Karnataka J. Agril. Sci., 13(4):(947-951) 2000

Allelopathic Effect of *Eucalyptus* Plant Extracts on Germination and Seedling Growth of Cucumber *

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(Received : April, 1999)

Abstract : *In vivo* studies were conducted to assess the allelopathic effects of *eucalyptus* leaf, bark and root extracts at different concentration gradients (1.0 to 10.0%) on the germination and seedling growth of cucumber germination and seedling growth were severely affected by leaf extract than those of bark and root. Germination percentage and seedling growth were severely hampered as concentration gradient increased from 1.0 to 10.0 per cent. The interaction effect of leaf extract at 10 per cent concentration resulted in the lowest germination percentage and poor seedling growth.

Introduction

Allelopathic studies have assumed greater significance in recent years in view of growing awareness about agroforestry and other tree based land use systems, where in woody perennials and herbs are grown on same piece of land to increase the productivity of land on sustainable basis. Allelopathic effects of eucalyptus have always been considered as one of the main factors for poor performance of associated companion crops (del Moral and Mullar, 1970 and Bhaskar and Dasappa, 1988) under agroforestry ; basides other limiting factors such as moisture, nutrient and light stress. In order to design and develop suitable tree management practices in agroforestry system for optimization of yield, it is essential to know which part of eucalypthus plant has greater allelopathic influence on growth and development of associated crops. Hence, different sources of plant extracts from leaf, bark and roots have been taken into consideration for studying allelopathic influences so that management practices can be standardized. For instance, if leaf appears to be major source of allelopathy, then canopy can be managed so that litter deposition can be minimised, thus allelopathic effects of tree species on crop plants under agroforestry can be reduced.

Material and Methods

The experiment was conducted in laboratory during 1998, consisting of different sources (leaf, bark and root) and concentration (1.0, 2.5, 5.0 and 10.0 per cent), replicated thrice. The leaf, bark and root samples collected from eucalyptus grown in agroforestry plantation were collected and washed with tap water to remove the dirt. Samples were first air dried for 2-3 days and then completely dried in hot air oven at 70°C for 48 hr. The dried leaves, bark and root samples were ground to get fine powder. To prepare aqueous extract of different concentration, 10.00, 25.00, 50.00 and 100.00g powder from leaf, bark and root was soaked in 1000 ml distilled water for 5 days. The leachates were filtered to get solution of 1.0, 2.5, 5.0 and 10.0 per cent concentration.

Cucumber seeds of uniform colour and size were surface sterilized with 0.03% formalin

*Part of Ph.D. thesis submitted by the senior author to the University of Agricultural Sciences, Dharwad - 580 005

solutions for one hour and then thoroughly washed with tap water followed by distilled water. The sterilized seeds were then placed on germination paper which was moistened with leachates of different concentrations according to the treatment requirement. Besides plant extract, seeds were also treated with distilled water alone as control. Seed germination test was conducted by following standard procedure (Anon., 1985). In order to measure the seedling vigour in different treatments, 10 normal seedlings from standard germination test were randomly selected on seventh day and their root and shoot length was measured (Abdulbaki and Anderson, 1973).

Results and Discussion

Significant differences were observed with respect to germination per cent and seedling growth of cucumber in response to different source of extracts, concentrations and their interaction effects.

The highest germination percentage (94.60%), shoot (9.46 cm) and root (10.50 cm) length were observed in cucumber when it was treated with only distilled water (control) and which was significantly superior to any other treatments or their interactions (Table 1).

Significantly the lowest germination percentage (50.20%), shoot (7.04 cm) and root (6.51 cm) length were observed in cucumber due to leaf extract of eucalyptus when compared to bark and root. Though the effects of bark and root extracts were less harmful then leaf extract, still their allelopathic effects cannot be ruled out entirely. The stronger effect of leaf extract of eucalyptus on germination of cucumber could be the result of higher concentration of allelopathic substances in the leaves. Inhibitory compounds such as essential volatilized oils have been identified and isolated from the leaves of eucalyptus (del Morel and Muller, 1969 ; 1970 ; Singh *et al.*, 1991). Reduced germination due to leaf extract of eucalyptus may be attributed to the release of toxic substance from the leaves. These toxic substances as such called allelochemicals, will impart inhibitory effect on cell division and elongation. Many workers have reported and adverse effect of aqueous extract of eucalyptus on seed germination (Bisla *et al.*, 1992 ; Padhy *et al.*, 1992 and Singh *et al.*, 1992).

Germination percentage and seedling growth varied due to concentration gradient and maximum being 94.60 per cent in control and which was significantly superior over different concentration gradient. The lowest percentage of germination (41.0%) and shoot (6.95 cm) and root (7.12 cm) length was observed due to 10 per cent extract concentration (Table 1). The linear decrease in per cent germination and seedling growth was observed due to increased concentration. Negative allelopathic effects of eucalyptus on shoot and root length in different crops have been reported by many workers (Harper, 1977 ; Sexena and Singh, 1978). The harmful effect of higher concentration on growth parameter might be due to development of weaker seedlings as manifested in the lowest root and shoot length. Positive correlation was observed between increase in leachate concentration and inhibition of germination on different crops. (Bisla *et al.*, 1992 in wheat ; mustard and berley ; Bahadur *et al.*, 1994 in mustard ; Puri, (1992) in *phaseolus* ; Padhy, (1992 in finger millet). The harmful effect of higher extract concentration on growth

Table 1. Allelopathic effects of eucalyptus (*Eucalyptus terticornis*) on seed germination and seedling growth of cucumber

Concentration (C) (%)	Germination (%)				Shoot length (cm)				Root length (cm)			
	Source				Source				Source			
	(S_1)	(S_2)	(S_3)	(S_4)	(S_1)	(S_2)	(S_3)	(S_4)	(S_1)	(S_2)	(S_3)	(S_4)
1.0 (C_1)	53.56 (64.70)	54.94 (67.00)	61.80 (77.70)	56.77 (69.90)	8.23	10.16	10.16	9.52	9.26	8.10	9.76	9.04
2.5 (C_2)	47.48 (54.38)	55.55 (68.00)	61.35 (77.00)	54.79 (66.70)	7.73	9.76	9.20	8.90	5.70	10.00	9.60	8.43
5.0 (C_3)	44.81 (49.70)	53.73 (65.00)	50.77 (60.00)	49.77 (58.30)	6.40	8.96	8.63	8.00	5.93	7.70	7.93	7.18
10.0 (C_4)	34.65 (32.30)	47.87 (35.00)	36.86 (36.00)	39.80 (41.00)	5.80	8.46	6.60	6.95	5.16	8.33	7.86	7.12
Mean	45.13 (50.20)	53.02 (63.80)	52.60 (63.10)		7.04	9.34	8.65		6.51	8.53	8.79	
Uneven control				76.66 (94.60)				9.46				10.80
	S.Em±		C.D.(0.05%)		S.Em±		C.D.(0.05%)		S.Em±		C.D.(0.05%)	
Source	0.298		0.875						0.207		0.608	
Concentration	0.345		1.011						0.239		0.702	
S x C	0.597		0.597						0.415		1.216	

S_1 = Eucalyptus leaf extract S_2 = Eucalyptus bark extract S_3 = Eucalyptus root extract

Figures in parantheses are per cent values.

parameters might be due to increased concentration on growth parameters might be due to increased concentration of allelochemicals which inhibit gibberellin and IAA induced growth (Nandal *et al.*, 1992).

The interaction effects of source and concentration proved to be highly significant. Per cent germination (32.30%) and seedling growth as manifested in shoot (5.80 cm) and root (5.16 cm) length in cucumber was severely hampered by leaf extract of eucalyptus when used at higher concentration of 10 per cent. Bark and root extract at lower concentration did not affect the germination per cent and seedling growth, but magnitude of their detrimental effect was more at higher concentration (Table 1).

Leaf extract of eucalyptus proved to be most detrimental on the germination and seedling growth than the bark and root. In view of this fact, tree management practices like felling or branch pruning at standard interval of years may be advocated in eucalyptus if it is to be included in agroforestry land use system. Tree felling not only helps to reduce deposition of litter but also provide wood resources for agricultural implement, staking in vegetables or fuel. After felling, coppiced shoot and stump will act as hedge row to prevent soil erosion and alleys may beutilized for vegetable crops in areas where conservation of land and soil resources through agroforestry is the main purpose of tree planting, eucalyptus hedge may be maintained for the purpose.

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