INFLUENCE OF COPPER AND CYPERMETHRIN ON SOIL ENZYME ACTIVITY

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Background, Aim and Scope. Pollution of soil environment has become a serious problem in many countries. Repeated application of bordeaux mixture and pyrethroids insecticides have led to elevated copper and pyrethroids concentrations in vineyard surface soils. Therefore, it is recommended to evaluate the combined effect of Cu and pyrethroids on soil enzymes. Our aim was to get a more comprehensive understanding of the effects of Cu and cypermethrin on the soil catalase, and to provide more information about the potential ecological risk of chemicals on the soil ecosystem.

Materials and Methods. The dried and sieved soil sample was first thoroughly mixed with aqueous solution of $CuSO_4 \cdot 5H_2O$, and acetone solution of cypermethrin according to the orthogonal design, and then incubated at 25 °C for 35 days. Five concentration levels for each pollutant (Cu and cypermethrin) were studied. Control without any artificial contaminated received the same amount of distilled water and acetone. Each test was conducted with three replications. Moisture in the incubated soil samples was kept at 60% of the full soil water holding capacity by weighting daily. Catalase activity was determined by back-titrating residual H_2O_2 with $KMnO_4$ after 7, 14, 21, 28, and 35 days. Data treatment was essentially based on analysis of variance test.

Results. During the incubation time, soil catalase activity was lower than the control samples, and the result is ranged from 70.64% to 100%, except for that of the samples S6 and S13. The catalase activity in all samples declined after application of Cu without addition of cypermethrin. Without addition of Cu, when concentration of cypermethrin ranged from 0 to 150 $mg \cdot kg^{-1}$ the variety of catalase activity was in the following: restrained-activated-restrained. The combined effect of cypermethrin and Cu on soil catalase activity depends largely on concentration of pollutants.

Discussion. The presumable explanation of the result that the catalase was inhibited by single Cu was due to: (1) complexation of the substrate, (2) combination with the protein-active groups of the

enzymes, or (3) reaction with the enzyme–substrate complex. In our study, there were some differences in the catalase when soil samples were treated with different concentration of cypermethrin. This is possibly related to the protect mechanism of soil catalase. In addition, the combined effect of cypermethrin and Cu on catalase activity is stronger than single cypermethrin, while weaker than single Cu . One of the possible explanations of this phenomenon is related with the interaction between cypermethrin and Cu. Another may be related with bioavailability.

Conclusions. The combined effect of cypermethrin and Cu on soil catalase activity depends largely on concentration of pollutants. The magnitude and type of interaction may be strongly dependent on the level of response and the relative proportion of the components in the mixture. These factors should therefore be considered in risk assessments and in the setting of soil quality criteria.