EFFECTIVENESS OF CERTAIN INSECTICIDES AGAINST LARVAE OF *CULEX PIPIENS* IN RELATION TO CHEMICAL STRUCTURE

A THESIS

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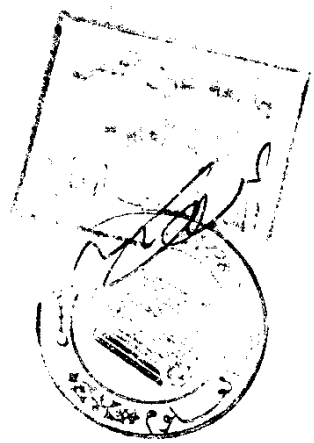

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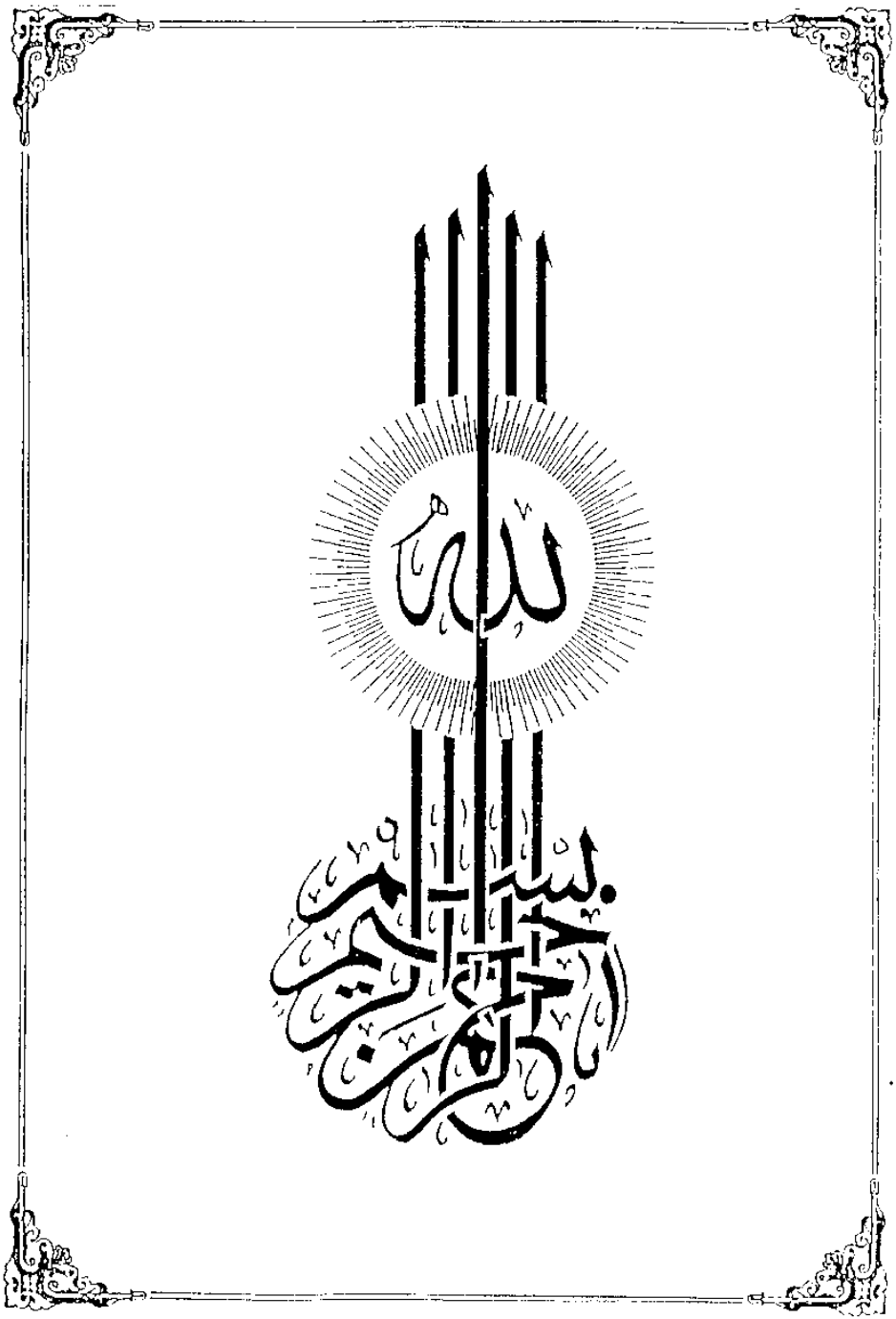

C O N T E N T S

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1 INTRODUCTION

I. INTRODUCTION

The common mosquito, Culex pipiens, is an active and effecient vector for the transmission of Filariasis in A.R.E. and many other serious diseases all over the world.

The appearance and development of mosquito resistance to chlorinated hydrocarbon insecticides and more recently to organophosphorus insecticides makes it imperative that every new selective insecticide should be thoroughly evaluated as a potential agent for mosquito control. Accordingly, it appears important to study the chemical structure-bioactivity relationships. In this respect, extensive studies were performed to throw light on this relation for different insecticide groups.

Most of these studies were based on the comparison of the insecticidal potencies of available analog series and derivatives of parent compounds. However, since the acheivement of the toxic action of an insecticide is a complex process, involving cuticle penetration, detoxication and activation of the insecticide in insect body, primary actions on the target site, secondary and tertiary effects as a result of the primary action, and eventual death of insects, the structure - activity relationships obtained through this approach

do not necessarily give a clear cut answer.

The starting point in this concern is to clarify experimentally the comparative primary action of studied structures on the target site.

For a group of insecticides that inhibits an enzyme system as the primary action, such experiments would be relatively easy to perform in vitro. This is the case for carbamate and organophosphate insecticides, for which a good deal of informations have been accumulated by in vitro experiments with cholinesterase enzyme. However, this approach is not applicable for some other insecticides whose target site is not an enzymic system, but nerve membrane. The proper preparation that contains the target site should be chosen to establish representative evaluation experiment in concern of structure - activity relationship.

The present investigation aimed at studying the insecticidal activities of certain insecticides belonging to organophosphates as well as synthetic pyrethroids on different enzymic systems including cholinesterase, ATPase and acid phosphatase. Moreover, the behaviour and biological effectiveness of these compounds at different temperatures were also studied.

The studied aspects could be pointed out as follows:-

a. Chemical structure activity relationships of certain insecticides against the fourth larval instar of the mosquito, Culex pipiens.

b. Effect of post-treatment temperature on the bioactivity of the studied compounds against mosquito larvae.

c. Activity of different mosquito enzyme systems, namely, cholinesterase, ATPase and acid phosphatase, to the studied structures.

d. Histochemical and ultrastructural studies on effect of the tested insecticides on cholinesterase, ATPase and acid phosphatase enzyme systems in mosquito larvae.

II REVIEW OF LITERATURE

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I. Insecticidal Activity in Relation to Chemical Structure.

Mulla et al. (1961) indicated that several organophosphates with methyl analogues showed slightly more activity than the ethyl analogues against mosquito larvae Culex pipiens.

Hadaway et al. (1970 a), showed that N,N dimethylcarbamates were much less toxic and much more volatile than the corresponding N-methyl carbamates. N-acylation of N-methylcarbamates was also generally accompained by a loss in intrinsic toxicity to adult mosquitoes.

Hadaway et al. (1970 b) demonstrated that N-methylcarbamates derived from thiophenols possessed insecticidal activity against the mosquitoes Anopheles stephensi and Aedes aegypti, and the sulphur containing compounds were much less toxic than the oxygen compounds.

Hadaway et al. (1970 c) investigated the effects of changes in structure of some halogenated organophosphorus esters on toxicity to adult mosquitoes. They proved that the iodo-derivatives has a higher intrinsic toxicity than the chloro-compound, replacement of methyl by ethyl results in a reduction of intrinsic toxicity to the mosquitoes and the P=O compound has a greater intrinsic toxicity to mosquitoes than P=S compound.

Hadaway et al. (1970 d) found that a number of new pyrethrin type compounds were more toxic than the earlier synthetic pyrethroids namely, Allethrin and Dimethrin, to adult mosquitoes.

Nakanishi et al. (1970) stated that Kikuthrin pyrethroid is about 3 times more effective to houseflies and 1.3 times to the german cockroach than Allethrin in direct contact application. Kikuthrin was found to be as 13.7 times effective as Allethrin against mosquito larvae.

Sagar et al. (1972) synthesized several optically active DDT analogues and tested them for toxicity on the housefly, Musca domestica (L.).The obtained results revealed that the chloro-bromo derivatives were better than the fluro-bromo compounds and substitution of a hydrogen for a halogen on one of the phenyl rings resulted in a reduction of toxicity.

Elliott et al. (1973) proved the potent pyrethroid insecticides from modified cyclopropane acids. They showed that the insecticidal activity of new halogenated pyrethroids such as Bioresmethrin can be increased by small changes in the molecule at sites, such as C-3 on the cyclopropane ring.