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Effect of systemic fungicides on total protein, carbohydrate and phenolic contents of *Solanum melongena* and *Avena sativa*

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ABSTRACT

Effect of systemic fungicides viz. topsin-M (Methyl thiophenate) and benlate (benomyl) on protein, carbohydrate, and phenoilc contents of *Solanum melongena* and *Avena sativa* were examined. Benlate (Benomyl) showed greater decrease in protein and carbohydrate contents of both the test species as compared to topsin-M (Methyl thiophenate). An increase in phenolic contents was recorded in the two species.

INTRODUCTION

The introduction of systemic fungicides is a major landmark in the history of chemical control of plant disesases. Topsin-M (Methyl thiophenate) and benlate (Benomyl) are systemic fungicides of benzimidazol group which are used for the control of diseases such as powdery mildew, downy mildew, brown rust, grey mould, rust and smuts of wheat (Thomson, 1985; Singh, 1991). Despite their use, systemic fungicides have been reported phytotoxic. The application of benomyl was found to produce chlorosis and irregular depression at the central and marginal portion of saffron leaves (Reyes, 1975). Alcholor metaxyl induced sharp decrease in cell division (Coman et al., 1990). Bezimidazol-N-Sulfonamide interfered electron transport system (ETS) by combining NADH or succinate (Pillonel, 1993). Likewise carbendazim induced chromosomal aberration in somatic and germ cells of pearl and sunflower (Harchand *et*

al., 1991). It is presumed that the metabolic changes induced by fungicides will certainly affect the chemical composition of the host. This important aspect has been dealt only by a few workers (Berger and Cwick, 1990). The present study was undertaken to examine the effect of topsin-M (Methly thiophenate) and benlate (benomyl) on *Avena staiva* and *Solanum melongena.* Protein and carbohydrate were selected as an indicator for changes in nutritive value and phenols as an indictor for the stress developed due to the presence of fungicides.

MATERIAL & METHODS

Seeds of *Avena sativa* and *Solanum melongena* obtained from National Institute of Agriculture and Biology (NIAB) Faisalabad were surface sterilized with 0.1% mercuric chloride for 10 min. Then washed with distilled deionized water.

The seeds were sown in 16" earthen pots containing 15 kg soil mixed with cowdung manure in 3:1 ratio. Ten seeds were sown in each pots. The pots were regularly watered and kept in glass house at temperature of 30-35°C and 35-45% R. H. Fifteen-day-old seedlings were sprayed separately with topsin-M (Methyl thiophenate) and benlate (benomyl). These fungicides were applied at the rate of 400, 600, 800 and 1000 mg/l with hand sprayer. the concentration of spray solution was based on formulations. Unsprayed plants were kept as control. Leaf samples were collected randomly after 2 weeks of treatment and changes in total protein content in leaves was measured after the extraction 5% cold trichloroacetic acid (TCA) and estimated through using folin phenol reagent, optical density read at 750 nm (Lowry *et al.*, 1951). Carbohydrate was detected by using anthrone reagent, optical density read at 520 nm (Yemm & Willis, 1956), while phenolic content was recorded after the extraction in ethanol and estimated using 10% folin reagent (Swain and Hillis, 1959), optical density was observed at 660nm. Erma photic 100 spectrophometer was used for each analysis and quantity expressed in mg/mg fresh weight by using standard curve. Three replicates were used for each analysis.

RESULT & DISCUSSION

Application of systemic fungicides viz. topsin-M (Methyl thiophenate) and benlate (benomyl) decreased the protein content of *S. melongena* and *A. sativa* (fig. 1). However, benlate (benomyl) exhibited phytotoxicity which resulted in greater reduction in protein content of *A. sativa* at 1000 mg/l, with reference to concentration of fungicide up and down trend was found. While slight increase in protein content was recorded in *Solanum melongena* when treated with benlate (benomyl) 800 mg/l.

Decrease in carbohydrate content of *S. melongena* and *A. sativa* was recorded (fig. 1). However, maximum. decrease over control was measured in *A. sativa* treated wiht benlate (benomyl) 1000 mg/l.

An increase in phenolic content was observed in the two test species (fig. 1). However, maximum increase was recorded when plants were treated with benlate (benomyl) 1000 mg/l.

Application of systemic fungicide viz. benlate (benomyl) and topsin-M (Methyl thiophenate) have been increased during last 20-30 years. The metabolic changes induced as a result of phytotoxicity of systemic fungicides reduces mineral contents and inhibite biosynthesis of protein, carbohydrate and vitamins (Berger & Cwick, 1990). An osmotic shock effect of systemic fungicides results in the release of protein and loss of membrane transportability in the leaf cells (Amar & Rienhold, 1973). In contrast, in present study benlate (benomyl) has been found to increase NAD and NADP ratio (Godvary & Waywood, 1970) and increase in NADP and ATP level (Mishra & Waywood, 1968) by inducing a change in the enzyme system which may result in the conservation of leaf protein and chlorophyll in detached wheat leaves (Person *et al.*, 1957). It has been suggested that plants sprayed with systemic fungicides suffer from chemical stress (Ahmed & Siddiqi, 1995) and the compound produced as a result of stress may act as protective compound against pathogenic fungi (Friend, 1977; Ahmed & Siddiqui, 1995).

Stress condition causes abnormalities in the biochemical pathway due to which toxic phenolic compound like flavones are formed (Reld et al., 1992). Compounds produced by chemical stress were potential inhibitors of germination and seedling growth (Heisy, 1990). Phytotoxin in the form of phenolic compounds are responsible for limiting cell

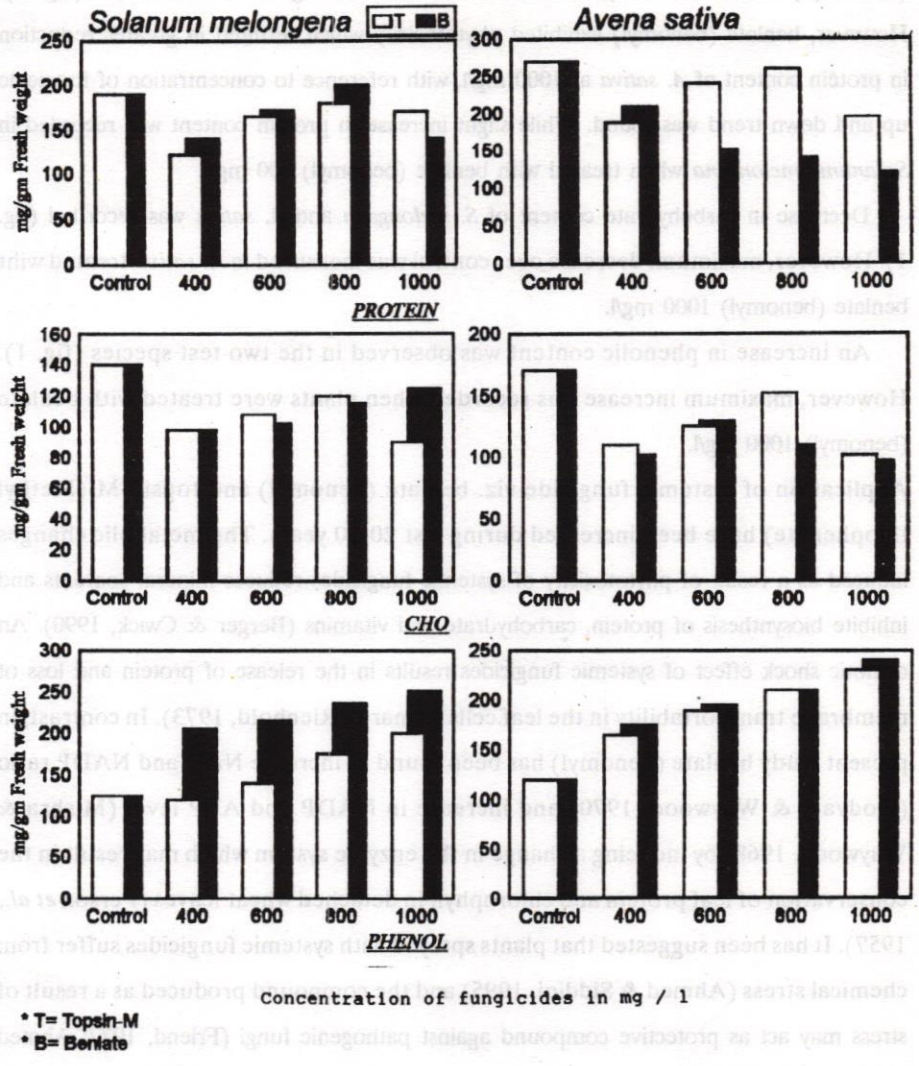

Fig. 1. Effect of topsin-M and benlate on protein, carbohydrate and phenolic contents of *Solanum melongena* and *Avena sativa.*