VI- SUMMARY

VI- SUMMARY

The present study deals with the evaluation of efficiency of the surfactants (Triton 20, Triton X - 100 and Tween 80) synergistic effect when used in combination with the chemical insecticides (Sumicidin, Fenitrothion, Malathion and Propoxur) against resistant strain of ***Culex pipiens*** larvae under laboratory condition. Histochemical, biochemical and the ultrastructural effect were studied to throw some light in this evaluation. The obtained results indicate the following : -

1) Susceptibility tests :

The insecticidal activites of the tested insecticides against ***Culex pipiens*** resistant larvae were arranged as the following on the bases of their LC_{50} values, Sumicidin > Fenitrothion > Malathion > Propoxur. Their LC_{50} values were 0.06, 0.2, 1.49 and 4.2 ppm, respectively.

2) The combined effect of the surfactants with the chemical insecticides.

The addition of the surfactants to the tested chemical insecticides increased their efficiency as represented below :

2.1) Effect of the surfactants with the pyrethroid.

Results indicated that the ***Culex pipiens*** larvae were quite susceptible to the synergistic effect of the surfactants when used in mixture with Sumicidin. Higher larval mortality resulted from the combination of Triton 20 followed by Tween 80, but Triton X-100 showed a slight synergistic effect.

2.2) Effect of the surfactants with the organophosphorus.

The obtained data revealed that the larval exposure to the Fenitrothion with each of the surfactants mixture induced significant higher larval mortality. Tween 80 was the highest one followed by Triton 20 then Triton X-100. Malathion insecticidal activities was increased following the addition of Triton 20 then Tween 80 the least one was the Triton X-100. Addition Triton X-100 to the insecticides results indicated its slight effect on increasing the toxicity of both of Fenitrothion and Malathion.

2.3) Effect of the surfactants with the carbamate.

The obtained data revealed that the surfactants have a slight synergistic effect when added to Propoxur, however the Triton X-100 almost have no synergistic effect on Propoxur.

3) Biochemical assays of enzyme activity of *Culex pipiens* larvae in relation to the synergistic effect of surfactants .

3.1) ATPase

The obtained data demonstrate that the pyrethroids plays a very important role in the ATPase inhibition concerning its toxicity to ***Culex pipiens*** larvae followed by the organophosphorus and then the carbamate. Addition of Triton 20 to Sumicidin proved to exhibit the highest inhibitory effect on the ATPase of the ***Culex pipiens*** larvae

followed by its addition to Fenitrothion and Malathion, then the least effective addition was found to the Propoxur.

Addition of Tween 80 to Sumicidin resulted in a significant inhibtion to ATPase followed by its addition to Fenitrothion and Malathion and the least one was the Propoxur.

Triton X-100 was found to be the least effective among the tested surfactants in inhibition of ATPase activity.

Malathion and Fenitrothion behaved almost the same to the surfactants addition in increasing the inhibitory activity of ATPase.

3.2) Acid phosphatase

The obtained data revealed that the organophosphorus insecticides (Fenitrothion and Malathion) stimulated the activity of the free and total acid phosphatase of ***Culex pipiens*** larva followed by the carbamate (Propoxur) and then the pyrethroid (Sumicidin).

- Addition of the surfactant Triton 20 resulted in a significant increase in acid phosphatase activity to the ***Culex pipiens*** larvae treated with Sumicidin as just as that added to the organophosphate insecticides.

- Triton X-100 exhibited no changes on the specific activity of free and total acid phosphatase following its addition to the tested insecticides in comparison with Triton 20 or Tween 80 addition.

- Surfactants addition to Propoxur resulted in a relatively low change in the total and the free acid phosphatase activity of the ***Culex pipiens*** larvae.

4) Histopathological studies :

The histopathological effect of the larvae treated with the insecticides alone or with its mixture with the surfactant additives were evaluated by examining the sectioned materials. The results of this study were as follows : -

4.1 - The light microscope studies :

The larvae treated with the insecticides separatly or in mixtures with surfactants when examined histopathologicaly revealed that the insecticides cause damage to the epithelial midgut cells.The other affected tissues and cells were muscle bundle, fat body layers, gastric caeca and the peritrophic membrane. Addition of the surfactants to the insecticides resulted in extensive damage to the previously affected cells or tissues.

A striking feature appeared in larvale section with that treated with a mixture of the insecticide and the surfactant showing the complete destruction to the layers beneath the cuticle.

4. 2- The electron microscope studies :

The ultrastructural results of the normal larvae revealed unusual ultrastructural characteristics which is the absence of the H-band and presence of Z - tubules in the muscle cells .

In Sumicidin treated ***Culex pipiens*** larvae the midgut epithelial cells lost their normal structure. Mitochondria were coalesced and puffed. The Golgi bodies, the cell membranes and the rough endoplasmic reticulum were destructed, also the organelles of gastric casca were affected. The muscles were degenerated, in addition, vacuoles and fissures appear in it. The surfactants addition to the insecticides resulted in the extensive damage occur to the previously mentioned tissues and cells.

5) Ultrastructural localization of certain enzyme in *Culex pipiens* larvae

5.1- ATPase.

The normal distribution of ATPase activity in a non treated ***Culex pipiens*** larvae was found in the mitochondrial matrix, in the rough endoplasmic reticulum, in between muscle cells, in integumental hypodermis and also found free in accumulation near the nucleus. Profile obtained after Sumicidin treatment indicates that inhibition occur to the ATPase activity, while addition of the surface active agent to the insecticides resulted in the complete inhibition of ATPase.

5.2- Acid phosphatase :

The normal distribution of acid phosphatase activity in ***Culex pipiens*** midgut was observed in the lysosomes, in rough endoplasmic reticulum and also free inside the cell. Profiles obtained after the insecticide treatment indicated the leakage of the acid phosphatase activity, while on adding the surfactant to the insecticides, the acid phosphatase activity was found to be more pronounced.

Based on the experimental results of bioassaying, each of the tested insecticides individually or in combination as well as on studying their histopathological, biochemical and histochemical action, it is preferable to use these insecticides in combination with the surfactants in mosquito control programmes particularly in resistant larval strain control .