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## Effect of hexaconazole and triazophos on $\alpha$ -amylase, protease and acid phosphatase activities in germinating seeds of spinach and gaur

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### ABSTRACT

Hexaconazole and Triazophos are pesticides are commonly used for control of fungal diseases and insect pest respectively in vegetable crops. The effect of these two pesticides on enzymatic activities in germinating seeds of spinach and gaur is studied in present investigation.  $\alpha$ -Amylase activity is found to increase in 0.10% and 0.15% Hexaconazole treated seeds of spinach (*Spinacea oleracea* L.) and gaur (*Cyamopsis tetragonolobus* L. Taub) as compared to control, whereas lower concentrations of Triazophos inhibit its activity in spinach. The Triazophos stimulate enzyme activity at 0.05%, 0.20% and 0.30% in germinating seeds of gaur. The minimum activity of protease observed in all concentrations of Hexaconazole and Triazophos than control of both vegetable crops. The activity of acid phosphatase found to be increased in germinating seeds of spinach and gaur treated with increasing concentrations of Hexaconazole while it is decreased with increasing concentration of Triazophos.

**Key words :** Hexaconazole, Triazophos,  $\alpha$ -amylase, Protease, Acid phosphatase, *Spinacea*, *Cyamopsis*

### INTRODUCTION

Vegetables represent an essential part of our regular diet which supplies nutrients and minerals. These plays a key role in neutralizing the acids produced during digestion of proteinaceous and fatty foods and provides valuable roughage [1]. In our country population is predominately vegetarian; desirable's amount of vitamins and minerals can only be supplied by increasing the production of vegetables. The various diseases (leaf spot, mildew, rust, wilt) and insect pest (leaf minor, leaf eater, caterpillar, leaf borer) often attack and damage the vegetable crops. Pesticides are the modern tools to the farmers to control these diseases and pests and are used in agriculture mainly for the purpose of increasing plant productivity. A lot of work has been done on the role of pesticides in providing protection to plants in terms of crop yield [1-4]. By repeated and extensive application, pesticides reach the plant body and soil, which in turn interact with plant growth and soil organism and their metabolic activities [5]. Only a little work has been established on the role of pesticides in affecting biochemical characteristics of the crop plants [6]. By keeping all these in view, the present endeavor to focus on the effects of two pesticides like Hexaconazole 5% EC and Triazophos 40% EC on enzymes activity of  $\alpha$ -amylase, protease, acid phosphatase during seed germination in spinach (*Spinacea oleracea* L.) and gaur (*Cyamopsis tetragonolobus* L. Taub) which are an important vegetable crops grown in India. Hence the enzymological changes pertaining to the applications of these pesticides has been attempted in present study.

## MATERIALS AND METHODS

Healthy seeds of spinach and gaur were used for treatment of Hexaconazole 5% EC and Triazophos 40% EC separately. The concentrations of pesticides range from 0.05%, 0.1%, 0.15%, 0.2% and 0.3% were selected for present investigation. The exposure periods of 12 hours were followed for the seed treatment using these concentrations. The treated seeds were thoroughly washed with distilled water after the completion of treatment and then allow to germinate in petriplates lined with moist filter paper. The germinating seedlings of 10 days were selected for enzymatic study. The enzyme  $\alpha$ -amylase is estimated by the method of Katsumi and Fukuhara [7], enzyme protease by Penner and Ashton [8] as described by Chinoy *et al.* [9] and enzyme acid phosphatase by the method of Mc Lachlam [10].

## RESULTS AND DISCUSSION

$\alpha$ -Amylase is important enzyme synthesized during seed germination [11]. This enzyme is abundant in the germinating cereals and catalyses a random hydrolysis of  $\alpha$ -1, 4 glucosidic linkage in the starch component [12]. The effect of Hexaconazole and Triazophos on  $\alpha$ -amylase activity in germinating seeds of spinach and guar were studied in present work and results are depicted in Table 1 and Figure A and B. The enzyme  $\alpha$ -amylase activity is found to increase in 0.10% and 0.15% Hexaconazole treated seeds of spinach and gaur as compared to control, whereas lower concentrations of Triazophos inhibit its activity in spinach. The Triazophos stimulate enzyme activity at 0.05%, 0.20% and 0.30% in germinating seeds of gaur. In gaur,  $\alpha$ -amylase activity increases doubles with increasing concentrations of Triazophos. Santhguru and Thamizhchelvan [13] reported that, the lower concentration of rogor significantly increased the  $\alpha$ -amylase activity in germinating seeds of *Cyamopsis tetragonoloba* and similar results were also found by Mathur *et al.* [14] in *Vigna mungo*. On the other hand Prasad *et al.* [15] noticed the decreased activity of enzyme amylase in the germinating seeds of *Vigna mungo* by the influence of Metasystox and Cuman-L.

The protease activity is related to growth performance of seedlings [16]. In the present work the minimum activity of protease observed in all concentrations of Hexaconazole and Triazophos than control in germinating seeds of both vegetable crops. In spinach and gaur, activity of protease is retarded with increasing concentrations of Triazophos, but not more than control. Hexaconazole affect more at its lower concentration in spinach while it influence negatively at higher concentrations in gaur. Overall inhibitory effect on protease activity has been observed during pesticidal treatment to germinating seeds of both crops (Table 1 and Figure C and D). According to Sammaiah *et al.* [17] amylase activity decreases with increases concentrations of Endosulphan and Kitazin treated to germinating seeds of *Solanum melongena* L. (Brinjal) while Pathak and Mukherji [18] noticed carbaryl pesticide revealed no detrimental effects on the activity of amylase and protease in germinating seeds of *Vigna radiata*.

Acid phosphatases are mainly involved in hydrolysis of a wide range of orthophosphates, phosphomonoesters, sugar phosphates and ATP [19]. During early phases of seed germination the enzyme plays a vital role in phosphorus metabolism by catalyzing biochemical reactions and it regulates plant metabolism by changing the level of inorganic phosphorus [20]. The hydrolytic enzymes are released during stress conditions. The treatment of pesticides imposes an osmotic stress hence increase in the acid phosphatase activity [21]. The activity of acid phosphatase found to be increased in germinating seeds of spinach and gaur treated with increasing concentrations of Hexaconazole while it is decreased with increasing concentration of Triazophos (Table 1 and Figure E and F). From this it is concluded that, higher concentrations impose pesticide stress resulted in increasing acid phosphatase activity.

**Table 1. Effect of Hexaconazole and Triazophos on enzymatic activities in germinating seeds of spinach and guar.**

Enzymes	Control	Hexaconazole ( 5% EC)					Triazophos (40% EC)				
Spinach											
	V/V	0.05%	0.10%	0.15%	0.20%	0.30%	0.05%	0.10%	0.15%	0.20%	0.30%
$\alpha$ -Amylase	0.76	0.90	1.48	1.52	0.82	0.61	0.49	0.52	0.62	0.77	0.91
Protease	20.92	11.65	12.76	14.09	17.41	19.23	17.76	16.24	14.68	13.23	11.76
Acid Phosphatase	3.28	3.58	5.54	6.39	7.93	8.57	3.01	2.89	1.70	1.34	0.92
Gaur											
$\alpha$ -Amylase	0.83	0.90	1.49	1.32	1.23	0.72	0.90	1.02	1.21	1.94	2.14
Protease	12.13	11.03	10.89	8.47	6.52	4.89	10.27	9.81	7.45	6.57	5.13
Acid Phosphatase	5.59	6.03	7.36	9.47	10.14	11.83	5.40	5.20	4.12	2.40	1.42

The values of  $\alpha$ -Amylase are expressed in  $\mu\text{g amylase hydrolysed min}^{-1} \text{g}^{-1}$  fresh weight.

The values of Protease are expressed in  $\mu\text{g tyrosine liberated h}^{-1} \text{g}^{-1}$  fresh weight.

The values of Acid Phosphatase are expressed in  $\Delta\text{OD h}^{-1} \text{mg}^{-1}$  Protein fresh weight

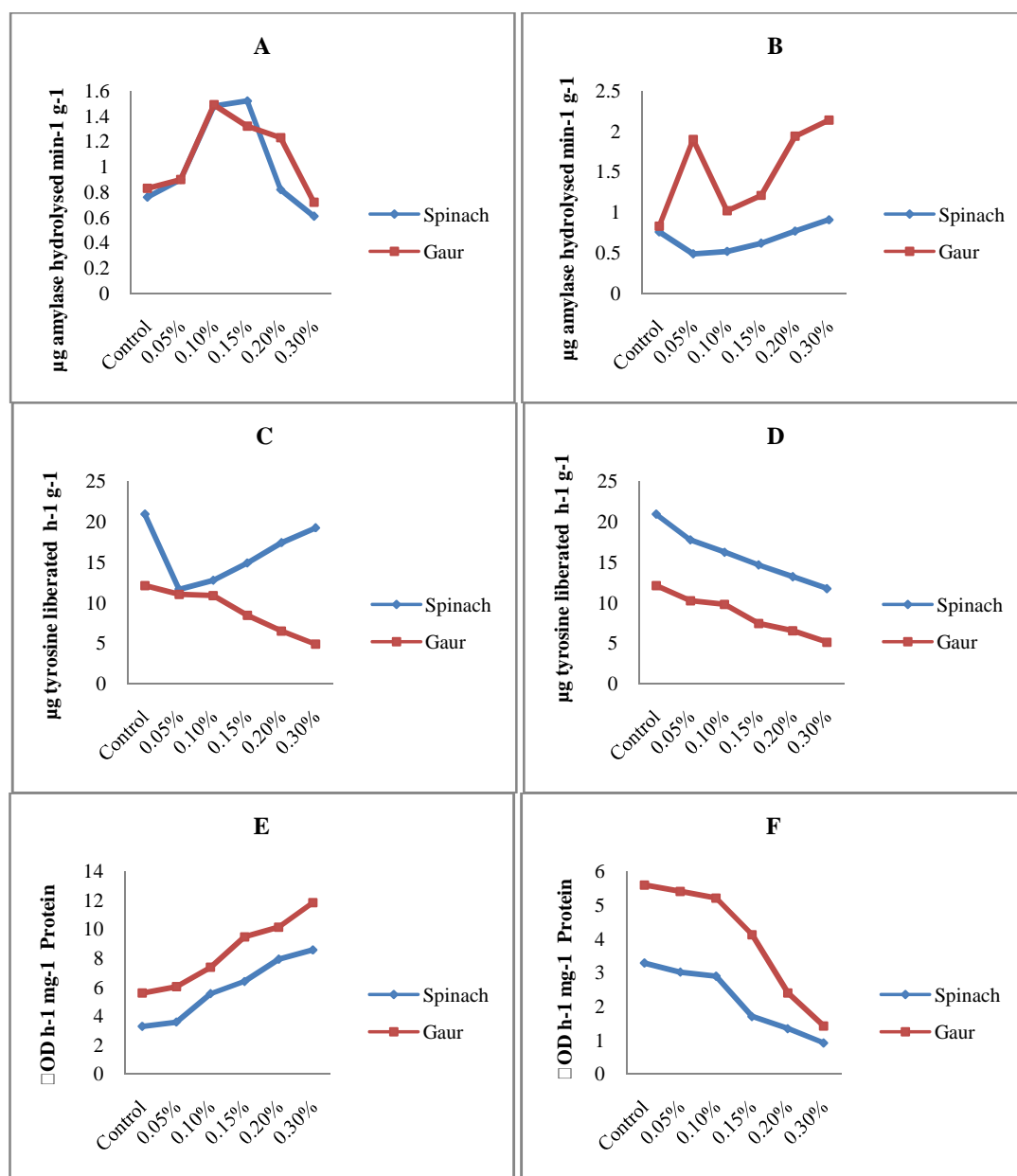


Fig. A : Effect of Hexaconazole on enzyme activity  $\alpha$ -amylase in spinach and gaur.

Fig. B: Effect of Triazophos on enzyme activity  $\alpha$ -amylase in spinach and gaur.

Fig. C : Effect of Hexaconazole on enzyme activity protease in spinach and gaur.

Fig. D : Effect of Triazophos on enzyme activity protease in spinach and gaur.

Fig. E : Effect of Hexaconazole on enzyme activity acid phosphatase in spinach and gaur.

Fig. F : Effect of Triazophos on enzyme activity acid phosphatase in spinach and gaur.

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