

MORPHO CYTOLOGICAL EFFECTS
OF
SOME NEMATOCIDES

A THESIS SUBMITTED FOR

PH.D

IN BOTANY (CYTOLOGY)

BY

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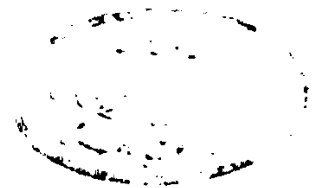
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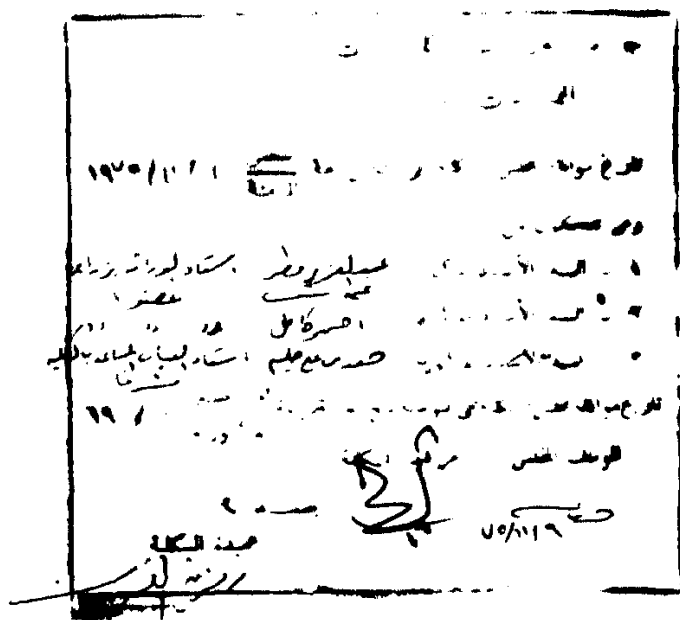
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INTRODUCTION

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The effect of drugs and other chemicals on plants are still problems of major importance either on the metabolic or cellular level. Thus knowledge of such systems and their mechanism of action is of vital importance.

Nowadays scientists have made much progress in the study of plant parasitic nematodes. Zoologists - although few of them - have made investigations of the fluctuations of nematodes in soil, Franz (1955), Stöckli (1958). Wallace (1961) has done excellent work on the reactions of nematodes during changing physical conditions in the soil.

So far the prospects of finding a method of biological control of nematodes are poor, apparently the best way of control lies in methods of cultivation, crop rotation and avoiding growing susceptible crops and so on. The progress in the methods of chemical control has made its way during the past years, Taylor (1951). It has already produced many good results and the rate with which the chemical industry progresses makes it certain that this method is a prominent mode of control.

Nematologists are nowadays aware and are restricting themselves to the control of plant parasitic nematodes alone and never neglected to guard other soil organisms much more than any other time, specially the microorganisms which make our soil fertile through decomposition.

A general trend should be taken at the moment to avoid the so called side effects of chemical control. A combination of chemical and biological control to the use of specific poisons rather than all round toxicants in order to guard other useful organisms in the soil.

Many years ago stöckli (1952) found an unexpected resurgence of nematodes (undefined spp-) after application of Gesapan (DDT - oil emulsion) and counted 3 - 6 times more nematodes in the treated plots than the control. Recently Miller and Waggoner (1963) treated apple trees against *Pratylenchus penetrans* and *Rhizoctonia Solani* with a combination of nematicide and fungicide found that the more persistent fungicide killed the useful nematode trapping fungi.

Many authors came into contact with the questions of nematicides residues among them Taylor (1963) who gave

figures showing that the residues from a certain nematicide have been found to accumulate in plants to high degree up to 300 ppm. On the other hand Christa (1953) found that nematicides had no influence on nitrifying bacteria.

Many research works have been conducted to study the effect of Nemagon and Nemacur on crop yields and nematode populations among them Bindar and Chabra (1972), Smith et al. (1973) and Ranjit et al. (1974) on nemagon. Homeyer (1973), Singh (1974) and Miller and Saul Rich (1974) studied nemacur effects on crop yield and nematode populations.

As to the mode of action of the two nematicides :

1 - Nemagon a halogenated hydrocarbon (DBCP), its mode of action is achieved by reducing the nematode population through the initial action of the chemical and not through residual activity. Bains and coworkers (1958) and Reynolds & O'Bannon (1958) reported that excellent control of *Tylenchulus semipenetrans* on the roots and in the soil around citrus could be obtained without damage to trees by using moderate amounts of DBCP.

2 - Nemacur the organophosphorous aromatic compound, when it is applied in the soil, it is absorbed by the plant roots and kills both ectoparasitic and endoparasitic nematodes; Bayer (1971). Mostinger (1961), Kondrollochis et al. (1970) and Nelmes and Keerweeman (1970) reported that organo-phosphate nematicides inactivate the treated nematodes rather than killing them directly. Nelmes et al. (1973) suggested that direct contact of nematodes with organophosphate nematicides, or their metabolites in soil or plant, may influence both the behaviour and development of the nematode, further, nematicides solutions were shown by some authors to affect the posture of nematodes, Kondrollochis et al. (1970) and Evans & Thomason (1971).

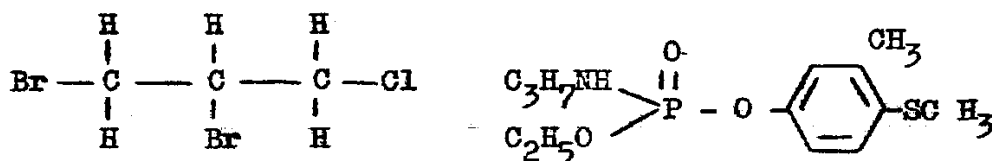
Despite the wide spread use of nematicides in agriculture, little is known about their cytological effects. The present study represents an approach to this point with respect to the cytological effects of nemagon and nemacur on Vicia faba plant.

MATERIAL AND METHODS

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The Broad or horse bean Vicia faba ($2n = 12$ or 14) is one of the most commonly used plant material for cytological, radiobiological and physiological studies, consequently it has the advantage of being thoroughly investigated from a cytological and from a physiological point of view, in addition to its many favourable properties as a test material.

In the present study Vicia faba seeds (var-Rebaya 40) were subjected to the effect of two nematicides namely : Nemagon a halogenated aliphatic compound (1,2-dibromo-3 chloropropane) and Nemacur a phosphorous aromatic compound : O-ethyl -O (3-methylthiophenyl)- isopropylamido phosphate. Nemagon is a shell company product 75% and Nemacur a Bayer Company product 5%. The structural formulae of the used nematicides are



This study is mainly concentrating on morphological and cytological effects of the two mentioned nematicides. Two types of experiments were conducted : 1) Field experiments using the actually applied field doses, and 2) Laboratory experiments using other experimental concentrations.

1 - Field experiments : In these experiments the actual field doses used in bean fields were applied : either in soil or in sow dust. For nemagon 7.5, 6.2, and 5 p.p.m. concentrations were prepared from the original solution and for nemacur 3.8, 2.8 and 1.9 p.p.m. concentrations were prepared from the original solid.

For each treatment 20 pot were used each containing 5 seeds previously soaked for 24 hour in tap water were sown at one level in soil. The soil or the sow dust being mixed thoroughly with the experimental solutions prior to sowing. For irrigation tap water was used.

Morphological studies:

Percentage of germination :

For each treatment the percentage of germination was calculated 4 & 6 days after sowing from 10 pots containing 50 seeds.

Shoot length and node number :

Shoot length of 50 plants was measured taking the soil as a start point 12 days after sowing, then repeated weekly along the growth season until complete maturity when node number was calculated.

Root length :

It was measured 4, 6, 8, 10, 12 and 14 days after sowing taking the cotyledons as a start point.

Cytological studies :

1- ~~Field experiments~~ :

a. Mitosis :

The effect of the two nematocides on mitosis of Vicia plants was studied in secondary roots 12 days old using actually applied field doses. The roots were cut and fixed in Carnoy's fixative (1 : 3 acetic alcohol) for 24 hours, stored under refrigeration in 70% alcohol, hydrolysed in 1 N HCl at 58 - 60°C for 8 minutes, washed thoroughly in distilled water and stained for one hour in leuco basic fuchsin, and then squashed in 45% acetic acid. The squashes were made permanent as follows :