FIELD EVALUATION OF SOME INSECTICIDES AND THEIR MIXTURES WITH FUNGICIDES AGAINST THE 2ND INSTAR LARVAE OF *SPODOPTERA LITTORALIS* (BOISD)

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Abstract

Insecticidal activities of four compounds namely Profenofos, Esfenvalirate, Flufenoxuron and Spinosad were evaluated either separately or in mixture with fungicides or IGRs against the 2nd instar larvae of the cotton leaf worm *S.littoralis* by using semi field bioassays technique throughout 2012 and 2013 seasons. The results indicate that mortality % of all tested insecticides at recommended rate alone at zero time after application was 87.75, 87.75, 85.71 and 93.87% larval mortality and residual effects after 15-days of treatments were 26.53, 22.44, 32.65 and 34.69 % larval mortality for profenofos, esfenvalirate, spinosad, and flufenoxuron respectively. Also, at half recommended rate at zero time mortality % was 51.02, 51.02, 53.03 and 51.02% larval mortality and residual effect reached 20.40, 12.24, 12.24 and 12.24 at 15-days after treatments with the same insecticides respectively. Interestingly, the same insecticides in combination with tested fungicides or insect growth regulator at half recommended rate were the most effective treatments giving excellent control and better results than that obtained by using full and half recommended rate alone against the 2nd instar larvae of *S.littoralis* throughout the two seasons. Fore, example, profenofos alone at half recommended rate at zero time interval caused 51.02 but recording 83.6, 95.91 and 91.83 % mortality when mixed with (difenoconazol, (penconazol) and (flufenoxuron) at half-recommended rate in the same period respectively. Also, esfenvalirate at half rate alone caused 51.02% mortality but recording 93.87, 91.83 and 89.75 % mortality when mixed with (difenoconazol) , (penconazol) and (flufenoxuron) at half-recommended rate in the same period after treatment. Concerning, spinosad at half recommended rate alone at zero-time resulted in initial kill of 51.02% larval mortality, but caused 87.75, 91.83 and 93.87 % mortality when mixed with (difenoconazol), (penconazol) and (flufenoxuron) in the same period after treatment respectively. Moreover flufenoxuron alone gave 53.03 % mortality increased to 93.87, 93.87 % mortality when mixed with difenoconazol , penconazol, respectively. Generally, mixtures containing insecticides and EBI fungicides or IGRs at low rate were the most effective treatments of the tested insecticides giving excellent control and better results than that obtained by using full and half recommended rate of all compounds alone against the 2nd instar larvae of *S.littoralis*. It could be concluded that both EBI fungicides and IGR appeared promising in combination with insecticides as result of significant increasing its initial kill and residual effect.

INTRODUCTION

The cotton plants attacked by several pests all over their growing seasons. Cotton leaf worm, *Spodoptera littoralis* (Boisd.) is the most destructive pest attack all parts of cotton plant including green bolls.

Ergosterol biosynthesis inhibiting (EBI) fungicides are widely used in controlling plant pathogenic fungus. This group of fungicides inhibits fungi by blocking the cytochrome P-450 dependent dimethylamino at the C-14 position and thus inhibiting biosynthesis of the principal fungal sterol ergosterol (Ragsdak and Sisler, 1991). This group of fungicides has been identified as potent synergists of pyrethroid insecticides in the honey bee (Colin and Belzunces, 1992). For example, 9 and 16 folds enhanced toxicity was recorded for the pyrethroid insecticide lambada-cyalothrin when combined with the fungicides prochloraz and propiconazol, respectively (Pilling and Jepson, 1994). The mechanism of this synergism has been studied by Pilling, *et al*. (1995) who reported that prochloraz delayed the metabolism, detoxication, excretion of lambada-cyalothrin by inhibiting microsomal oxidation, effectively enhancing the toxicity of pyrethroids to the honey bee. Schmuck, *et al*. (2003) found that slight synergistic effect of the thiacloprid to cyprodinil fungicide was observed with honey bee while a significant enhancement was found with fungicides prochloraz and tebuconazol.

The insect growth regulator are acting as chitin synthesis inhibitor in insects, which confers a remarkable specification with low toxicity to mammals, birds, and fish (Flint and Smith, 1977). Also, the mixing of these compounds with traditional insecticides increases the efficiency of these insecticides (Abdel-Sattar and EL-Gundy, 1988). Also, Raslan (2003) found that all mixtures of 25 ml Spinosad with Consult, Atabron and Dursban at their half- recommended rates per feddan increased their activity against the 3rd instars larvae of cotton leaf worm, *S. littoralis*. Also, Helalia, *et al*. (2006) found that the toxicity of the biocides was greatly enhanced when used at low rates of conventional insecticides such as pyrethroids and some organophosphorus compounds in combination with *B. thuringiensis* proved to be suitable to control the cotton leaf worm *S. littoralis*. Abd-EL-Mageed, *et al*. (2006), reported that spinosad gave moderately initial and residual effect when tested alone whereas the most pronounced initial effect was achieved when spinosad was mixed with methoxyfenozide. Also, they reported that the highest residual activity was noticed when spinosad was mixed with chlorpyrifos. Arakawa (2008) found that the fungicide Polyoxin AL that inhibits chitin synthesis, showed a synergistic effect with benzoylphenylureas insect growth regulators in killing *S. litura* larvae.

The present work was conducted to evaluate two fungicides, insect growth regulators and both organophosphorus, pyrethroid insecticides and the natural product spinosad against the2nd of cotton leaf worm *S. littoralis*

MATERIALS AND METHODS

1-INSECTICIDES:

1-1- Selecron (profenofos 72 % E.C)

1-2 –Sumiat (esvenvalirate 5 %E.C)

1-3-Cascade (flufenoxuron 10 % E.C)

1-4-Spintor (Spinosad 24 % E.C)

2 -FUNGICIDES

2- 1- Score (difenoconazol, 25 % E.C)

2 - 2 - Topaz (penconazole, 20 % E. C)

3-Laboratory rearing to cotton leaf worm S. littoralis

The field strain started as egg-masses collected from the cotton field experiments and reared as described by El-Dafrawy, *et al.* (1964) under laboratory condition at 25±2˚C and 65±5 % R.H. Eggs masses were kept separately in 400 ml glass jar covered with muslin. Larvae were transferred three days after hatching to clean larger jars. The jars were provided with castor bean leaves for larval feeding until pupation. The resulting pupae were placed inside each jar, the emerged moths were supplied with a piece of cotton watted with 10% sugar solution and *Nerium oleander* branches for eggs oviposition. The oviposition egg-masses were collected daily and left till hatching. The newly hatched larvae were transferred to fresh castor oil leaves and the instar was differentiated. The newly moulted 2nd instar larvae of *S. littoralis* were used in these studies.

2- Field evaluation on cotton leaf worm

To evaluate the initial and residual activity, chemical insecticides tested were used alone or in combination with both fungicides and insect growth regulators under field condition. These insecticides were used alone at full, half of recommended rate and their combination at half recommended rate with fungicides (100 ppm) or IGR (50 ppm) were sprayed on cotton plants in field experiments. The formulated insecticides were sprayed after dilution with 200 litters water / feddan using knapsack sprayer. An area about 700 m2 was divided into plots, each 36.84 m2, in complete randomized block design to evaluate the toxicity of the tested insecticides against the 2nd instar larvae of cotton leaf worm *S .littoralis*. Treated cotton plant leaves were collected from each treatment after spraying at different periods, i e zero- time, 3, 6, 9,12 and

15- days and offered to the 2nd instars larvae. Each treatment contains 5 larvae and replicated 10 times, as the check treatments sprayed with water. Mortality was recorded after 24h in case of insecticides only or in mixture with EBI fungicides then larvae were fed on untreated leaves. In case of insecticide mixtures with insect growth regulators the mortality was recorded after 48 hr post treatments then the larvae were fed on untreated leaves. Corrected mortality was calculated using Abbott's formula (1925) and data analyzed using Duncan. (1955).

RESULTS AND DISCUSSION

1- Effect of the tested compounds on larval mortality of cotton leaf worm season (2012)

Results in Table (1) indicate that mortality percentage increased at zero time from treatments with the tested compounds. But considerable drop in mortality was achieved at 3, 6, 9, 12 and 15-days intervals observations when larvae were fed on cotton leaves treated with both half and full recommended rate at same compounds throughout two seasons (2012 and 2013). Fore example, profenofos at full recommended rate was effective at zero-time (initial kill) recording 87.75 % mortality, considerable drop in mortality achieved at 3, 6, 9,12 and 15-days intervals observations reached 73.46, 59.18, 36.73, 30.61 and 26.53 % mortality, respectively, when larvae were fed on cotton leaves treated with full recommended rate of profenofos. Also, profenofos at half-recommended rate cause 51.02 % mortality at zero-time post-treatments, considerable drop in mortality observed at the same different intervals of feeding post-treatments showing 46.93, 42.85, 30.61, 22.44 and 20.40 % mortality, respectively. Concerning half-recommended rate- fungicides or IGR mixtures with same insecticides shown in the same table, it was clearly indicated that fungicides or IGR significantly increased the activity of insecticides against 2nd instar larvae of S*. littoralis.* For example, profenofos caused 51.02 % larval mortality when used at half-recommended rate alone at zero-time, but the mixtures between EBI fungicides (difenoconazol and penconazol or IGR (flufenoxuron) at half-recommended rate lead to significant effect similar or more than the full recommended rate reached to 83.6, 95.91 and 91.83 % mortality in the same period after treatment, respectively, both EBI fungicides or IGR appeared promising in combination with profenofos as result of significant increasing its initial kill and residual effect, for instance profenofos at half-recommended rate caused 26.53 % larval mortality at 15-days post-treatments, when used alone, significantly increased to 36.73, 44.89 and 30.61e % mortality at the same interval after mixing with difenoconazol, peconazole or flufenoxuron as respectively. Regarding esfenvalirate, at

full recommended rate was more effective at zero-time interval (initial kill) reached to 87.75 % mortality. Considerable drop in mortality was achieved at 3, 6, 9,12 and 15-days intervals of observations when larvae were fed on cotton leaves treated with full recommended rate of esfenvalirate reaching 61.22, 51.02, 44.89, 34.89 and 22.44 % mortality, respectively. Also, half-recommended rate caused 51.02 % mortality at zero-time post-treatments. Also, considerable drop in mortality was observed at the same different intervals of feeding post-treatments with esfenvalirate reaching 40.81, 26.53, 24.48, 14.28 and 12.24 % mortality respectively. Concerning half-recommended rate-fungicides or IGR mixtures was clearly indicated that fungicides or IGR significantly increased the activity of esfenvalirate against 2nd instar larvae of S*. littoralis.* For example esvenvalirate caused 51.02 % mortality when used at half-recommended rate alone at zero-time, but the mixtures between fungicides (difenoconazol and penconazol) or IGR (flufenoxuron) caused significant effect similar or more than the full recommended rate when used alone reaching to 93.87, 91.83 and 89.75 % mortality in the same period after treatment, respectively. It could be concluded that either EBI fungicides or IGR appeared promising in combination with esfenvalirate as result of increasing its initial kill and residual effect. For instance, esfenvalirate at half-recommended rate caused 12.24 % larval mortality at 15-days post-treatments, significantly increased to 57.14, 57.14 and 30.61 % mortality at the same interval after mixing the half-recommended rate with difenoconazol, penconazol or flufenoxuron respectively. Concerning spinosad, the results show that spinosad at full recommended rate was effective at zero-time interval (initial kill) recorded 85.71a % mortality considerable drop in mortality was achieved at 3, 6, 9, 12 and 15-days intervals of observations when larvae were fed on cotton leaves treated with full recommended rate of spinosad reaching 65.30, 55.10, 48.97, 38.77 and 32.65 % mortality, respectively. Also, spinosad at half-recommended rate- or IGR indicate that EBI or the IGR significantly increased the activity of spinosad against 2nd instar larvae of S*. littoralis.* For example spinosad caused 53.06 % mortality when used at half-recommended rate alone at zero-time, but the mixtures between (difenoconazon, penconazol) and (flufenoxuron) at half-recommended rate caused significant effect similar or more than the full recommended rate where lead to 87.75, 91.83 and 93.87 % mortality in the same period after treatment respectively. It could be concluded that or the IGR appeared promising in combination with spinosad as result of increasing its initial kill and residual effect, for instance at half-recommended rate caused 53.06 % larval mortality at 15-days post-treatments, in comparison with 59.17, 63.26 and 42.85 % mortality at the same interval after mixing the half-recommended rate with (difenoconazol, penconazol) or (flufenoxuron) respectively.

Also the results in the same table show that flufenoxuron at full recommended rate was effective at zero-time interval (initial kill) recorded 93.87 % mortality considerable drop in mortality was achieved at 3, 6, 9, 12 and 15-days intervals of observations when larvae were fed on cotton leaves treated with full recommended rate of flufenoxuron reaching 83.67, 61.22, 51.02, 40.81 and 34.69 % mortality, respectively. Concerning flufenoxuron at half-recommended rate-EBI showed in the same table it was clearly indicate that EBI significantly increased the activity of flufenoxuron against 2nd instar larvae of S*. littoralis.* For example flufenoxuron caused 51.02 % mortality when used at half-recommended rate alone at zero-time, but the mixtures between (difenoconazon,penconazol)) at half-recommended rate caused significant effect similar or more than the full recommended rate where lead to 93.87, 93.87 % mortality in the same period after treatment respectively. It could be concluded that EBI appeared promising in combination with flufenoxuron as result of increasing its initial kill and residual effect, for instance at half-recommended rate caused 12.24 % larval mortality at 15-days post-treatments, in comparison with 61.22 and42.85 % mortality at the same interval after mixing the half-recommended rate with (difenoconazol, penconazol) respectively.

2- Effect of the tested compounds on larval mortality of cotton leaf worm season (2013)

Results in Table (2). Data show that the profenofos at full recommended rate were effective at zero-time (initial kill) recording 83.33 % mortality. Considerable drop in mortality was achieved at 3, 6, 9, 12 and 15-days intervals of observations when larvae were fed on cotton leaves treated with full recommended rate of profenofos reaching to 77.08, 68.75, 41.66, 31.25 and 18.75 % larval mortality respectively. Also, half-recommended rate when was used alone caused 52.08 % mortality at zero-time post-treatments. Also, considerable drop in mortality was observed at the same different interval of feeding post-treatments reaching to 43.75, 39.58, 27.08, 16.66 and 14.58 % larval mortality respectively. Concerning half-recommended rate-fungicides or IGR mixtures show in the same table it was clearly indicated that fungicides or IGR significantly increased larval mortality causing significant increase in the activity of profenofos against 2nd instar larvae of S*. littoralis.* For example, profenofos caused 52.08 % larval mortality when used at half-recommended rate alone at zero-time, but the mixtures between (difenoconazol, penconazol and (flufenoxuron) at the same-recommended rate caused significant effect or more than the full recommended rate reaching to 89.58, 79.16 and 85.41 % mortality in the same period after treatment, respectively. It could be concluded that both fungicides or IGR appear promising in combination with profenofos as result of increasing its

initial kill and residual effect, for instance, profenofos at half-recommended rate when was used alone caused 14.58 % larval mortality at 15-days post-treatments, in comparison with 35.41, 39.58, 29.18 and 22.91 % mortality at the same interval after mixing the half-recommended rate with difenoconazol, penconazol or flufenoxurun, respectively. Also. the results in the same table showed that the esfenvalirate at full recommended rate were effective at zero-time interval recording initial kill reaching to 85.41 % mortality. Considerable drop in mortality was achieved at 3, 6, 9, 12 and 15-days intervals of observations when larvae were fed on cotton leaves treated with full recommended rate of esfenvalirate reached to 70.08, 62.5, 39.58, 27.08 and 20.83 % mortality respectively. Also, half-recommended rate when used alone caused 52.08 % mortality at zero-time post-treatments, also, considerable drop in mortality was observed at the same different interval of feeding post-treatments reaching to 39.58, 33.33, 18.75, 12.5 and 10.41 % mortality respectively. Concerning esfenvalirate at half-recommended rate-EBI fungicides or IGR mixtures showed in the same table clearly indicate that EBI fungicides or IGR increased the activity of esfenvalirate against 2nd instar larvae of *S. littoralis.* For example esfenvalirate caused 85.41 and 52.08 % mortality when used at both full recommended rate and half-recommended rate alone at zero-time, but the mixtures between (difenoconazol and penconazol) or (flufenoxuron) at half-recommended rate gave effect similar or more than the full recommended rate reaching to 85.41, 81.25 and 87.5 % mortality in the same period after treatment, respectively. It could be concluded that both fungicides or IGRs appeared promising in combination with esfenvalirate as result of increasing its initial kill and residual effect, for instate esfenvalirate at half-recommended rate alone caused 12.24% larval mortality at 15-days post-treatments, compared with 33.33, 35.41, 25.07 and 20.83 % mortality at the same interval after mixing the half-recommended rate with difenoconazol, penconazol as or flufenoxuron, respectively.

Concerning spinosad the results in the same table showed that the spinosad at full recommended rate were effective at zero-time interval recording initial kill reaching to 85.41 % mortality. Considerable drop in mortality was achieved at 3, 6, 9, 12 and 15-days intervals of observations when larvae were fed on cotton leaves treated with full recommended rate of Spinosad reached to 70.08, 62.5, 39.58, 27.08 and 20.83 % mortality respectively. Also, half-recommended rate when used alone caused 52.08 % mortality at zero-time post-treatments, also, considerable drop in mortality was observed at the same different interval of feeding post-treatments reaching to 39.58, 33.33, 18.75, 12.5 and 10.41% mortality respectively. Concerning spinosad at half-recommended rate- fungicides or IGR mixtures showed in the same table clearly

indicate that EBI fungicides or IGR increased the activity of Spinosad against 2nd instar larvae of S*. littoralis.* For example esfenvalirate caused 85.41and 52.08 % mortality when used at both full recommended rate and half-recommended rate alone at zero-time, but the mixtures between (difenoconazol and penconazol) or (flufenoxuron) at half-recommended rate gave effect similar or more than the full recommended rate reaching to 81.25, 79.16 and 85.41 % mortality in the same period after treatment, respectively. It could be concluded that both fungicides or IGRs appeared promising in combination with Spinosad as result of increasing its initial kill and residual effect, for instate Spinosad at half-recommended rate alone caused 10.41 % larval mortality at 15-days post-treatments, compared with 25.0, 14.58 and 27.08 % mortality at the same interval after mixing the half-recommended rate with difenoconazol, penconazol as or flufenoxuron, respectively. Also, the results in the same table showed that the flufenoxuron at full recommended rate was effective at zero-time (initial kill) recording 89.58 % mortality. Considerable drop in mortality records was achieved at 3, 6, 9 and 12-days intervals of observations when larvae were fed on cotton leaves treated with full recommended rate of flufenoxuron reaching to 81.25, 58.33, 47.91, 35.41 and 29.16 % mortality, respectively. Also, half-recommended rate caused 52.08% mortality at zero-time post-treatments. But, considerable drop in mortality was observed at the same different intervals of feeding post-treatments reaching to 37.5, 22.91, 20.83, 10.41 and 8.33 % mortality respectively. Concerning flufenoxuron at half-recommended rate- fungicides mixtures shown in the same table it was clearly indicate that fungicides increased the activity of flufenoxuron against 2nd instar larvae of S*. littoralis.* For example, flufenoxuron caused 52.08 % mortality when used at half-recommended rate alone at zero-time, but it caused 87.5 and 83.33 % mortality at the same interval after mixing the half-recommended rate with difenoconazol, penconazol**,** respectively. It could be concluded that both fungicides or IGRs appeared promising in combination with flufenoxuron as result of increasing its initial kill and residual effect, for instate flufenoxuron at half-recommended rate alone caused 8.33 % at 15- post-treatments, compared with 25.0 and 35.41% at the same interval after mixing the half-recommended rate with difenoconazol, penconazol respectively.

All over results mentioned before agree with that reported by (Schmuck, *et al.,* 2003) and (Pilling, *et al*., 1995). They found that the fungicides did not have toxic effect to honey bee. It is known that these fungicides inhibit cytochrom P450 monooxygenase system which prevents the biosynthesis ergosterol in fungi. Since, monooxygenase are also involved in the metabolism of organophosphorus, and pyrethroid insecticides (Littele, *et al*., 1989 and Johnston *et al* 1989).Thus fungicides may delay the toxification, of insecticides by inhibiting monooxygenase system in the

insects, and enhanced their toxic action against larvae. Moreover, it has been reported that fungicides did not inhibit the biosynthesis of ergosterol in fungi did not enhance the toxicity of thiacloprid to honey bee (Schmuck, *et al*., 2003). These results also, agree with the previous studies (Colin and Belzunnces 1992). They reported that the fungicides have been identified as synergists of pyrethroids insecticides in the honey bee. (Plling and Jepson 1994). Found that the toxicity of pyrethroid was enhanced from 9-16 folds when combined with EBI fungicides Prochloraz and Propiconazol to honey bee. The insect growth regulators are acting as chitin synthesis inhibitor in insects which confers a remarkable specification with low toxicity to mammals, birds and fish (Flint and Smith 1977). Also, the mixtures between these compounds (IGRs) and traditional insecticides increase the efficiency of these insecticides insecticides (Abdel-Sattar, 1988). Also, (Raslan 2003) found that all mixtures of 25 ml Spinosad with Consult, Atabron and Dursban at their half- recommended rates per feddan resulted in increasing their activity against the 3rd instars larvae of cotton leaf worm. Also, (Helalia, *et al*. 2006) found that the toxicity of the biocides spinosad was greatly enhanced when using low rates of conventional insecticides such as pyrethroids and some organophosphorus compounds in combination with *B*. *thuringiensis* proved to be suitable to control the cotton leaf worm *S. littoralis* Abd-EL-Mageed, *et al* (2006) reported that spinosad gave moderately initial and residual effect when tested alone whereas the most pronounced initial effect was achieved when spinosad was mixed with methoxyfenozide. Also, they reported that the highest residual activity was noticed when spinosad was mixed with chlorpyrifos. Arakawa (2008) found that Polyoxin AL a fungicide that inhibits chitin synthesis, showed a synergistic effect with benzoylphenylurea insect growth regulators in killing *Spodoptera litura* larvae. The antioxidant butylated hydroxyanisol (BHA) which is a food grade chemical, enhanced the activety 0f fungicides thiabendazol and imazalil against *Colletotrichum musae*, the caused fungal pathogen of banana anthracnose (Kan, *et al*., 2001).

As mentioned before it could be used as mixtures of these fungicides or IGR with the insecticides to increase the insecticidal activity at low rate and decrease the resistance to insecticides against the2nd of cotton leaf worm *S. littoralis*. Also, these mixtures could be also used to minimize the environmental pollution

Table 1. Larval mortality percent of *S. littoralis* as affected by feeding the 2nd instars larvae on cotton leaves treated with the tested compounds separately, and in mixtures with EBI fungicides or insect growth regulators at different periods and rates in lab –field using semi field bioassay (season 2012)

COMPOUND	% CORRECTED MORTALITY AFTER INDICATING TIME INTERVALS					
	ZERO-TIME	3-DAYS	6-DAYS	9-DAYS	12-DAYS	15-DAYS
PROFENOFOS						
1000 ML/FEDDAN	87.75A	73.46A	59.18A	36.73A	30.61A	26.53A
500 ML/FEDDAN	51.02B	46.93B	42.85B	30.61B	22.44B	20.40B
500ML+100PPMDIFENOCONAZOL	83.6C	77.55C	67.34C	55.10C	42.85C	36C.73
500ML + 100 PPM PENCONAZOL	95.91D	91.83D	85.71D	73.46D	61.22D	44.89D
500ML +50PPMFLUFENOXURON	91.83E	89.79D	87.75D	79.59E	63.26E	30.61E
L.S.D AT 5%	1.5	2.3	2.1	2.7	1.4	1.7
ES-VENVALIRATE						
750 ML / FEDDAN	87.75A	61.22A	51.02A	44.89A	34.69A	22.44A
375ML	51.02B	40.81B	26.53B	24.48B	14.28B	12.24B
375ML +100PPM DIFENOCONAZOL	93.87C	85.71C	81.63C	75.51C	69.38C	57.14C
375ML +100PPM PENCONAZOL	91.83D	87.75D	79.59D	71.42D	63.26D	40.81D
375ML +50PPM FLUFENOXURON	89.75E	85.71E	81.63E	75.51E	59.18E	30.61E
L.S.D AT 5%	1.3	1.162	1.729	1.751	2.3	1.523
SPINOSAD						
50 ML/FEDDAN	85.71A	65.30A	55.10A	48.97A	38.77A	32.65A
25ML	53.06B	38.77B	28.57B	24.48B	14.28B	12.24B
25ML +100PPM DIFENOCONAZOL	87.75C	79.59C	77.55C	71.42C	65.30C	59.17C
25ML +100PPM PENCONAZOL	91.83D	89.79D	85.71D	79.59D	75.51D	63.26D
25ML+50PPM FLUFENOXURON	93.87E	89.79D	83.67E	73.46E	63.26E	42.85E
L.S.D AT 5%	1.9	1.5	1.3	1.2	1.5	1.4
FLUFENOXURON						
200 ML/FEDDAN	93.87A	83.67A	61.22A	51.02A	40.81A	34.69A
100 ML	51.02B	40.81B	26.53B	24.48B	14.28B	12.24B
100 ML+ 100PPMDIFENOCONAZOL	93.87C	89.79C	85.71C	79.59C	73.46C	61.22C
100ML+100 PPM PENCONAZOL	93.87C	87.75D	75.51D	71.42D	63.29D	42.85D
L.S.D AT 5%	1.4	2.0	2.3	0.936	0.5434	0.5404

Means values in each column have the same letters are not significantly different at < 0.0 5(Duncan test)

Table 2. Larval mortality percent of *S. littoralis* as affected by feeding the 2nd instars larvae on cotton leaves treated with the tested compounds separately, and in mixtures with EBI fungicides or insect growth regulators at different periods and rates in lab –field using semi field bioassay (season 2014).

COMPOUND	% CORRECTED MORTALITY AFTER INDICATING TIME INTERVALS					
	ZERO-TIME	3-DAYS	6-DAYS	9-DAYS	12-DAYS	15-DAYS
PROFENOFOS						
1000 ML/FEDDAN	83.33A	77.08A	68.75A	41.66A	31.25A	18.75A
500 ML/FEDDAN	52.08B	43.75B	39.58B	27.08B	16.66B	14.58B
500ML+100PPMDIFENOCONAZOL	89.58C	83.33C	70.83C	66.66C	52.08C	39.58C
500ML + 100 PPM PENCONAZOL	79.16D	75.0D	68.75D	56.25D	45.83D	29.18D
500ML +50PPMFLUFENOXURON	85.41E	83.33C	70.83C	64.58E	47.71E	22.91E
L.S.D AT 5%	1.5	2.3	2.1	2.7	1.8	1.751
ES-VENVALIRATE						
750 ML / FEDDAN	83.67A	61.22	51.02A	44.89A	38.77A	28.57A
375ML	51.02B		36.73B	20.40B	14.28B	12.24B
375ML +100PPM IFENOCONAZOL	85.41A	75.0B	68.75C	58.33C	45.83C	35.41C
375ML +100PPM PENCONAZOL	81.25C	72.91C	66.66D	56.25D	37.5D	25.07D
375ML +50PPM FLUFENOXURON	87.5D	70.83D	58.33E	47.91E	33.33E	20.83E
L.S.D AT 5%	2.3	2.1E	2.7	1.7	1.9	2.5
SPINOSAD						
50 ML/FEDDAN	85.41A	70.08A	62.5A	39.58A	27.08A	20.83A
25ML	52.08B	39.58B	33.33B	18.75B	12.5B	10.41B
25ML +100PPM DIFENOCONAZOL	81.25C	68.75C	58.33D	45.83C	39.58C	25.0D
25ML +100PPM PENCONAZOL	79.16E	72.91E	54.16E	39.58D	20.83D	14.58E
25ML+50PPM FLUFENOXURON	85.41A	79.16F	77.08F	56.25E	47.91E	27.08F
L.S.D AT 5%	1.30	1.6	1.3	1.5	2.2	2.1
FLUFENOXURON						
200 ML/FEDDAN	89.58A	81.25A	58.33A	47.91A	35.41A	29.16A
100 ML	52.08B	37.5B	22.91B	20.83B	10.41B	8.33B
100 ML+ 00PPMDIFENOCONAZOL	87.5C	75.0D	66.66C	56.25C	43.75D	25.0D
100ML+100 PPM PENCONAZOL	83.33E	72.91E	68.75C	56.25C	45.83E	35.41E
L.S.D AT 5%	1.4	2.093	2.3	0.936	0.5434F	0.540F4

Means values in each column have the same letters are not significantly different at < 0.0 5(Duncan test)

REFERENCES

1. Abbott, W.S. 1925. A methods for computing the effectiveness of insecticides .J.Econ.Entomol., 18:256-257.
2. Abd El-Mageed, M.E.A., M. E. Anwar,., A.R.L Elgohary and H.F Dahi 2006. Field efficiency of novel biocide Spinosad singular, mixed with different groups of insecticides and compared with other biocide in sequence experiment on cotton leaf worm *Spodoptera littorals*. Bull.Ent. Soc. Egypt Ser(32) 91-99
3. Arakawa 2008. Synergistic effect of a fungicide containing polyoxin B with insect growth regulators (IGRs) in the killing of common cutworm *Spodoptera litura* (Lepidoptera: Noctuidae) App. Entomol and Zool. 43, pp. 167- 171.
4. Colin, M.E., and L. Belzunces 1992. Evidence of synergism between prochloraz and deltamethrin in *Apis melifera* Biological approach. Pistic .Sci 36:115
5. Duncan. D.B. 1955. Multiple range and multiple F-Test. Biometric, 11: 1-42.
6. El-Dafrawy, M. E., A. Toppozada., N. Mansuora, and M. zeid 1964. Toxicological studies on the Egyptain cotton leaf worm, *prodenia dittorab* L. susceptibility of different larval instar of *prodenia*. J. Econ. Entomol. 57: 591- 593
7. Flint, H.M and R.L.Smith.1977. Laboratory evaluation of TH 6o- 40 against the pink bollworm. J.Econ. Entomol., 70:51-53
8. Helalia, A. R., S.A, Abou-Donia., O.K. Mustafa. N. S. Abdel-Hai. 2006. Effect of certain insecticides in enhancing the potency of *Bacillus thuringinsis* against thecotton leaf worm *Spodoptera littoralis*. Ann..Agric.. Sci
9. Johnston,G., G. Collet., C. Walker., I. Dawson., and D. Osbom 1989. Enhancement of Malathion toxicity to the hybrid red legged partridge following exposure toProchloraz Pistic. Biochem.Physiol.35:107-11
10. Kan,S.H., ked, J. and Magan, N. 2001. Control of the anthrancnose pathogen of banana Colletotrichum musae) using antioxidants alone and in combinationwith thiabendazole or imazalil. Plant Pathol., 50: 601- 608.
11. Littele, J., A.R. McCaughey., C.H. Walker, and T. Parker 1989. Evidence for enhancedmetabolism of C ypermethrin by a monooxygenase in pyrethroids resistantstrain of the tubaco budworm (*Heliothis veresens*) Pest. Biochem.Bhysiol.34:58-68

12. Pilling, E.D., and P.C. Jepson 1994. Synergism between EBI fungicides and apyrethroids fungicide and pyrethroids insecticides in the honey bee (*Aphismelifera*). Pestic .Sci.39:294-297
13. Pilling, E.D., K.A Bromly-challenor., C. Walker., and P.C. Jepson 1995. Mechanism of synergism between the pyrethroid insecticides lambadacyalothrin and imidazol Fungicides prochloraz. Pistic.Biochem.Physiol 51: 1-11
14. Ragsdale, N.N. and H.D. Sisler 1991. Mode of action of fungicide in Chemistry,Biochemistry and Toxicology of Pestic Education Program Organ StateUniversity P41-45
15. Raslan,A.A.S. 2003. Comparison of natural product Spinosad with some recommended Insecticides for the control of the cotton leaf worm at sharkia governorate Egypt.Egypt J. Appl.Sci 18 (4B)
16. Schumuck, R., T. Stadler and H.W. Schmidt 2003. Field relevance of a synergisticeffect observed in the laboratory between EBI fungicides and chloronicotinyleInsecticide in the honeybee (*Aphis melifera).* Pestic. Manag. Sci. 59: 279
17. Sun, Y.P. and E.R. Johnson 1960. Analysis of joint action of insecticides against houseflies. J.Econ. Entomol., 53: 87-92 .Cairo. 51: (2) 573-5

التقييم الحقلى لبعض المبيدات الحشرية ومخاليطها مع المبيدات الفطرية المثبطة لتخليق الايرجسترول في الفطريات ضد يرقات العمر الثانى لدودة ورق القطن

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في تجربة معملية– حقلية تم تغذية العمر الثانى لدودة ورق القطن على ورق قطن معامل فى الحقل با لمعدلات الموصي بها أونصف المعدل لكلا من البروفينو فوس ومركب اسفينفاليرت ومركب الاسبينوساد وكذالك مركب الفلوفينوكسيرون أو خلط نصف المعدل لهذة المبيدات مع منظمات النمو الحشرية أو المبيدات الفطريه المثبطة لتخليق الايرجسترول فى الفطريات. ودلت النتائج علي أن معدلات استخدام هذةالمبيدات انخفضت إلي النصف عندما خلطت بنصف معدلات الاستخدام مع المبيدات الفطرية أو منظمات النمو الحشرية وأعطت أفضل النتائج عن استخدام كل مركب بمفردة بمعدل الاستخدام الكامل علي يرقات العمر الثانى لدودة ورق القطن. فمثلا كلا من مركب البروفينوفوس ومركب اسفنفاليرات ومركب الاسبينوساد وكذلك مركب الفلوفينوكسيرون بعد٢٤ ساعة اعطت ٨٧,٧٥، ٨٧,٧٥، ٨٥,٧١، ٩٣,٨٧ % عندما استخدمت بمعدلات الاستخدام الموصي بها على التوالى. كذلك أعطت ٥١,٠٢ و٥١,٠٢ و٥٣,٠٣ و٥١ ,٠٢ %عندما استخدمت بنصف معدل الاستخدام الموصي بها منفردا على التوالى بينما أعطت أفضل النتائج عند استخدامت هذة المركبات مخلوطة بنصف معدل الاستخدام مع كلا من المبيدات الفطرية المثبطة لتخليق الايرجسترول فى الفطريات ومنظمات النمو الحشرية حيث أعطى مركب البروفينوفوس ٨٣,٦٣ و ٩٥,٩١ و٩١,٨٣ % موت عندما خلط بنصف المعدل مع الداى فينوكونازول والبنكونازول من المبيدات الفطرية المثبطة لتخليق الايرجسترول فى الفطريات ومركب الفلوقينوكسيرون من منظمات النمو الحشرية على التوالى مقارنة ب ٥١,٠٢ %عندما استخدم بنصف معدل الاستخدام بمفردة بينما اعطى مركب اسفنفاليرات ٥١,٠٢ %عندما استخدم بمفردة بنصف المعدل مقارنة ب ٩٣,٨٧ و ٩١,٨٣ و٨٩,٧٥ %عندما خلط بنصف المعدل مع الداي فينوكونازول والبنكونازول من البيدات الفطرية المثبطة لتخليق الايرجسترول فى الفطريات وكذلك مركب الفلوفينوكسيرون من منظمات النمو الحشرية على التوالى وكذالك مركب الاسبينوساد اعطى ٥٣,٠٦ %عند استخدامة بمفردة و ذادت الفاعلية الى ٨٧,٧٥ و٩١,٨٣ و٩٣,٨٧ %عندما تم خلطة بنصف المعدل مع كلا من الداى فينوكونازول والبنكونازول والفلوفينوكسيرون على التوالى . وكذلك مركب الفلوفينوكسيرون بمفردة اعطى ٥١,٠٢ % ذادت الفاعلية الى ٨٧, ٩٣ و٨٧, ٩٣ % على التوالى عندما تم خلطة بنصف المعدل مع كلا من الداى فينوكونازول والبنكونازول وهكذا مع كل المركبات موضع الدراسة فى الموسمين الحقليين. وعلي هذا قترح استخدام مخاليط هذة المبيدات الحشرية بنصف معدل الاستخدام مع المبيدات الفطرية المثبطة لتخليق الايرجسترول في الفطريات أو مع منظمات النمو الحشرية لزيادة فاعلية هذة المبيدات علي يرقات العمر الثانى لدودة ورق القطن مما يؤدي إلي تقليل معدل استخدام هذة المبيدات وكذلك تقليل التلوث البيئي وتقليل ظاهرة المقاومة ضد فعل المبيدات.