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RE-EXAMINATION OF ALLELOPATHIC POTENTIAL OF *LANTANA CAMARA* L.

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Allelopathic effects of *Lantana* foliar leachates on water-hyacinth (*Eichhornia crassipes* (Mart.) Solms) growth, and wheat (*Triticum vulgare*) percentage germination as well as its seedling growth were investigated. Adverse effects on wheat germination were nil. Dry weights of water-hyacinth plants as well as of wheat seedlings were similarly greater, about 10-15% and 25-55% in *Lantana* leachates than that of control plants growing, respectively in the tap water and garden soil.

Key Words : Allelopathy, *Lantana camara, Eichhornia crassipes, Triticum vulgare.*

Lantana camara is an exotic obnoxious terrestrial weed, particularly in the hilly areas of the Himalayan ranges. Several reports suggest it to be allelopathic to the crop plants as well as to natural vegetation (Wadhwani and Bhardwaj, 1981; Achhireddy & Singh 1984; Achhireddy *et al.*, 1985; Mersle and Singh, 1987; Singh & Achhireddy, 1987 and Jain *et al.*, 1989). Recently Saxena (1991) also reported allelopathic effects of *Lantana* on another obnoxious exotic aquatic weed, the *Eichhornia crassipes* which occurs commonly in the ponds, lakes and waterways of our country (Gopal, 1990). *Eichhornia*, being a problem of international magnitude (Gopal, 1987), has drawn attention of scientists of world over. Saxena's (1991) report encouraged us to conduct field trials of *Lantana* foliar leachates for controlling water-hyacinth in a pond near Mansagar reservoir. Surprisingly, we did not observe water-hyacinth death. This led us to made a series of experiments. Effects of *Lantana* foliar leachates on water-hyacinth growth, and wheat seed germination together with its seedling growth are described in this communication.

MATERIALS AND METHODS

Aerial branches of *Lantana* were collected from the Botanical garden, University of Rajasthan, Jaipur, and *Eichhornia* plants from downstream of Mansagar reservoir, formerly known as Jalmahal. Leachates of 0.5, 1.0, 2.0 and 3.0% concentrations (W/V) of *Lantana* leaf were prepared after soaking a known weight of fresh leaves in 1.5 l of tap water filled in each of the 3 l sized earthen pots. Leaves were removed from these pots ater 48h of soaking. Contrl sets were filled in with tap water only. Five replicates were prepared for each concentration and the control. Two sets of pots having *Lantana* leachates and tap water (control) were prepared. Nutrients were not added in the pots of one set while concentrate solutions of KNO_3 and KH_2PO_4 were added in each pot of second set to raise nitrate and phosphorus levels in the water to 50 ppm and 5 ppm, respectively. One waterhyacinth plant was added in each pot of first set on 15th January, 1993, and in the pots of second set on 20th January, 1993. Initial average dry weights of water-hyacinth plant used in the first and second set pots were 350 mg and 650 mg respectively. Water level in each pot was maintained daily with dechlorinated tap water. Water-hyacinth plants were harvested after 21 days of growth. Their offshoots were counted. The plants of a pot were then dried to constant weight in a hot air oven at 80°C, and weighed. pH and electrical conductivity of leachates and tap water (control) were measured in the beginning as well at time of final harvest with Eliaco pH meter (Model L-15) and conductivity meter (EI, Model 611-E).

In another series of experiments, both germination and growth of wheat seadling's were studied in *Lantana* foliar leachates. 10 seeds were placed in a petridish on blotting paper moistened from below by cotton pad on 4th Feb. 1994. Petridishes were kept in diffuse light in the laboratory at room temperature (24.1±3.7°C). *Lantana* leachates of 0.5, 1.0, 2.0 and 3.0% concentrations were prepared after 24 and 48 h of soaking as before. Extract of aforesaid concentrations of decomposing *Lantana* leaf was also prepared after filtering

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Table 1: 1 Physico-chemical characteristics of *Lantana* leachates and tap water (control) without (X) and with (Y) nutrients in the beginning (A) and in the end of the study (B).

Concen-tration		Colour		pH		Conductivity (mmho/cm)	
		X	Y	X	Y	X	Y
Control	A	Colourless	Colourless	7.0	7.0	0.45	0.72
	B	Colourless	Colourless	7.0	7.5	0.60	0.62
0.5%	A	Pale Yellow	Light yellow	6.4	7.1	0.65	0.78
	B	Pale Yellow	Light yellow	8.0	7.7	0.65	0.74
1%	A	Dark Yellow	Yellow	6.1	7.2	0.67	0.81
	B	Dark Yellow	Yellow	7.5	7.8	0.71	0.84
2%	A	Brownish Yellow	Dark Yellow	6.6	7.4	0.79	1.36
	B	Reddish	Dark Yellow	7.8	7.9	0.84	0.82
3%	A	Red	Red	6.5	7.5	1.00	1.46
	B	Red	Red	7.7	7.7	0.94	0.99

Table 2: Dry weight (mg) of water-hyacinth plants (A) and offshoot number (B) in *Lantana* leachates and tap water (control)

Concentration		Leachates and tap water (control): Without nutrients	Leachates and tap water (control): with nutrients
Control	A	640.2 ±116.0	1002.4 ± 160.4
	B	0.8 ± 0.8	2.0 ± 1.6
0.5%	A	651.6 ± 42.6	989.3 ± 213.3
	B	0.8 ± 0.8	1.8 ± 0.4
1.0%	A	614.3 ±146.5	1140.6 ± 287.9
	B	1.0 ± 1.0	2.0 ± 1.2
2.0%	A	727.6 ±126.3	1023.3 ± 190.2
	B	1.4 ± 0.9	1.6 ± 0.5
3.0%	A	697.9 ±256.0	1611.7 ± 365.6
	B	0.6 ± 0.5	1.8 ± 1.1

± - S.D

Table 3: Analysis of variance for waterhyacinth dry weight.

Source of variation	Degree of freedom	Sum of Square	Mean sum of square	Variance ratio 'F'
(A) Leachates without nutrients				
Among replicates	4	81226.2	20306.55	0.8545
Concentration	4	42349.8	10587.45	0.4455
Control Vs Treatment	1	4395.65	4395.65	0.1850
Error	16	380201.75	23762.6	
(B) Leachates with nutrients.				
Among replicates	4	106476.6	26619.1	0.41
Concentration	4	1384431.0	346107.7	5.32
Control Vs Teatment	1	149691.6	149691.6	2.30
Error	16	1040167.8	65010.5	

* Significant at 5% probability

water soaked *Lantana* leaf decomposed for 168 h. These were used to mosit cotton pad. However, distill water was used in the control set. Effects of decomposing *Lantana* leaf extract on wheat seedlings growth were also studied in fifty 0.51 sized plastic troughs filled with the garden soil. 10 pots each were irrigated separately with nutrients enriched *Lantana* leaf extract of 0.5, 1.0, 2.0 and 3.0% concentrations, and control sets with the tap water supplemented with nutrients similar to previous study. 20 seeds were sown in each pot. These were covered with wire mesh cages to protect from the birds, and watered daily in the morning with tap water. Two harvests, respectively after 11 and 18 days of seedling's growth were made. At each harvest, 5 pots belonging to each concentration, and also of control were harvested separately. Shoot height and root length of the seedling growing the best in a pot were measured as there was wide scattering in wheat seed germination in both control and *Lantana* leaf extract. These were then dried separately in groups of three each, and weighed as described before. Average shoot dry weight was then calculated. The data was subjected to relevant statistical analysis.

Physico-Chemical Characteristics of Thelantana Leachates and Tap Water

Lantana leachates were colored, varying from yellow to reddish yellow (Table 1). pH of the nutrient deficient leachates was slightly acidic in the beginning, but changed to alkaline in the end of study (Table 1). It is due to the fact that water-hyacinth is known to change pH of medium to slightly alkaline after it invades any aquatic system (See, Gopal, 1987). pH of the nutrient enriched leachates was, however, alkaline throughout

Table 4: Shoot (A) & root (B) length (cm) of wheat seedlings including their dry weight (C, mg) in soils irrigated with decomposing *Lantana* leaf extracts and tap water (control).

Concentration		Ist harvest	IInd harvest
Control	A	12.2 ± 1.5	20.4 ± 3.2
	B	9.9 ± 2.9	18.8 ± 3.3
	C	33.1 ± 5.0	47.9 ± 4.0
0.5%	A	13.1 ± 1.2	21.9 ± 3.0
	B	13.5 ± 2.8	17.9 ± 3.0
	C	37.9 ± 8.0	50.7 ± 7.0
1.0%	A	12.1 ± 1.1	21.4 ± 3.0
	B	9.7 ± 2.2	21.2 ± 2.6
	C	39.7 ±10.0	61.4 ±25.0
2.0%	A	11.8 ± 1.9	21.8 ± 1.8
	B	9.8 ± 2.1	16.9 ± 2.2
	C	31.0 ± 4.0	51.9 ± 3.0
3.0%	A	14.8 ± 1.5	22.3 ± 2.4
	B	10.5 ± 3.0	13.9 ± 2.1
	C	51.9 ±16.0	47.6 ± 5.0

± - S.D.

Table 5: Anova of shoot height, root length and dry weight of wheat seedlings.

Source of variation	Degree of freedom	Sum of Square	Mean sum of square	Variance ratio 'F'
(A) Shoot height in the first harvest.				
Among replicates	24	51.5	2.15	0.94
Concentration	4	141.8	35.45	15.50**
Control Vs Treatment	1	1.4	1.43	0.62
Error	96	219.5	2.29	
(B) Shoot height in the second harvest.				
Among replicates	21	44.8	2.13	0.67
Concentration	4	36.6	9.14	2.88*
Control Vs Treatment	1	27.2	27.20	8.56**
Error	84	266.6	3.17	
(C) Root length in the first harvest.				
Among replicates	24	112.7	4.70	0.62
Concentration	4	242.7	60.68	8.06**
Control Vs Treatment	1	0.92	0.92	0.12
Error	96	722.5	7.52	
(D) Root length in the second harvest.				
Among replicates	21	110.3	5.25	1.04
Concentration	4	687.5	171.8	34.03**
Control Vs	1	52.6	52.6	10.43**
Error	84	424.2	5.05	
(E) Dry weight of wheat seedlings in first harvest.				
Among replicates	6	1157.4	192.9	2.6*
Concentration	4	1778.8	444.7	6.0**
Control Vs Treatment	1	174.4	174.4	2.35
Error	24	1775.7	74.0	
(F) Dry weight of wheat seedlings in second harvest.				
Among replicates	6	336.0	56.0	1.28
Concentration	4	84.3	21.1	0.48
Control Vs. Treatment	1	6.3	6.3	0.14
Error	24	1051.4	43.8	

* Significant at 5% and ** 1% probability

the study period (Table 1). Control set's pH was neutral in beginning, and becoming slightly alkaline in the end of study (Table 1). Electrical conductivity (EC) of the leachates with nutrients were higher than those without nutrients (Table 1). It also increased with the concentration of leachates, and changed little with time (Table 1). This holds true for the control sets as well.

RESULTS AND DISCUSSION

Dry weight of waterhyacinth plants growing in nutrient deficient *Lantana* leachates did not differ significantly with the control plants growing in the tap water (Tables 2 & 3). Their dry weights were, however, greater in comparison to the control in nutrients enriched leachates, and differences due to concentrations were significant (Tables 2 & 3). This suggests that waterhyachinth would grow better in eutrophic water bodies having *Lantana* leachates. Offshoot development, however, remained unaffected (Table-2). On an average, one offshoot per plant was present in nutrient deficient leachates as well as in the tap water (control sets) while two offshoots per plant in the leachates and control sets supplemented with nutrients. Saxena (1991), however, reported complete death of water-hyacinth plants growing in 3% twenty four and forty eight hours *Lantana* leaf leachates.

Wheat germination was 100% in the control, leaf leachates (24 and 48 h) and decomposing leaf extract of 0.5, 1.0, 2.0 and 3.0%. Seedling heights as well as their dry weights were greater in the *Lantana* extract than in the control sets and differences due to concentrations of *Lantana* extract were significant (Tables 4 & 5). Unlike shoot height, root length in the extract of higher concentrations was, however, affected adversely in the second harvest and differences due to concentrations of *Lantana* extract were significant in both harvests (Tables 4 & 5). Contrarily, Mersil and Singh (1987) reported phytotoxic effects of *Lantana* shoot residue on weeds and several crop plants such as wheat, corn, soyabean etc. This may be due to several reasons such as difference in *Lantana* population, ecoclimate, soil characteristics etc. Our findings suggest that use of *Lantana* for the control of water-hyacinth as suggested by Saxena (1991) will rather create more problems in eutrophic waters as growth of water-hyacinth in nutrient rich leachates was comparatively better than in the control.

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