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Effect of Triazophos on soil enzyme activities in paddy (*Orizae sativa sp*.) cultivated soil

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Abstract— The present study aimed that reveals the relation between soil dehydrogenase and urease enzyme activity and various concentrations of triazophos an organophosphorus insecticide**.**The effects of pesticides on soil micro organisms can cause a ripple effect that can last for years. Triazophos is an organophosphorous broad-spectrum insecticide and acaricide with contact and stomach action. It penetrates deeply into plant tissues through translaminar action. It controls thrips ,aphids, beetles, midges, spider mites , caterpillars, and whiteflies in field paddy, cotton, vegetables, ornamentals and fruit trees. Micro-organisms are essential to healthy soil. Without them, plants will not reach their true potential. In order to determine the changes in microbial activity in a black clay soils of paddy (*Oryzae sativa sps.*) cultivated fields, the laboratory studies were conducted to resolute the effects of triazophos (organophosphorus insecticide) on enzymatic activities of soil microorganisms in paddy cultivated soils at different concentrations of 10, 25, 50, 75 and 100 ppm. Soil enzymes are dehydrogenase and urease activities were determined. The lower and higher dose of triazophos resulted in the significant decrease in dehydrogenase and urease activity till third and fourth week of treatment compared to untreated control.

Index Terms— Dehydrogenase, Organophosphorus insecticide, *Oryzae sativa sps*,,Triazophos, Urease.

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1 Introduction

India is an agriculture based country. About 60-70% population is dependent on agriculture. The demand for agriculture crops is increasing day by day due to rapidly increasingly population. Hence, there is need for a huge increase in quantity of agricultural produce and improvement in its quality. Agrochemicals like insecticides, fungicides, pesticides and herbicides used of better quality seeds are being used. About 30% of agricultural produce is lost due to pests. Hence, the use of pesticides has become indispensable in agriculture [1].Pesticides have become an integral part of modern agricultural systems because their use has benefited modern society by improving the quantity and quality of the world's production while keeping the cost of that food supply reasonable. Because of continuous pest problems, their usage possibly cannot be discontinued in the near future since the greatest contribution towards the control of these pests has come from the use of pesticides. Triazophos primarily controls sucking and chewing insects in rice, cotton, oil seeds and vegetables, fruits and plantation like tea, coffee and cardamom. These pesticides eventually reach the soil and may effects the growth of soil microbial community [2]. The activities of microorganisms in soil are essential to the global cycling of carbon, nitrogen, sulphur, phosphorus and other elements, because of many substances cannot be degraded by organisms other than microbes [3][4]. Microorganisms are the dominant producers of enzyme activities in soil [5]. The overall biochemical activity of soil results from a series of reactions catalyzed by enzymes, either as intracellular components of the microbial community or as extra cellular enzymes. Accordingly, the biochemical activity of accumulated enzymes for certain reactions has been estimated to be more important than that of the microbial cells [6]. In spite of being non-systemic, Triazophos can penetrate deeply in the plant tissues due to its translaminar properties and can effectively control leaf miner. There has been no report of resistance since inception and has been recommended for use in resistance management programme. Among the monocot crops, *Oryzae sativa* (Asian rice) is one of the major important profitable crops grown throughout the year in India. Rice is the major source of food for as much as 60% of the world's population [7] and the predominant food crop in the tropical countries. Rice is the major food crop in Srikalahasti, Chittoor district of Rayalaseema region, Andhra Pradesh, India. Several insect pests are reported to attack paddy crops at various stages of growth impending potential crisis for monocot. Among these, target pests such as, Bacterial Blight caused by *Xanthomona soryzae,* Bacterial Leaf Streak caused by *Xanthomona soryzae,* Foot Rot caused by *Erwinia chrysanthemi,* Downy mildew caused by *Sclerophthora macrospore*, Leaf Smut caused by *Entylomaoryzae*, Aggregate sheath spot caused by *Ceratobasidium oryzaesativae*. Indeed, losses of the total world rice crop due to insects has been estimated to occur at a rate of 28%, which is four times greater than the average for other world cereal crops [8].Due to its degree of toxicity it persists in soils, water and become an important group of contaminants. Thus it is required to estimate soil biological responses to the pesticides. To date, many efforts have been made to understand the effect

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of pesticides on soil enzyme activities, dehydrogenase and urease but little is known about the effect of triazophos.

2 MATERIALS AND METHODS

2.1 Collection of soil sample

The soil samples were collected from Srikalahasti, Chittoor district a semi-arid region in Andrapradesh, India, to a depth of 10-15 cm were air dried and sifted through a 2mm sieve before use.

2.2 Insecicide used in the present study

The chemical formula of Triazophos is $C_{12}H_{16}N_3O_3PS$ and the international union of pure and applied chemistry(IUPAC)diethyl o-(1-phenyl-1h-1,2,4-triazol-3-yl)phosphorothioate. Triazophos an organophosphorus insecticide (40% emulsifying concentration) was obtained from Sudarshan chemical industries Ltd. 162, Wellesley Road, Pune, India.

2.3 Soil incubation

Five and one gram portion of the soil samples were weighed and dispersed into sterile test tubes (25 x 150 mm). Stock solutions from selected insecticide triazophos was added at the rate of 10, 25, 50, 75 and 100 ppm soil equivalent to field application rates of 1.0, 2.5, 5.0, 7.5 and 10 kg ha-1 respectively. Soil samples without insecticide treatment served as controls. Soil samples were mixed thoroughly for uniform distribution of insecticide added. Triplicates were maintained for each treatment at room temperature (28 ± 4ºC) with 60% water holding capacity throughout the incubation period. After desired intervals (24 hour, 7 days, 14 days, 21 days and 28 days) of incubation, soil samples were extracted in distilled water for estimation of enzyme activities.

2.4 Assay for dehydrogenase activity

To 5g air dried soil sample, 1 mg glucose solution (30 mg/L) and 0.5mL of a 3% solution of 2,3,5-triphenyltetrazolium chloride were added and the volume was made to 5 ml by adding of 0.1M Tris buffer (pH 7.8). After incubating at 37°C for 24 hours, the formazan formed was extracted with 10 ml ethanol and estimated spectrophotometrically at 485 nm. The concentration of formazan was calculated from its standard curve. The dehydrogenase activity is expressed as μg formazan formed/g dry weight of soil [9].

2.5 Assay for urease activity

Urease activity in soil samples (1g) was determined following the method of phenol hypochlorite [10]. Untreated and insecticide- treated soil samples (1g) were mixed with 4 ml of 0.1 M sodium phosphate buffer at pH-7.0 and 1 ml of 1 M urea solution and incubated for 30 minutes. After incubation, 10 ml of 2M KCl were added and the mixtures were kept at 4°C for 10 min, to stop the enzymatic reaction. Suspensions were centrifuged for 5 min. Two ml of supernatant was mixed with 5 ml of phenol sodium nitroprusside solution and 5ml of 0.02 M

sodium hypochlorite, and the mixture was incubated for 30 minutes in the dark, and the blue color formed was read at 630 nm in a spectrophotometer. This method employed for the assay of This method employed for the assay of urease [10][11][12].

3 RESULT AND DISCUSSIONS

3.1 Assay for dehydrogenase activity

Soil dehydrogenase activity is considered as a valuable parameter for assessing the side effects of pesticide treatments on the soil microbial biomass and can also be used as an indicator of the micrbiological redox system [13]. Dehydrogenase can be regarded as an indicator of the overall microbial activities of soil [14].Our experiment has revealed that dehydrogenase activity has more drastically decreased at all concentrations (1.0, 2.5,5.0, 7.5 10.0 kg ha-1) of triazophos treated soils than the untreated controls presented in Fig. 1. At the same time Dehydrogenase acivity increased upto 21 days of incubation period at all concentrations of the triazophos, after 21 days of incubation period enzyme activity was declined. Suggesting that the enzyme is rather sensitive to triazophos. Other reports show variable results. Mayanglambam et al. [15] studied the effect of organophosphate insecticide (quinalphos) on dehydrogenase activity (DHA) in soil and observed 30% ($p<0.05$) inhibition in DHA after 15 day. Very recently [16] revealed that acetamiprid increased dehydrogenase activity up to 22% after first insecticide application.

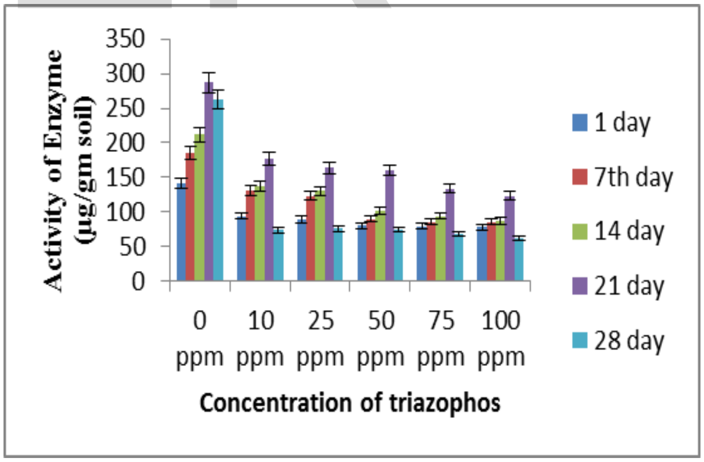

Figure 1 Effect of triazophos on dehydrogenase enzyme activity

3.2 Assay for urease activity

Urease is an enzyme that catalyzes the hydrolysis of urea into CO2 and NH3 and is a key component in the nitrogen cycle in soils. Our experiment was revealed that urease activity has slightly decreased at lower concentration (1.0 kg ha^{-1}) of triazophos and drastically decreased at remaining concentrations (2.5,5.0, 7.5 10.0 kg ha^{-1}) of triazophos treated soils than the untreated controls presented in Fig. 2. At the same time urease acivity increased upto 21 days of incubation period at all concentrations of the triazophos, after 21 days of incubation period urease enzyme activity was declined. Decreased urease activity in soil with the application of pesticides reduces urea hydrolysis which is generally beneficial, because it helps to maintain N in a form (NH4+) less leachable [17]. Rasool and Reshi (2010) [18]also reported a significant decrease in urease activity with mancozeb at different application rates over the control. But many reports show various results on urease activity. Gooty Jaffer Mohiddin et al. (2011)[19] noticed that two insecticides, acephate and imidacloprid at 10, 25, 50 µg g-1 levels, individually caused increments of 30-77 and 46-54% increase in urease activity on the control in black soil at a 10-day interval, respectively. In another study, urease activity was not affected by the presence of glyphosate at 5.4 kg ha-1 in soil [20].

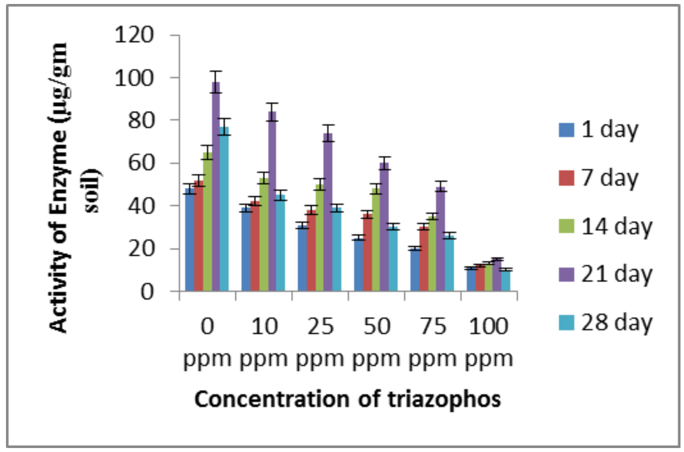

Figure 2 Effect of triazophos on urease enzyme activity

4. CONCLUSION

This study conclude that the inhibitory effect was remarkable at low and higher doses of triazophos for the treatment duration of four weeks. Therefore, the very low dose of triazophos application in the cultivated soil would facilitate to maintain healthy soil microbial activity, which in turn is important for the effective management of fertility levels of the agricultural soils.

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