

BIOLOGICAL STUDIES ON THE TOLERANCE OF DIFFERENT
DEVELOPMENTAL STAGES OF THE MOSQUITO, CULEX PIPIENS
TO GAMMA RADIATION THROUGH THE FIRST FIVE GENERATIONS

A THESIS

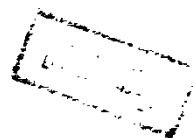
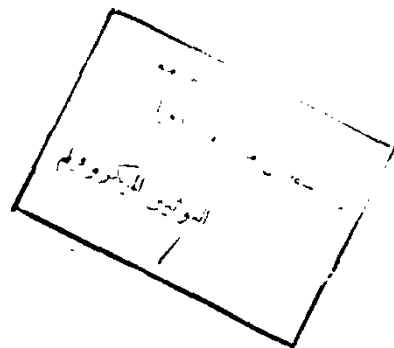
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DEDICATION

I have a great honour to dedicate this dissertation and the including research to the spirit of my Professor Prof. Dr. **Awni Mohamed Guneidy**. To whom I am really indebted for all I have been learned in both moral and scientific aspects.

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ARABIC SUMMARY

INTRODUCTION

I. INTRODUCTION

The common mosquito Culex pipiens L. is one of the most wide spread culicid and the research on its control has recently been increased because of its importance for transmission of filariasis and Rift Vallay fever (Hoogstraal et al., 1979. Morgan et al., 1980).

It is well known that Culex pipiens had developed a high degree of resistance to most of insecticides used for mosquito control. Accordingly, it appears important to study the role of irradiation only or combined with insect growth regulators as a new alternative approach for mosquito control.

One of the suggested methods for mosquito control was the sterile insect technique (SIT) using gamma radiation Krishnamurthy et al;1963; Weidhaas and Schmidt1963Patterson, et al;1977. Subsequently such studies have been reported in Egypt on the effect of gamma radiation on mosquito biology and behaviour (Abdel-Malek et al., 1966, 1967a, 1967b, 1975, 1978, Abdel-Rahman et al, 1988; Tantawy et al; 1966, 1967a, 1967b; Wakid et al; 1976, 1987, 1988) ... etc. However, many adverse effects of radiation have been reported in some of these reports.

Moreover, much genetic variability exists in even long established laboratory colonies of mosquitoes Isolation

of mutants within the study of physiological genetics has an important application in biological control (Stahler, 1971).

The present study was designed also to investigate the ability of mosquito resulted from successively irradiated generations to develop tolerance to gamma radiation, when eggs, larvae or pupae of the mosquito, Culex pipiens complex L. were irradiated with chronic gamma dosages. Different biological aspects were studied as experimental criteria for this purpose.

In other words, the aim of this work was to study the following:

1. The possibility of developing mosquito tolerance throughout the successive generations.
2. The role of the irradiated developmental stages of the mosquito, Culex pipiens in developing tolerance.
3. The effects of the age on the susceptibility of the laboratory colony of mosquito to gamma radiation.
4. The effect of radiation dosages delivered to the mosquito in each generation on the different developmental stages.

It is hoped that this investigation may contribute to a proper understanding and establishing a more sound method for the mosquito control.

REVIEW OF LITERATURE

II. REVIEW OF LITERATURE

A- Biological Effects of Gamma Radiation on Different Developmental Stage of Mosquito, *Culex pipiens*.

Ghosh et al. (1961) reported that no effect on prehatching period and most of the eggs that hatched gave rise to normal adults when recently deposited egg rafts of *Culex pipiens* (*fatigans*) were exposed to X-ray doses up to 15 Gy. At the dose 25 Gy, few, eggs hatched but all the larvae died during embryonic development.

Ramakrishnan et al. (1962) concluded that sterilized males of *Culex fatigans* were highly competitive at a ratio 9:1:1.

Smittle (1968) reported that female *Culex pipiens quinque fasciatus* resulting from treated one day old pupae with 2000-9000 r gamma dose showed sterility at different exposures ranging from 12% at 2000 r to 60% at 6000 r. At 7000 r or more, no eggs were deposited. The author proved that complete female sterility due to gamma irradiation was accomplished by inhibition of egg production rather than by induction of sterility in the eggs produced.

Koshy and Singh (1970) exposed males of *Culex pipiens* (*fatigans*) to 8050 r of gamma irradiation at 24 $\pm$ 1 hour old and then mated them with untreated virgin females and judged

sterility by the viability of the deposited egg rafts. In competition of treated males and untreated ones to mate with normal female , there was an increase in the number of sterile egg rafts as the proportion of the sterile males increased.

Smittle et al. (1971) exposed eggs, larvae, pupae and adults of Culex pipiens quinquefasciatus to gamma rays. They reported that eggs are the most sensitive at dosage of 100 r. Over 95% of the eggs hatched but only 1% emerged as adults. The larvae were less sensitive, with a big loss at a dose of 4000 r but most of the mortality occurred either in the pupal stage or in the emerging adults. They also reported that when pupae of Culex pipiens quinquefasciatus were exposed to 10-12 Krad. of gamma rays, about 99% sterility was observed in the resulting adult males, while exposure to 6-9 Krad produced 46.3-97.1% sterility.

Abdel-Malek and Ahmed (1972a,b) exposed the pupae of the mosquito Culex pipiens molestus to 16 doses of gamma rays ranging from 500-8000 r, and they found an irregular decrease of adult emergence at doses from 500-6000 r. The percentage of egg hatchability oviposited from those adults decreased gradually as the dose was increased. The dominant lethals induced in the eggs of this species were significantly increased with increasing the dose from 500-7750 r reaching 95.4% at 7750 r. Larval induced lethality also significantly

increased from 2000-5500 r, at 6000 r it reached 100%. The longevity of treated emerging females was greater than that of both treated and control males. The average number of eggs/female deposited each day decreased rapidly in females from pupae that had been treated at more than 4000-5000 r and no eggs were laid when treatment had been at 8000 r. The decrease in egg production caused by irradiation was brought about through a decrease in the average number of eggs/raft. The viability of the eggs fell steadily as dosages were increased.

Irradiation of pupae at 500-5000 r generally reduced percentage pupation in the F_1 generation, and irradiation at 200-4500 r produced an irregular decline in the percentage emergence of the adults of the F_1 generation. No adults emerged when the dosage had been 5000 r or more. The proportion of females emerging from treated pupae was greater than from untreated ones, but the sex ratio in the F_1 generation was not affected. Females from treated pupae generally lived longer than males and longer than females from untreated pupae.

Sonoda (1972) found that 2-days-old male pupae of Culex pipiens molestus (Forsk) were treated with gamma rays at dosages ranging from 1000 to 12000 rad. The effects on