Microbiological studies on soil pollution with some carbamate pesticides

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Carbamate pesticides are widely used in agriculture for pests control which attack different crops, such as insects; nematodes; fungi and weeds. However, the continual application of these compounds to soil influence some beneficial soil microorganisms, pollution of soil and water.In general, microorganisms play an important role in the biodegradation and detoxification of pesticides. Therefore, the premeditation removal of pesticides residues from the environment by microorganisms has become an important area of research.The aim target of the present investigation concerns the use of local microorganisms in remediation the environmental pesticides contamination. So, The study included the isolation of some microorganisms from pre-treated soil by carbofuran and tested for their tolerance and abilities to degrade carbofuran and aldicarb nematicides, which are used extensively in Egypt against many pests. To achieve these objectives, a series of laboratory and pot experiments were designed and carried out. Obtained results could be summarized in the following parts:1591.Isolation of carbofuran degrading microorganisms.This part of investigation was just a preliminary experiment to select and isolate the microorganisms able to degrade carbofuran and use it as a sole source of carbon and nitrogen by using soil enrichment technique. Results showed that only two kinds of microorganisms were able to grow and withstand the toxicity of carbofuran. One of them belongs to bacteria and the other belongs to actinomycetes, which were identified as A. brasilense and Strep. vio/aceusniger, respectively.2.Persistence rate and decomposition of carbofuran in liquid cultures of the isolated microorganisms.A set of experiment were carried out to study the persistence rate and decomposition of carbofuran in the liquid cultures of the isolates. Results indicated that carbofuran dissipation in culture of A. brasllense was faster than that in culture of Strep. violaceusniger, since 7.5 and 10.5% of the applied carbofuran were detected in the culture of A. brasilense and Strep. violaceusniger, respectively at the end of experiment (21 days). On reverse, the biodegradation of carbofuran by Strep.160violaceusniger was more rapidly than that occurred by A. bras/tense, since six metabolites were detected in Strep. violaceusniger culture, three of them were identified as carbofuran—phenol; 3-0H—carbofuran and 3-keto carbofuran. Whereas the other three metabolites were unidentified while, A. brasilense degraded carbofuran to only three compounds, two of them could be identified as carbofuran—phenol, and 3-keto-carbofuran and the third one could not be idenified.Generally, the obtained results revealed that Strep. violaceusniger could tolarate carbofuran concentrations more than A. brasilense. Also, the PH values of the liquid cultures of the two strains tended to alklinity throughout the experimental period, this may aid carbofuran to be hydrolized chemically.3. Persistence rate and decomposition of temik in liquidcultures of the isolated microorganisms.This part of investigation Was conducted to study the ability of carbofuran degradable isolates to temik degradation. The obtained results showed that these isolates were capable to tolerate and decompose temik nematicide in the liquid culture.1I6!However, temik disappeared from either Step. Violaceusniger or A. brasilense liquid culture but its dissipation rate from A. brasllense culture was slower than that from Strep. vio/aceusniger since only 54.8 and 84.36% of added amounts disappeared from the two cultures, respectively after 60 days of application.Also, temik nematicide showed low depressing effect on the count of each A.brasilense and Strep. violaceusniger. Temik was degraded slowly by both strains producing small amounts of temik sulfone and other three

unidentified compounds. In addition, the PH values of the liquid cultures throughout the experimental period were in the range of neutrality and did not affect the stability of temik.Generally, The disappearance rate of temik in the liquid culture of the tested microorganisms was more slowly than that of carbofuran disappearance.4. Decomposition of carbofuran and temik in autoclavedand non-autoclaved soils inoculated with the isolated microorganisms.A laboratory experiment was carried out to study the persistence rate and decomposition of both carbofuran and temik163in autoclaved and non-autoclaved soils inoculated with A. brasilense and/or Strep. violaceusniger. Results indicated that the total microbial counts, actinomycetes counts and dehydrogenase activity in non-autoclaved soil were more than autoclaved one. Also, the disappearance rate of temik and carbofuran and their decomposition were more rapid in non-autoclaved soil than that in autoclaved one. The application of carbofuran or temik to soil led to a decrease in each of total microbial counts, actinomycetes counts and dehydrogenase activity. On the other hand, the inoculation of soil with the above mentioned strains combined with insecticides application increased total microbial counts, actinomycetes counts, dehydrogenase activity and accelerated the dissipation rate and transformation of both carbofuran and temik, specially when the mixture of the two strains was used. Carbofuran and temik disappeared rapidly from the non-autoclaved soil treated with the mixture of (A.brastiense and Strep. violaceusniger) if compared with the soils inoculated with each strain separatly. Also, results showed that carbofuran and temik disappeared rapidly from the soil inoculated with Strep. violaceusniger than that inoculated with A. brasilense. The main compounds of carbofuran transformation were carbofuran-163phenol; 3-keto carbofuran; 3-hydroxy-carbofuran and other unknown compound. Temik also, was transformed mainly to temik sulfone, temik sulfoxide and other unknown compounds.5. Decomposition of carbofuran in cultivated soil with tomato and inoculated with the isolated microorganisms.This part of investigation was carried out to study the efficacy of the microbial inoculants of A. brasilense-, Strep. violaceusniger and their mixture in cultivated soil with tomato and treated by one and double recommended rate of carbofuran. Results showed that carbofuran treated samples with either recommended or double recommended dose exhibited a temporary inhibitive effect on total microbial counts, actinomycetes counts and dehydrogenase activity.On reverse, the soil inoculated with the tested microorganisms showed an increase in total microbial counts, actinomycetes counts as well as the dehydrogenase activity specially, when the mixture of A.brasllense and Strep. violaceusniger was used.Carbofuran dissipation rate in inoculated soil samples was higher than that in un-inoculated ones. The highest164disappearance rate was showed in soil inoculated with the mixture of A. brasilense and Strep. violaceusniger since,the time intervals for 90% disappearance of carbofuran in soil traeted with recommended rate were 50, 37, 36.5 and 31 days for uninoculated soil; soil inoculated with Strep. violaceusniger, A. brasilense and that inoculated with their mixture, respectively; whereas they were 54, 40, 40 and 34 days in the soil treated with double recommended rate of carbofuran.However, the decomposition of carbofuran was faster in inoculated s'oil than that un-inoculated one. This result indicates the presence of other microorganisms in soil able to degrade carbofuran. The main compounds produced from carbofuran decomposition were carbofuran- phenol; 3-keto — carbofuran;OH- carbofuran and some other unknown compounds.Further studies are necessary to identify the unknown compounds produced in carbofuran and temik biodegradation by Strep, violaceusniger and A. brasilense to elucidate metabolic pathways of them.Ultimately, it is suggested that inoculation of soil with Strep. violaceusniger, A.brasllense or a mixture of them is of almostI65importance for biodegradation of carbofuran and temik to remove their residues from the contaminated soil.