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EFFECT OF WILD PLANT RESIDUES ON THE GERMINATION AND SEEDLING GROWTH OF WHEAT CULTIVARS

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Abstract

The effect of *Withania somnifera, A. indicum, A. leptopus* and *P. glandulosa* residues on germination and seedling growth of wheat cultivars was examined. There was no inhibitory effect of plant residues on seed germination. *P. glandulosa* residues significantly inhibited shoot and root growth. Root growth was affected more than shoot growth. Residues of *W. somnifera, A. indicum* and *A. leptopus* showed similar inhibitory effects on seedling growth of wheat.

Introduction

Exudates, leachates and residues of many plants have been reported to affect the growth of other crops (Bhowmik & Doll, 1982; Fisher *et al.*, 1978; Garcia & Anderson, 1984; Rice 1984; Pardales & Dingal, 1988; Azmi & Alam, 1989). A wide range of injurious effects on crop growth has been reported as being due to phytotoxic decomposing products (McCalla & Haskins, 1964; Patrick *et al.*, 1963). Water extracts of a number of crop residues inhibited germination and growth of wheat, corn and sorghum (Guenzi & McCalla, 1961). The phytotoxic effects of 14 aqueous root extracts upon germination and seedling growth of 15 plant species has been reported (Lawrence & Kilcher, 1962). Le Tourneau *et al.*, (1956) found that water extracts from 23 common weed and crop species inhibited germination and growth of wheat seedlings. The Quackgrass *(Agropyron repens)* reduced growth of wheat tops (Minar, 1974), root exudates of wild oats *(Avena fatua)*, reduced growth of leaves and leaves of wheat (Schumacher *et al.*, 1982). The effect is often attributed to water soluble phytotoxins either leached from the residues or produced during microbial decay (Harper & Lynch, 1982; Waller *et al.*, 1987; Lovett & Potts, 1987).

Prosopis glandulosa, Abutilon indicum, Withania somnifera and *Antigonon leptopus* are common weeds which have been shown to possess very high antibiotic activities (Naqvi *et al.*, 1985). They are being studied in our laboratory as the inhibitors of nitrification. Their use as nitrification inhibitors would be useless if they also show inhibitory effects on crop growth. The present study was therefore undertaken to find out if these plants also show inhibitory effect on the germination and growth of wheat plants.

Materials and Methods

Green leaves of *Withania somnifera, Abutilon indicum, Antigonon leptopus* and *Prosopis glandulosa* were collected from the field, washed several times with distilled water and dried in an electric oven at 70°C for 24h. Leaves were ground in a Wiley mill to pass through a 20 mesh screen and stored in plastic bottles at room temperature.

One g ground plant residue of each species was incorporated and mixed thoroughly with 50 ml of 0.8% agar-gel in glass bowls. The bowls with only agar-gel were kept as control. Seeds of wheat cvs., Sind-81 and Pak-81 were disinfected for 3 min. in 1% sodium hypochlorite solution, rinsed thoroughly in sterile distilled water and 10 healthy wheat seeds were placed carefully on the surface of solidified agar-gel of each treatment. The glass-bowls were then covered with 9cm diam. Petri-dishes and incubated at 25±2°C. Each treatment was replicated 4 times in a randomized complete block design. Germinated seeds were counted and their shoot and root lengths measured after 5 days.

Results and Discussion

Incorporation of wild plant residues had no significant effect on germination of wheat cultivars (Table 1). Shoot and root growth significantly decreased with the incorporation of different plant residues with a highly significant decrease recorded in *P. glandulosa* residues. Decrease in shoot and root was 34% and 69% in Sind and 36% and 56% in Pak-81.

There was a differential phytotoxicity of aqueous extracts among the wild plants. Putnam & Duke (1974) have suggested that wild plant may possess high allelopathic po-

Table 1. Effect of wild plant residues on the germination and seedling growth of wheat cultivars.

Treatments	Wheat (cv. Sind-81)			Wheat (cv. Pak-81)		
	Germination %	Shoot length (cm)	Root length (cm)	Germination %	Shoot length (cm)	Root length (cm)
Control (No residue)	98 NS	7.84 a	8.61 a	97 NS	6.57 a	7.58 a
Withania somnifera	100	6.78 b	5.43 d	100	5.75 b	5.99 d
Abutilon indicum	96	6.87 b	6.40 c	100	5.65 b	7.06 b
Antigonon leptopus	97	6.63 b	6.91 b	100	5.60 b	6.87 c
Prosopis glandulosa	92	5.19 c	2.30 e	98	4.21 c	3.31 e

tential. The reduced growth of wheat cultivars would demonstrate that water soluble toxins released from the residues or produced by micro organisms during decomposition, affected crop growth. Root growth was affected more than the shoot growth and *P. glandulosa* residue suppressed root growth more than other plant residues tested. The roots which were in continuous contact with the residues were exposed to possible toxins evolved either through the process of leaching or action of microorganism upon decomposition (McCalla & Haskins, 1964).

The growth inhibition caused by allelochemicals from residues could be due to interference with many plant growth processes. Reduced growth may be due to reduced cell division (Avers & Goodwin, 1956) or auxin induced growth of roots (Geissman & Phinney, 1972). Plant residues have also been found to cause injury if the residues were in contact with or in the immediate vicinity of plant roots (Rice, 1984; Patrick, 1971).

The present study would indicate that all 4 wild plant residues have no adverse effect on the germination of wheat cultivars. *P. glandulosa* residue however showed highly significant inhibitory effects on the growth of both shoot and root of wheat cultivars tested.

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