بسم الله الرحمن الرحيم

شبكة المعلومـــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of 15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــــل

USE OF MATHEMATICAL MODELS TO ESTIMATE SOME CHARACTERISTICS OF INSECTICIDE GROUPS

A Thesis

Presented to the Faculty of Science

Ain Shams University

In Partial Fulfillment for the award of the M.Sc. Degree

(Entomology)

By

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B.Sc.

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8) Chemistry of pesticides and resistance.
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III. MATERIAL AND METHODS

1. Mathematical modelling:

Here we describe our mathematical model and the approach taken in its analysis. First, we provide a brief perspective on the insecticides resistance and degradation problems. Second, we illustrate in details the general notes about the behavior of changing of the LC_{50} from age stage to another for each group of insecticides and degradation of insecticides with time. Finally, the programming, computation and analysis of the model are described.

1.1. Resistance mathematical model:

1.1.1. Resistance mathematical model construction:

For prediction of LC_{50} or LD_{50} to certain stage of insect by knowing these values to another stage of the same insect firstly, we need to create a mathematical relation between these stages. This mathematical relation depends on previous experimental data collected. To set up the tables of collected data we arrange the data by certain trend and take into account fixing the factors affecting these data in all tables of tested insecticide groups.

We use in this thesis two methods of exposure contact and topical for bio-insecticides, carbamates, organophosphates, chlorinated hydrocarbons and pyrethroids to three orders of insects. We represent each insecticide group by the most common three insecticides and fix the unit of insecticide exposure to all stage of same insecticide. By this method we obtained a table, each collected value of this table is a mean of different values from different papers but all values affected by certain factors as the method of insecticide exposure, order of insect, stage of insect, insecticides group and insecticide applied.

1.1.2. Resistance model kinetics:

A parameter is suggested to describe the change of the LC_{50} when going on the life cycle from a stage to another stage we call it "*m*". It simply represents the ratio of the difference between the value of the LC_{50} in the second stage and the first stage to the LC_{50} of the first stage at the same affecting factors. For example:

$$m\ [\text{egg, larvae}] = \frac{LC50\,Larvae - LC50\,egg}{LC50\,egg}.$$

Similarly, m values are estimated to all collected data and set in another tables show the relation between all stages. By this equation we find the mathematical relation between the insect stages of the same insect at same conditions.

The mean of m values and their standard deviations are estimated to be used in the prediction of (LC_{50} or LD_{50}) equation. Then, the main equation of prediction is created taking into account the values of previously estimated m, σ, $\overline{m}$ (fixed) and LC_{50} or LD_{50} values of stage of experiment under study with symbol (x) (variable).

Finally, we construct computational program to ease the prediction method to any user without these long estimation method. The program enables the user to predict the LC_{50} or LD_{50} of certain stage by knowing their value at any other stage (user input) at the same condition of experiment.

1.2. Degradation mathematical model:

1.2.1. Degradation mathematical model construction:

Models to simulate the fate of pesticides in the environment are frequently used for risk assessments within the registration process. An adequate description of pesticide degradation in soil is important to provide input for these models. DT_{50} values are often obtained by fitting first-order kinetics to observed degradation patterns. The result depends on the handling of pesticide data (e.g. logarithmic transformation) and initial concentrations (variable or fixed). Kinetics other than first-order may be more suitable to describe the decline of measured concentrations. The methodology used to derive model input parameters must be consistent with the approach used within the simulation model.

For construction the degradation model we collected data that represents the remaining percent residues of insecticides of different insecticide groups (bio-insecticides, carbamates, organophosphates, chlorinated hydrocarbons and pyrethroids). The data collected showing the effect of different factors on these insecticides degradation in soil. The selected factors represent somewhat the main factors affecting degradation rate of many insecticides, these factors are: soil microorganisms, soil temperature, moisture content of soil, soil pH and soil types.

We collect data showing the factors effects to certain insecticides of each insecticide group, then use "*mathematica 7*" program to estimate value of (*K*) degradation rate constant. We tabulate these resulted data and compare between these values to know the differences in degradation effects of different environmental factors on insecticides of same group.

Also, we compare the factors effects between insecticides groups.

We use the following degradation kinetics to construct our computational program. This program enables the user to predict the concentration of insecticides remianants at certain time determined by the user (user input) by knowing the initial concentration at time zero (user input). Also, the program can estimate the half- life time and degradation rate constant.

1.2.2. Degradation model kinetics:

Degradation parameters required for modelling can be derived from previous studies where the dissipation of a pesticide in soil is affected by biotic and abiotic condition. The decline of concentrations with time is often described according to first-order kinetics (Eq. 1a):

$$dC/dt = -kC \qquad (1a)$$

where C is the concentration % , t is the time (day) and K is the degradation rate constant $(day)^{-1}$. The change of pesticide concentration with time (dC/dt) is proportional to the concentration at this time. The integrated form of (Eq. 1a) gives (Eq. 1b):

$$C_t = C_0\, e^{-kt} \qquad (1b)$$

(Eq. 1b) was used to calculate the residues after time where C_t is the concentration after time t (day), C_0 is the initial concentration at time 0 and K (day) $^{-1}$ the degradation rate constant. In most cases, the first-order exponential equation provided the best fit to the data **(Awasthi and Prakash (1997) and Gupta and Gajbhiye (2002))**.

A linear relationship is given for the logarithmic form of (Eq. 1b) with:

$$ln\, C_t = ln\, C_0 - kt \qquad (2)$$

The time at which the concentration reaches half the initial concentration is referred to the half-life [$t_{1/2}$; time for 50% degradation of the initial amount of a pesticide (days)]. **(Kyriakidis *et al.* (2000), Mailahn *et al.* (2008) and Sukul *et al.* (2010))** make substitution into (Eq. 2) to give:

$$t_{1/2} = ln\, 2 / K \qquad (3)$$