Research Paper

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Impact of Different Plant Parts of *Eucalyptus alba* L. upon Germination and Growth parameters of *Trifolium alexandrinum* L. (In vitro and In vivo Conditions)

Agriculture

KEYWORDS : Allelopathic effect, Germination, Eucalyptus alba L., Trifolium alexandrinum L.

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ABSTRACT

Present study was carried out to study the allelopathic effect of aerial and underground parts of Eucalyptus alba L. on germination and early growth seedling of Berseem (Trifolium alexandrinum L.) in vitro and in vivo conditions. Different plant parts viz., leaf, bark, flower, root extracts were used to run the experiment under laboratory and pots respectively. Maximum germination was observed in all the extracts of plant parts over control whereas, maximum shoot length and root lengths were observed at 25% concentration of leaf and flower extract and 100% concentration of bark and root extract of Eucalyptus respectively. In case of in vivo conditions maximum germination, shoot length and root length was observed in 25%, 50% concentrations respectively in all the extracts as compared to control. Germination and early seedling growth of four extracts were reduced significantly. The relative responses of different extracts were Foliar>Root> Flower> Bark subsequently.

INTRODUCTION- Allelopathy is an interference mechanism, in which live or dead plant materials release chemical substances, and also inhibit or stimulate the associated plant growth [1], [2]. In nature plants have to face various stresses (biotic and abiotic). The inhibition of one plant by another through the release of allelochemicals is well known [3], [4]. Higher concentrations had negative effects on mean rate of germination; plumule length and seedling dry weight [5], [6] and decrease in seed germination simultaneously with mitotic index of roots *Allium cepa* by *Shorea robusta* leachate [7]. Aqueous extract of some plants inhibit seedling growth [8], root and shoot growth, [7], germination [9], and induce mortality of plants [10]. The allelopathic effects of eucalyptus have been studied extensively [11], [12], [13], [14], [15]. Phenolic acids and volatile oils released from the leaves, bark and roots of certain Eucalyptus spp. have deleterious effects on other plant species [13], [16]. The allelopathic effect of *Eucalyptus camandulensis* on species of Trifolium, Onobrychis, Festuca, Vicia indicated reduced significantly by increase of extract concentrations so indicated more sensitive to alleopathic effect of *E. cmandulensis* [17]. In present paper we studied the effect of Eucalyptus plant parts (leaf, root, flower, bark) on Berseem (*Trifolium alexandrinum* L.). Our ultimate goal is to develop suitable strategies establishment of mixed stands of native species and Eucalyptus.

METHODOLOGY-

Collection of samples and preparation of extracts: - Fresh samples (leaf, bark, flower, and root) of *E. alba* and Berseem were collected from the nearby site of D. E. I., Agra. The collected samples were allowed it to dry at room temperature 27°C. Powdered form was used of the eucalyptus. Then added distilled water in the ratio 1:10 (Plant material: Water) and aqueous extract was further filtered. Four different parts (leaf, bark, flower, root) of *E. alba* L. and five concentrations (Conc.) of each plant part extract [0 (control), 25, 50, 75, 100 g/L] was combined in factorial arrangement respectively.

IN VITRO* and *IN VIVO

The petridishes containing seeds of Berseem were daily treated with 1 ml conc. of extracts of Eucalyptus. Then the germination of seeds, root length and shoot length was recorded at regular intervals i.e., 5, 10, 15 days after soaking (DAS) *in-vitro*. The treatment made by distilled water only served as control.

$$\text{Germination percentage (\%)} = \frac{\text{Number of seed germination (N)}}{\text{Total number of seeds (T)}} \times 100$$

20 seeds of fodder crop Berseem were soaked in each conc. of extract for 24 hours. The soaked seeds was transferred in pots filled with soil. 25 ml of extract was pouring in pots at the day of seeds transfer and 5 ml of extract were sprayed on germination of seeds, root length, shoot length were recorded frequently. The changes occurred in *Trifolium alexandrinum* L. seedlings due to the allelopathic response of Eucalyptus (5th, 10th, 15th DAS) were observed respectively.

RESULTS AND DISCUSSION -

TABLE 1- GERMINATION PERCENTAGE, SHOOT LENGTH, ROOT LENGTH OF* TRIFOLIUM *ALEXANDRINUM L. SEEDS IN LEAF, BARK, FLOWER, ROOT EXTRACT OF* EUCALYPTUS ALBA *L. IN VITRO CONDITION.

Extract Concentration	Root Extract			Leaf Extract			Bark Extract			Flower Extract		
	Germination Percentage (%)	Shoot Length (cm) Mean±SD	Root Length (cm) Mean±SD	Germination Percentage (%)	Shoot Length (cm) Mean±SD	Root Length (cm) Mean±SD	Germination Percentage (%)	Shoot Length (cm) Mean±SD	Root Length (cm) Mean± SD	Germination Percentage (%)	Shoot Length (cm) Mean±SD	Root Length (cm) Mean±SD
25%	90	14.4±1.70	7.2±.9	90	20.1±3.36	8.1±1.76	90	18.1±1.60	4.2±.36	90	20±4.21	8.1±1.73
50%	90	16.0±1.00	7.8±.62	90	17.6±2.16	8.0±1.27	90	18.4±.52	5.4±1.0	90	18±4.22	8±1.73
75%	90	19.7±4.44	8.0±1.31	90	15.8±1.02	7.16±1.66	90	19.7±.64	6.3±.41	90	16±3.21	7±2
100%	90	22.5±4.80	8.1±1.85	90	14.5±.86	6±1.00	90	20.8±.76	6.4±2.19	90	15±2.66	6.5±2.17
0% (Control)	80	12±1.80	4.16±.35	80	12±1.80	4.16±.35	80	12±1.80	4.16±.35	80	12±1.80	4.16±.35

In Table 1 states about germination percentage, shoot and root length of *Trifolium alexandrinum* L. seeds soaked in different parts of *Eucalyptus alba* L.

The results in table 1 shows seeds germination of Berseem (*Trifolium alexandrinum* L.) seedling. Berseem treated with *E. alba* extracts (leaf, bark, flower, root) at the conc. (25%, 50%, 75%, 100%) as compared with distilled water (control), Germination % of the Berseem with Eucalyptus extracts showed 90% germination in all the concentrations. As compared with distilled water (control), germination percentage of the Berseem effect with *Eucalyptus alba* extracts showing 80% germination of Berseem seeds.

Table 1 shows that leaf extract significantly increases shoot growth 20.1± 3.36 while control had the lowest (12±1.80) shoot length. Maximum (Max.) root lengths were found in 8.1±1.85 in case of root extract and minimum (Min.) was observed in bark extracts 6.4±2.19.

TABLE 2- GERMINATION PERCENTAGE, SHOOT LENGTH, ROOT LENGTH OF *TRIFOLIUM ALEXANDRINUM* L. SEEDS IN LEAF, BARK, FLOWER, ROOT EXTRACT OF *EUCALYPTUS ALBA* L. IN VIVO CONDITION.

Extract Concentration	Root Extract			Leaf Extract			Bark Extract			Flower Extract		
	Germination Percentage (%)	Shoot Length (cm)	Root Length (cm)	Germination Percentage (%)	Shoot Length (cm)	Root Length (cm)	Germination Percentage (%)	Shoot Length (cm)	Root Length (cm)	Germination Percentage (%)	Shoot Length (cm)	Root Length (cm)
		Mean±SD	Mean±SD		Mean±SD	Mean±SD		Mean±SD	Mean±SD		Mean±SD	Mean±SD
25%	100	41.5±3.16	14± 1	100	48.2±4.47	10.2±1.53	70	25±2.59	12.2±1.36	80	30.0±4.32	15.03±.77
50%	100	26.1±3.32	12.2±.75	80	33.6±4.36	8.3±1.44	70	22.6±2.46	11.1±1.20	80	27.1±1.75	12.6±1.52
75%	90	17.6±2.75	8.7±.96	80	33.5±2.64	7.23±1.55	60	19.3±2.75	9.4±1.1	70	24.1±3.40	10.7±1.16
100%	70	16.2±2.12	7.2±.66	60	22.1±2.40	6.16±1.04	50	10.5±2.17	5.4±.51	60	11.8±1.44	6.16±.76
0% (Control)	50	10.66±1.75	6.16±1.04	50	10.66±1.75	6.16±1.04	50	10.66±1.75	6.16±1.04	50	10.66±1.75	6.16±1.04

In case of vivo condition the germination of percentage was found min. in case of control (50%) and max. was observed in 25% conc. in leaf extract (100%) and 25% and 50% conc. of flower, bark, root extracts. Max. and min. shoot length in 25% conc. and in 100% conc. as same as in case of root length the max. mean values and SD value was observed in 25% conc. and min. in 100% conc. in case of root extract of *Eucalyptus alba* L. In case of leaf extract the max. shoot length and root length found in 25% conc. Bark extract showed max. shoot length and root length in 25% conc. and min. observed in 100% conc. In case of flower extract, max. shoot length and root length mean values and SD values was observed in 25% conc.

In vivo condition the min. germination of percentage was found min. at 50% in control and max. Percentage was at 25% at 100% conc. in case of leaf extract. In table 2 shows that leaf extract significantly increase shoot length 48.2±4.47 while min. in bark extract 25±2.59. Max. root length was observed in root extract of Eucalyptus (14±1) as compared to control.

The results of present study were similar to those of [18], [15], [19] that studied allelopathic effects of *E. globulus* leaf extract on germination and seedling growth of some vegetable and crop plants. Similar results were obtained in tomato by [20], in wheat by [21] and in cucumber by [22] through leaf extract of various Eucalyptus species.

CONCLUSION- It can be concluded that various solvent extracts of leaves of *E. alba* had allelopathic effects on germination and seedling growth of Berseem (*Trifolium alexandrinum* L.). It can thus be concluded that 25%, 50%, 75% and 100% conc. of different extract of Eucalyptus have almost same effect on germination percentage of Berseem. All extracts root extract and leaf extract were most effective on shoot length of Berseem as compared to other extracts. But in case of root length of Berseem, all extract have equal effect by root extract of Eucalyptus while by leaf extract it was change increasingly by increasing conc. Maximum shoot elongation was observed (22.5±4.80) in 100% conc. of root extract *of Eucalyptus alba* L. while shoot elongation was observed (48.9±4.47) in 100% conc. of leaf extract of *Eucalyptus alba* L. Extracts of different parts (Leaf, bark, Flower, Root) of *E. alba* are beneficial in Agricultural practices/aspects.

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