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ALLELOPATHIC EFFECT OF *Cyperus rotundus* AND *Echinochloa crus-galli* ON SEED GERMINATION, AND PLUMULE AND RADICLE GROWTH IN MAIZE (*Zea mays* L.)

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ABSTRACT

Present study was conducted to evaluate the allelopathic effect of Cyperus rotundus and Echinochloa crus-galli on seed germination and plumule and radicle growth of maize. The experiment was layout out in completely randomized design. The data indicated that aqueous extracts of Cyperus rotundus and Echinochloa crus-galli greatly inhibited the seed germination and plumule and radicle growth of maize. Echinochloa crus-galli was found to be more allelopathic to maize than Cyperus rotundus. Further studied are suggested to find tune our findings..

Key Words: Allelopathy, weeds, maize, seed germination, growth.

INTRODUCTION

Some plants inhibit the seed germination and growth of other plants by means of producing toxic allelochemicals or allelopathins. Allelochemicals are the secondary metabolites produced by plants and are byproducts of primary metabolic processes (Levin, 1976). They have both stimulatory and inhibitory effects on the growth and development of their own kind and also on other species grown in their vicinity. All plants use the same primary metabolic processes for growth, development and production of seeds for the next generation. But these toxin-producing plants differ widely in their production of secondary metabolites; hence they vary in their ability to produce allelopathic effects (Waller & Feng, 1996). There are several ways in which these toxic chemicals are produced. Allelopathic trees release a chemical in the form of a gas through their stomata. Other plants absorb this toxic chemical and die. Some plants store protective chemicals in the leaves they drop. When the leaves fall to the ground, they decompose. The chemicals are thus released and they inhabit growth of other plants. Some plants release defensive chemicals into the soil through their roots. These chemicals are absorbed by the roots of other plants living in close proximity. As a result, other plants are damaged (Angiras *et al.*, 1988, Saxana, 1990).

The weeds have been known as very tough competitors of crops for resources. Besides competition, weeds may also cause biochemical inhibition of the growth of crop plants (Chaghtai *et al.*, 1988). Crops have also reportedly shown allelopathic effects (Putnam *et al.*, 1983; Yenish *et al.*, 1995).

The proper use of allelopathy may reduce the overuse of pesticides (herbicides, fungicides, nematocides and insecticides). Allelochemicals may also reduce pollution and decrease detrimental effects of autotoxicity and soil sickness in agriculture and forestry

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(Waller, 1987). Recent research has revealed that there are some plants producing chemicals which are more effective in promoting growth of the other plants gibberellins or IAA (Hasegawa, 1993).

Cyperus rotundus and *Echinochloa crus-galli* are two important weeds of maize in Peshawar and adjoining areas. Present study was carried out at Botany Department University of Peshawar, in order to evaluate the allelopathic effects of *Cyperus rotundus* and *Echinochloa crus-galli* on seed germination, plumule and radicle growth of maize.

MATERIALS AND METHODS

An experiment was conducted during 1998 at Botany Department, University of Peshawar in order to evaluate the allelopathic effects of shoots and rhizomes of *Cyperus rotundus* and *Echinochloa crus-galli* on seed germination and seedling growth of maize. Seeds of a local maize cultivar "Tarowal" were used for the purpose. The shoots and rhizomes of *Cyperus rotundus* and *Echinochloa crus-galli* were crushed to powder form. Then 0.5 g, 1.0 g, 5 g and 10 g of these powders were added to 100 ml distilled water and were soaked for 6 hrs and 12 hrs at 25 °C. The extracts thus obtained were filtered. The Petri dishes were provided with filter paper bed, litter bed, litter bed and sand bed combined. Five seeds were placed in each Petri dish and the aqueous extract was added. These Petri-dishes were then kept in the incubator for 96 hours. After 96 hours these Petri dishes were taken out and the germination rate along with radicle and plumule length was determined for different treatments. The data were statistically analyzed by completely randomized Design (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The seed germination was significantly inhibited by *Cyperus rotundus* roots and *Echinochloa crus-galli* shoots extracts. Maximum allelopathic effect (66.0 %) was recorded for ESC_1T_2 (12 hrs of *Echinochloa crus-galli* shoot with 5 g concentration) and ESC_2T_2 (12 hrs extract of *Echinochloa crus-galli shoot* with 10 g conc.) treatments. In *Cyperus rotundus treatments*, maximum seed inhibition was recorded for CRC_1T_2 (12 hrs of *Cyperus rotundus* rhizome with 5 g concentration). In other treatments there was no significant effect on the seed germination rate. The results coincide with that of Angiras *et al.* (1988) who reported that *Cyperus rotundus* and *Echinochloa crus-galli* extracts had delayed the germination of maize seeds.

Plumule growth was also greatly effected. Maximum plumule length was recorded for control litter bed treatment (LB) i.e. 2.910 cm while least plumule length was observed for ESC_2T_2 (0.030 cm). In *Cyperus rotundus* extracts, CRC_2T_2 (0.034cm) showed maximum inhibition of plumule length. In *Echinochloa crus-galli* extracts, ESC_2T_2 (0.030 cm) showed maximum plumule inhibition. The results showed that aqueous extracts of both *Cyperus rotundus* and *Echinochloa crus-galli* greatly inhibited the plumule growth in maize. Angiras *et al.* (1988) also reported that percentage germination was unaffected by the extracts of *Cyperus esculentus* and *Echinochloa crus-galli*.

Radicle growth was also significantly affected by different treatments. The maximum radicle length was recorded for litter bed (check) treatment i.e. 5.86 cm. The lowest length was recorded for ESC_2T_1 (1.54 cm). In *Cyperus rotundus* extracts treatments, least inhibition in radicle length was observed in CRC_2T_1 (3.72 cm), while CSC_2T_2 (1.94 cm) resulted in maximum radicle inhibition. In *Echinochloa crus-galli*, least inhibition in radicle length was observed for ERC_1T_2 (3.27 cm), while ESC_2T_1 (1.54 cm) showed maximum growth inhibition. However, in *Cyperus rotundus* extracts the radicle length inhibition was least compared to that of *Echinochloa crus-galli* extracts treatments.

Present results are in agreement with those of Angiras *et al.* (1988) who reported that radicle growth in maize was inhibited by extracts of *Echinochloa crus-galli* and *Cyperus rotundus*.

Table-1. Allelopathic effects of *Cyperus rotundus* and *Echinochloa crus-galli* on seed germination, plumule length and radicle length of maize (*Zea mays* L.)

Treatments	Weed added (g)	Extract duration (hr)	Seed germination (%)	Plumule length (cm)	Radicle length (cm)
0 (Check)	-	-	96 ab	0.762 d	3.96 cdef
CSC_1T_1	5	6	94 abc	0.212 f	2.83 ghij
CSC_1T_2	5	12	96 ab	0.212 f	3.01 fghi
CSC_2T_1	10	6	100 a	0.094 f	2.43 hijk
CSC_2T_2	10	12	82 abcd	0.052 f	1.94 jk
CRC_1T_1	5	6	92 abc	0.038 f	2.45 hijk
CRC_1T_2	5	12	76 cd	0.156 f	2.19 ijk
CRC_2T_1	10	6	94 abc	0.698 de	3.72 defg
CRC_2T_2	10	12	92 abc	0.034 f	2.12 ijk
ESC_1T_1	5	6	92 abc	0.114 f	2.44 hijk
ESC_1T_2	5	12	66 d	0.114 f	2.22 ijk
ESC_2T_1	10	6	88 abc	0.158 f	1.54 k
ESC_2T_2	10	12	66 d	0.030 f	1.56 k
ERC_1T_1	5	6	100 a	0.130 f	2.98 fghi
ERC_1T_2	5	12	98 ab	0.248 ef	3.27 efgh
ERC_2T_1	10	6	90 abc	0.106 f	2.08 ijk
ERC_2T_2	10	12	88 abc	0.168 f	2.34 hijk
LB (Check)	-	-	86 abc	2.91 a	5.86 a
$LBCSC_3T_2$	0.5	12	80 bcd	1.98 b	3.96 cdef
$LBESC_3T_2$	0.5	12	92 abc	1.402 c	4.04 cde
SLB (Check)	-	-	96 ab	2.204 b	5.09 ab
$SLBCSC_4T_2$	1.0	12	92 abc	1.89 b	4.77 bc
$SLBESC_4T_2$	1.0	12	92 abc	2.098 b	4.69 bcd
$LSD_{0.05}$			19.10	0.4564	0.9994

Abbreviations used in the Table

C:	*Cyperus rotundus*	E:	*Echinochloa crus-galli*		
S:	Shoots	R:	Rhizomes	C_1:	5 grams
C_2:	10 grams	C_3:	0.5 grams	C_4:	1.0 grams
T_1:	6 hrs	T_2:	12 hrs	LB:	Litter bed
SLB:	Sand + Litter bed				

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