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ALLELOPATHIC EFFECTS OF SOME WEEDS ON CHICKPEA CROP

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ABSTRACT

Apot experiment was designed to study the allelopathic effect of two weeds (Cyperus rotundus L. and Sorghum halepense L.) against chickpea plants. The experiment was undertaken in the Weed Science Research Laboratoryof the University of Agriculture Peshawar during winter season 2012. The experiment was laid out in a completely randomized design (CRD). Weed samples for extract purpose were dried, ground with the help of grinder and then weighed. Each time two concentrations were made from each sample @ 150 and 200 g L^{-1}. The chickpea variety Karak-1 was used in the experiment.Ten seeds of chickpea were planted in Plastic pots with 12 cm height and 15 cm diameter filled with soil. The results showed that all the parameters of chickpea were significantly affected by the allelopathic extracts of Cyperus rotundusand Sorghum halepense. Further research is suggested to investigate the actual phenomena responsible for this variationwithin thesetested plants.

Key words: Allelopathy, chickpea, concentration, extract, weeds.

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INTRODUCTION

Chickpea (*Cicer arietinum* L.), belonging to family leguminoceae, is the third most important legume crop in the world after peas and dry beans (FAO, 2003). This crop provides an important source of dietary protein for human consumption and also plays important role in soil fertility due to nitrogen-fixing ability (Maiti, 2001).In Pakistan, chickpea is the most important pulse as well as vegetable crop. The area under chickpea cultivation in Pakistan during 2008-09 was 1080.6 thousand ha with production of 740.5 thousand tons, while the average yield was 685 kg ha^{-1}. In Khyber

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Pakhtunkhwa, the area under chickpea cultivation was 42 thousand ha with a production of 20 thousand tons (MINFA, 2009). Chickpea yield in Pakistan is lower as compared to other advanced chickpea growing countries. There are many factors which cause low yields in chickpea including weeds, lack of organic manuring, water stress, late planting and variety of low genetic base.

Chickpea is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stages of crop growth and establishment (ICARDA, 1985; Bhan and Kukula, 1987).Common weeds of chickpea are *Asphodelus tenuifolius* L., *Medicago polymorpha* L., *Anagallis arvensis* L.,*Cyperus rotundus* L., *Fumaria indica, Cynodon dactylon* L.*, Lathyrus aphaca* L.,*Convolvulus arvensis* L.and *Carthamus oxyacantha* L. (Saxena, 1979).Weeds compete with chickpea crop for available moisture, nutrients, space and sunlight and weed infestations also deteriorates the quality of chickpea seed which creates storage problem and also affects market rate of the product. Allelopathy is a chemical (biochemical) relationship among the plants. These relations include both inhibitory and stimulatory reciprocal chemical actions (Rice, 1984). She used the term allelopathy as direct or in direct harmful effect of one plant on other plant through release of chemicals (allelochemicals). Today allelopathy is widely studied both in weeds and crops. Khan et al. 2012, reported that Parthenium and Eucalyptus extracts significantly reduced the density of weeds as compared to control check.

Keeping the importance in view, the experiment was conducted at the Weed Science laboratory of the University of Agriculture Peshawar with the objectives to figure out the response of chickpea germination to allelopathic extracts from the different weed species, and also to find out the effect of different concentrations of the extracts on fresh and dry biomass of chickpea.

MATERIALS AND METHODS

Pot experiments were conducted at the Department of Weed Science, the University of Agriculture Peshawar, Pakistan. The experiments were laid out in a completely randomized design (CRD). *Cyperus rotundus* L. and *Sorghum halepense* L.were collected from research fields of the Research Farm of the university. Plants were cut from the base with the help of sickle. The collected samples were washed with tap water and then the weeds were kept in Micro oven (Wiseven Model-WOF-155) (S.No. WOF-155070615001) for 24 hours. The dried weed samples were ground with the help of grinder and than weighed. Two concentrations were made from each sample i.e. 150-200ml.Extracts were obtained by filtering the water through a muslin cloth.The chickpea variety used in experiment wasKarak-1. 10 seeds

of Chickpea were planted in Plastic pots with 12 cm height and 15 cm diameter filled with soil. When crop gained the maximum height, the data were then recorded on the parameters of fresh biomass and dry biomass.There were 5 treatments in the experiment which included*Cyperus rotundus* 150 g/lit, *Cyperus rotundus* 200 g/lit,*Sorghum halepense* 150 g/lit, *Sorghum halepense* 200 g/lit and control (untreated plot).

Data were recorded three times on germination percentage, fresh and dry biomasses, and plant height. The germination percentage was calculated by the formula,

$$\text{Germination \%} = \frac{\text{Germinated seed}}{\text{Total seeds}} \times 100$$

For fresh biomass, five plants were randomly selected from each pot and their fresh biomasses were taken with the help of electric balance and their average was calculated. Similarly, the selected samples were kept in oven for 24hours for drying. After 24hours their dry weight were taken with electric balance and their average was calculated.Before taking plant height data, the roots were cut from the samples. The height was taken in centimeters with the help of a measuring tape.

Statistical analysis

The data were recorded in both the experiments for each parameter and were individually subjected to ANOVA using MSTATC software package to establish differences among the treatment means and the significant means were then subjected to LSD test to decipher the differences among the treatment means (Steel and Torri, 1980).

RESULTS AND DISCUSSION

Germination (%)

The statistical analysis of variance revealed that weeds extracts showed positive allelopathic effects on germination of chickpea. The data in (Table-1) showed that maximum (100%) germination of chickpea was recorded in the pot assigned with *Cyprus rotundus* extract @ 150 g/liter fallowed by *Sorghum halepense* extract @ 150g/liter that gave 96.6% germination. The minimum germination (66.6%) was recorded in control. Our results are greatly at par with Oudhia (1999), he reported that allelopathic effects of *Datura stramonium* extracts produced positive effects on germination and seedling vigour of chickpea seeds. Our results are in line with the results of Kadioglue *et al.* (2005). They stated that *Glycyrrhiza glabra* L., *Sorghum halepense* L., and *Reseda lutea* L. extracts stimulated the germination of chickpea at rates of 95%, 94%, and 93%, respectively.

Fresh biomass

The statistical showed (Table-3) significant and positive effects on fresh biomass of chickpea. Maximum (2.39 g) fresh biomass was recorded in *Cyprus rotundus* @ 200 g L^{-1} while, the minimum (1.59 g) fresh biomass was recorded in control pot. However, more meaningful results could be obtained if plant allelopathy was studied under various environmental conditions.

Dry biomass (g)

The statistical analysis of variance in (Table-4) revealed that both the studied weed extracts significantly affected the dry biomass of the chickpea like all other parameters. The highest (0.57g) was recorded in *Sorghum halepense*@ 200 g L^{-1} while, the lower dry biomass (0.37 g) was noted in control. Most of the weed species have inhibitory effects on crops; yet, some weed species also exhibited stimulatory effects on the seed germination, fresh weight, dry weight and yield of crops (Narwal, 2004).

Plant height (cm)

The data in (Table-2) showed the effect of both weed extracts on plant height of chickpea. The statistical analysis showed non-significant effect of both weeds extract on the height of chickpea. However maximum (26.16 cm) plant height was recorded in *Sorghum halepense* @200 g/liter treated pot,followed by *Sorghum halepense* @ 150 g/liter that gave (26 cm) plant height while, the minimum (21.33) plant height was recorded in control pot. SimilarlyKhan et al. (2000) reported a non significant effect onplant height with the application of some weed extract and herbicides.

Table-1. Chickpea germination percentage, fresh biomass (g), dry biomass (g) and plant height (cm) against the weed species extract concentrations

Treatments	Germination (%)	Fresh biomass (g)	Dry biomass (g)	Plant height (cm)
Cyperus rotundus 150 g L^{-1}	100.0 a	1.96 ab	0.43 bc	24.60
Cyperus rotundus 200 g L^{-1}	86.6 b	2.39 a	0.52 ab	24.50
Sorghum halepense 150 g L^{-1}	96.6 a	2.32 a	0.54 ab	26.00
Sorghum halepense 200 g L^{-1}	90.0 a	2.38 a	0.57 a	26.16
Control (untreated)	66.6 c	1.59 b	0.37 c	21.33
$LSD_{0.05}$ for concentrations	10.992	0.59	0.11	NS

CONCLUSION

Differences were observed in different extracts. The extracts had a positive effect on chickpea crop and no adverse effects were found. The allelopathic extracts of *Cyperus rotundus* and *Sorghum*

halepense were effective in influencing the agronomic parameters of chickpea crop. Therefore,this weed control method being environmental friendly is recommended for the farmers. Further study is also suggested to confirm these findings in all chickpea growing areas.

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