

FIELD EVALUATION OF SOME INSECTICIDES AGAINST PINK AND SPINY BOLLWORMS ON COTTON PLANTS

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ABSTRACT

Three conventional insecticides i.e., *S-fenvalerate* (F), *profenofos* (P) and *thiodicarb* (T) were evaluated against both pink and spiny bollworms on cotton plants using six different spray programmes, i.e., spraying each of the tested insecticides individually in one spray (F, P, T), spraying *S-fenvalerate* in the first spray followed by *profenofos* in the second (F+P), spraying *profenofos* in the first spray followed by *thiodicarb* in the second (P+T), and spraying *S-fenvalerate* in the first spray followed by *profenofos* in the second spray and then *thiodicarb* in the third (F+P+T). These programmes were started when percent of boll infestation reached 1,3,5,7 and 9% through two consecutive cotton growing seasons of 1998 and 1999. Moreover the effect of the three spraying programmes (F, F+P and F+P+T) on the population reduction of some predaceous arthropod species were also investigated. The obtained results showed that F+P and F+P+T spray programmes seemed to be the most efficient against pink and spiny bollworms as cotton plants treated with them showed low percents of boll infestation with each and yielded high amounts of seed cotton. Cotton plants treated by different spray programmes at 5% boll infestation were less infested by both bollworms and gave the highest yield compared either with other tested levels or with check experiment. Consequently, F+P program can be recommended to control pink and spiny bollworms in cotton fields and the third spray of the other program (F+P+T) can be excluded and this is very useful for reducing control costs as well for increasing activity of parasitic and predaceous natural enemies of insects and true spiders. F, F+P and F+P+T programs had an adverse effect on the population of predaceous arthropods prevailing in cotton fields.

Key words: Bollworms, Control programs, Insecticides, Cotton plants, Natural enemies, Yield.

INTRODUCTION

Cotton considers an important crop in all over the world, hence it is a strategic crop by sharing in Egyptian national income. Cotton like other field crops are prone to attack by several species of insect pests during its growing season. In Egypt, bollworms are the most destructive pests infesting cotton plants causing usually severe damage resulting in high loss in both quantity and quality of the obtained yield (Gupta and Katiyar, 1985; Gupta *et al.*, 1991; Abdalla, 1991/1992; El-Feel *et al.*, 1991; El Feshawi *et al.*, 1991; Simwat *et al.*, 1991; Jangra and Jaglan, 1995; Lohag and Nahyoon, 1995 and Khidr *et al.*, 1996).

Cotton control program including different sprays with conventional insecticides is recommended by the Egyptian Ministry of Agriculture to combat these pests. So, several investigators studied the effect of sequential application of different insecticides against bollworms infesting cotton plants during successive

seasons under different levels of infestation to determine the best sequence for control these pests (Abdel-Salam *et al.*, 1990; Bramhankar *et al.*, 1990; Nada, 1990; Abdalla, 1991 /1992; El-Feel *et al.*, 1991; El-Feshawi *et al.*, 1991; Mourad *et al.*, 1991 a and b; Khidr *et al.*, 1996; Raslan 1994; Bellettini *et al.*, 1999; Nassef and Watson, 1999; Abo Sholoa *et al.*, 2000 and Aioub *et al.*, 2000). Moreover, the population densities of most predaceous insects and spiders prevailing in cotton fields are negatively affected by the used insecticides in controlling cotton bollworms (Nada, 1990; Kostandy, 1995; Singh and Sircar, 1995; Mohyuddin *et al.*, 1997; Laba *et al.*, 1998 and Aioub *et al.*, 2002).

The present work was carried out in Belbeis region, Sharkia Governorate during 1998 and 1999 cotton growing seasons to evaluate six programmes of three conventional insecticides against both pink and spiny bollworms at different levels of infestation as well the side effect of three spray programmes on some predaceous insects and true spiders prevailing in cotton fields.

MATERIALS AND METHODS

Cotton seeds of Giza 85 variety were sown in mid March during both 1998 and 1999 cotton growing seasons at Meat-Rabeae village, Belbeis district, Sharkia Governorate, Egypt. Normal agricultural practices were executed in due time. An area of about 1.4 feddan of cotton was divided into 5 plots. Each plot was divided into 7 subplots and each was divided into 3 replicates (42 m² for each). The five plots were sprayed at five different levels of infestation; i.e, 1, 3, 5, 7 and 9 % of bolls infestation with cotton bollworms. Cotton plants of each level of infestation were sprayed with three conventional insecticides applying in 6 control programmes namely; S-fenvalerate 20% EC (F), profenofos 72% EC (P), thiodicarb 37.5% FL(T), F+P, P+T and F+P+T. Untreated (control) plots were left without any treatment. S-fenvalerate, profenofos and thiodicarb were sprayed at the rate of 30, 540 and 375 g a.i./fedd., respectively. A knapsack motor sprayer (20 liters in capacity) was used at the rate of 400 liters water / feddan. The first spray at different levels of infestation in 1998 cotton season was carried out on the 1st, 4th, 7th, 10th and 13th of July for 1, 3, 5, 7 and 9 % infestation levels, respectively. While in 1999 cotton season this spray was carried out on the 29th of June and 2nd, 6th, 10th and 13th of July at the same levels of infestation with the studied bollworms, respectively. Interval period between S-fenvalerate treatment and profenofos was 21 days, whereas that between profenofos and thiodicarb sprays was 15 days.

Samples of green cotton bolls were collected (33 green bolls per replicate) immediately after boll formation and continued at 3 days intervals until reaching 1, 3, 5, 7 and 9 % infestation levels. Samples of cotton bolls were collected weekly after treatment in different tested control programmes. Cotton bolls were externally and internally inspected to calculate the infestation percentage of both pink and spiny bollworms before and after treatment as well larval population density. Henderson and Tilton (1955) equation was used to calculate the infestation reduction percentage after treatment. At harvest time, seed cotton yield was carefully collected from the two inner ridges of each plot (6 and 7th) where no green bolls were taken for sampling to determine the effect of the evaluated insecticide treatments on cotton yield as compared with untreated plots.

To study the side effect of the three control programmes, F, F+P and F+P+T on some predaceous arthropods in cotton fields, an area of

about one feddan for each programme was divided into three replicates. By using sweeping net, 50 double strokes were performed in the two diameters of each plot (at cross directions). This technique was carried out weekly for one time daily at 9 a.m.. The collected flying insects in the net were quickly anaesthetized by ether and then killed in cyanide jar in the field. The dead captured insects and spiders were sorted, identified and counted in the laboratory on the same day. Moreover, reduction percentages in their population at weekly intervals from the 1st spray until the last week of September were calculated according to the previously mentioned equation.

All the obtained results were statistically analyzed according to completely randomized design and factorial experiments. The appropriate methods were used for the analysis of data according to Little and Hills (1975) and the proper "F" value was calculated as described by Fisher (1944 and 1950) and Snedecor (1957).

RESULTS AND DISCUSSION

1. Effect on the percentage of boll infestation

1.1. The pink bollworm, *Pectinophora gossypiella* (Saund.)

Analysis of variance of the results compiled in Table (1) clearly demonstrate that the effects of the six different sprays programmes (F, P, T, F+P, P+T and F+P+T) and the infestation levels (1, 3, 5, 7 and 9%) as well as their interaction effect (spray program x infestation levels) on cotton green bolls infestation with *P. gossypiella* proved to be highly significant in both 1998 and 1999 cotton growing seasons. All tested programmes reduced the degree of boll infestation as compared with check plants which showed the highest level of infestation of 23.71 and 28.50 % during the first and second seasons, respectively. The 4th program wherein S-fenvalerate was sprayed in the first spray followed by profenofos in the second one, appeared to be the most efficient against pink bollworm showing the lowest percentages of bolls infestation of 6.62 % in 1998 season and 8.82 % in 1999, whereas P+T in the first season and T in the second season showed the least effect indicating the corresponding averages percentages of 11.04 and 14.33 %. As regarded the influence of infestation level whereon the spray program was applied, the obtained results obviously show that cotton plants sprayed with different programmes at 7% infestation level during the first season and 9%

during the second season had the lowest average of boll infestation of 9.19 and 11.37 %, respectively. In respect to the combined impact of different tested spray programmes and infestation levels, it is evident that the highest efficient treatment against pink bollworm in cotton fields was represented by the treatment of spraying cotton plants when infestation reached 5% and 7% with S-fenvalerate

in the first spray and profenofos in the second one showing the lowest mean percentages of boll infestation of 5.06 and 4.82 % during 1998 and 1999 seasons, respectively. Whereas, the highest mean percents of boll infestation that showed the lowest efficacy were obtained with P+T x 3% in the first season (13.36%) and T x 5% in the second (18.09%).

Table (1): Efficacy of different spray programs by certain conventional insecticides on the infestation percentage of bolls with pink bollworm after their application at different levels of infestation during 1998 and 1999 cotton growing seasons

| Infestation Levels Spray Programmes 1 st 2 nd 3 rd | The mean infestation percentage of cotton green bolls at indicated levels during | | | | | |
|---|--|---------|--------|--------|--------|---------|
| | 1998 season | | | | | |
| | 1 % | 3 % | 5 % | 7 % | 9 % | Avg. |
| F | 10.41 | 7.21 | 8.24 | 7.45 | 10.18 | 8.70 D |
| P | 8.76 | 6.91 | 7.85 | 9.64 | 11.09 | 8.85D |
| T | 11.96 | 8.09 | 6.76 | 9.24 | 16.48 | 10.51C |
| F P | 6.61 | 6.65 | 5.06 | 5.67 | 9.09 | 6.62E |
| P T | 8.73 | 13.36 | 10.79 | 11.27 | 11.03 | 11.04B |
| F P T | 6.61 | 7.85 | 5.91 | 8.45 | 12.67 | 8.30D |
| Control | 30.39 | 28.27 | 29.91 | 12.58 | 17.39 | 23.17A |
| Average | 11.92 A | 11.02 B | 10.65B | 9.19C | 12.56A | |
| | 1999 season | | | | | |
| F | 14.69 | 15.94 | 17.15 | 9.39 | 8.76 | 13.19B |
| P | 15.24 | 12.12 | 16.30 | 13.36 | 8.69 | 13.14BC |
| T | 15.79 | 16.76 | 18.09 | 10.09 | 10.94 | 14.33B |
| F P | 10.48 | 12.03 | 10.73 | 4.82 | 6.06 | 8.82D |
| P T | 16.00 | 12.58 | 5.42 | 6.91 | 8.06 | 9.79CD |
| F P T | 11.48 | 12.12 | 5.97 | 8.15 | 7.55 | 9.05D |
| Control | 22.00 | 29.15 | 28.42 | 33.42 | 29.52 | 28.50A |
| Average | 15.10A | 15.81A | 14.58A | 12.31B | 11.37B | |

F= S-fenvalerate

P= profenofos

T= Thiodicarb

F. test

1998

1999

Spray programmes

** (Highly significant)

**

Infestation levels

**

**

Spray prog. x Inf. level

**

**

Data given in Table (2) evidently demonstrate that all tested treatments reduced percent of cotton boll infestation with this species of bollworm, but percent reduction varied according to spray program and infestation level whereon the program was begun to be applied. In both seasons of the present study, the spray program F+P showed the highest averages reduction percent of 83.62% and 73.26% in 1998 and 1999 seasons, respectively. The lowest reduction effect was obtained with P+T program (71.47%) in the first season and T program (56.03%) in the second. Respecting the effect of infestation level, the obtained results indicate that cotton plants treated at 7 and 9% in 1998 season and 5% in 1999 season gave the highest averages of

reduction percents of 86.28, 86.48 and 82.72%, respectively; whereas 1% and 3% in the first season and 1% in the second showed relatively low reduction effect.

Many investigators in different parts of the world such as Thimmaiah (1985), Kurtadikar and Vidulya (1987), Abdalla (1991/ 1992), El-Feel *et al.* (1991), El-Feshawi *et al.* (1991), Gupta *et al.* (1991), Simwat *et al.* (1991), Raslan (1994), and Jha *et al.* (1995), who evaluated several conventional insecticides against pink bollworm larvae in cotton fields. Their findings are in harmony with the present results.

Table (2): Efficacy of different spray programs by certain conventional insecticides on the reduction percentage of bolls infestation with pink bollworm after their application at different levels of infestation during 1998 and 1999 cotton growing seasons

| Infestation Levels Spray Programs 1 st 2 nd 3 rd | Average percentages of reduction of cotton green bolls infestation at indicated levels | | | | | |
|---|--|-------|-------|-------|-------|-------|
| | 1998 season | | | | | |
| | 1 % | 3 % | 5 % | 7 % | 9 % | Avg. |
| F | 65.75 | 74.49 | 72.75 | 88.16 | 88.29 | 77.89 |
| P | 71.17 | 75.56 | 73.75 | 84.67 | 87.25 | 78.48 |
| T | 60.64 | 71.38 | 77.39 | 85.31 | 81.05 | 75.15 |
| F P | 78.24 | 76.34 | 83.08 | 90.91 | 89.55 | 83.62 |
| P T | 71.27 | 52.74 | 63.93 | 82.08 | 87.31 | 71.47 |
| F P T | 78.25 | 72.23 | 80.24 | 86.57 | 85.43 | 80.54 |
| Average | 70.89 | 70.46 | 75.19 | 86.28 | 86.48 | |
| | 1999 season | | | | | |
| F | 33.23 | 63.54 | 75.86 | 61.14 | 67.03 | 60.16 |
| P | 30.73 | 72.78 | 77.06 | 42.89 | 67.29 | 58.05 |
| T | 28.23 | 61.67 | 74.54 | 56.87 | 58.82 | 56.05 |
| F P | 52.36 | 72.49 | 84.89 | 79.39 | 77.19 | 73.26 |
| P T | 27.27 | 71.23 | 92.37 | 70.46 | 69.99 | 66.20 |
| F P T | 47.78 | 72.28 | 91.59 | 65.16 | 71.58 | 69.68 |
| Average | 36.60 | 68.92 | 82.72 | 62.65 | 68.60 | |

1.2. The spiny bollworm, *Earias insulana* (Bosid.)

Data presented in Table (3) obviously reveal that, in both seasons cotton green boll infestation with spiny bollworm was high significantly varied according to the impacts induced by spray programs, infestation levels and the different interactions between these two main factors. Cotton plants treated with the six tested spray programs showed average percentages of boll infestation lesser than untreated cotton plants exhibiting averages ranging from 1.15 – 2.40 % in the first season and 1.43 – 2.19% in the second compared with 3.66 and 5.16% for check plants, respectively. It is obvious that the 6th program (F+P+T) proved to be the most effective among other tested programs since it shows the lowest average percentage of boll infestation of 1.15 and 1.43% in 1998 and 1999 seasons, successively. This can be attributed to spray three insecticides in three successive sprays and the insect activity concentrated during the late period of cotton growing season and more exposed to the effect of the third insecticide (thiodicarb) and this is appeared in reducing boll infestation. On the other hand, the 2nd program wherein profenofos was applied in one spray had the lowest efficiency in both seasons showing the highest average

percentages of boll infestation of 2.40% in 1998 season and 2.19% in 1999.

The lowest average percentages of boll infestation of 1.93% in 1998 season and 1.98% in 1999 were obtained when cotton plants were treated at 5% level of bolls infestation, whereas the highest averages of infestation percent differently occurred in the two investigating seasons showing the highest averages of 2.42 and 2.74% at 3% and 1% levels of infestation during the first and second seasons, respectively. By comparing the efficiency of different tested spray programs in suppressing spiny bollworm activity, it is evident that the 6th treatment, (F+P+T) proved to be the most effective among other tested treatments showing the lowest mean percentages of boll infestation of 0.31% at 7% infestation level in 1998 season and 0.78% at 3% infestation level in 1999. Meanwhile, treatments of P X 9% in the first season and P X 1% in the second appeared to be less efficient in depressing spiny bollworm activity showing the highest mean of bolls infestation of 2.72% in each.

The present findings in Table (4) clearly reveal that in the first season, the tested programs can be arranged descendingly according to their reduction effect as follows: F+P+T, F+P, P+T, F, T and P showing averages % reduction of 73.31,

59.09, 53.78, 46.12, 44.76, and 42.05%, respectively.

Table (3): Efficacy of different spray programs by certain conventional insecticides on the infestation percentage of bolls with spiny bollworm after their application at different levels of infestation during 1998 and 1999 cotton growing seasons.

| Infestation Levels Spray Programmes 1 st 2 nd 3 rd | Mean percentage of cotton green bolls infestation at indicated levels during | | | | | |
|---|--|-------|--------|-------|--------|--------|
| | 1998 season | | | | | |
| | 1 % | 3 % | 5 % | 7 % | 9 % | Avg. |
| F | 2.64 | 2.40 | 2.17 | 1.79 | 2.02 | 2.20CD |
| P | 2.49 | 3.03 | 1.79 | 1.95 | 2.72 | 2.40B |
| T | 2.64 | 2.41 | 2.10 | 1.79 | 2.41 | 2.27BC |
| F P | 1.79 | 1.71 | 1.79 | 1.39 | 1.56 | 1.65E |
| P T | 1.87 | 1.79 | 2.02 | 1.71 | 1.87 | 1.85D |
| F P T | 1.69 | 1.64 | 0.77 | 0.31 | 1.32 | 1.15F |
| Control | 3.10 | 3.96 | 2.88 | 4.03 | 4.35 | 3.66A |
| Average | 2.32B | 2.42A | 1.93C | 1.85C | 2.32A | |
| | 1999 season | | | | | |
| F | 2.40 | 2.25 | 1.71 | 2.17 | 2.02 | 2.11B |
| P | 2.72 | 2.02 | 1.79 | 2.25 | 2.17 | 2.19B |
| T | 1.32 | 1.63 | 2.40 | 2.33 | 2.02 | 1.94B |
| F P | 2.65 | 1.63 | 1.55 | 1.94 | 1.87 | 1.93BC |
| P T | 1.39 | 1.47 | 1.94 | 1.47 | 1.79 | 1.61C |
| F P T | 2.25 | 0.78 | 1.01 | 1.47 | 1.64 | 1.43C |
| Control | 6.44 | 5.13 | 3.49 | 5.59 | 5.13 | 5.16A |
| Average | 2.74A | 2.13C | 1.98BC | 2.46A | 2.38AB | |
| F. test | | 1998 | | 1999 | | |
| Spray programmes | | ** | | ** | | |
| Infestation levels | | ** | | ** | | |
| Spray prog. xinf. level | | ** | | ** | | |

Table (4) : Efficacy of different spray programs by certain conventional insecticides on the reduction percentage of bolls infestation with spiny bollworm after their application at different levels of infestation during 1998 and 1999 cotton growing seasons.

| Infestation Levels Spray Programmes 1 st 2 nd 3 rd | Average percentages of reduction of cotton green bolls infestation at indicated levels | | | | | |
|---|--|-------|-------|-------|-------|-------|
| | 1998 season | | | | | |
| | 1 % | 3 % | 5 % | 7 % | 9 % | Avg. |
| F | 57.41 | 39.39 | 24.65 | 55.58 | 53.56 | 46.12 |
| P | 59.84 | 23.48 | 37.85 | 51.61 | 37.47 | 42.05 |
| T | 57.41 | 39.14 | 27.08 | 55.58 | 44.59 | 44.76 |
| F P | 71.13 | 56.82 | 37.85 | 65.51 | 64.16 | 59.09 |
| P T | 69.84 | 54.79 | 29.68 | 57.57 | 57.01 | 53.78 |
| F P T | 72.74 | 58.59 | 73.26 | 92.31 | 69.66 | 73.31 |
| Average | 64.73 | 45.37 | 38.39 | 63.03 | 54.41 | |
| | 1999 season | | | | | |
| F | 25.47 | 12.28 | 51.00 | 22.36 | 21.25 | 26.47 |
| P | 15.53 | 21.25 | 48.71 | 19.49 | 15.39 | 25.07 |
| T | 59.01 | 36.45 | 31.23 | 16.64 | 21.25 | 32.92 |
| F P | 17.70 | 36.45 | 55.59 | 30.59 | 27.09 | 33.48 |
| P T | 56.83 | 42.69 | 44.41 | 47.41 | 30.21 | 44.31 |
| F P T | 30.12 | 69.59 | 71.06 | 47.41 | 36.06 | 50.85 |
| Average | 34.11 | 36.45 | 50.33 | 30.56 | 25.21 | |

In the second season, the same trend of efficiency was detected except in case of F and T as well as F+P and P+T treatments wherein a switch in their positions were taken place. As regards the influence of infestation level whereon the programs began to be applied on the reduction percent of bolls infestation, the highest average of reduction percentages of 64.73% in the first season and 50.33% in the second were obtained with 1 and 5% levels of infestation, successively; whereas the corresponding lowest averages of 38.39% was detected with 5% in 1998 season but that concerning 1999 season (25.21%) was obtained with 9% level of infestation. From the present results, it is evident that the treatment F+P+T X 7% and 5% infestation levels was the most efficient in reducing boll infestation showing the highest averages of 92.31% and 71.06% reduction in the first and second seasons respectively. On the contrary, F treatment gave the lowest reduction percentages of 24.65 and 12.28% when cotton plants were treated when percent of boll infestation reached 5% in 1998 season and 3% in 1999, successively.

These results agree with the findings of Gupta and Katiyar (1985), Thimmaiah (1985), Gupta *et al.* (1991), Khidr *et al.* (1996) and Nassef and Watson (1999) who stated that the application of conventional insecticides either individually or in sequences against spiny bollworm reduced the infestation percentage of cotton green bolls.

2. Effect of different spray programs on seed cotton yield

Considering the results of seed cotton yield arranged in Table (5), it can be concluded that in both 1998 and 1999 seasons, the difference between mean yields were statistically highly significant for both spray programs and infestation levels but those between means of different interactions of the above mentioned treatments proved to be not significant. In both seasons, the highest yields were recorded with the 6th spray program (F+P+T) showing the highest averages of 9.64 and 8.16 kantars/ feddan in the first and second seasons, respectively. The other tested programs can be arranged descendingly according to their yields as follows: F+P (8.90), P+T (8.67), F (7.96), T (4.86) and P (4.58) in the first season, whereas in the second one the arrangement slightly varied to show a switch in position between P+T and F treatments. Control (check) plots wherein no chemical treatments were applied gave the lowest averages yield of 3.78 kantars/feddan in 1998 and 2.67 in 1999. From the present data, it is evident

that in both seasons, cotton plants treated when percent of infestation of green bolls with pink and spiny bollworms reached 3 and 5% yielded the highest averages of 8.26, 6.17 kantars/ feddan and 7.54, 5.52 during the first and second seasons, alternatively, whereas other infestation levels showed low average yield being the lowest of 5.53 kantars/ fedd. with 9% in 1998 season and 4.67 and 4.66 with both 7% and 9% in 1999, respectively. Although the insignificant effect of interactions, the highest mean yield of seed cotton was obtained with F+P+T X 3% infestation level in both first and second seasons showing the highest means of 12.14 and 9.39 kantars / feddan. On the contrary, the lowest means of 3.55, 3.34 and 3.46, 3.34 kantars / fedd. were achieved with the second program (P) X 5% and 9% infestation levels during the first and second seasons, successively.

The impact of different spray programs using different conventional insecticides against pink and spiny bollworms on seed cotton yields was studied in different parts of the world by many authors such as Abd El-Salam *et al.* (1990), Bramhankar *et al.* (1990), Nada (1990), El-Feshawi *et al.* (1991), Raslan (1994), Lohag and Nahyoon (1995), and Jha *et al.* (1996), who found similar results.

3. Effect of certain spray programmes on the occurrence of some predaceous arthropods

Results in Table (6) clearly show that all tested spray programs negatively affected the incidence of the studied predaceous arthropods as compared with their activity in control (untreated) cotton fields. Statistical analysis obviously revealed that this impact proved to be highly significant in case of all species during both seasons excepting those concerning true spiders in the first season and *Syrphus corollae* in the second which appeared significant effects at 0.05 level of probability. It is worthy to note that the effect varied according to the tested spray program as the decline in the predator population gradually increased when the number of sprays increased from one (F) to two (F+P) and three (F+P+T). For example, *Chrysoperla carnea* showed averages numbers of 3.04, 3.64; 1.86, 2.71 and 1.71, 2.48 adults / 50 double strokes in case of F, F+P and F+P+T treatments during 1998 and 1999 seasons, respectively; compared with the highest populations of 4.83 and 5.83 recorded in untreated cotton fields (check experiment). The same trend was also obtained with other arthropod predators.

Table (5): Seed cotton yield as influenced by different spray programs using certain conventional insecticides at different levels of infestation of bolls with pink and spiny bollworm during 1998 and 1999 cotton growing seasons.

| Infestation Levels Spray Programmes 1 st 2 nd 3 rd | Mean yield (kantar / feddan) at indicated infestation levels of cotton green bolls | | | | | |
|---|--|-------|--------|--------|-------|--------|
| | 1998 season | | | | | |
| | 1 % | 3 % | 5 % | 7 % | 9 % | Avg. |
| F | 6.89 | 10.31 | 8.2 | 6.44 | 7.94 | 7.96B |
| P | 6.49 | 4.44 | 3.55 | 5.09 | 3.34 | 4.58C |
| T | 4.44 | 4.77 | 5.95 | 5.33 | 3.83 | 4.86C |
| F P | 7.38 | 11.35 | 10.58 | 8.29 | 6.9 | 8.90AB |
| P T | 8.12 | 11.34 | 10.42 | 7.4 | 6.07 | 8.67AB |
| F P T | 9.84 | 12.14 | 9.71 | 9.16 | 7.34 | 9.64A |
| Control | 3.66 | 3.84 | 4.34 | 4.13 | 3.31 | 3.87C |
| Average | 6.69BC | 8.26A | 7.54AB | 6.55BC | 5.53C | |
| | 1999 season | | | | | |
| F | 6.41 | 7.44 | 6.99 | 4.75 | 4.59 | 6.04B |
| P | 4.56 | 3.96 | 3.46 | 4.17 | 3.34 | 3.92D |
| T | 5.41 | 5.39 | 3.28 | 4.37 | 4.49 | 4.59CD |
| F P | 5.68 | 8.72 | 8.09 | 4.06 | 4.44 | 6.19B |
| P T | 4.78 | 5.32 | 5.35 | 5.45 | 6.26 | 5.34BC |
| F P T | 8.09 | 9.39 | 8.89 | 7.52 | 6.93 | 8.16A |
| Control | 2.86 | 2.95 | 2.61 | 2.39 | 2.55 | 2.67D |
| Average | 5.41ABC | 6.71A | 5.52AB | 4.67BC | 4.66C | |

F. test 1998 1999
 Spray programmes ** **
 Infestation levels ** **
 Spray prog. xlnf. level N.S.(Not significant) N.S.

Table (6) Incidence of some predaceous arthropod species in cotton fields treated with three spray programmes during 1998 and 1999 growing seasons

| Predaceous arthropod Species | Average numbers of adults/ 50 double strokes | | | | F. test |
|------------------------------|--|--------|-------|---------|---------|
| | F | F+P | F+P+T | Control | |
| <i>1998 season</i> | | | | | |
| <i>Chrysoperla carnea</i> | 3.04B | 1.86C | 1.71C | 4.83 A | ** |
| <i>Coccinella</i> spp. | 5.29A | 4.25B | 3.44C | 5.81 A | ** |
| <i>Paederus alferii</i> | 2.61B | 1.56C | 1.46C | 4.75 A | ** |
| <i>scymnus</i> spp. | 3.59B | 2.69C | 2.04D | 4.79 A | ** |
| <i>Orius</i> spp. | 8.81B | 7.60C | 6.56C | 11.15 A | ** |
| <i>Syrphus corollae</i> | 0.36B | 0.29BC | 0.23C | 0.58 A | ** |
| True spiders | 1.21B | 1.00B | 0.81B | 1.51 A | * |
| <i>1999 season**</i> | | | | | |
| <i>Chrysoperla carnea</i> | 3.64B | 2.71C | 2.48C | 5.83A | ** |
| <i>Coccinella</i> spp. | 5.92A | 3.98B | 3.94B | 6.21A | ** |
| <i>Paederus alferii</i> | 2.73B | 1.77C | 1.29C | 3.85A | ** |
| <i>scymnus</i> spp. | 2.92B | 2.48C | 1.54D | 5.31A | ** |
| <i>Orius</i> spp. | 4.89B | 4.02BC | 3.37C | 8.15A | ** |
| <i>Syrphus corollae</i> | 0.39BC | 0.35BC | 0.25C | 0.59A | * |
| True Spiders | 0.50B | 0.42B | 0.35B | 1.31A | ** |

In regard to the relative hazard effect of each spray program on the population density of the previously mentioned predaceous arthropods as compared to that obtained with check experiment (untreated plots), data given in Table (7) represent averages percentages of population reduction in the three tested spray programs and obviously reveal that in both 1998 and 1999 seasons, the third spray program (F+ P – T) gave the highest adverse effect, which showing averages percentages of population reduction ranging from 48.38% (*Coccinella* spp.) to 75.92% (*Orius* spp.) in the first season and from 48.63% (*Orius* spp.) to 76.96% (true spiders) in the second. On the other hand, the first program (F) had the least adverse effect showing the lowest averages percentages of reduction, 25.77 and 25.51% with *Coccinella* spp. and *Orius* spp. during first and second seasons, respectively. The second program (F+P) appeared to have a moderate reverse effect in both seasons.

By calculating the general averages of reduction percentages of adult populations for each predator irrespective of spray program and for each program irrespective of predator species as well for each season irrespective of both program and predator, the present data can be generally recapitulated to show the general negative effect of three spray programs on adult population levels of seven arthropods species during 1998 and 1999 seasons as follows:

1-Irrespective of the differences between arthropod species in their susceptibility to the tested chemical programs, the third program (F+P+T) had the highest bad effect showing the highest averages % reduction of 64.32 and 63.45% in the first and second seasons, respectively. Whereas, the first program (F) showed the least effect exhibiting the lowest averages % reduction, 48.41% and 40.55% during 1998 and 1999 seasons, successively. The second program showed a moderate effect (52.42-55.21% reduction).

2-As clearly shown from the present results, the sensitivity of seven predaceous arthropod species to the impact of three spray programs irrespective of the tested program, greatly varied according to species and season. *Coccinella* spp. in the first season and *Orius* spp. in the second were more tolerant to spray programmes exhibiting the lowest reduction percentages of 37.67 and 40.35%,

respectively. On the contrary, the population of *Paederus alfieri* and true spiders were greatly declined due to insecticide treatments by 66.36 and 66.17% during 1998 and 1999 seasons, respectively.

3-As regards the seasonal variations of the reduction in adult populations of seven predaceous arthropods in cotton fields treated with three insecticides in three programs, it is evident that the total negative influence measured as % of reduction was nearly equal showing averages of 55.05 in the first season and 53.07% in the second with a difference of about 2%.

The present results are in fully agreement with those obtained by many authors such as Critchly *et al.* (1985), Hamburg and Guest (1997), Murray and Lloyd (1997), Qingnian *et al.* (1997), Abo-Elhagag (1998), El-Saadany *et al.* (1999) and Aioub *et al.* (2000), who reported that insecticide applications in cotton fields against different pests had an adverse and highly significant effect on numbers of both insect and spider predators prevailing during cotton growing season. Meanwhile, Campbell *et al.* (1979), Benedict *et al.* (1986) and Nada (1990), found that insecticides slightly reduced the populations of predaceous insects and spiders associated with cotton pests and the differences between their numbers in treated and untreated fields were not significant. This partial disagreement can be attributed to variations in insecticide mode of action, time of application, number and method of application and the effect of other unconsidered environmental factors on predator activity between their experiments and the present ones.

CONCLUSIONS

1-Spraying S-fenvalerate in the first spray and profenofos in the second is the most efficient insecticide program against both pink and spiny bollworms infesting cotton plants.

2-Number of insecticide sprays on cotton plants must be minimized as possible due to their bad side effects on predaceous insects and spiders prevailing in cotton fields

Table (7): Population reduction of some predaceous arthropod species in cotton fields treated with three spray programmes during 1998 and 1999 growing seasons.

| Predaceous arthropod species | Average % of population reduction | | | General average |
|------------------------------|-----------------------------------|-------|-------|-----------------|
| | F | F+P | F+P+T | |
| 1998 season | | | | |
| <i>Chrysoperla carnea</i> | 55.99 | 56.98 | 69.89 | 60.95 |
| <i>Coccinella</i> spp. | 25.77 | 38.86 | 48.38 | 37.67 |
| <i>Scymnus</i> spp. | 55.24 | 58.03 | 62.78 | 58.68 |
| <i>Paederus alfieri</i> | 64.35 | 65.94 | 68.79 | 66.36 |
| <i>Orius</i> spp. | 38.62 | 44.22 | 75.92 | 52.92 |
| <i>Syrphus corollae</i> | 59.52 | 60.71 | 72.62 | 64.28 |
| True spiders | 39.33 | 42.21 | 51.87 | 44.47 |
| General average | 48.41 | 52.42 | 64.32 | 55.05 |
| 1999 Season | | | | |
| <i>Chryoperla carnea</i> | 40.68 | 46.34 | 60.52 | 49.18 |
| <i>Coccinella</i> spp. | 40.02 | 48.12 | 62.52 | 50.22 |
| <i>Scymnus</i> spp. | 37.72 | 47.48 | 57.17 | 47.46 |
| <i>Paederus alfieri</i> | 41.59 | 59.86 | 69.04 | 56.83 |
| <i>Orius</i> spp. | 25.51 | 46.92 | 48.63 | 40.35 |
| <i>syrphus corollae</i> | 49.05 | 65.48 | 69.29 | 61.27 |
| True spiders | 49.26 | 72.28 | 76.96 | 66.17 |
| General average | 40.55 | 55.21 | 63.45 | 53.07 |

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التقييم الحقلي لبعض المبيدات الحشرية ضد دودتي اللوز القرنفلية والشوكية على نباتات القطن

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قيمت ثلاث مبيدات حشرية تقليدية (إس-فيناليرات (ف)، بروفينوفوس (ب) وثيوديكارب (ث)) ضد دودتي اللوز القرنفلية والشوكية على نباتات القطن مستخدمين ستة برامج رش مختلفة وهي رش كل مبيد منفرداً في رشة واحدة (ف، ب و ث) ، رش إس - فيناليرات في الرشة الأولى يعقبه بروفينوفوس في الرشة الثانية (ف+ب) ، رش البروفينوفوس في الرشة الأولى ويعقبه الثيوديكارب في الرشة الثانية (ب + ث) ، ورش إس-فيناليرات في الرشة الأولى ويعقبه البروفينوفوس في الرشة الثانية ثم الثيوديكارب في الرشة الثالثة (ف+ب+ث). ولقد بدأ استخدام هذه البرامج عندما وصلت نسبة اصابة لوز القطن الأخضر ١، ٣، ٥، ٧ و ٩% خلال موسم نمو محصول القطن متتاليين وهما ١٩٩٨ و ١٩٩٩ ، وبالإضافة الى ذلك فلقد درس تأثير ثلاثة برامج رش وهي (ف، ف+ب و ف+ب+ث) على انخفاض تعدادات بعض المفترسات مفصلية الأرجل.

اظهرت النتائج المتحصل عليها أن برنامجي الرش (ف+ب) و (ف+ب+ث) هما الأكثر فعالية ضد دودتي اللوز القرنفلية و الشوكية حيث اظهرت نباتات القطن المعاملة بهما اقل نسب مئوية للأصابة بكلتا الحشرتين وأعلى انتاجية من القطن الزهر. ولقد لوحظ ان نباتات القطن المعاملة بالبرامج المختلفة عند مستوى اصابة ٥% كانت اقل اصابة بكلتا الحشرتين واعطت اعلى انتاجية مقارنة بمستويات الأصابة المختبرة الأخرى وكذلك المقارنة. وبناء على ذلك من الممكن التوصية بالبرنامج (ف+ب) فى مكافحة كل من دودتي اللوز القرنفلية والشوكية فى حقول القطن ومن الممكن الاستغناء عن الرشة الثالثة فى البرنامج الأخر (ف+ب+ث) وهذا يعتبر مهم جدا لتقليل نفقات عملية المكافحة ، وكذلك لزيادة نشاط الأعداء الحيوية من متطفلات ومفترسات حشرية وعناكب حقيقية. ولقد وجد ان لبرامج الرش سواء فى رشة واحدة (ف) او رشتين (ف+ب) وثلاث رشات (ف+ب+ث) تأثيرا عكسيا على تعدادات مفصليات الأرجل المفترسة فى حقول القطن.