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Allelopathic Effects of Aqueous Extract of Chickpea (*Cicer arietinum*) and Wheat (*Triticum aestivum* L.) on each other's Growth and Quality

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ABSTRACT

Allelopathic effects of aqueous extract of chick pea (*Cicer arietinum*) and wheat (*Triticum aestivum*) on each other's growth and quality was studied. The suppressive effects of extracts from both the sources were concentration dependant being maximum at 100% concentration. Root and shoot length of wheat was greatly affected by water extract of chickpea. Quality characteristics including protein, ash, starch, K and P contents of each crop were also affected due to allelopathic effects of the water extracts.

Key Words: Allelopathy; Aqueous extracts; Chickpea; Wheat

INTRODUCTION

Biochemical interactions between plants both inhibitory and stimulatory, through the release of secondary substances into the environment by decomposition of plant residues, root exudates or leaching by rain are termed as "Allelopathy" (Rice, 1984). Evenari (1949) listed 101 plants with allelopathic potential. These allelochemicals may have suppressive or promotive effects on seed germination, seedling growth and seedling quality of other plants. Many crops such as barley, cucumber, wheat, rye, sunflower, chickpea and sorghum are found to have allelopathic substances. The concept that some crop plants are allelopathic to certain other crops is gaining interest. Therefore, the present study was planned to evaluate the allelopathic effects of chickpea (*Cicer arietinum)* and wheat (*Triticum aestivum* L.) on each other's germination.

MATERIALS AND METHODS

Field grown wheat and chickpea plants (uprooted at maturity) were dried at room temperature (30°C ± 4) for 15-18 days and then chopped into 5 cm pieces with hand fodder cutter. Chopped plant material was dried in an oven at 70°C for 48 hours. The dried material of each plant was ground in a grinder and soaked in distilled water for 24 hours at room temperature (30 ± 4) in the ratio of one gram herbage:20 ml water (Hussain & Gadoon, 1981). The water extract of both the plants was obtained by filtering the mixture (herbage and water) through a Whattman # 42 filter paper and used fresh for making 25, 50 and 75% concentrations by diluting with distilled water.

Ten seeds of each of chickpea and wheat were grown in separate petri–dishes of 9 cm diameter replicated four times in completely randomized design. Filter paper (Whattman # 42) was used as medium of germination. In total, 4 cm^3 of solution was applied, half (2 cm^3) of which was used as moisture for filter paper receiving seeds in the dishes and remaining half was applied to the covering filter paper. The control treatment received 4 cm^3 of distilled water similarly. Both treated and control petri dishes were kept moist by applying distilled water whenever needed. The dishes were kept at room temperature (30°C ± 2) for seed germination in the laboratory. The observations recorded included seed germination (%), root length (cm), shoot length (cm), fresh and dry weight of seedlings (gm). The seedlings were also analysed for their starch, protein, K, P and ash contents following the standard procedures (AOAC, 1984). The data on seed germination, root length, shoot length, and fresh and dry weight of seedlings were subjected to statistical analyses using Analysis of Variance (ANOVA) and LSD at 5% probability as described by Steel and Torrie (1984).

RESULTS AND DISCUSSION

It is evident from the results (Table I) that there was a difference in the germination of wheat seeds between the undiluted (100%) chickpea water extract (CWE) group compared with those treated with distilled water (0%) and the diluted (25, 50 and 75%) CWE groups. It indicates that germination

Table I. Effects of chickpea and wheat water extract on growth of wheat and chickpea, respectively

Treat.	Seed germ (%)	Root length (cm)	Shoot length (cm)	Fresh weight (gm)	Dry weight (gm)
Chickpea water extract					
0% (C)	80a	1.628ab	2.545a	0.7450a	0.34a
25%	60ab	2.3a	2.658a	0.5350ab	0.2575a
50%	70a	1.450b	1.577b	0.4975ab	0.2750a
75%	55ab	1.405b	2.475a	0.4475b	0.24a
100%	35b	1.035b	1.392b	0.2875b	0.1325b
Wheat water extract					
0% (C)	NS	2.395a	NS	NS	NS
25%	NS	1.650b	NS	NS	NS
50%	NS	1.430b	NS	NS	NS
75%	NS	1.317b	NS	NS	NS
100%	NS	1.148b	NS	NS	NS

NS= Non-significant; Treat.= Treatments; Germ= Germination
C= Control

decreased with an increase in the concentration of CWE which suggested an inhibitory effect of CWE on wheat germination. Likewise, an inhibitory effect of CWE on root length, shoot length, fresh and dry weight of wheat seedlings was oberved. In contrast to it, there was no inhibitory effect of wheat water extract (WWE) on germination of chickpea seeds, shoot length, fresh and dry weight of wheat seedlings was recorded. However, WWE was found to have a stimulatory effect on the root length of wheat seedlings. The results of the chemical analyses of wheat and chickpea seedlings have been presented in Table II.

Table II. Effects of chickpea and wheat water extract on chemical composition of wheat and chickpea seedlings, respectively

Treat.	Starch (%)	Protein (%)	P (%)	K (%)	Ash (%)
Chickpea water extract					
0% (C)	66	4.6	0.29	0.014	6.0
25%	80	0.8	1.0	0.026	7.5
50%	60	0.85	0.88	0.0208	8.5
75%	65	3.1	0.94	0.014	6.5
100%	55	1.9	0.56	0.0212	5.5
Wheat water extract					
0% (C)	72	4.90	0.376	0.4160	6.5
25%	88	5.00	0.44	0.0742	9.0
50%	64	5.10	0.24	0.345	8.0
75%	69	1.01	0.71	0.0791	8.0
100%	70	7.61	1.14	0.0840	7.0

Treat; Treatments; C= Control

The best starch contents (80 and 88%) in seedlings of wheat and chickpea were found at a concentration of 25% of CWE and WWE, respectively; which was even better than the control. An inhibitory effect of CWE on protein contents of wheat seedlings was recorded at all the concentrations used compared with control. However, WWE was positively affected the protein contents of chickpea seedlings at all concentrations except at 75% level. Phosphorus and Potassium of wheat seedlings increased at all levels of CWE, best being on 25% concentration compared with control. Similarly, Phosphorus of Chikpea seedlings increased at all levels of CWE, best being on 100% concentration. However, WWE negatively affected the potassium of chickpea seedlings at all levels. Both CWE and WWE increased the ash contents of wheat and chickpea seedlings, respectively.

Similar inhibitory or stimulatory effects of different plants have been reported previously (Evenari, 1949; Singh, 1957; Guenzi & McCalla, 1966; Worsham, 1984; Aslam & Azmi, 1989).

CONCLUSIONS

Chickpea and wheat extracts contain some substances which have inhibitory and/or stimulatory effects on each other. Therefore, further studies to exploit their beneficial roles may be carried out.

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