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STUDIES ON ALLELOPATHIC EFFECT OF SOME WEEDS

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Allelopathic effect of some common weeds (*Parthenium hysterophorus*, *Asphodelus tunifolius* and *Pluchea lanceolata*) on seed germination and seedling growth in *Triticum aestivum* (var. PBW 154) was studied. Microchemical test of root leachates from different weeds exhibited the presence of phenolics. There was a significant reduction in the percentage of germination and seedling growth of wheat seeds soaked in root leachates and root and leaf extract of all the three weeds. Similarly, the seeds sown in the soil obtained from the vicinity of weeds inhibited seed germination and seedling growth.

Keywords: Allelopathy, *Asphodelus*; *Parthenium*. Phenolics; *Pluchea*.

Introduction

Allelopathy has been defined as a branch of science in which plant chemicals either stimulate or inhibit growth of other plants[1]. The science of allelopathy has been recognised since the time of inhibition of chick pea (*Cicer aeritinum*) by weeds[2]. This science in recent years has received support from both agricultural as well as from the environmental sectors. In the former, it is identified as a possible component of the integrated pest management system especially useful in sustainable agriculture of the third world countries. Presently, allelopathy is confined to a very great extent on the role of trees, e.g. eucalyptus, neem and a few weeds, some of which may not be seen in crop fields. Present investigation has been undertaken to study the allelopathic effect of *Parthenium hysterophorus, Asphodelus tunifolius* and *Pluchea lanceolata*, the common weeds of Agra on seed germination and seedling growth in wheat (*Triticum aestivum* Var. PBW 154).

Materials and Methods

The plants of three weeds namely, *Parthenium hysterophorus* (Asteraceae), *Asphodelus tunifolius* (Liliaceae) and *Pluchea lanceolata* (Asteraceae) growing in the fields were dug out with their roots intact. These rooted plants were kept in wide mouth bottles with their roots dipped in distilled water for 100 hours. Later, the plants were removed and the distilled water containing leachates were tested for the presence of phenolics by Ferric Chloride test[3]. In the distilled water containing root leachates from different weeds, 100 seeds of *Triticum aestivum* (var. PBW 154) were soaked for 24, 48 and 72 hours. Fresh root and leaf extracts were prepared by grinding 10 g leaves or roots in 100 ml distilled water and it was concensidered 100 per cent extract. From this, by dilution 25, 50 and 75 percent extracts were made. In each contration of root and leaf extracts thus prepared, 100 seeds of wheat were soaked for 24 hours. For control seeds were soaked in distilled water for same period in each experiment. Soil from the vicinity of roots of different weeds was dug out and 100 seeds of wheat were sown in this soil. For control seeds were sown in normal garden soil. Data on days taken for germination, germination percentage and seedling growth was collected after 15 days of sowing.

Results and Discussion

I. Microchemical Test of Root Leachates: The results of microchemical test made with ferric chloride solution on root leachates of various weeds used in the present study clearly indicated the presence of large quantity of phenolics.

II. Effect of Root Leachates on Seed Germination: The effect of root leachates of differ-

ent weeds on days taken for germination, germination percentage and seedling growth is shown in Table 1.

A. Days taken for germination: It is clear from Table 1 that days taken for germination were considerably enhanced with the increase in the period of soaking. The seeds soaked in root leachates of *Parthenium, Asphodelus and Pluchea* for 72 hours took 8, 7 and 9 days for germination respectively as compared to control seeds taking only 2-3 days.

B. Germination percentage: Percentage of germination of wheat seeds soaked in root leachates of different weeds was reduced and the reduction increased with the increase in period of soaking. Maximum reduction was recorded in the seeds soaked in root leachates for 72 hours as there was only 28, 28 and 20 per cent germination in root leachates of *Parthenium, Asphodelus and Pluchea* respectively as compared to 80-85 per cent germination in control seeds (Table 1).

C. Seedling growth: There was a marked reduction in growth of wheat seedlings obtained from seeds soaked in root leachates of various weeds. Reduction in the seedling growth increased with the increase in the soaking period and maximum reduction was observed in the seedlings soaked in leachates of *Parthenium*.

III Effect of Root and Leaf Extract: The effect of root and leaf extract of various weeds on days taken for germination, germination percentage and seedling growth in wheat is shown in Table 2.

A. Days taken for germination: It is clear from Table 2 that the seeds soaked in various concentrations of root and leaf extract of different weeds took more days for germination as compared to control seeds which took only 2-3 days. The seeds soaked for 24 hours in 100 per cent root extract of various weeds took 6-9 days. On the other hand, the seeds soaked in 100 per cent leaf extract for 24 hours took 5-6 days for germination. The extracts of root and leaves of *Pluchea* were more inhibitory.

B. Germination percentage: The percentage of germination of seeds soaked for 24 hours in different concentations of root and leaf

Table 1: Effect of root leachates on seed germination in wheat.

Weed	Soaking period (h)	Days for germination	Germination (%)	Seedling length (cm)*	
				Root	Shoot
Parthenium hysterophorus	24	5	44	7.1	6.5
	48	6	40	6.9	4.5
	72	8	28	6.0	5.0
	Control	2	80	10.7	12.0
Asphodelus tunifolius	24	5	60	9.7	10.0
	48	6	35	8.0	9.0
	72	7	28	7.0	8.0
	Control	2	80	15.0	13.0
Pluchea lanceolata	24	5	40	10.0	9.7
	48	7	30	8.6	9.4
	72	9	20	7.5	9.3
	Control	2	85	15.0	14.0

* Mean value of 100 seedlings

Table 2. Effect of root and leaf extract on seed germination in wheat.

Weed	Root extract					Leaf extract				
	Conc. (%)	Days for germination	Germination (%)	Seedlings lengh (cm)* Root	Shoot	Conc.(%)	Days for germination	Germination (%)	Seed length (cm)* Root	Shoot
Parthenium	Control	2	80	9.1	8.0	Control	3	88	8.3	6.7
	25	3	65	8.0	7.0	25	3	76	7.1	6.5
	50	3	60	6.1	7.0	50	4	68	6.8	6.1
	75	4	40	4.8	6.2	75	5	60	6.4	5.9
	100	5	32	4.5	6.0	100	7	40	6.0	5.7
Asphodelus	Control	3	72	8.4	7.0	Control	2	100	8.4	7.5
	25	3	60	7.5	6.5	25	3	78	8.1	7.0
	50	4	44	6.1	6.0	50	4	65	7.9	6.7
	75	5	36	5.0	5.9	75	5	60	7.8	6.3
	100	6	28	4.8	5.7	100	6	48	7.4	6.1
Pluchea	Control	2	72	8.5	7.1	Control	3	92	8.4	6.2
	25	3	44	7.3	6.3	25	4	72	8.2	6.1
	50	3	40	6.7	6.0	50	5	60	7.1	5.9
	75	4	32	6.3	6.0	75	7	48	6.8	5.7
	100	6	20	6.0	5.3	100	9	42	6.4	5.5

* Mean value of 100 seedlings

extracts of various weeds was reduced and the maximum reduction was caused by 100 per cent leaf extract of *Pluchea* in which there was only 20 per cent germination as compared to 72 per cent germination of control seeds (Table 2). However, root extracts of all the weeds studied on germination was less inhibitory and there was 40 per cent germination of wheat seeds soaked in 100 per cent root extracts of *Parthenium*.

C. Seedling growth: Table 2 also indicates that the seedling growth was inhibited by soaking wheat seeds in various concentrations of root and leaf extracts of different weeds. Maximum reduction in seedling growth was caused by seeds soaked in 100 per cent leaf extract of *Parthenium* (4.5 x 6.0 cm) and *Asphodelus* (4.8 x 5.7 cm). Effect of root extract on seedling growth was less inhibitory and the maximum reduction was recorded in wheat seedlings (6 x 5.7 cm) soaked in 100 per cent root extracts of *Parthenium*.

IV. Effect of Soil from the Vicinity of Plants: The effect of soil dug from the vicinity of various weeds on time taken for germination, germination percentage and seedling growth is shown in Table 3.

A. Days taken for germination: It is clear from Table 3 that the days taken for germination by wheat seeds sown in the soil taken from the vicinity of weeds was enhanced as compared to that by control seeds (5-6 days). The seeds shown in soil from different weeds took 8-12 days for germination.

B. Percentage of germination: There was only 30-40 per cent germination of wheat seeds sown in the soil obtained from the vicinity of different weeds as compared to 75-80 per cent germination of seeds sown in garden soil (control).

C. Seedling growth: The growth of wheat seedlings grown in soil dug from the vicinity of all the three weeds was much inhibited as

Table 3. Effect of soil from the vicinity of weeds on seed germination of wheat.

Weed		Days for germination	Germination (%)	Seedling length (cm)*	
				Root	Shoot
Parthenium	Soil	10	30	4.0	5.30
	Control	5	80	6.8	10.4
Asphodelous	Soil	8	40	3.5	5.7
	Control	6	75	6.9	9.8
Pluchea	Soil	12	32	4.1	5.9
	Control	5	80	7.0	9.9

compared to that of control soil. Maximum reduction in the seedling growth (3.5 x 5.7 cm) was recorded in the soil brought from *A. tunifolius* field.

Plants produce and store large amounts of primary and secondary metabolic products, although the later are not only in bulk but are most familiar to allelopathy scientists.[4] These vary in their chemical composition, concentration and localization according to species. Phenolic acids and coumerins are among the class of allelopathic compounds[5]. The compounds identified have been shown to have role in plant growth and usually affects the growth of another plant or even its own species. Phenolics are important allelochemicals and their presence in soil has been of great concern to scientists. A large number of allelopathic scientists have studied the effect of various plant leachates on the germination and seedling growth. The plants are *Parthenium*,[6,7] *Lantana*[8], *Eucalyptus*, their leaf and bark extracts[9]. The allelopathic potential of several C_3 and C_4 weeds on seedling vigour of wheat has been studied. Various kinds of phenols has also been reported to be present in soil.[5]

Thus, the root leachates, root and leaf extracts and soil near the roots of all the three weeds presently studied possess phenolics causing high allelopathic effect on seedling growth in *Triticum aestivum*.

References

1. Molisch P 1996, Methodology in Allelopathy. In : Narwal SS and Tauro P (Edib), *Allelopathy: Field observation and methodology.* Scientific Publishers, Jodhpur.
2. Rice EL 1974, *Biochem. Syst. Ecol.* **5** 201.
3. Mann FG and Saunders BC 1960, *Practical organic chemistry*, Orient Longman's Pvt. Ltd., Calcutta, pp. 346.
4. Narwal SS and Tauro P 1996, *Allelopathy: Field observation and methodology.* Scientific Publishers, Jodhpur.
5. Waller and Feng 1996, Presence of phenolics in Oklahama Soil. In : Narwal SS and Tauro P (Edis). *Allelopathy: Field observation and methodology.* Scientific Publishers, Jodhpur.
6. Srivastava JN, Shukla JP and Srivastava RG 1985, *Acta Botanica Indica* **13** 194.
7. Rahman A 1997, *Int. J. Mendal* **14**(1-2) 23.
8. Chaturvedi Meenu and Sharma KP 1997, *Indian J. Environ. Sci.* **1**(1) 11.
9. Bharadwaj SD and Thakur Vidya 1995, *J.Tree. Sci.* **14** (2) 95.