The Effect of Some Insecticides on Parasitized and Non- Parasitized Spodoptera littoralis Larvae

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ABSTRACT

Three insecticides, recommended by the Ministry of Agriculture, Egypt, for use against cotton and vegetable pests were tested. These insecticides were methomyl, methamidophos and chlorpyrifos. These insecticides were tested against the third instar of Spodoptera littoralis (Boisd.) larvae parasitized by Microplitis rufiventris (kok.) and non-parasitized S. littoralis larvae of the same age. In the first part which larvae fed on castor oil leaves contaminated with insecticides. The insecticides can be arranged in the following descending order according to their LC50’s and statistical analysis. In larvae, chlorpyrifos, methomyl and methamidophos. In the second part which larvae fed on poisoned semi-artificial died. The tested insecticides can be arranged in the following descending order according to their LC50’s and statistical analysis. In both parasitized and non-parasitized larvae, methomyl, methamidophos, chlorpyrifos.

Keywords: Spodoptera littoralis (Boisd.), Microplitis rufiventris, (kok.) insecticides

INTRODUCTION

Cotton is considered to be the most important fiber crop grown in the world. This important crop is unfortunately highly susceptible to arthropod infestations, which are reported to attack all parts of the plant through the growing season. The geographical situation of Egypt, its mid climate and fertile soil, make it vulnerable to accidental introduction and spread of exotic pests (Kamal, 1951). The most important exotic pests, is the cotton leaf worm Spodoptera littoralis (Boisd.). It is apolyphagous and active almost all the year round. (Boisd.). It is apolyphagous and active almost all the year round. S. littoralis is widespread in the tropics and subtropics of the Old World and is also found in the Canary Islands, Madeira and the southern Mediterranean (Khalifa et al., 1982).

The chemical control of S. littoralis has been extensively reported, especially in relation to cotton in Egypt. Numerous organophosphorus, synthetic pyrethroids and other insecticides have been used, with appearance of resistance and cross resistance in many cases (Issa et al., 1984a; 1984b; Abo-El-Gharet et al., 1986). However, compulsory limitation of the application of synthetic pyrethroids to one per year on cotton in Egypt has stopped the appearance of new resistance (Sawicki, 1986).

In Egypt, many attempts had been carried out in this respect by Kamal (1951) and Hafez (1951) to control the cotton leaf worm S. littoralis by using the exotic larval parasite Micromoritis demolitor introduced from Australia in 1940 and 1946 Microplitis rufiventris, a braconid parasitoid, (recorded for the first time in Egypt by El-Minshawy 1963) proved to be an effective parasitoid against the first four larval instars of the cotton leafworm S. littoralis (Hammadet al.,1965, Shalaby, 1968, Hegaziet al., 1973). The aim of this study is to evaluate the effect of some recommended insecticides against the cotton leafworm and one of its most important parasitoids; M. rufiventris.

MATERIALS AND METHODS

A) Insecticides used:

To study the effect of certain insecticides on parasitized and non-parasitized host larvae of the cotton leafworm by the internal larval parasitoid M. rufiventris three insecticides were tested.

1- Tamaron:
Common name: methamidophos,
Chemical name: O,S-dimethyl phosphoramidothioate.
It was supplied by Bayer Pflanzenschutz, Leverkusen (West Germany) as Tamaron, 60%, SI

2- Dursban:
Common name: Brodan, Chlorpyrifos-ethyl, Detmol
Chemical name: O,O-diethyl O-(3,5,6-trichloro-2-pyridinyl) phosphorothioate
It was supplied by Dow Chemical Company (U.S.A.) as Dursban, 48%, EC.

3- Lannate:
Common name: Mesomile, Methomex, Nudrin
Chemical name: (E,Z)-methyleneN-{{[(methylamino)carbonyl]oxy}ethanimidothioate.
It was supplied by DuPont De Nemours Company (Switzerland) as Lannat, 90%, Sp.

B) Testing insecticides on the host larvae:

1- Residual film method:
This method was carried out by dipping castor oil leaves into the insecticide concentration for 30 seconds and then left to dry. Ten of the parasitized and non-parasitized larvae were confined in each container with the treated leaves. Larvae of the same age offered untreated castor-leaves to serve as control.

The average percentage of mortality resulting from the treatment with each concentration were plotted against the concentration on log-probit paper and the concentration mortality regression lines were fitted by eye. LC50 values were calculated, and statistically analyzed was applied according to Litchfield and Wilcoxon (1949).

2- Poisoned semi-artificial diet method:
Semi-artificial diet was prepared according to Hegaziet al.(1977). Nine grams of this media was thoroughly mixed with one gram of the tested insecticide concentration. The host larvae at their 3rd instar (5 days-old) were subjected individually to M. rufiventris females for parasitism. Parasitized larvae...
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were reared for 6 days, then, they were used as test organisms. Normal non-parasitized larvae of the same age (11-days-old) were subjected to the insecticide treatment and served for comparing the reactions of the parasitized and non-parasitized larvae to the tested insecticides. Every treatment was represented with ten larvae for each replicate, and three replicates were made for each treatment. Larvae of the same age were fed with untreated semi-artificial diet to serve as control. Mortality counts were taken after 24 hours.

RESULTS AND DISCUSSION

Effect of tested insecticides on parasitized and non-parasitized S.littoralis larvae: 

1-Insecticide residual-film on castor oil leaves:

a) Effect of chlorpyrifos:

The effect of chlorpyrifos on the parasitized and non-parasitized S.littoralis larvae is shown in Fig.(1.A). In parasitized larvae, the tested concentrations gave mortality percentage between 20 and 100%, while the recorded data among non-parasitized larvae showed mortality percentages between 16.6 and 100%. Calculated values LC50 showed that, this insecticide gave LC50=28 ppm on the parasitized larvae while on non-parasitized larvae the LC50 = 96 ppm. This means that, chlorpyrifos was more toxic to parasitized larvae than non-parasitized larvae.

b) Effect of methamidophos:

The effect of methamidophos on the parasitized and non-parasitized S.littoralis larvae is illustrated in Fig.(1.B). The used concentrations gave mortality percentage in parasitized larvae between 13.30 and 86.66% while the mortality percentage on non-parasitized larvae ranging also between 13.33 and 86.66%. Calculated value LC50 was 385 ppm for parasitized larvae, while for the non-parasitized larvae the value was 290 ppm. This means that methamidophos was less toxic to parasitized larvae than non-parasitized larvae.

c) Effect of methomyl:

Concerning the effect of the selected series of concentrations of methomyl on parasitized and non-parasitized S.littoralis larvae. The recorded concentrations in Fig.(1.C) gave percentages mortality between 6.6% and 86.6% for parasitized larvae, and gave mortality percentages between 23.3% and 80.0% for non-parasitized larvae. The calculated LC50 values for this insecticide was 152 ppm for parasitized larvae and 104 ppm for non-parasitized ones. These results indicate that methomyl is more toxic to the non-parasitized larvae than parasitized larvae.

The corresponding arrangement for the relative toxicity of the tested materials on non-parasitized larvae as follows: Chlorpyrifos, methomyl and methamidophos.

Parasitized larvae were less sensitive to the insecticides, methamidophos and methomyl, however, with chlorpyrifos, the parasitized larvae were more sensitive than non-parasitized ones.

2- Poisoned semi-artificial diet:

The results of feeding of late 3rd instar of parasitized and non-parasitized S. littoralis larvae on insecticide treated semi-artificial diet are illustrated in Fig. 2.

a) Effect of chlorpyrifos:

The effects of chlorpyrifos on parasitized and non-parasitized S. littoralis larvae are given in Fig.(2A). The series of concentrations of chlorpyrifos on parasitized larvae gave percentages of mortality ranging from 6.66% to 100%, while the series of concentrations on non-parasitized larvae (Fig.2A) gave mortality percentages between 20 and 100%. The calculated LC50 values were 61 ppm and 55 ppm for parasitized and non-parasitized larvae, respectively.

b) Effect of methamidophos:

The effects of methamidophos on parasitized and non-parasitized S. littoralis larvae are graphically illustrated in (Fig.2B). The series of concentrations of methamidophos gave mortalities between 6.66% and 96.66% for parasitized larvae, 10% and 100% for non-parasitized larvae. The recorded LC50 values for methamidophos were 36 ppm for both parasitized and non-parasitized larvae.

c) Effect of methomyl:

Concerning the effect of methomyl (Fig.2C), the concentrations of this insecticide gave percentage mortalities of 3.33% to 66.36% and 10% to 90% for parasitized larvae and non-parasitized larvae, respectively. The recorded LC50 values for methomyl were 20 ppm for parasitized larvae and 17 ppm for non-parasitized larvae.

From the previous results, it can be arrange, the toxicity of these insecticides on parasitized as well as none parasitized larvae according to their LC50 values and the statistical analyses, in a descending order as follows: methomyl, methamidophos, chlorpyrifos.

By comparing the LC50 values on parasitized and non-parasitized larvae it is obvious that, confidence limits of LC50 values of methomyl on non-parasitized larvae (22.3-12.9) lie between the confidence limits of LC50 value of the same insecticides on parasitized larvae (27.2-14.7). The confidence limits of LC50 values of methamidophos and chlorpyrifos, either on parasitized larvae, showed the same previous trend. These results mean that no difference exists in the effects of methomyl, methamidophos and chlorpyrifos on parasitized or non-parasitized S. littoralis larvae.

By comparing the two methods of bioassay techniques (Figures 1,2) all the tested insecticides showed high toxic effect with poisoned semi-artificial diet than treated castor-oil bean leaves, except chlorpyrifos, which showed more toxicity to parasitized larvae when fed on treated castor-oil bean leaves compared to poisoned diet. These results are in good agreement with the results of Hegazi et al. (1981) who found that toxicity of methyl parathion, ethyl parathion and decamethrin, (either micro-encapsulated or emulsifiable concentrate formulations) was higher when the parasitized or non-parasitized larvae were fed on poisoned semi-artificial diet than those fed on treated castor-oil leaves. This fact is due to that semi-artificial
diet was in complete contact with the whole body of larvae, whereas, the treated castor-oil leaves were in partial contact with the body of larvae.

It is clear from Figures 1,2 that methomyl and methamidophos were more effective on non-parasitized larvae than parasitized ones, whether the larvae were fed on treated castor-oil bean leaves or on poisoned semi-artificial diet. These results agree with the results of Hegazi et al. (1981). They found that parasitized S.littoralis larvae were less susceptible to all tested insecticides than non-parasitized larvae. Results further agree with the findings of those obtained by Hegazi et al. (1978). They found that a decrease in appetite of parasitized S.littoralis larvae led to a decrease the amount of toxicant ingested by the parasitized larvae. Also, the last observation has the same trend for treated –castor-oil leaves by chlorpyrifos.

Fig. 1 : Effect of chlorpyrifos (A), methamidophos (B) and methomyl (C) on parasitized and non-parasitized S.littoralis larvae fed on castor- oil leaves.
Fig. 2: Effect of chlorpyrifos (A), methamidophos (B) and methomyl (C) on parasitized and non-parasitized *S.littoralis* larvae fed on semi-artificial diet.
REFERENCES


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