MICROBIAL ACTIVITIES IN RELATION TO ENVIRONMENTAL POLLUTION

By

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B.Sc. Agric. Sci. (Biochemistry), Fac. Agric., Cairo Univ., Egypt, 1997.
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ABSTRACT

A series of laboratory and pot experiments was executed to monitor vegetable growth: nematicide-resistant bacteria: nematicide interaction, is in an attempt to improve plant establishment and growth in agrochemical-stressed environments. Apart from chemical compound, culture medium accommodated 10^4 – 10^5 cfu ml^{-1} total bacteria when supplied with one third the recommended dose of either basamid, caratan, hayli, mocap, nemacur, rugby, temik, or vydate. Raising the agrochemical quantity to two thirds markedly decreased bacterial counts. Decrease percentages were the highest (59.2) with nemacur and the lowest (13.4) in nutrient agar received vydate. Significant negative correlations were recorded between nematicide concentration and bacterial population, the coefficients of determination (R^2) varied from 0.7951 to 0.9846. In general, the organophosphate agrochemicals did support bacterial propagation much better those of carbamate nature. Based on cultural features of colonies developed on nutrient agar medium containing the double recommended levels of tested nematicides, 65 diverse colonies were picked up and purified. Among those, five isolates were identified and were found belonging to the genera *Aerococcus* spp., *Aminobacter* spp., *Bacillus* spp., *Ensifer* spp. and *Pseudomonas* spp. Response of cabbage and eggplants to inoculation with a composite inoculum of the five nematicide-tolerant bacterial candidates was evaluated in soil treated with three nematicides. All the applied agrochemicals severely injured vegetable growth, but inoculation did partially overcome such effect. Tomato plants positively responded to diazotroph inoculation particulary in presence of rational N fertilizer level and a microbial preparation of nematicide-tolerant bacterial isolates. Collectively, this study conveys information to decision-makers for better hygienic vegetable production, an indispensable necessity for exportation.

Keywords: Nematicides, soil biota, nematicide–tolerant bacteria, cabbage, eggplant, tomato.

DEDICATION

For my father, mother, family and my dear husband

I would like to express my sincere thanks from my deepest heart to them, who have given me strong support and endless love that made me able to overcome difficulties faced me during the completion of this work.

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INTRODUCTION

Although the biological control concept is occupying non-tiny place on the map of sustainable agriculture along several decades, pesticides remain a particular manner for controlling the various pests in modern vegetable cultivation. This is due to the lack of commercially attractive cultivars with resistance traits and the reduced profit from growing vegetables in long rotations to allow soil-residential pests to decline. The high reliance of vegetable growers on pesticides for the control of associated pests, besides the repeated use of the same agrochemicals in vegetable-monoculture areas such as in Egypt, did result in conspicuous reduction of their biological efficacy. An explanation for such phenomenon was introduced by Karpouzas *et al.* (1999) as the loss of efficacy is attributed to the rapid microbial degradation of a vast array of agrochemicals by specialized fractions of soil biota. The vegetable-pesticide-microorganism panorama in soil is, therefore, of special concern to secure a proper, sufficient and safe agricultural product.

The endoparasitic nematodes are of critical threat for vegetable production worldwide. Hence, nematicides are universally used to manage nematodes in commercial vegetable cultivation, which did significantly decrease the yield losses (Fogain *et al.*, 1996; Araya and Chevez, 1997). Both non-fumigant carbamate and organophosphate nematicides inhibit nematodes (Opperman, 1992), thus killing or immobilizing them and preventing root penetration. But, when applied to soil, these chemical compounds and their metabolites also affect micro-inhabitants. It is well established that effects on soil microflora are increased when exposure to the same active ingredient is repeated, and microbial species capable of degrading the nematicides are selected.

Eight of nematicides, commonly applied for nematodes control in Egypt, were experimented in the present study for their impact on soil biofertility. Those are representing the various groups of agrochemicals recommended for vegetable cultivation and management. In addition, a number of bacterial candidates capable of carrying out some forms of degradation of these compounds have been isolated. This is in an attempt to secure the efficient microbial formulations to be incorporated into soil for scavenging the excess levels of nematicides possibly accumulate in soils.

A series of pot experiments was executed to monitor vegetable growth-nematicide resistant bacteria-diazotrophs interactions to complement between integrated pest management (IPM) and integrated fertilizer management (IFM) to ameliorate plant establishment and growth.

Collectively, this study conveys information to decision-makers for better hygienic vegetable production, an indispensable necessity for exportation.

REVIEW OF LITERATURE

Pesticides in general are widely used to improve the quality and yield of food crops. They must persist long enough to control biological targets, but should not become a pollution problem. For some time now, some very effective pesticides used in treatment of soil have presented a significant reduction of their pesticidal effect (Racke and Coats, 1990 and Slaoui *et al.,* 2007).

This problem is related to an increase in the biological capacity of the soil to degrade these products, due to the proliferation of microorganisms using the pesticides as source of carbon and energy.

This phenomenon is called enhanced biodegradation of pesticides (Kaufman and Edwards, 1982)**,** and occurs when microflora so adapts to a chemical (pesticides or nematicides), due to repeated application (Smelt *et al.,* 1987). So that, it is consider a one of the major practical consequences of the structure and the evaluation of the microbial population responsible for the mineralization of the xenobiotic pesticide in the soil (Slaoui *et al.,* 2007).

Substantive application of pesticides may cause contamination in biological system (Meyer and Thurman, 1996) and pesticides residue in food crops (Adeyeye and Osibanjo, 1999; Hura *et al.*, 1999; Jiguo *et al.,* 2007). Therefore, to control the application of pesticide, effective ways for removal of pesticide residue on vegetable are in sought as a preventive measure to avoid adverse impacts on human health.