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Effect of Parthenium and Nitrogen Content of Leucaena in Rabi Weeds

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ABSTRACT

The fresh plant parts extracts of Parthenium were used to observe the effect on cowpea seeds, which showed the significant increase in seed germination and different seedling growth parameters viz., germinability (% seed germination), emergence index, relative seed germination, relative root elongation and seedling growth. Cent percent germination was observed on 7th day with the concentrations of 20%, on 3rd day with 40% and 60% root extract. The same was also observed with 20% of stem extract on 5th day and 100% germination was observed with only 10% and 20% leaf extract on 9th day. Only 80% germination was observed with flower extract on 12th day. The stimulatory effect was recorded on other germination and seedling growth parameters of cowpea. The promotory effect in order of Parthenium parts extracts was Root and Shoot>Leaf and Flower. Moreover, very little water was added with 20 to 100 % concentrations as compared to control and other concentrations.

Keywords- Cowpea, Parthenium allelopathy, germination parameters

I. INTRODUCTION

Allelopathic effect of any weed or crop on another crop can be utilized to develop growth-promoting system (Mersie and Singh, 1987; Oudhia, 1996; Oudhia and Tripathi, 1998, 1999;Srivastava et al. 2010). In many studies the different allelopathic effects of different plants on different growth parameters have been studied (Oudhia and Tripathi, 2000; Oudhia 2000). P a r t h e n i u m hysterophorus L. (Family-Asteraceae) is one of the ten worst weeds in the world. It believed to have entered India accidentally in the mid 1950's and is now considered as a noxious weed because of its prolific seed production, fast spreading ability and strong competitiveness with crops (Dayama, 1986; Adkins, 1996). Weeds are considered unwanted plants that cause damage to our crops, thus they compete with crops. Its harmful effects on several crops have been reported. Parthenium contains growth inhibitors as allelochemicals (Kanchan, 1975). The allelopathic effect of Parthenium hysterophorus, Datura stramonium and Blumea lacera on the germination of soybean was investigated (Oudhia, 2000). Kohli et al. (1985) suggested that allelochemicals were responsible for significant decrease in seed germination and subsequent growth of cabbage, when placed in leaf and inflorescence leac hates from Parthenium. Nath (1988) studied the effect of Parthenium extract on germination and seedling growth of crops. Pandey (1994) studied the effect on Salvinia and Paddy seedlings.

On the basis of review the least work has been observed in leguminous crops, which are rich source of protein in vegetarian diet. The work has been selected to explore the potential use of this allelopathic plant, Parthenium, as positive or stimulatory effect on water requirement, seed germination and different seedling growth parameters of Vigna unguiculata (L) Walp (Cowpea / Lobia; family- Fabaceae) an annual plant.

II. MATERIALS AND METHODS

Preparation of Extract

The plants of Parthenium were collected from the college campus. The fresh plant parts (Root, Stem, Leaf and Flower) were used for the preparation of extract. The plant samples of weed were cut into fine pieces and immersed in lukewarm water (2 mg/ml), for 24 hrs at room temperature. The material was sieved through 2mm mesh and stock solution of extracts was prepared. From this stock solution, different concentrations (20, 40, 60, 80, 100, 120, 140, 160 and 200%) were prepared by adding distilled water (DW) against control. Culture Technique Seeds of cowpea were kept in 2.5 inch diameter Petridishes under room temperature (15-30° C) in the month Feb. 2007,2008,2009. Before soaking, the seeds were surface sterilized with 0.1% HgCl2. 10 seeds are socked in different concentrations of extracts for 2 hrs and transferred to Petridishes with 3 layers of extract-wet filter paper. DW was used for control. Parameters Recorded The observations were recorded at 3rd, 5th, 7th, 9th, and 11th days after soaking (DAS). Germination and seedling growth parameters were determined according to following formulae at final days of observation. The data is subjected to statistical analysis of variance subjected to

randomized block design as described by Panse and Sukhatme (1985).

A. Germinability (G%)
G%= (Total No. of Seeds Germinated /Total No. of Seeds Sown) X 100
B. Emergence Index (EI) was calculated by the formula of by Baskin (1969).
EI = (n1/dn1)+(n2/dn2)+(n3/dn3)……. (nx /dnx)
st nd rd
where n = No. of seeds emerged on the day 1 , 2 , 3 , …… nth day.

dn = No. of days from the day of sowing.

dnx = No. of days to the final count.

C. Relative Seed Germination (RSG)

RSG = (No. of seeds germinated in the extract / No. of seeds germinated in the control) x100

D. Relative Root Elongation (RRE)

RRE =(Mean root elongation in the extract / Mean root elongation in the control) x100

E. Seedling Growth (SG)

SG = Total seedling growth length (cm)/ No. of germinated seeds.

III. RESULTS AND DISCUSSION

The observations revealed that all the concentrations initiate early germination except 200% of RE (Table-1). On 3rd DAS, 100% emergence was recorded with 40 and 60% RE (Root Extract), 20% SE (Stem Extract), LE (Leaf Extract) and FE (Flower Extract) as compared to the control, where 80% emergence was recorded till 9th DAS (Table-3). RE with 20% concentration showed maximum germination till 7th DAS, whereas, 40 to 100 % of SE recorded maximum germination by 3 rd DAS, 40 to 200 % concentrations of LE completed germination by 5th DAS and all the concentrations of FE by 3rd DAS. Overall, the extracts above 100% concentrations reduced and delayed the germination.

After the initiation of germination the growing seedlings required the addition of water from 5th DAS with different extracts (SE, LE and FE), while RE required water from 7th DAS (Table-2). In control sets water was added every alternate day from 7th DAS and in total 26 ml of water was added. There was a significant reduction (50.0%) in the water addition with 20 to 60% of RE, while 80 and 100% of RE showed 46.15% reduction in water. With 20 to 60% of SE water was added twice only i.e. on 5th and 9th DAS only and reduced water consumption by 53.84% with 20 % of SE and 50.0% with 40 and 60% of SE, over control, while the G% was more than that of control. On the other hand, 80% of SE reduced water by 57,69% and G% was equal to that of control i.e. 80%. Almost, with all the concentrations of LE water was added either 3 or 4 times i.e. 7th to 11th DAS or 5th to 11th DAS (every alternate day). Overall, 53.84% water reduction with 20% of LE and 61.53% with 40 and 60% of LE was observed (Table-2). FE with 20% and 40% concentrations showed 38.46% and 61.53% reduction, respectively, in water requirement, over control. Other higher concentrations also significantly reduced water addition, but followed by reduction in G% (Table-2 & 3). The lower concentrations were stimulatory and require less water for seed germination and seedling growth.

The G% 100 % was recorded under 20 %, 40% and 60 % of RE and SE (Table-3), while, with LE and FE 100% germination was recorded only with 40% of concentration as compared to control (80%). In higher concentration the G was reduced significantly. The maximum RRE was recorded with 60% of RE (233.01), SE (117.34), and LE (341.33), while in FE the maximum RRE was recorded with 80% concentration (107.33). Similarly, the lower concentrations 20 to 60% RE and SE showed maximum RSG (150). On the other hand, 20 to 100% LE showed maximum RSG (125) and only 20% FE showed maximum RSG (150). Overall, higher concentrations, 100% or >100% of SE, LE and FE reduced RRE and RSG. The observation on SG showed that it is increased with lower concentrations of all treatments, while in higher concentration reduction was recorded. The maximum SG (cm) was recorded with 60% of RE (18.22), 80 % of SE (17.00) and LE (22.13) and 60 % of FE (16.99) as compared to control (9.33). The EI was maximum with 40% of RE and 20% of SE i.e. 5.59 to 4.48, while, 40% LE and FE showed maximum EI i.e. 3.92 and 2.94 respectively, as compared to control (1.49).

The present investigations indicated that the different extracts from four parts of P. hysterophorus stimulate the cowpea seed germination and seedling growth parameters with lower concentrations (20 to 80%) only, while higher concentrations reduced them. Our results are similar with the findings of Sukhada et al. (1979) who studied stimulatory effect on bajra (Pennisetum typhoideum Rich CV. 'H.B.I'). Oudhia et al. (1997 a, b) studied the allelopathic effect of Parthenium on germination of linseed and chickpea. They noticed stimulatory effect of Parthenium on 5th and 7th day. The stem and root residue supported growth of Lagenaria siceraria at lower doses and was inhibitory at higher dose (>30%). The study showed that L. siceraria is more sensitive to allelochemicals released by flower and leaf parts as compared of root and shoot of Parthenium into

aqueous medium (Singh et al., 2008; Singh, 2010). These studies are contrary with the findings of Pandey (1994).

It is mainly due to allelochemicals; germacrene D, geranial, Oct-len-3-ol, fumaric acid accumulates in the stems and leaves (Mall and Dagar, 1997; Chandra et al., 1998) and p-Anisic, p-hydroxy-benzoic and vanillic acid in the root (Towers et al., 1977). All these chemicals are present in different parts of Parthenium showed stimulation at lower concentrations. Fumaric acid is used to lower the pH (make something more acidic); this may help anti-microbial agents to work better. While, p-Anisic and Benzoic acids are also present which are further used as solvents, additive and penetrating agents. Vanillic acid might be used as stimulating agent. Allelochemical may alter the rate at which ions are absorbed by plants (Towers et al., 1977) and may act as stimulator. The inhibitory property of Parthenium is due to the presence of chemicals like p-coumaric and caffeic acids (Narwal, 1994). Earlier phytotoxicity of sesquiterpene lactones (from Parthenium) was studied (Pandey, 1996).

This experiment clearly indicate that seed germination and seedling growth parameters were enhanced with lower concentrations of different parts of Parthenium extracts as RE>SE>LE>FE. Thus, it is clear that different parts of weed have different allelopathic potential. Above all, the reduction in water requirement with low concentrations of Parthenium aqueous extracts suggest that strategies should be made for utilizing allelopathy as an aid in crop production including both avoidance and application protocols. There are immediate opportunities for management of weed and crop residues and minimize crop losses from allelopathy and also to use allelopathic crops for sustainable agriculture. Allelopathic-environmental interactions must be considered in efforts to benefit from allelopathy. Allelochemicals may also be adapted at farmers level to yield stimulants or environmentally sound plant growth regulators to overcome water scarcity.

Table 2 :Effect of different parts of Parthenium extracts on Water addition (ml) to the growing seedlings of cowper

Days of Soaking RE	3rd day	5th day	7th day	9th day	11th day	Total
CON	-	-	6	10	10	26
20%	-	-	2	6	5	13
40%	-	-	2	6	5	13
60%	-	-	2	6	5	13
80%	-	-	3	6	5	14
100%	-	-	5	6	3	14
120%	-	-	4	4	4	12
140%	-	-	4	3	3	10
160%	-	-	4	3	3	10
200%	-	-	3	1	1	5
SE						
20%	-	5	-	7	-	12
40%	-	5	-	8	-	13
60%	-	5	-	8	-	13
80%	-	4	3	4	-	11
100%	-	4	3	4	-	11
120%	-	3	5	4	2	14
140%	-	3	-	7	2	12
160%	-	5	-	7	-	12
200%	-	-	3	7	-	10
LE						
20%	-	4	2	2	4	12
40%	-	-	4	2	4	10
60%	-	-	4	2	4	10
80%	-	-	4	5	4	13
100%	-	-	4	4	2	10
120%	-	2	2	4	2	10
140%	-	4	2	2	1	9
160%	-	-	5	2	1	8
200%	-	-	2	5	1	8
FE						
20%	-	4	3	5	4	16
40%	-	2	4	4	2	12
60%	-	2	4	2	4	12
80%	-	-	4	5	4	13
100%	-	4	4	2	2	12
120%	-	4	2	2	2	10
140%	-	2	2	2	2	8
160%	-	2	5	1	-	8
200%	-	-	2	5	-	14

IV. DISCUSSION

Rainy season stimulated leaching of excess soluble salts below the root zone which in its turn, favored many species to germinate and thus a high floristic value. Subsequent fall in the number of species with the approaching winter season is ascribed to the drying up of the above ground portions of the majority of the species due to the intensified soil moisture stress and low temperature of season. Increasing salt level, poor aeration, unfavorable moisture regime are the characteristic aspect responsible for elimination of majority of the species concomitant to advancing dry months and only a few perennials viz Cynodon dactylon, Cyperus rotandus, Desmostachya bipinnata, Prosopis spicegera and Sporobolus diander were capable of surviving round the year . High values of pH during season is due to the percolation of neutral water soluble salt in the lower layer and hydrolysis of exchangeable sodium with formation of sodium hydroxide in the upper soil surface. Lower organic matter during monsoon months is attributed to the rate of organic matter.

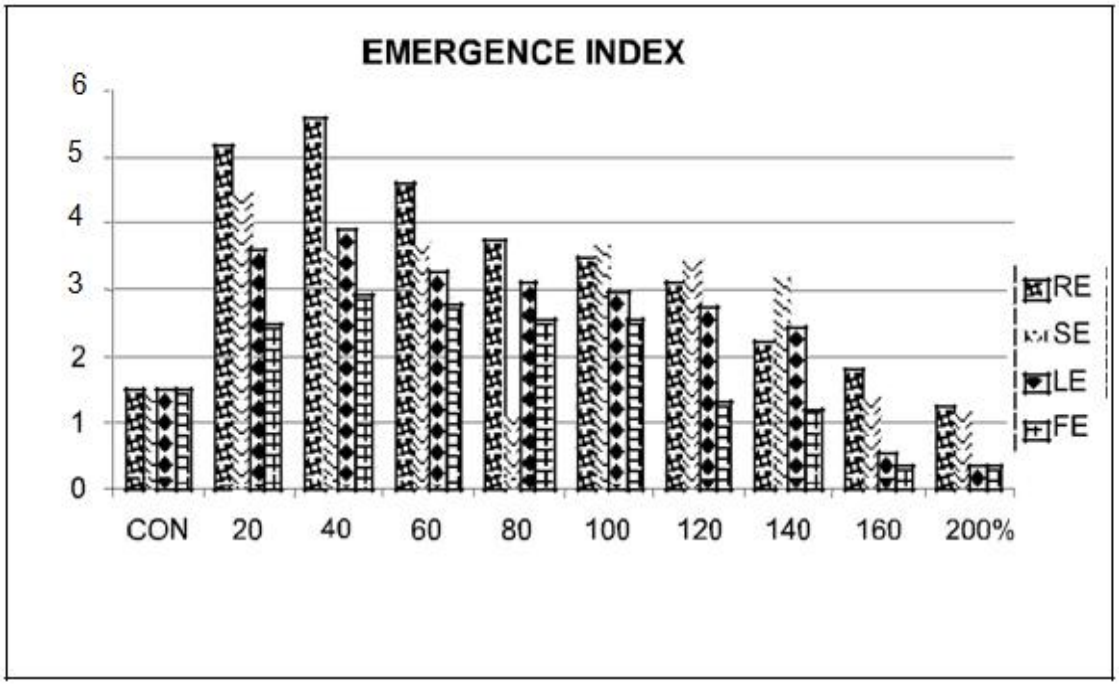
Table 3 : Effect of different parts of Parthenium extracts on different seed germination parameters of Cowpea

	Root Extract				Stem Extract			
Extract %	G%	RRE	RSG	SG (cm)	G%	RRE	RSG	SG (cm)
CON	80	100.00	100.00	9.33	80	100.00	100.00	9.33
20 %	100	178.80	150.00	11.21	100	100.0-	150.0	10.27
40 %	100	187.44	150.00	14.85	90*	100.00	150.0	12.85
60 %	100	233.01	150.00	18.22	90*	117.34	150.0	13.68
80 %	80*	211.33	125.00	12.27	80*	92.33	100.0	17.00
100 %	80*	197.44	125.00	11.97	70*	75.00	100.0	12.33
120 %	60	153.11	123.33	10.11	40	75.00	100.0	9.17*
140 %	50	138.90	123.33	9.93*	40	61.11	50.0	8.68*
160 %	50	66.67	60.00	9.51*	30	47.68	50.0	4.40
200 %	40	66.67	60.00	8.15	30	43.31	50.0	2.58
CD at 5% level	4.59			0.59	11.82			1.29

	Leaf Extract				Flower Extract			
Extract %	G%	RRE	RSG	SG (cm)	G%	RRE	RSG	SG (cm)
CON	80	100.00	100.00	9.33	80	100.00	100.00	9.33
20 %	100	312.0-	125.00	16.55	100	103.00	150.00	11.33
40 %	80*	329.00	125.00	17.33	90*	107.33	125.00	13.98
60 %	80*	341.33	125.00	18.85	70*	107.33	125.00	16.99
80 %	70*	272.66	125.00	22.13	70*	133.30	125.00	13.79
100 %	70	222.66	125.00	16.17	60	103.00	60.00	11.39*
120 %	30	201.33	60.00	15.77	30	80.00	60.00	9.49*
140 %	30	191.33	25.00	10.98*	20	80.00	60.00	8.68*
160 %	30	176.33	25.00	10.25*	20	75.66	60.00	8.11
200 %	20	129.66	25.00	9.33*	20	75.66	50.00	7.66
CD at 5% level	8.76			1.98	15.30			1.26

G% = Germinability; RRE = Relative Root Elongation; RSG= Relative Seed Germination; SG(cm) = Seedling Growth

Fig 1: Effect of different parts of Parthenium extracts on Seed Emergence Index of Cowpea (Each value is an average of three replicates)



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