

CONTENTS

	<u>Page</u>
I. INTRODUCTION	1
Aim of the present study	2
II. LITERATURE REVIEW	3
1. Integrated control of insects by using chemical and biological larvicides.....	3
2. Bacterial larvicides against mosquitoes...	11
2.1. <u>Bacillus thuringensis</u> serotype H-14..	11
2.2. <u>Bacillus sphaericus</u>	19
3. Chemical larvicide	29
4. Histopathological studies	31
4.1. <u>Bacillus thuringiensis</u> H-14	31
4.2. <u>Bacillus sphaericus</u>	38
4.3. Dieldrin larvicide	42
III. MATERIALS AND METHODS	43
1. Test insect	43
1.1. Origin of the stock colony	43
1.2. Laboratory rearing	43
2. Bacterial larvicides	46
2.1. <u>Bacillus thuringiensis</u> serotype H-14 (Teknar)	46
2.2. <u>Bacillus sphaericus</u> strain 1593-4 ...	46
3. Chemical insecticide	48
Dieldrin chemical structure	48
4. Bioassays	49
4.1. Preparation of the bacterial concentr- ations	49
4.2. Preparation of the dieldrin concentr- ations.....	50

	<u>Page</u>
4.3. Susceptibility experiments	50
4.4. Combined effect of bacterial and chemical larvicides	51
4.5. Mortality readings	53
4.6. Statistical analysis of the data	53
5. Histopathological studies	54
5.1. Processing of larval samples	54
5.2. Reagents used	54
5.3. Principle of the technique	55
IV. RESULTS	59
1. Susceptibility experiments	59
1.1. Bacterial larvicides	59
1.1.1. <u>Bacillus thuringiensis</u> serotype H-14 treatments	59
1.1.2. <u>Bacillus sphaericus</u> strain 1593-4 Treatments	62
1.2. Chemical larvicide	65
1.2.1. Dieldrin treatments	65
2. Comparative susceptibility of <u>Culex pipiens</u> larvae to the three tested larvicides	68
3. Combined effect of mixed formulations of the chemical and bacterial larvicides	70
3.1. Mixtures of dieldrin and <u>Bacillus thuringiensis</u> H-14	70
3.2. Mixtures of dieldrin and <u>Bacillus sphaericus</u> 1593-4	72

4.	The joint action between the two bacterial larvicides	74
4.1.	Mixture of <u>Bacillus thuringiensis</u> H-14 and <u>Bacillus sphaericus</u> 1593-4	74
5.	Comparative susceptibility of <u>Culex pipiens</u> larvae to the larvicides mixtures	76
6.	Effect of using the bacterial and chemical larvicides on <u>Culex pipiens</u> larvae in sequence	79
6.1.	Larvae pre-treated with <u>Bacillus thuringiensis</u> H-14 for 24 hr & then <u>B. sphaericus</u> or dieldrin was added	79
6.2.	Larvae pre-treated with <u>Bacillus sphaericus</u> 1593-4 for 24 hr and then <u>B. thuringiensis</u> or dieldrin was added.....	82
7.	Effect of pre-treating <u>Culex pipiens</u> larvae with dieldrin for 24 hr then bacterial larvicides was added	85
8.	Comparative susceptibility of <u>Culex pipiens</u> larvae to the larvicides mixtures when used in sequence	88
9.	Histopathological studies	91
9.1.	<u>Bacillus thuringiensis</u> H-14 treated larvae	91
9.2.	<u>Bacillus sphaericus</u> 1593-4 treated larvae	94
9.3.	Dieldrin treated larvae	95

	<u>Page</u>
9.4. Larvae treated with (diel dr in & <u>B. thuringiensis</u>) mixture	97
9.5. Larvae treated with (diel dr in & <u>B. sphaericus</u>) mixture	98
9.6. Larvae treated with (<u>Bacillus thuringiensis</u> & <u>Bacillus sphaericus</u>) mixture	99
V. DISCUSSION AND CONCLUSIONS	124
1. Larvicidal activity of the used formulations	124
1.1. <u>Bacillus thuringiensis</u> serotype H-14.	124
1.2. <u>Bacillus sphaericus</u> 1593-4	125
1.3. Diel dr in chemical larvicide	127
2. Effectivness of bacterial and chemical larvicides mixtures on <u>Culex pipiens</u> larvae	128
2.1. <u>Bacillus thuringiensis</u> H-14 & diel dr in mixture	129
2.2. <u>Bacillus sphaericus</u> 1593-4 and diel dr in mixture	130
3. Effectiveness of bacterial larvicide mixture against <u>Culex pipiens</u> larvae	130
4. Evaluation of <u>Culex pipiens</u> larval susceptibility to the larvicides when used simultaneously or in sequences	131
VI. SUMMARY	134
VII. LETERATURE CITED	141
VIII. ARABIC SUMMARY	