Summary

V. SUMMARY

In field-laboratory study, the environmental toxicological effects of four pesticides (Pyriproxyfen, Azadirachtin, Chromafenozide and Ethoxazole) was studied against three different populations of the cotton leafworm *Spodoptera littoralis* (early-season strain, late-season strain and laboratory reference strain).

To study the environmental effects on the tested pesticides, either as parent or/and as residues resulted from degradation, both initial and bioresidual activity was investigated through bioassay using treated cotton leaves collected at specific intervals, *i.e.*, 0-1*st* day, 7*th*-8*th* day, 14*th* -15*th* day and 21*st* -22*nd* day after spray. The 4*th* instar larvae were exposed to and fed for 2 days on treated leaves, collected at the prementioned testing intervals, followed by feeding for 3 days on untreated leaves.

The environmental toxicological effects includes three main topics and the obtained data could be summarized as follow :

1- Initial and bioresidual toxicity of different pesticides on the cotton leafworm larvae:

1- Initial toxicity :

All insecticides exhibited highly pronounced initial toxicity (62-100 %) against laboratory reference strain, (55-100 %) against early-season field strain(before spraying program) while the least initial toxicity (43-81 %) was recorded against late-season field strain(after spraying program), after feeding the 4*th* instar larvae for 2 days on treated cotton leaves, collected at zero and one day after application, followed by 3 days feeding on untreated leaves.

2- Bioresidual activity :

a- The highest residual toxicity against the 4th instar larvae of laboratory strain was recorded in Chromafenozide (82 %) at the

2*nd* testing interval while the bioresidual toxicity ranged between 48-76 % and 36-70 % for all insecticides during the 3rd and 4th testing intervals, respectively.

b- The early-season field strain (before spraying program) resulted in bioresidual toxicity during the testing intervals ranged between 15 and 78 %.

c- The bioresidual toxicity for different pesticides against the late-season field strain (after spraying program) ranged between 5-65 within all testing intervals and the highest bioresidual toxicity (65 %) was recorded for Chromafenozide (400 ml/fed.) while the least in this respect (5 %) was recorded for Pyriproxyfen (150 ml/fed.).

II- The latent effects of certain pesticides on different developmental aspects in the cotton leafworm biology :

1- Effect on accumulated larval mortality :

The latent effect on accumulated larval mortality was more pronounced in laboratory reference strain (37-100 %) while in early-season field strain(before spraying program) ranged between 18-100 % and in late-season field strain (after spraying program) it was 67-93 %. Chromafenozide exhibited the highest accumulated latent larval mortality in all strains.

2- Effect on larval duration :

The larval duration was elongated remarkably in laboratory and early-season strains recording percent increase ranged 0.6-81.3 % and 1.3-73.3 % for both, respectively while remarkably lower increase (6.7-20 %) in larval duration was recorded in late-season strain. However, the highest increase was associated with Pyriproxyfen treatment particularly the higher rate.

3- Effect on larval weight :

Mean larval weight was considerably reduced for the three strains at the four testing intervals compared with control. The

reduction reached 9.4-85.9 %, 7.7.-78.2 % and 9.1-68.6 % for laboratory strain, early-season field strain (before spraying program) and late-season field strain (after spraying program), respectively. The highest reduction in mean larval weight was recorded for Chromafenozide at 400 ml/fed. And Azadirachtin at 100 ml/fed.

4- Effect on pupation and pupal malformation :

a- Remarkable reduction in pupation rate in compare with control was recorded for all tested insecticides and strains associated with remarkably and high abnormality percent in the resulted pupae at the early-season strain followed by laboratory reference strain and late-season strain, respectively.

b- The highest reduction in pupation rate and increase in abnormality percent was recorded in Chromafenozide treatments in all strains tested.

5- Effect on pupal duration :

Pupal duration was considerably reduced in all insecticidal treatments, particularly in Pyriproxyfen and Chromafenozide, when tested against larvae of the three strains.

6- Effect on pupal weight :

Pupal weight was remarkably reduced in all treatments compared with control by 3.1-62.8 %, 4.0-56.6 % and 2.0-38.8 % for laboratory, field strain (after spray program) and field strain (before spraying program), respectively. The only exception was for pyriproxyfen and Ethoxazole at the 4*th* testing interval where they recorded increase in pupal weight reached 20.2-24.1 % and 32.2-40 % for both, respectively, in field strain (after spraying program).

7- Effect on pupal mortality :

The effect on pupal mortality was remarkably low and was mostly within the natural mortality where the differences between

treatments and the control were relatively low. The early-season field strain recorded the highest mean pupal mortality (2.0-27 %) and laboratory, reference strain came next (2.0-19 %) while the least mean pupal mortality was recorded for the late-season field strain (1-8 %) versus 9-13% for the control treatment.

8- Effect on adult emergence :

a- Remarkably low adult emergence not exceeding 3-12% was resulted by laboratory strain while 3-22 % adult emergence was recorded in early-season field strain (before spraying program) versus 2-12 % adult emergence in late-season field strain (after spraying program) compared with 80-87 % adult emergence in control treatment.

b- Chromafenozide treatments exhibited in general the highest inhibition (zero % in adult emergence) in most testing intervals within the three tested strains.

9- Effect on adult longevity :

a- Adult longevity was remarkably reduced during most testing intervals and for all treatment except in case of Pyriproxyfen where remarkable increase in adult longevity of 5.8-86.7 %, 14.7-80 % and 4.0-5.3 were recorded in laboratory strain (1*st* -3*rd* tenting intervals), in early-season strain (1*st* - 2*nd* testing intervals) and in late-season strain (1st testing interval), respectively.

b- The reduction in adult longevity was more pronounced in laboratory and early-season strains particularly in Azadirachtin and Chromafenozide treatments.

10- Effect on adult fecundity :

a- The adult fecundity was remarkably reduced in all tested strains and reduction was highly pronounced in the 1st testing interval (0-1 day) recording 82.9-100 %, 78.6-100 % and 52.9-83.6 % reduction

in fecundity of adults resulted from laboratory, late-season and early-season strains, respectively. Relatively lower reduction in fecundity of 30-80, 24.0-50 and 24-68 % was recorded in adults produced at the *4th* testing interval (21-22 day) for the prementioned strains, respectively.

b- Chromafenozide exhibited the highest reduction in adult fecundity during most testing intervals where almostly no emerged adults were recorded.

11- Effect on eggs viability :

a- Viability of eggs deposited by adults emerged in larval treatments was remarkably affected, recording inhibition in eggs hatch percentages reached 98.6-100 % in laboratory strain, 75.7-100 % in early-season field strain (before spraying program) and 60-100 % inhibition in late-season field strain (after spraying program).

b- The maximum latent effect on egg hatch was demonstrated by the highest eggs hatch inhibition in Chromafenozide followed by Pyriproxyfen in all tested strains.

III- Effect of different pesticides on the consumption, digestion and utilization of food in the larval stage of cotton leafworm different strains:

1- Food consumption (CW) :

a- All insecticides tested except Pyriproxyfen resulted in remarkable reduction in consumed food during all testing intervals ranged between -42.12 % and -3.77 % for early-season strain larvae and-47.74 % and -10.84 % for laboratory strain larvae while it was -35.09 % and +3.79 % for late-season strain larvae during 1*st* -3*rd* testing intervals.

b- In contrast, Pyriproxyfen treatments recorded considerable increase in food consumed by larvae of early-season strain ranged between +38.62 % and +2.25 % at 1*st* -3*rd* testing interval while it was

+46.01 % to +7.73 % for larvae of laboratory strain versus reduction ranged -25.71 % and -13.37 % for larvae of late-season strain at the same testing intervals.

c- The reduction based on overall mean consumed food was in general positively associated in most treatments with the concentration level, regardless of the tested insecticide.

2- Consumption index (CI) :

a- The CI data was found to be associated with the amount of food consumed and though showed in general trend similar to that of CW where all insecticides except Pyriproxyfen resulted in remarkable reduction in CI values ranged between -42.42% ad -3.3% for early-season strain, -48.45 and -17.14% for late-season strain and -54.55% and -9.09% for the laboratory strain.

b- Pyriproxyfen treatments caused increase in CI ranged between +42.42 % and +2.86 % for early-season strain and ranged between +66.67 % and +8.57 % for laboratory strain while remarkable reduction in CI values ranged between -37.14 % and -28.57 % was recorded in cases for the late-season strain.

c- Based on the overall mean CI values during all testing intervals, Pyriproxyfen exhibited CI values statistically similar to control and both were significantly higher than treatments of other pesticides.

3- Growth rate (GR) :

a- Comparison on the basis of the overall mean growth rate (GR) between the three tested strains revealed that Pyriproxyfen resulted in an increase in GR of early-season and laboratory strains significantly higher than control and other treatments while overall means growth rate in all treatments and control in late-season strain were insignificant.

b- The highest reduction in growth rate was resulted while the tested pesticides were at its highest level within the initial testing interval (0-1 day) and was recorded by chromafenozide (-51.66 and

-50.33 %) in early-season strain, by Azadirachtin (-39.00 and -40.33 %) in late-season strain while it was by Chromafenozide (-65.67 and -61.67 %) in laboratory strain.

c- All treatment except Pyriproxyfen resulted in remarkable reduction GR values, reached its maximum at initial testing interval (0-1 day) then the reduction percent decreased gradually with progress in time after spraying till the 4*th* testing interval (21-22 day) recording the least percent reduction in GR values.

4- Approximate digestibility (AD) :

a- Based on the overall mean AD during all testing intervals, it was obvious that Chromafenozide treatments increased significantly the AD % of early-season strain (92.07-92.3 %) whereas other treatments, except Pyriproxyfen, including control came significantly next (87.65-90.55%). On contrary Pyriproxyfen exhibited significantly the least AD % (85.05 %).

b- Almostly similar trend was achieved in case of laboratory strain while no significant variations were recorded between different treatments and control in late-season strain.

5- Efficiency of conversion of ingested food (ECI) :

a- Comparison on the basis of the overall mean ECI values within different testing intervals in early-season and laboratory strains indicate that ECI values in all treatments except Pyriproxyfen were slightly lower and insignificant when compared with control.

b- However, Pyriproxyfen treatments in both prementioned strains exhibited significantly higher ECI values when compared with other treatment including control.

6- Efficiency of conversion of digested food (ECD) :

a- Comparison on overall mean basis indicated that larvae of early-season and laboratory strains performed almostly similar and all

treatments except Pyriproxyfen, particularly at the higher rate, resulted in significantly lower ECD values., versus significant increase in ECD value of Pyriproxyfen when compared with other treatments including control.

b- The data in general indicate that ECD was directly proportional to the ECI and inversely proportional to AD.

c- The least ECD values were recorded for Chromafenozide treatments, particularly at the high rate (400 ml/200L) in early-season and laboratory strains.