ECOLOGICAL INTERACTION BETWEEN FUNGICIDES AND SOIL MICROFLORA

BY

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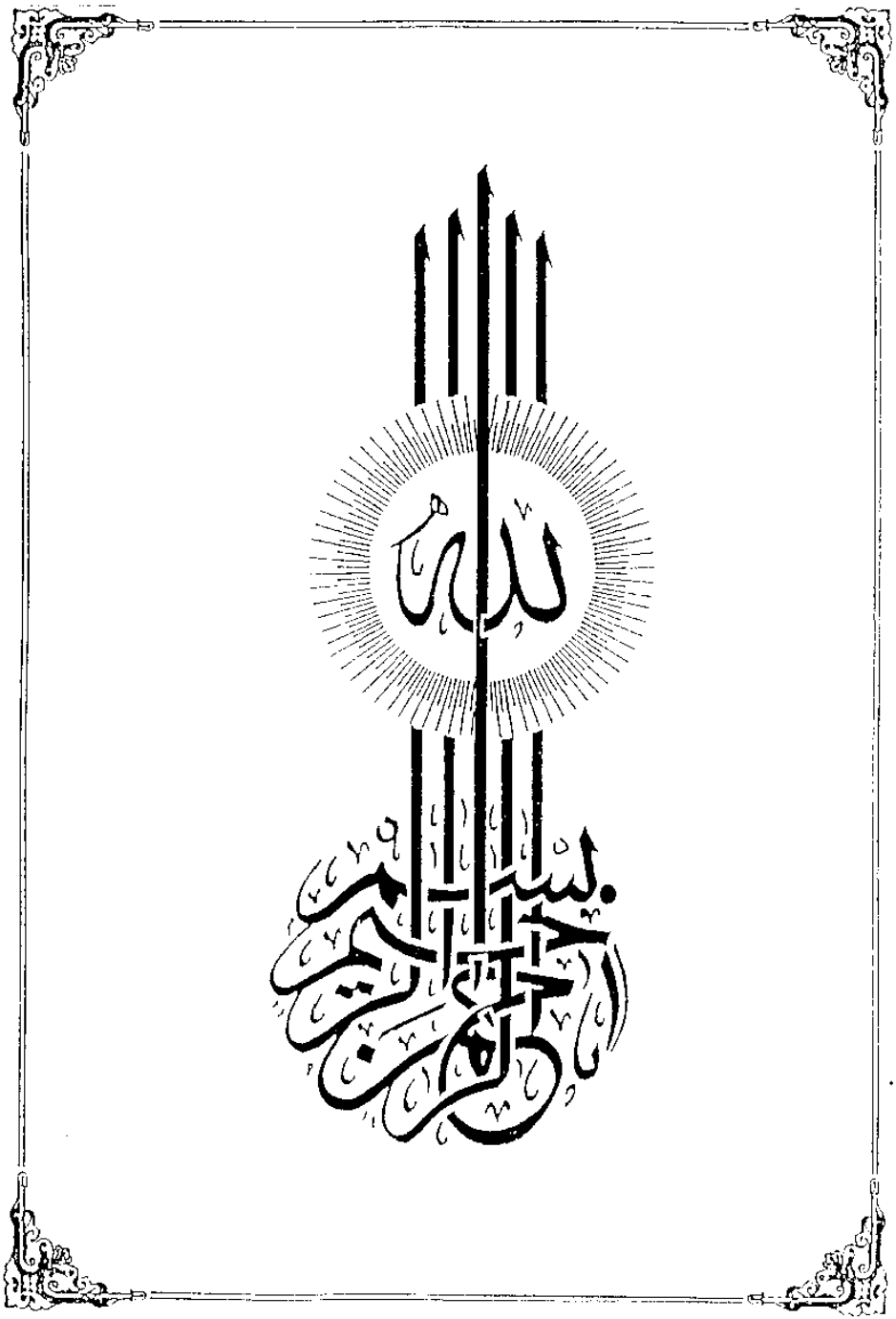

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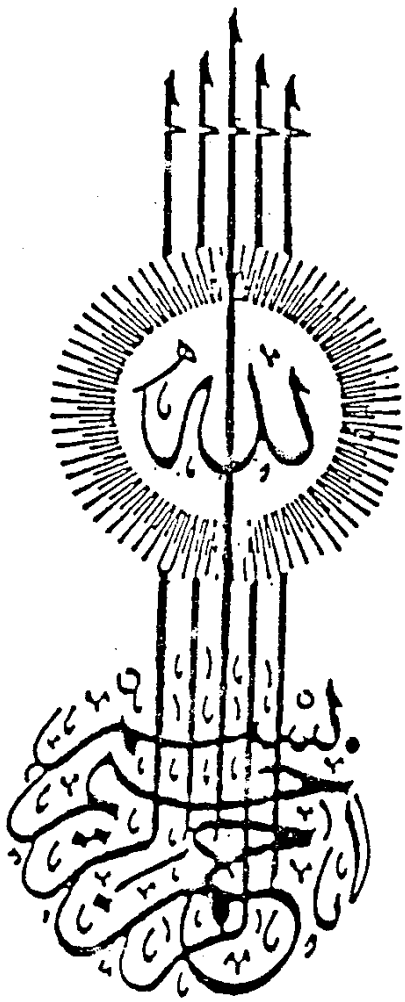

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صدق الله العظيم

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Introduction

Although the organic pesticides have greatly enhanced the agricultural production, yet it can not be assumed that a potential hazard does not exist when large quantities of such chemicals are introduced into the environment . The new compounds developed as pesticides should be extensively screened for their side effect on the soil environment .

Since soil microorganisms are responsible for important processes such as organic matter turnover, nitrogen transformation, nitrogen fixation and phosphate solubilization which have a major influence on plant growth, the benefit of a pesticide should be evaluated in the light of its detrimental effect on the non-target soil microorganisms .

Among pesticides, fungicides are currently used in a large scale in agriculture to reduce the great losses in food production caused by fungal diseases . A desirable soil fungicide is one which selectively kills or inhibits pathogenic fungi in soil when used at concentrations nontoxic to other soil microorganisms. Nevertheless, the continual application of fungicides to soil generally influences other constituents of the soil microflora as well as the pathogens. Therefore, intensive studies should be carried out to determine changes in the microbial population of soil following treatment with fungicides . Recognition of

these microbial changes is essential for evaluation of prospective soil fungicides and may declare hazards from toxic residues accumulated in soil .

The aim of the present work was to study the ecological interaction between fungicides and soil microflora, i.e., the effect of fungicides on soil microbial populations and activities as well as the effect of soil microorganisms on the biodegradation of fungicides in soil. Effects of three dicarboximide fungicides namely; procymidone (sumisclex), iprodione and vinclozolin on soil microflora were detected. The influence of procymidone application to uncultivated soil as well as onion cultivated soil was extensivly investigated. Samples of such treatments were periodically subjected for microbiological, enzymatic, chemical and fungicidal analyses. Microbiological analyses included determination of the count of total microorganism, total fungi, mycorrhiza, azotobacters and azospirilla. Enzymatic and chemical determinations were dehydrogenase and nitrogenase activities, CO_2 evolution, ammonification and nitrification rates. The persistence of procymidone and its biodegradation were also traced. Furthermore, a trial for isolation of fungicide decomposing organisms and screening for the most efficient strain was carried out .

2 - Review of Literature

The importance of pesticides to modern agricultural production practices is now well recognized .

Pesticides are synthetic organic chemicals which have essentially replaced inorganic chemicals and other cultural practices as a tool for pest control . The advantages of these modern pesticides over other means of pest control include their effectiveness in controling pests even when the chemical are applied at such low levels as a few milligrams per hectare .

When pesticides are applied under appropriate soil and environemental conditions in prescribed amount using specified procedures , they can be proven to be effective in pest control with little adverse effects on the surrounding environment (Cheng, 1990 a).

2-1 Fungicides :

The chemicals employed to protect agricultural crops against fungal diseases are called fungicides. The word fungicide has originated from two latin words viz, fungus and caedo, the word caedo means "to kill" . Most fungicides protect a plant by destroying the infection before entry of the pathogen, preventing infection of the plant or rendering a static action on the infection source by stopping the development and distribution of the pathogen. Only few substances

are capable of curing or healing plants by exterminating or inhibiting pathogens after infection has occured . Depending on how fungicides act on pathogens, protective and curative fungicides are distinguished. Protective fungicides mainly inhibit the reproductive organs of a pathogen and act on it at the place of infection before a plant is infected (Gruzdyev, 1988).

Fungicides are divided into groups according to different specific properties, for instance they may be divided according to their chemical composition and structure, the nature of action on pathogens, their behaviour in a plant , method of application and designation. The classification of fungicides according to the chemical structure is included in different groups . However, it will be focused here on the chemical structure of the dicarboximide fungicides including procymidone, iprodione and vinclozolin , which are the subject of the present study .

The term dicarboximide fungicide has been loosely applied to anti-fungal compounds of the general formula shown in Fig. (I) . Structural formula of the most important dicarboximides vinclozolin (Ronilan), iprodione (Rovral) and procymidone (sumisclex) are given in Fig (II) according to Dekker and Georgopulos (1982) .

Procymidone (sumisclex) is an antifungal compound that is toxic to a number of phytopathogenic fungi , particularly *Sclerotinia* and

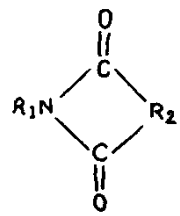
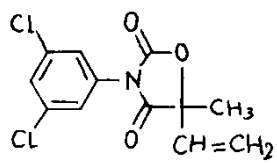
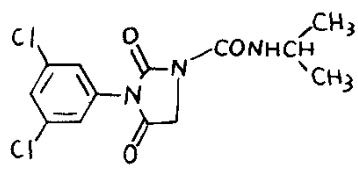


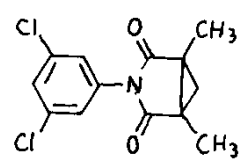
Fig.(I) Genral structural formula of the dicarboximide fungicides; R1 has invariably been a 3,5 dichlorophenyl group but R2 may have various structures .



vinclozolin



iprodione



procymidone

Fig (II) structural formulae of vinclozolin, iprodione and procymidone.