SUMMARY

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The present study aimed to throw some light on the toxicological effects of some insecticides and IGRs on ***Culex pipiens*** larvae, collected from two different geographic areas ; Miet El-Attar and El-Saygh villages, Qualyubia Governorate . Also this work was an attempt to study the rates of development and reversion of resistance to baygon insecticide . In addition, the patterns of resistance spectra in the parent field strain, and of cross-resistance in the laboratory selected strain were investigated and compared .

In an attempt to exploit pairs of insecticides that would prove synergistic against the larvae, several binary insecticide mixtures were tested against the resistant strains .

Studies on the possible defense mechanisms that may exist in the baygon-resistant strain were also undertaken through the use of certain synergists, P.b, sesame oil (Known to inhibit function oxidative enzymes) and clove oil .

The results obtained can be summarized as follows :

1- Susceptibility of *Culex pipiens* larvae to some larvicidal agents :

1.1 Chemical insecticides :

On the basis of their Lc_{50} values, the efficiency of the tested chemical insecticides could be arranged as follows :

Dursban > permethrin > sumicidin > sumithion > baygon > diazinon , for Miet El-Attar strain. Their LC_{50} values are 0.0016 , 0.0018, 0.002 , 0.015 , 0.20 & 0.26 ppm, respectively (Miet El-Attar strain) .

Sumicidin > dursban > permethrin > sumithion > diazinon > baygon, for El-Saygh strain . Their Lc_{50} values are 0.0006 ,0.0017 , 0.003, 0.011 , 0.37 & 0.63 ppm, respectively (El-Saygh strain) .

Both strains were almost equally susceptible to dursban insecticide . However, Miet El-Attar strain appeared slight more susceptible to diazinon, baygon and permethrin than El-Saygh . In contrast this strain was less susceptible to sumithion and sumicidin than El-Saygh strain .

The tested insecticides proved effect against the two tested strains of ***Cluex pipiens*** larvae ; and there was no evidence of development of resistance .

1.2 Insect growth regulators (IGRs) :

The two tested strains of ***Cluex pipiens*** larvae were almost equally susceptible to IGR_s tested . However, IKI was slight more potent than bay sir .

The Lc_{50} values of IKI & bay sir for Miet El-Attar strain were 1.30 , 0.30 & 0.13 ppm & 1.79 , 0.26 & 0.19 ppm after 24, 48 & 72 hrs. post-treatment , respectively and the slope functions were of low values of 1.85 , 2.92 & 3.38 & 3.16 , 3.36 & 3.63 for IKI and bay sir, respectively indicating high degree of homogeneity of the population to the different concentrations of IGR_s tested .

Similarly the Lc_{50} values of IKI and bay sir For El-Saygh strain were 1.48, 0.44 & 0.27 ppm and 1.89 , 0.46 & 0.32 ppm after 24 , 48 & 72 hrs. post-treatment, respectively and the slope functions were of low values of 1.18, 2.95 & 3.34 for IKI and 2.79, 3.29 & 3.12 for bay sir.

These findings would recommend the use of these insecticides and IGRs as promising control agents against the two field-strains of ***Culex pipiens*** larvae .

2- Development and reversion of baygon-resistance in *Culex pipiens* larvae .

2.1- Development of resistance .

The larvae of ***Culex pipiens*** was subjected to continuous laboratory selection with baygon for 15 successive generations .

Resistance to baygon was increased gradually throughout the successive generations of selection, but after 12 generations of selection the level of resistance was suddenly increased to 49.5 times higher than the parent larvae . At the end of selection generation (F_{15}) the level of resistance was increased to 308.7 times more resistance than the parent . During selection the slope function values of the regression lines were gradually declined with selection indicating progression of the development of resistance .

2.2- Reversion of resistance :

The baygon-resistant strain after achieving the high level of resistance of 308.7 fold resistance at generation 15 was left without

chemical pressure for 18 successive generations . The results showed that levels of resistance gradually decreased during the successive relaxed generations compared to the normal strain . It reached about one tenth the level of R-strain after 18 relaxed generations . The high resistance to baygon may occur in the larvae of *Culex pipiens* by the interaction of several genetic factors .

3- Resistance spectrum of baygon-resistant strain to various insecticides and IGRs.

The pattern of cross-resistance to several insecticides and IGRs was studied in baygon-resistant strain and compared with the susceptible strain . The data reveald that there were no significant differences in susceptibility between the two strains ($P > 0.05$) . The relative resistabilities of baygon selected strain revealed a slight positive correlation, indicating no clear cross-resistance between baygon resistance and the all insecticides tested (sumithion 3 fold, diazinon 1.46 fold , sumicidin 1.7 fold & permethrin 1.22 fold) . A siginificant difference was observed with dursban insecticide ($P < 0.05$) and positive correlation was only recorded with it (4.8 fold) .

The data of IGRs revealed that baygon-resistant strain was quite susceptible to the two IGRs tested and there were no significant differences in susceptibility between the two strains . The levels of resistance after 24, 48 & 72 hrs. exposure periods were 1.48, 1.73 & 1.76 folds for IKI and 1.56, 1.81 & 1.32 fold for bay sir, respectively indicating no correlation .

4- Joint action of baygon with various insecticides and IGRs against the baygon-resistant strain of *Culex pipiens* larvae .

The results of the potencies of baygon and other insecticides and IGRs mixtures on the larvae of the resistant-strain revealed that baygon produced synergistic effects (potantiation) with permethrin and diazinon . An additive effect was observed with sumicidin and sumithion however, antagonism effect was only produced with dursban .

Where, for IGRs baygon produced synergistic effect (potantiation) to IKI after 24 hour exposure period . However, additive effects were produced with IKI and bay sir after 48 & 72 hrs. and 24 , 48 & 72 hrs. of treatments .

5. Synergism and antagonism of baygon against baygon-resistant strain of *Culex pipiens* larvae .

The results revealed that the presence of the synergists sesame oil and piperonyl-butoxide were considerably enhanced the toxicity of baygon regarding from the mortality regression lines and cotoxicity coefficients . Also clove oil potentiated baygon insecticide but to lower extent than sesame oil and p.b. . The effect of each synergist showed very higher significant difference at the highest concentration of each one ($P < 0.001$), whereas, no significant difference was observed at the lower concentrations ($P > 0.05$), so that the activity of each synergist was always concentration dependent . These findings indicated that the mixed function oxidase system of microsoms was the major defense mechanism responsible for baygon resistance in the larvae of *Culex pipiens* .

Generaly speaking, based on the obtained results, it seems that, a simple control program could be planned against field-strains of ***Culex pipiens*** larvae in their breeding sites in Qualubia Governorate by using a number of insecticides from different groups and insect growth regulators (IGR_s) . Also, resistant strain can be controlled by using combination with some pyrethrin synergists . These insecticides and the rates of pollution can be reduced through them .