BIOLOGICAL STUDIES ON THE EFFECTS OF PESTICIDE(S) ON THE LIVER OF EXPERIMENTAL ANIMAL (RAT)

Thesis

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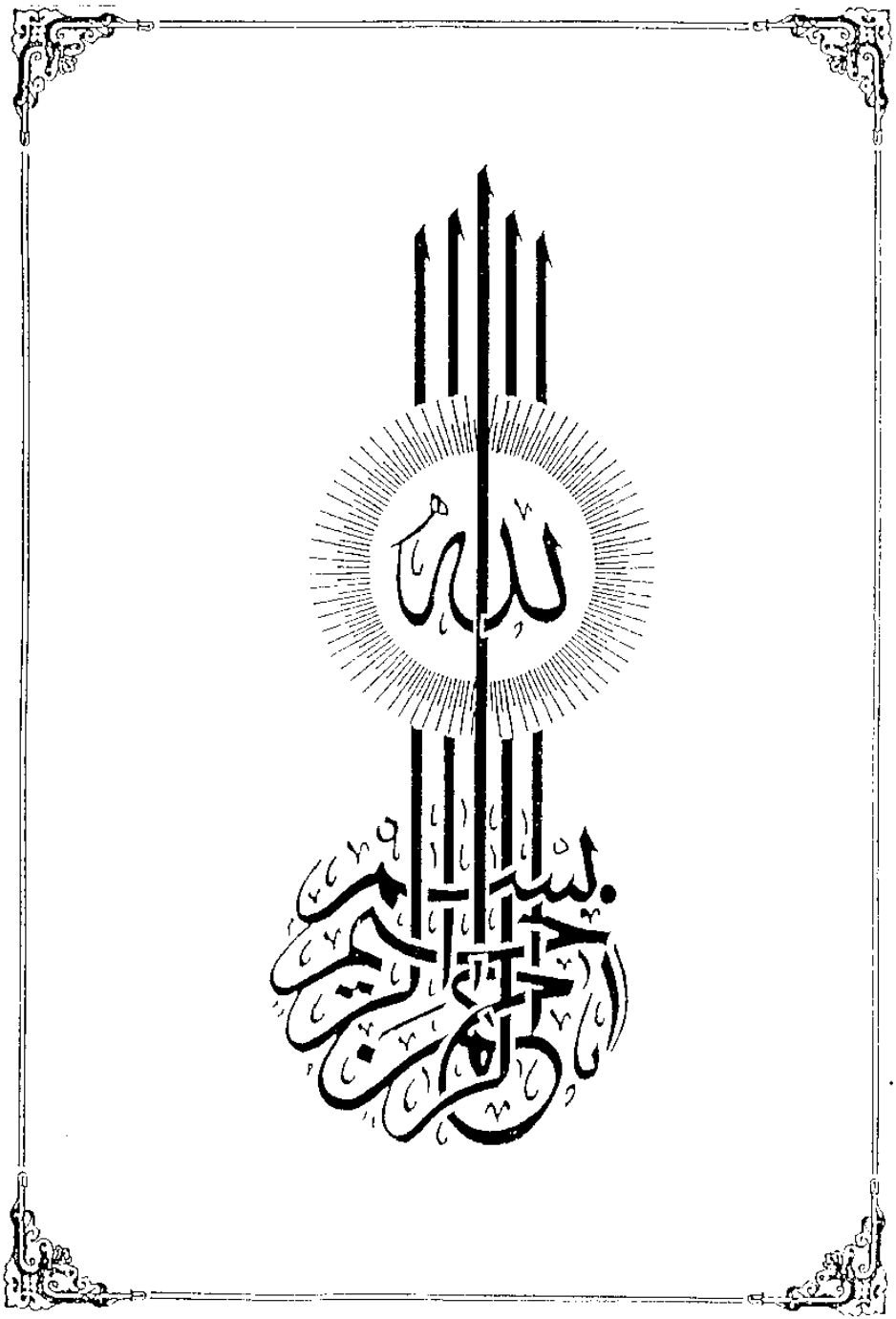

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BBREVIATIONS USED

AL	Albumin
ALP	Alkaline phosphatase
ALT	Alanine transferase
AST	Aspartate transferase
ChE	Choline esterase
D_a	Acute dose of Dithane M45
D_c	Chronic dose of Dithane M45
G	Globulin
Gr	Group
Gamma-GT	Gamma-glutamyl transferase
LD_{50}	Lethal dose 50%
LDH	Lactate dehydrogenase
mg	Milligram
NC	Normal control
P	Probability
Prot	Protein
r.p.m.	Revolutions/minute
S_a	Selicron acute dose
S_c	Chronic dose of Selicron
S.D.	Standard deviation
S.E.	Standard error
$\bar{x}$	Mean

INTRODUCTION

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The increased use of various types of pesticides in the modern world has led to much greater emphasis on the possibility of serious environmental contamination arising from their use.

Pesticides by necessity are poisons, but the toxic hazards of different compounds vary greatly. As far as the possible risks associated with the use of pesticides are concerned, we can distinguish between two types; first, acute poisoning, resulting from the handling and application of toxic materials, and second, chronic risks from long term exposure to small quantities of materials or from their ingestion. The question of acute toxicity is obviously of paramount interest to people engaged in manufacturing and formulating pesticides and to those responsible for their application. Supposed chronic risks, however, are of much greater public interest because of their potential effect on the consumer of agricultural products. Fatal human poisoning by pesticides is uncommon and is due to accident, ignorance, suicide, or crime (George, 1975).

The distribution and persistence of a pesticide within the environment is a complex function of physical, chemical and biological parameters. The factors which contribute to the fate of a pesticide in soil, water and air

may be considered as inherent (solubility, polarity, volatility, charge distribution, molecular size) and external (adsorption, water and air movement, temperature, pH, various biological and non biological, pressures, light). Under field conditions the dissipation is often very rapid, however, if a pesticide is resistance to some or all of the forces which have the potential to attenuate its effects, it may persist for long periods of time.

As a result its distribution by air and water currents may often be measured on a global rather than a local scale. In addition, the transport of pesticides in or on animal and plant material may be a subtle factor in determining the geographical rang of particular compound (Burns, 1976).

Early, in the stages of developing a pesticide for further experiments and exploration, toxicity data were collected on the pure toxicant as required by the Environmental Protection Agency (EPA).

These tests are conducted on test animals that are easy to work with and whose physiology, in some instances, is like that of man. Test animals include white mice, white rats, white rabbits, guinea pigs, and beagle dogs. Inhala-

tion studies may involve any of the test animals. but rats guinea pigs, and rabbits are most commonly used.

With regard to the classification of pesticides, their general toxicities in decreasing order would be insecticides > desiccants > fungicides within the most toxic class, the insecticides, the categories would fall in the general order; organophosphates > carbonates > cyclodienes > botanicals > activators or synergists > inorganic in their dermal hazard to man. (George, 1975).

For the safe and effective utilization of pesticides it is important that there are sensitive methods for determining their levels in the environment. There are two major categories of analyses, the first being quality control on the part of the manufacturer or governmental laboratory; the second detection and quantification of pesticides in the various segments of biosphere.

The actual methods involved are essentially similar in both cases, excepting that in environmental work more sophisticated extraction and purification methods are required to isolate the specific chemical from the vastarrary of other substances found. It is primarily due to advances in instrumentation that the modern analytical chemist has at his command an impressive array of selective and sensitive tools, originally developed to study fundamental

physicochemical properties rather than for pesticide analysis (Bollage, 1976).

Despite the beneficial uses of pesticides there exist major dangers to man and wild life. Some highly toxic chemicals and their breakdown products persist in the environment for long periods of time and may move into the water of streams, rivers and seas or be carried in the atmosphere. Such is the mobility of some pesticides that no area of this planet remains free from at least some level of contamination and residues. Therefore, it is clear that over and above intended purpose of pesticides there are side effects which are as difficult to predict as they are potentially dangerous. Pesticides may harm non target organisms directly, as occurs when an animal easts treated seeds or is sprayed accidentally. Indirect damage presents a little less obvious relationship which an understanding of one of the basic ecological principles the food chain may help to explain (Edwards, 1976).

The health effects of pesticides and their prevention have preoccupied the specialized agencies of the United Nations, often in joint efforts.

The scientific evaluation of the health effects of pesticides in food has been carried out by joint FAO/WHO

meetings. The WHO expert committee on vector biology and control has considered the methodology for:-

(1) The assessment of hazards of pesticides for man.

(2) The chemistry and specification of pesticides.

(3) The safe use of pesticides.

(4) Evaluations of the carcinogenicity of pesticides.

The establishment of occupational exposure limits requires a two step procedure.

The first step is the development of recommended health-based exposure limits derived from data on exposure effect and exposure response relationship (Report of a WHO, 1982).

In considering the effects of toxic substances in the atmosphere, the concepts of exposure effect and exposure response are useful. The exposure effect relationship expresses an average effect in all individuals at the same exposure levels, thereby suggesting that all individuals can be considered to be more or less equally susceptible. An exposure response relationship however, takes into account the variation in susceptibility within a group of individuals, it indicates the proportion of person affected.

The second step is the translation of these health-

based limits into operational limits (or standards) by the responsible authorities).

The principle objective is to protect humans (during production and during applications of pesticides). Animal data give valuable information and should be used as appropriate whenever, possible to supplement human data. The human data available for evaluation cover only a limited range of health status, environmental and socioeconomic conditions. Because human data are lacking in many areas, the difficulties of extrapolating animal data to man were stressed. It is important to have data on the various types of exposures including long term exposure.

With increasing exposure, the severity and the number of adverse effect increase, and with decreasing exposure, a limit is reached below which no adverse effects or no adverse response are observed (Report of a WHO, 1982).