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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 3 (12): 2148-2150, 2000

Effects of Systemic Fungicides on Nutritive Composition of Diseased and Healthy Plants of *Triticum aestivum* L.

Zemin Shaheed Siddiqui and Soaliha Ahmed
Department of Botany, University of Karachi, Karachi, 75270-Pakistan

Abstract: Application of systemic fungicides showed significant ($p<0.001$) decrease in total protein and carbohydrate content of both diseased and healthy plants as compared to control. Diseased plants more adversely affected than healthy. Whereas substantial increase in total phenol was observed in both diseased and healthy plants. Among the amino acids proline, methionine, tyrosine and tryptophane were found in appreciable amount in diseased plants.

Key words: Systemic fungicides, protein, carbohydrate, amino acids, phenols

Introduction

Chemical control of the harmful organisms of crop plants is an accepted application at the present time. Now a days many modern pesticides are in the use all over the world. Among modern pesticides, systemic fungicides are being extensively used in agriculture. Benlate and calixin are systemic fungicides used for the control of diseases such as smut, grey mold, leaf spot, brown patch, downy mildew, powdery mildew and rust in wheat (Singh, 1991). Despite its enormous application, priority should be given to the possible side effects of these chemical on non targeted host (plant). There are reports where the application of benlate produced chlorosis and irregular depression at the central and marginal portion of saffron leaf (Reyes, 1975). Alcholor metalaxyl induced sharp decrease in cell division (Coman *et al*., 1990). Triarimol inhibits the seedling growth of pea (Shive and Sister, 1976). The present study, was therefore under taken to examine the effects of systemic fungicides on protein, amino acids, carbohydrate and phenolic content of *Triticum aestivum* L. under diseased and healthy plant condition.

Materials and Methods

Seeds of *Triticum aestivum* var. Mexi Pak collected from Pakistan Agriculutre Research Council (PARC) Karachi at university campus were sown in plots. Twenty seeds were sawn in each plots of an area about 9x4 feet. The plots were regularly watered and seedlings were grown at a temperature of 30-35°C and 65-75% relative humidity. Fifteen days old seedlings were inoculated with suspension of uredospores of *Puccinia recondite* (275 spores/ drop) by hypodermic and foliar inoculation served as diseased plants The inoculum was about a year old and had more than 85% viability when tested in moist chamber at 20°C. While healthy and control plants were allowed to grow at a distance from the inoculated plants to minimize the dissemination of spores from the infected plants. In both the sets of diseased and healthy plants were sprayed with benlate and calixin at 1000, 1500 and 2000 ppm with the Hp of spray machine, when traces of rust postules were sbserved on leaves of diseased plants. Unsprayed plant were served as control. Leaf samples were collected randomly after 20th day of the spray. Change in total protein contents in leaves was measured by the method of Lowry *et al*. (1951), carbohydrate (Yemm and Willis, 1954), Amino acid (Brenner *et al*., 1969) and total phenols (Swain and Hillis, 1959). Earma photic 100 spectrophotometer was used for each analysis and quantity was expressed in mg/gm fresh weight using standard curves. Each treatment was replicated thrice. Probability of analyses was determined in a costat (computer package).

Results and Discussion

Application of systemic fungicides viz. benlate and calixin showed significant decrease ($p<0.001$) in total protein content of diseased and healthy plants of *T. aestivum* (Fig.1). Benlate did greater effect on diseased sample reducing the total protein content as compared to control and calixin. The phytotoxicity was considerably high at higher doses of applied fungicide. An osmotic shock effect of systemic fungicides results in the release of protein and loss of membrane transport ability in the leaf cells (Amar and Reinhold, 1973). It has been suggested that toxicant produced by the application of systemic fungicides inhibits protein synthesis by binding to the larger ribosomal sub units inducing change in the enzyme system (Person *et al*., 1957) ceasing ATP and NADP formation (Mishra and Waywood, 1968; Siddiqui, 1997). The analyses revealed that the total carbohydrate content was significantly decreased ($p<0.001$) by the application of benlate and calixin (Fig. 1). However, maximum decrease(24%) was found in diseased plants when treated with calixin at 2000 ppm. The results obtained are illustrated in Table 1. Ninhydrine positive compound were detected from the treated and control plants. Among these, neutral amino acids like glycine, leucine, alanine, phenylalanine, aspargine *were* present in both treated as well as in control samples. Whereas methionine, tryptophane tyrosine and proline were present in appreciable amounts in treated samples of both diseased and healthy plants. Changes have been observed in amino acid content of diseased and healthy plants of *T. aestivum* after the spray of fungicides except a few amino acids appeared in both treated and untreated plants. Activation of enzymes involved in amino acid and amides biosynthesis in plants, have been observed in certain cases resulting increased levels of various amino acids and amides (Ahmed *et al*., 1985). The accumulation of amino acids might be the consequent of protein hydrolysis which might enter the tricarboxylic acid cycle either pyruvate by di-amination or by transamination with a ketoglutaric acid or oxalo acetic acid.
Increase in total phenolic content was recorded in all treated plants (Fig. 1). Maximum increase (23.1 %) was measured in the diseased plants when treated with calixin

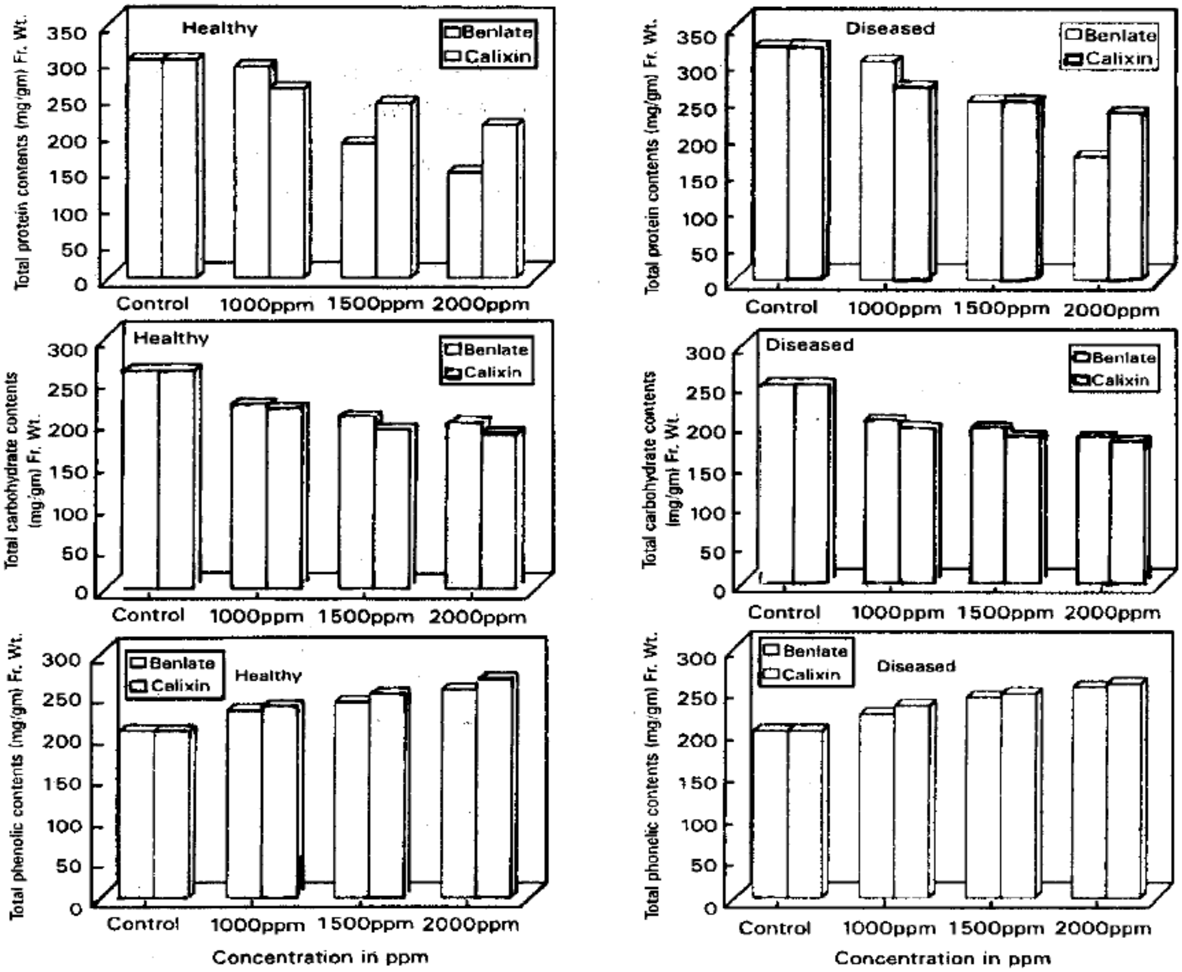

Fig. 1: Effect of systemic fungicides on total protein, carbohydrate and phenolic contents of diseased and healthy plant of *T. aesrivum L.*

Table 1: Effect of benlate and calixin on amino acids of diseased and healty plants of T. *aestivum* L.

	Benlate				Calixin		
Amino acids	Cont.	1000 ppm	1500 ppm	2000 ppm	1000 ppm	1500 ppm	2000 ppm
Diseased Plants							
Glycine	+ +	-	+	+	-	+	+
Leucine	+	+	-	+	-	+	+ +
Phenylalanine	+ + +	-	+ +	+	+	-	+ +
Asparagine	+	+ +	+	+	+	+	+ +
Methionine	+	+ + +	+ +	+ +	+	+ +	+ +
Tryptophane	-	+ + +	-	+ + +	+	+ +	+ +
Tyrosine	-	+ +	+ +	+ + +	+	+ +	+ +
Praline	-	+	+	+ +	-	+ +	+ + +
Alanine	+ +	+	-	+	+	-	-
Healthy Plants							
Glycine	+ +	-	+	+	-	+	+
Leucine	+	+	-	+	-	+	+ +
Phenylalanine	+ + +	+	+ +	+ +	+	-	+ +
Asparagine	+	+ +	-	-	+	+	+ +
Methionine	+	+ + +	+ +	+ + +	+ +	+ +	+ + +
Tryptophane	-	+ + +	+ +	+ + +	+	+ +	+ +
Tyrosine	-	+ +	+ +	+ + +	+	+ +	+ +
Praline	-	+	+ +	+ +	+	+ + +	+ + +
Alanine	+ +	-	-	+	+	+	-

at 2000 ppm. It has been reported that plants treated with fungicides suffer from the chemical stress (Siddiqui *et al*., 1997). Phenolic compound are produced as a result of this stress. may act as protective compounds against pest (Friend, 1979). Toxicant produced by the application systemic fungicide inhibits respiration, photosynthesis and protein synthesis by inhibiting activity of NADH cytochrome "c" oxidases in respiratory chain and accumulation of suucinate and blocking of alternative pathway of respiration (Berger and Cwick, 1990; Pillonel, 1995). A correlation has been reported between phenolic content of healthy tissue and resistant in various host parasite system like potatol*Verticlium* spp (McLean *et al*., 1961) and cottonl *Afternaria* in macrospora (Bashan, 1986; Prasad and Lal, 1977). Consequently, It may be suggested that synthesis of various metabolic products would also be affected by the application of systemic fungicides probably at higher concentration. However discriminate use of systemic fungicides is therefore recommended in order to minimizes the risk of phyotoxic effect on non targeted host and development of resistance of the pathogen against fungicides.

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