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SUPPRESSING EFFECTS OF *Eucalyptus camaldulensis* L. ON GERMINATION AND SEEDLING GROWTH OF SIX WEEDS

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ABSTRACT

The suppressing effect of aqueous extract of Eucalyptus camaldulensis L. was investigated at the Department of Agronomy, Gomal University, Dera Ismail Khan, Pakistan during 2003, by its application to different weed species viz. field bindweed (Convolvulus arvensis L.), barley (Hordeum vulgare L.), London rocket (Sisymbrium irio L.), wild safflower (Carthamus oxycantha M.B.), wild oat (Avena fatua L.) and common lambsquarters (Chenopodium album L.). Five ml of aqueous extract of leaves was applied with an interval of 3 days to each treatment except control. The data showed significantly lower fresh and dry weight of each tested weed as compared to water applied treatment (control). Germination of weeds was adversely affected and count of normal seedlings also was significantly lower than control due to suppressing effect of extract. These results suggest that aqueous extract of Eucalyptus could be used as biological suppressant for weed control.

Key words: Suppressing effect, *Eucalyptus* extract, weeds.

INTRODUCTION

Global concerns about herbicidal and pesticidal use, their residues in soil and plant systems as well as their hazardous effect on ecology and environment have diverted the attention of plant scientists to find eco-friendly approach to plant protection against weeds, diseases and insects. The world is still in search of and in the process of developing farming techniques, which are sustainable for environment, crop production as well as from the socio-economic point of view. Integrated weed management is one of such approaches where allelopathy can play its eco-friendly role in weed management. (Hussain *et al*.,2007).

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Allelopahty as defined by the international Allelopathy Society is "any process involving secondary metabolites produced by plants, algae, bacteria and fungi that influence the growth and development of agricultural and biological system" (Anonymous, 1996). The phenomenon though existing in nature since centuries has drawn special attention over couple of decades. In Pakistan, weeds inflict 20-30% losses in different crops on the average (Anonymous, 2005).

Forest trees produce allelo-chemicals that affect the growth of other crops and weeds growing near to it. *Eucalyptus camaldulensis* L. belongs to the family Myrtaceae. It is a large perennial woody tree, having distinctive glaucous hue, symmetrical growth having amenity value. It can be grown from tropical to temperate zone. It s widely distributed in open forests of Australia, Tasmania, Southern Victoria and New South Wales. Essential oil produced by *Eucalyptus* sp., and its leaves has shown allelopathic activity. It is one of the quickest growing species with roots having shallow penetrating habit (Inoue *et al*., 2001).

Putnam (1984) reported that *Eucalyptus* species released volatile compounds such as benzoic, cinnamic and phenolic acids, which inhibit growth of crops and weeds growing near to it. Bisal *et al.* (1992) reported that *Eucalyptus* has harmful effects on germination and seedling growth of wheat, barley, lentil, chickpea, mustard and many weeds. Schumann *et al*. (1995) reported that water extracts of *Eucalyptus grandis* significantly reduced weed establishment.

Allelochemical compounds had injurious effect on the growth and development of crop plants. Allelochemicals released either from leaves, stem, bark of living or dead trees or plants can be classified into terpenes, glucocides, coumanines, aldehyds and phenolic compounds. The leaves of *Eucalyptus* are main releasing source of toxic compounds. The volatile compounds are also considered a threat to the environment (Alam and Islam, 2002). The *E. camaldulensis* L. has been planted in the command area of Chashma Right Bank Canal, Dera Ismail Khan, NWFP, Pakistan. The tree is considered of having allelochemicals and volatile compounds in its all parts. These chemicals have harmful effects on the crops in the ecosystem resulting in the reduction and delaying of germination, mortality of seedling and reduction in growth and yield (Ghafar *et al*., 2000).

The concept of using allelochemical crop extracts for controlling weeds was first given by Putnam (1984). He found that *Eucalyptus* species residues reduced normal weed population by 60 to 95%.

Nowadays there is much emphasis on search for new methods of weed control which are safe, harmless, less expensive and use farm produced material. Allelopathy has emerged as an important area of weed research and has been accepted very recently as an important ecological phenomena. This study was, therefore, undertaken to determine the harmful effects of *E. camuldulensis* L. on weeds under the laboratory conditions at Faculty of Agriculture, Gomal University, Dera Ismail Khan, NWFP. Pakistan.

MATERIALS AND METHODS

An experiment was conducted to determine the allelopathic effect of aqueous extracts of *E. camaldulensis* L. on some of the growth parameters of some weeds of wheat in the laboratory of the Department of Agronomy, Faculty of Agriculture, Gomal University, Dera Ismail Khan during 2003. The weeds studied were field bindweed (*Convolvulus arvensis* L.), barley (*Hordeum vulgare* L.), wild safflower (*Carthamus oxycantha* M.B.), wild oat (*Avena fatua* L.) common lambsquarters (*Chenopodium album* L.) and London rocket (*Sisymbrium irio* L.) The leaves extracts were made according to the following protocol:

Fresh mature leaves of *E.camaldulensis* were collected, washed with water and dried in the sun for two days, then samples were dried in oven at 78^0C for 48 hours. After grinding of dried leaves, 20% (w/v) leaves: water extract was prepared by soaking the ground material of leaves in distilled water for 72 hours. The extract was filtered through whatman No.1 filter paper. 50 seeds were placed on germination paper in petri dishes. Five ml aqueous extract of *Eucalyptus* leaves was applied with an interval of three days to each treatment except the control where only water was applied. The petri dishes where only distilled water was applied were treated as control. The sets were placed at $25C^0$ for 15 days. Treatments were replicated four times in Completely Randomized design. Germination %, normal seedling counts, fresh weight (g), and dry weight (g) were determined for each treatment. The data for individual parameters were analyzed and the significant means were separated using Fisher's protected significant difference test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Germination (%)

Eucalyptus extract significantly decreased the weeds germination as compared to water application (Table-1). The lowest

germination (%) was registered in the field bindweed (7.5), while the maximum seed germination was recorded in wild safflower (42%). The lowest ranking in the field bindweed was however shared by all the species tested except wild safflower. The germination in the *Eucalyptus* extract ranged between 7.5% to 42% as compared to 33% to 72.5% in the control. The highest reduction (40.5%) in the seed germination of field bindweed could be due to sensitivity of its embryo towards allelo-chemicals. The results validate the findings of Ebrahim *et al.* (1999), Khan *et al.* (1999) and Khan *et al*. (2007) who reported that leaf extract of *Eucalyptus camaldulensis* L. and *Eucalyptus microthecia* L. delayed and inhibited germination of maize.

Normal seedlings

Normal seedlings are those which produce proper root and shoot from embryo. Wild safflower produced maximum number of normal seedlings which showed its less sensitivity towards allelochemicals while wild mustard was most sensitive to allelochemicals (Table-1). It is clear from data that *Eucalyptus* extract affected the formation of root from radical and shoot from the plumule. Yamane *et al*. (1992) reported that all the basic plant processes such as hormonal balance, protein synthesis, respiration, photosynthesis, chlorophyll formation, permeability and plant water relations may be disturbed by allelopathy. Similarly Blake (1985) reported the inhibitory effect of *Eucalpytus* on the growth of its associated species by reducing their germination, photosynthesis and yield.

Fresh weight (g)

The data on fresh weight given in Table-2 revealed that all weeds have significantly lower fresh weight influenced by *Eucalyptus* extract than water. Maximum fresh weight was recorded in wild safflower while, minimum fresh weight was recorded in the London rocket. *Eucalyptus* extract reduced fresh weight (4.71g) as compared to water (9.81 g). The difference in fresh weight between *Eucalyptus* extract and water ranged from 2.99 to 7.51g. The maximum decrease in fresh weight of wild safflower by *Eucalyptus* extract may be due to allelopathic effect. Wild sunflower produced significantly more fresh weight than other weeds except wild barlay. Similar findings were reported by Sanginga and Swift (1992), Lisanework and Michelson (1993) and Khan *et al*. (1999), who found that *Eucalyptus* extract reduces the fresh weight of maize seedlings.

Table-1. Effect of aqueous extract of *Eucalyptus* on germination % and normal seedlings %.

Treat.	Field bindweed		Barley		Wild safflower		Wild oat		Common lambsquarters		London rocket	
	Germ. %	Normal Seedling	Germ. %	Normal Seedling	Germ. %	Normal Seedling	Germ. %	Normal Seedling	Germ. %	Normal Seedling	Germ. %	Normal Seedling
Extract	07.5e	02.25d	17.0de	06.00cd	42.0b-d	12.25bcd	08.5e	03.25cd	11.5e	03.00cd	14.5e	01.75d
Water	58.0abc	13.5bcd	62.0ab	21.50ab	65.0ab	27.50a	62.5ab	14.75bc	33.0cde	11.75bcd	72.5a	14.75bc
Mean	32.75bc	07.87b	39.5ab	13.75ab	53.75a	19.88a	35.5bc	09.00b	22.5c	07.38b	43.5ab	08.25b

Means sharing a common letter in the respective column are not significantly different by L.S.D test at P≤0.01.
Treat. = Treatments, Germ. % = Germination %

Table-2. Effect of aqueous extract of *Eucalyptus* on Fresh weight (g) and Dry Weight (g).

Treat.	Field bindweed		Barley		Wild safflower		Wild oat		Common lambsquarters		London rocket	
	Fresh wt (g)	Dry wt (g)	Fresh wt (g)	Dry wt (g)	Fresh wt (g)	Dry wt (g)	Fresh wt (g)	Dry wt (g)	Fresh wt (g)	Dry wt (g)	Fresh wt (g)	Dry wt (g)
Extract	04.04de	0.35	05.66d	0.42	04.79de	0.56	5.66d	0.32	4.41de	0.43	3.67e	0.31
Water	10.50b	0.94	11.20ab	0.74	12.30a	1.30	9.42b	0.56	8.73c	0.80	6.70c	0.43
Mean	07.29b	0.65ab	08.40a	0.59b	08.55a	0.93a	7.54b	0.44bc	6.57bc	0.62ab	5.17c	0.37c

Means sharing a common letter in the respective column are not significantly different by L.S.D test at p≤0.01.

Dry weight (g)

Table-2 revealed that *Eucalyptus* extract reduced the dry weight of weeds as compared to the water applied treatment. Different weeds have differences among themselves regarding the dry weight. However, wild sunflower produced maximum dry weight. Differences in dry weight of seedlings grown in *Eucalyptus* extract and water applied treatments ranged 0.12 to 0.74g. These results corroborate to those of Sanginga and Swift (1992) and Khan *et al.* (1999) who reported reduction in dry weight of plants by *Eucalyptus* extract application.

CONCLUSIONS

It can be concluded from the results that allelochemicals present in the aqueous extract of *Eucalyptus* suppressed all the parameters studied in the species studied. Use of *Eucalyptus* as allelopathic agent will be eco-friendly, cheaper and effective mode of weed control. Further studies are suggested to encompass reactive ingredient of *Eucalyptus* to understand the different behavior and plant responses to their application.

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