.56	629.3	34.7	0.87	386	21.2	0.77	253	11.7
Helban Chloropyriphos 48% EC	Lab strain	2.271	30.30	----	2.271	21.55	----	2.271	21.55	----
	2012 strain	1.23	403.52	13.31	0.77	453.6	21.04	1.13	324.51	15.05
	2013 strain	1.82	1317.1	61.1	1.40	553.3	25.7	0.89	862.9	28.5
Pestban Chloropyriphos 48% EC	Lab strain	2.177	30.30	----	2.177	30.30	----	2.177	30.30	----
	2012 strain	1.23	403.52	13.31	1.05	99.87	3.2	0.93	616.59	20.34
	2013 strain	0.89	641.7	21.2	1.3	420	13.8	0.86	862.9	28.5

Resistance ratios of pyrthroides insecticides against three strain of *pectinophoragossypiella*during 2012 and 2013 seasons.

Compared with the susceptible strain WH-S, some field populations evolved various levels of resistance to eight of the nine insecticides tested: emamectin benzoate (4- to 348-fold), indoxacarb (2- to 41-fold), spinosad (5- to 38-fold), chlorantraniliprole (2- to 44-fold), tebufenozide (2- to 87-fold), chlorfluazuron (3- to 31-fold), cypermethrin (79- to 1240-fold), and chlorpyrifos (8- to 3,080-fold), but no significant resistance was detected to chlorfenapyr (0.4- to 7-fold). This indicates that chlorfenapyr has no cross-resistance with these other currently used insecticides. Four consecutive years' resistance screening at two places shows that resistance patterns were different between populations from Luhe (Jiangsu Province) and Fengxian (Shanghai), which are ≈300 km apart. Resistance levels to chlorpyrifos were much higher in populations from Luhe (877- to 3,080-fold) than from Fengxian (8- to 110-fold). Fengxian populations developed moderate levels of resistance to tebufenozide (13- to 87-fold), but no resistance in Luhe populations (2- to 6-fold). However, Luhe populations developed moderate levels of resistance to chlorfluazuron (21- to 31-fold), but there was no resistance in Fengxian populations (3- to 5-fold). It is suggested that local insecticide selection determined resistance patterns although *S. exigua* has long-distance migratory potential. Adaptive resistance management tactics (such as rotations) should be designed and implemented based on the resistance patterns of *S. exigua* for each geographic area.

Resistance ratios of pyrethroid insecticides tested against three strains of P. gossypella collected from some governorates (Menofia, Sharkia and Dakahlia) during 2012 and 2013 cotton seasons are shown in table (2). The results indicated that resistance ratios fluctuated from one year to other and from one governorate to others during tow cotton season (2012 and 2013). Cyper showed high levels of resistance in all governorates in 2012 cotton season, the resistance ratio fluctuated between 8.97 and 19.39 fold. But in 2013 cotton season resistance ratio decreased in all governorates. The resistance ratios were (7.50, 7.47 and 5.30) fold respectively in Menofia, Sharkia and Dakahlia governorate. Also resistance ratios for Alpha cyoer fluctuated between (8.20 and 19.08) levels in three governorates in 2012season and in 2013 season fluctuated between (7.58 and 12.90) fold in three governorates. On the other hand Fentrate- S showed critical level of resistance ratios in both seasons. The resistance ratios were 52.98, 33.57 and 21.61, respectively for menofia, sharkia and dakahlia governorates, but in 2013 season resistance ratio were (47.75, 35.60 and 19.61)fold, respectively in governorates. Also in sumi – alpha the resistance ratios fluctuated between ttow cotton seasons 2012 and 2013. Ventix recorded high levels of resistance in all governorates during both seasons, the resistance ratios were 36.10, 39.84 and 32.02)level respectively in 2012 season for menofia, sharkia and dakahlia. But in 2013 cotton season resistance ratios were(54.80, 36.06 and 35.52) fold respectively in there governorates. Also in Agrestar showed high level of resistance in tow cotton seasons. In 2012 season resistance ratio were (38.21, 25.60 and 25.56) fold respectively, for three governorates. On the other hand in 2013 season resistance ratios were (35.00, 23.43 and 28.83) fold respectively for all governorates. Fenethrin had tolerance level in menofia and sharkia. The resistance ratio were (3.89 and 4.63) fold. But in dakahlia governorate showed moderate of resistance ratio was 8.98 fold during 2012 cotton season. But in 2013 resistance ratios were increased in all governorates, the resistance ratios were 28.04, 5.46 and 9.84 fold.

Demethrin showed moderate level in 2012 season resistance ratios were (7.70, 8.58 and 5.84) respectively for menofia, sharkia and dakahlia governorates. But in 2013 resistance ratio were (10.57, 9.76 and 3.98) fold respectively, that showed moderate levels of resistance in menufia and sharkia, the resistance ratio were (10.57 and 9.76) level but was tolerance level in dakahlia, resistance ratio was 3.98 level. Finally in lambada- Z observed high level in all governorates the resistance ratio fluctuated between 11.51 and 20.73 in all governorates and tow cotton seasons in 2012 season resistance ratios were (11.57, 19.27 and 13.21) fold respectively, for menufia, sharkia and dakahlia governorates. But in 2013 season resistance ratios were (20.73, 11.51 and 16.40) fold respectively, for three governorates.

Table 2. Monitoring of resistance to some pyrethroides insecticides in pink bollworm *pectinophoragossypiell*(saund)collected from three Governorates during 2012 and 2013 seasons.

Insecticides	Season	Menofia			Sharkia			Dakahlia		
		Slope	LC_{50}	RR	Slope	LC_{50}	RR	Slope	LC_{50}	RR
Cypermethrincyper 10 % EC	Lab strain	2.01	28.13	----	2.01	28.13	----	2.01	28.13	----
	2012	2.76	306.61	10.89	2.09	545.52	19.39	1.67	252.34	8.97
	2013	2.05	212.77	7.5	1.97	189.62	6.74	1.79	149.19	5.30
Alpha cypermethrin Alpha- cyper 10 % EC	Lab strain	2.52	32.24	----	2.52	32.24	----	2.52	32.24	----
	2012	2.73	615.21	19.08	2.71	264.62	8.20	1.81	397.64	12.33
	2013	2.93	317.53	9.84	2.22	416.00	12.90	1.96	244.52	7.58
Esfenvalerate Fentrate –S 5 % EC	Lab strain	2.65	8.31	----	2.65	8.31	----	2.65	8.31	----
	2012	2.81	440.34	52.98	1.96	279.02	33.57	1.31	179.61	21.61
	2013	2.12	396.88	47.75	1.92	295.90	35.60	2.09	162.96	19.61
Esfenvalerate Sumi- Alpha 5 % EC	Lab strain	2.62	35.37	----	2.62	35.37	----	2.62	35.37	----
	2012	1.17	251.80	7.11	2.42	454.92	12.86	1.54	303.67	8.58
	2013	1.93	204.06	5.76	2.81	286.48	8.09	2.32	225.31	6.37
Gama cyhalotherin Ventix 6 % EC	Lab strain	1.60	1.92	----	1.60	1.92	----	1.60	1.92	----
	2012	1.93	69.38	36.13	2.04	76.47	39.82	1.63	61.48	32.02
	2013	2.13	105.23	54.80	2.08	69.24	36.06	2.32	68.21	35.52
Lambadycylothrin Agrestar 2.5 % EC	Lab strain	2.12	3.21	----	2.12	3.21	----	2.12	3.21	----
	2012	1.78	122.67	38.21	1.94	82.19	25.60	1.78	82.06	25.56
	2013	2.43	112.35	35.00	2.54	75.23	23.43	2.45	92.56	28.83
Fenpropathrin Finethrin 30 % EC	Lab strain	2.11	14.15	----	2.11	14.15	----	2.11	14.15	----
	2012	1.46	55.05	3.89	2.42	65.92	4.65	1.93	127.20	8.98
	2013	2.12	396.88	28.04	2.53	77.35	5.46	2.22	193.34	9.84
Deltamethrin Demethrin 2.5 % EC	Lab strain	2.22	16.56	----	2.22	16.56	----	2.22	16.56	----
	2012	2.14	127.58	7.70	2.25	142.20	8.58	1.92	96.73	5.84
	2013	2.04	175.10	10.57	2.93	161.75	9.76	2.81	65.92	3.98
Lambadycylothrine Lambda - Z	Lab strain	1.87	3.42	----	1.87	3.42	----	1.87	3.42	----
	2012	1.42	39.59	11.57	2.29	65.92	19.27	1.46	45.41	13.21
	2013	1.99	70.93	20.73	3.14	39.36	11.51	2.11	56.12	16.41

Abou- Yousef *et.al*. (2008) monitoring of resistance to pyrethroid insecticides in pink bollworm), *pectinophoragossypiella (Saund.)* during 2006-2007 cotton seasons in Egypt. Six field strains of pink bollworm), *pectinophoragossypiella*(Saunders) were collected from different Governorates of upper and Lower Egypt during 2006 and 2007 seasons for monitoring of its resistance to 7 different pyrethroidinsecticides

Nour El-Hoda*et.al.* (2012) Field experiments were conducted during 2010 and 2011 cotton growing seasons at Sakha Agricultural Research Station Farm to evaluate the efficacy of five insecticides, i.e., two synthetic pyrethroids (-cypermethrin, lambda-cyhalothrin), two organophosphorus (profenophos, chlropyrifos) and one carbamate (methomyl), against both pink bollworm (PBW), *pectinophoragossypiella* (saund).

The treatments could be arranged descendingly according to the average of the two seasons as follows;-cypermethrin (81.45%), lambda-cyhalothrin (71.91%), methomyl (68.33%), profenophos (66.75%) and chlorpyrifos (62.58%) against PBW.

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